

# **MATLAB® Release Notes**

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<b>Version 7 (R14) MATLAB Software Compatibility Summary .....</b>	<b>723</b>



# MATLAB Release Notes

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## Summary by Version

This table provides quick access to what's new in each version. For clarification, see "Using Release Notes" on page 2.

<b>Version (Release)</b>	<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
<b>Latest Version V7.13 (R2011b)</b>	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.12 (R2011a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.11.1 (R2010bSP1)	No	No	Bug Reports Includes fixes
V7.11 (R2010b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.10 (R2010a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.9.1 (R2009bSP1)	No	No	Bug Reports Includes fixes
V7.9 (R2009b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.8 (R2009a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.7 (R2008b)	Yes Details	Yes Summary	Bug Reports Includes fixes

<b>Version (Release)</b>	<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
V7.6 (R2008a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.5 (R2007b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.4 (R2007a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.3 (R2006b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.2 (R2006a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.1 (R14SP3)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.0.4 (R14SP2)	Yes Details	Yes Summary	Bug Reports Includes fixes
V7.0.1 (R14SP1)	Yes Details	Yes Summary	Fixed bugs
V7 (R14)	Yes Details	Yes Summary	Fixed bugs

## Using Release Notes

Use release notes when upgrading to a newer version to learn about:

- New features
- Changes
- Potential impact on your existing files and practices

Review the release notes for other MathWorks® products required for this product (for example, MATLAB® or Simulink®). Determine if enhancements, bugs, or compatibility considerations in other products impact you.

If you are upgrading from a software version other than the most recent one, review the current release notes and all interim versions. For example, when you upgrade from V1.0 to V1.2, review the release notes for V1.1 and V1.2.

## **What Is in the Release Notes**

### **New Features and Changes**

- New functionality
- Changes to existing functionality

### **Version Compatibility Considerations**

When a new feature or change introduces a reported incompatibility between versions, the **Compatibility Considerations** subsection explains the impact.

Compatibility issues reported after the product release appear under Bug Reports at the MathWorks Web site. Bug fixes can sometimes result in incompatibilities, so review the fixed bugs in Bug Reports for any compatibility impact.

### **Fixed Bugs and Known Problems**

MathWorks offers a user-searchable Bug Reports database so you can view Bug Reports. The development team updates this database at release time and as more information becomes available. Bug Reports include provisions for any known workarounds or file replacements. Information is available for bugs existing in or fixed in Release 14SP2 or later. Information is not available for all bugs in earlier releases.

Access Bug Reports using your MathWorks Account.

## **Documentation on the MathWorks Web Site**

Related documentation is available on [mathworks.com](http://mathworks.com) for the latest release and for previous releases:

- Latest product documentation
- Archived documentation



# Version 7.13 (R2011b)

## MATLAB Software

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This table summarizes what's new in Version 7.13 (R2011b).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized under these topics:

- “Desktop Tools and Development Environment, MATLAB Version 7.13 (R2011b)” on page 7
- “Mathematics, MATLAB Version 7.13 (R2011b)” on page 11
- “Data Analysis, MATLAB Version 7.13 (R2011b)” on page 14
- “Programming, MATLAB Version 7.13 (R2011b)” on page 15
- “Graphics and 3-D Visualization, MATLAB Version 7.13 (R2011b)” on page 22
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.13 (R2011b)” on page 23

- “External Interfaces/API, MATLAB Version 7.13 (R2011b)” on page 24

# Desktop Tools and Development Environment, MATLAB Version 7.13 (R2011b)

New features and changes introduced in this version are:

- “Command Window” on page 7
- “Editor” on page 8
- “Internationalization” on page 9

## Command Window

### Error Messages Reformatted for Improved Readability and Navigation

Error messages in the Command Window no longer appear with question marks or arrows. In addition, error messages for each function now provide a link to that function’s documentation.

The following images show examples of the differences in presentation:

- Built-in functions:
  - MATLAB Version 7.13 (R2011b)

```
>> eig
Error using eig
Not enough input arguments.
```
  - MATLAB Version 7.12 (R2011a) and earlier

```
>> eig
??? Error using ==> eig
Not enough input arguments.
```
- Functions that are not built in:
  - MATLAB Version 7.13 (R2011b)

```
>> num2str
Error using num2str (line 40)
Not enough input arguments.
```

- MATLAB Version 7.12 (R2011a) and earlier

```
>> num2str
??? Error using ==> num2str at 42
Numeric array is unspecified
```

## Editor

New Desktop features and changes introduced in this version are:

### Automatically Renaming All Variables and Functions in File

Under certain conditions, as you rename a variable or function, a tooltip opens. The tooltip indicates that MATLAB can rename all instances of the function or variable in the current file. This is helpful in preventing errors that result if you change names manually and overlook or mistype one or more instances of the name. For a video overview, watch this video demo

```
value1 = 0:1:6*pi;
y=sin(val1)
plot(val1,val2)
title('Sine Wave','FontWeight','bold')
xlabel('x')
ylabel('sin(x)')
set(gca,'Color','w')
set(gcf,'MenuBar','none')
```

Press **Shift+Enter** to rename 3 instances of 'val1' to 'value1'

For details, including the circumstances under which MATLAB prompts you, see “Automatically Rename All Functions or Variables in a File”.

## Internationalization

### Displaying Multilingual Characters on Mac OS X Platforms

On Apple Mac OS® X platforms, you might see garbled text if you try to use multilingual characters. Suppose you create a variable in the MATLAB command window containing multilingual characters. You can type the multilingual characters, but if you display the contents of the variable, the characters are corrupted.

MATLAB text files include scripts and user-defined functions and classes. MATLAB displays characters in a text file using an *encoding scheme*, which is defined in the MathWorks locale database. This encoding scheme supports characters for the language specified by the user locale setting. If you try to use multilingual characters in a text file, you may have to use a different encoding scheme. UTF-8 is often used to handle multilingual characters. In R2011b, to handle multilingual characters, you can change the default encoding scheme to UTF-8 by switching the MathWorks locale database. Note that changing the default encoding scheme might cause characters other than 7-bit ASCII characters in existing text files to be garbled.

See “How the MATLAB Process Uses Locale Settings” for more information.

**How to Change MATLAB’s Default Encoding to UTF-8.** You can change the default encoding scheme on Mac OS X platforms by using the UTF-8 locale database found in the *matlabroot/bin* folder. If you have text files containing characters other than 7-bit ASCII characters, you must convert the encoding before changing the default encoding. For instructions, see “How to Convert Text File Encoding to UTF-8” on page 9.

To change the default locale database, type:

```
mldir = fullfile(matlabroot,'bin');
copyfile(fullfile(mldir,'lcldata.xml'),...
    fullfile(mldir,'lcldata_default.xml'));
copyfile(fullfile(mldir,'lcldata_utf8.xml'),...
    fullfile(mldir,'lcldata.xml'));
```

**How to Convert Text File Encoding to UTF-8.** Before converting a file, copy the file to a new directory.

Use the Mac OS X TextEdit application to convert the file encoding. For example:

- 1** Open a MATLAB text file with TextEdit.
- 2** Select **File ->Save as...**
- 3** Change the file name.
- 4** Change **Plain Text Encoding:** to Unicode (UTF-8).
- 5** Save the file.

Alternatively, the following MATLAB code creates a new text file with the encoding set to UTF-8:

```
function convertencoding(infile, outfile)

fpIn = fopen(infile, 'r', 'n');
fpOut = fopen(outfile, 'w', 'n', 'UTF-8');

while feof(fpIn) == 0
    lineIn = fgets(fpIn);
    fwrite(fpOut, lineIn, 'char');
end

fclose(fpIn);
fclose(fpOut);
end
```

**Compatibility Considerations.** In a future release, the UTF-8 version of the MathWorks locale database will be the default on Mac OS X systems. Any text file created in MATLAB that is encoded in the user default encoding and contains characters other than 7-bit ASCII characters must be converted to the UTF-8 encoding scheme. Otherwise, MATLAB and other MathWorks products might not be able to properly load the files.

You must convert the file encoding before changing the default locale database.

## Mathematics, MATLAB Version 7.13 (R2011b)

New features and changes introduced in this version are:

- “New Functionality for Grid-Based Interpolation” on page 11
- “Performance Enhancements” on page 11
- “Permutation Option for randperm” on page 11
- “Return Permutation Information in Vector for qr” on page 11
- “Changes to meshgrid and ndgrid” on page 12
- “Functionality Being Removed or Changed” on page 12

### New Functionality for Grid-Based Interpolation

MATLAB includes a new class, `griddedInterpolant`, for grid-based interpolation. `griddedInterpolant` works with grids in `ndgrid` format and complements the functionality provided by `interp` to provide improved performance and memory efficiency.

### Performance Enhancements

The following functions show improved performance:

- Some integer math functions
- Some linear algebra functions, including `chol` and 3-output form of `qr`
- Trigonometric functions

### Permutation Option for randperm

The `randperm` function and the `RandStream.randperm` method now have the option of returning random permutations of `k` integers selected at random from the integers 1 through `n`.

### Return Permutation Information in Vector for qr

If you use the three-output form of `qr` in noneconomy mode, you can now specify `'vector'` as an input argument. The permutation information will return a vector instead of a matrix.

## Changes to `meshgrid` and `ndgrid`

The functions `meshgrid` and `ndgrid` have changed behavior under certain calling scenarios:

- When more than one input argument is passed to `meshgrid`, the dimensionality of the output arrays is deduced from the number of inputs. Previously the dimensionality was deduced from the number of outputs. For example, `[x,y] = meshgrid(1:3,1:4,1:5)` will now assume a missing third output argument and return 3-D output arrays `x` and `y`. Previously, the third input was ignored and the function returned 2-D arrays for `x` and `y`.
- When a single argument is passed to `ndgrid`, the dimensionality of the output arrays is dictated by the number of output arguments. `ndgrid` has been revised to maintain consistency in the case of a single input and output. `ndgrid` will now degenerate naturally to support 1-D outputs. For example, `x = ndgrid(1:5)` returns a 5-by-1 output vector `x`. Previously, a 5-by-5 array was returned.

## Functionality Being Removed or Changed

Functionality	What Happens When You Use This Functionality	Use This Instead	Compatibility Considerations
<code>bessel</code>	Errors	<code>besselj</code>	Replace all instances of <code>bessel</code> with <code>besselj</code> .
ODE solver syntax <code>solver('vdp',t0,tfinal,y0)</code> where <code>solver</code> is one of the ODE solvers <code>ode45</code> , <code>ode23</code> , <code>ode113</code> , <code>ode15s</code> , <code>ode23s</code> , <code>ode23t</code> , or <code>ode23tb</code>	Errors	<code>solver('vdp',[t0 tfinal],y0)</code> or <code>solver(@vdp,[t0 tfinal],y0)</code>	Replace all instances of the syntax <code>t0,tfinal</code> with <code>[t0 tfinal]</code> .



<b>Functionality</b>	<b>What Happens When You Use This Functionality</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
Values on and off for Mass property of odeset and odeget	Errors	Set the Mass property to a constant matrix or a function that evaluates the variable mass matrix.	Update your code to use a constant mass matrix or a function that evaluates the variable mass matrix. For more information, check the supported settings of Mass and MassStateDependency in the odeset properties.
MassConstant property of odeset and odeget	Errors	For a constant mass matrix, set the Mass property to that matrix. For a time-dependent mass matrix, set the Mass property to a function that evaluates the matrix and set the MassStateDependency property to none.	Update your code to use a constant mass matrix or a function that evaluates the variable mass matrix. For more information, check the supported settings of Mass and MassStateDependency in the odeset properties.

## **Data Analysis, MATLAB Version 7.13 (R2011b)**

There were no new features or changes in this version.

## Programming, MATLAB Version 7.13 (R2011b)

New features and changes introduced in this version are

- “Load and Save Parts of Variables in V7.3 MAT-Files” on page 15
- “Nonmatching Function Name Warning is Now an Error” on page 16
- “New narginchk Function Replaces nargchk” on page 17
- “Conversion of Error and Warning Message Identifiers” on page 17
- “New Spreadsheet Import Tool” on page 17
- “Two Functions Added to netCDF Low-Level Package To Aid Performance” on page 18
- “Improved Performance for TIFF Input and Output ” on page 18
- “Upgrades to Scientific File Format Libraries” on page 18
- “VideoReader Supports MPEG-4 and MOV on Windows 7 Systems” on page 18
- “MATLAB Warns if Listener Defined for Nonobservable Property” on page 19
- “MATLAB Warns if Property Is Not Member of Class When Defining Listener” on page 19
- “Built-In disp Works with Empty Objects” on page 20
- “MATLAB Warns if Class Defines Property as Dependent and Constant” on page 20
- “Support for Switch/Case Statements with Objects” on page 20
- “Functionality Being Removed or Changed” on page 21

### Load and Save Parts of Variables in V7.3 MAT-Files

The new `matfile` function creates a `matlab.io.MatFile` object that can efficiently load or save to parts of variables in Version 7.3 MAT-Files. Loading part of a variable requires less memory than loading the entire contents of that variable.

For example, these commands create a MAT-file and add data to part of variable X:

```
new = matfile('newfile.mat','Writable',true);  
new.X(6:10,6:10) = magic(5);
```

This command loads part of the data into variable partOfX:

```
partOfX = new.X(1:8,1:8);
```

---

**Note** Syntax such as `size(new.X)` or `new.X(end,end)` temporarily loads the entire contents of variable X into memory. To determine the size of a variable without loading, use the `size` method for `matlab.io.MatFile` objects:

```
sizeOfX = size(new,'X');
```

---

For more information, see the `matfile` reference page or watch this video demo.

## Nonmatching Function Name Warning is Now an Error

In previous releases of MATLAB, entering a function name that did not match any known function name in the given letter case resulted in a warning. After displaying this warning message, MATLAB attempted find a function that would match if letter case were ignored. If such a match were found, MATLAB ran this function instead.

In MATLAB R2011b, the MATLAB software generates an error if it can't find an exact-case match. The message displayed by the error may suggest the correct spelling for the function that was entered. The message identifier for this error reads as follows:

```
'MATLAB:dispatcher:InexactCaseMatch'
```

## Compatibility Considerations

If you have a program that calls another program with nonmatching letter case, the call to this function now throws an error.

## New `narginchk` Function Replaces `nargchk`

`narginchk` is a new function that replaces and adds to the functionality of `nargchk`.

The `narginchk` function differs from `nargchk` in the following ways:

- `narginchk` accepts only 2 inputs: the minimum and maximum allowable number of arguments one can pass to the currently running function.
- `narginchk` returns no outputs. Instead, it throws an error if the number of arguments passed to the current function is outside the allowable range

## Conversion of Error and Warning Message Identifiers

For R2011b, error and warning message identifiers have changed in MATLAB.

## Compatibility Considerations

If you have code that uses message identifiers that changed, you must update the code to use the new identifiers. Typically, message identifiers are used to turn off specific warning messages, or in code that uses a try/catch statement and performs an action based on a specific error identifier.

For example, the `MATLAB:eigs:NonPosIntSize` identifier has changed to `MATLAB:eigs:RoundNonIntSize`. If your code checks for `MATLAB:eigs:NonPosIntSize`, you must update it to check for `MATLAB:eigs:RoundNonIntSize` instead. For a mapping of the new identifiers to the original identifiers, see Technical Support solution 1-ERAFNC.

## New Spreadsheet Import Tool

The new Spreadsheet Import Tool allows you to select ranges of data and define rules for handling nonnumeric values. This tool opens instead of the Import Wizard for spreadsheets and comma-separated value (CSV) files. For more information, watch this video demo.

## Two Functions Added to netCDF Low-Level Package To Aid Performance

The NetCDF low-level package now includes two functions that you can use to improve performance:

- `netcdf.getChunkCache` – Return default chunk cache settings.
- `netcdf.setChunkCache` – Set the default chunk cache settings.

## Improved Performance for TIFF Input and Output

Input and output performance for TIFF files has been improved, when using `imread` and `imwrite`.

## Upgrades to Scientific File Format Libraries

The following table lists upgrades to scientific file format libraries used by MATLAB.

Library	Version Upgrade
NetCDF	4.0.1 to 4.1.2
HDF5	1.8.3 to 1.8.6
HDF4	4.2r4 to 4.2.5
HDF-EOS	2.16 to 2.17
TIFF	3.7.1 to 3.9.5

## VideoReader Supports MPEG-4 and MOV on Windows 7 Systems

VideoReader now imports MPEG-4 and Apple QuickTime® movies, and any other formats supported by Microsoft® Media Foundation, on Windows® 7 systems. For more information, see the VideoReader reference page.

## **MATLAB Warns if Listener Defined for Nonobservable Property**

If you attempt to create a `PreSet` or `PostSet` listener for a property that is not declared as `SetObservable`, MATLAB issues a `MATLAB:class:nonSetObservableProp` warning.

If you attempt to create a `PreGet` or `PostGet` listener for a property that is not declared as `GetObservable`, MATLAB issues a `MATLAB:class:nonGetObservableProp` warning.

In previous releases, MATLAB did not warn in either case, but did not call the listener callback function when a set or get event occurred. In a future release, these warnings will become errors.

## **Compatibility Considerations**

If you use class metadata or the `properties` function to get a list of properties for which you create listeners, add warning/error handling for these conditions. A better approach is to use `findobj` to get the list of observable properties for any given class and assign listeners only for those properties.

## **MATLAB Warns if Property Is Not Member of Class When Defining Listener**

When calling the `event.proplistener` constructor, or calling the `addlistener` method with an array of `meta.property` objects, warning messages alert you if a property is not a member of the correct class.

- **Nonscalar input objects:** if any one of the properties is not a valid member of the class of the object array, MATLAB issues the `MATLAB:class:PropNotMember` warning .
- **Scalar input object:** if any of the properties are not valid dynamic or class properties, MATLAB issues the `MATLAB:class:DynPropNotMember` or `MATLAB:class:PropNotMember` warning.

In previous releases, MATLAB did not warn in either case. In a future release, these warnings will become errors.

## Built-In disp Works with Empty Objects

It is now possible to call the built-in `disp` function with empty objects. For example, define the `TestClass` as:

```
classdef TestClass
    properties
        PropertyA = 1;
    end
end
```

Then call the built-in version of `disp`:

```
>> builtin('disp',TestClass.empty)
0x0 empty TestClass

Properties:
    PropertyA

Methods
```

In previous releases, calling the built-in `disp` function did not display anything with empty objects.

## MATLAB Warns if Class Defines Property as Dependent and Constant

MATLAB now issues a warning if a class defines properties as both `Dependent` and `Constant`. In a future release, this warning will become an error.

## Support for Switch/Case Statements with Objects

You can construct switch statement blocks using objects as both the switch expression and the case expression. The object's class must define or inherit an `eq (==)` method. See [Using Switch/Case Statements with Objects in “Functions Used with Objects”](#) for more information.



## Functionality Being Removed or Changed

<b>Functionality</b>	<b>What Happens When You Use This Functionality?</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
nargchk	Still runs	narginchk	Accepts only min and max inputs, returns no output, generates error.
nargoutchk	Still runs	nargoutchk (see new syntax)	Accepts only min and max inputs, returns no output, generates error.

## **Graphics and 3-D Visualization, MATLAB Version 7.13 (R2011b)**

There were no new features or changes in this version.

## **Creating Graphical User Interfaces (GUIs), MATLAB Version 7.13 (R2011b)**

There were no new features or changes in this version.

## External Interfaces/API, MATLAB Version 7.13 (R2011b)

New features and changes introduced in this version are:

- “Changes to Compiler Support” on page 24
- “New Object Support for mxGetProperty and mxSetProperty Functions” on page 25
- “MEX Header File Does Not Define C++ Type char16\_t” on page 25
- “New Support for Features in Microsoft .NET Framework” on page 25
- “COM Automation Server Error Message Formatting” on page 26

### Changes to Compiler Support

#### New Compiler Support

MATLAB Version 7.13 (R2011b) supports these new compilers for building MEX-files on Windows 64- and 32-bit platforms:

- Microsoft Windows Software Development Kit for Windows 7 and .NET Framework 4, Version 7.1
- Intel® C++ Composer XE 2011
- Intel Visual Fortran Composer XE 2011

MATLAB Version 7.13 (R2011b) supports the following new compiler for building MEX-files on Mac OS X 64-bit platforms:

- Apple® Xcode® 4.0.0 with gcc 4.2.x

#### Compiler Support To Be Phased Out

Support for the following compilers on Windows 64- and 32-bit platforms will be discontinued in a future release, at which time new versions will be supported. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

- Intel C++ Version 11.1

- Intel Fortran Version 11.1

## **New Object Support for mxGetProperty and mxSetProperty Functions**

You can read and modify properties of Java™ and COM objects using the `mxGetProperty` and `mxSetProperty` functions.

## **MEX Header File Does Not Define C++ Type `char16_t`**

The `matrix.h` header file, used by the `mex.h` header file for building C/C++ MEX-files, no longer defines the C++ type `char16_t`.

## **Compatibility Considerations**

If your MEX-file uses the `char16_t` type, you must include the appropriate header file for your compiler in order to build the MEX-file. For example, the header file for Microsoft® Visual Studio® Version 10.0 is `yvals.h`.

## **New Support for Features in Microsoft .NET Framework**

- “Support for Cell Arrays” on page 25
- “Support for Auto-Conversion of Multidimensional Arrays” on page 26

## **Support for Cell Arrays**

**Creating Cell Arrays from .NET Stings and Objects.** Use the MATLAB `cell` function to convert .NET `System.String` and `System.Object` arrays to MATLAB cell arrays. For more information, see “Converting .NET Arrays to Cell Arrays”.

**Passing Cell Arrays to .NET Methods.** If an input argument to a .NET property or method is an array of `System.Object` or `System.String`, you can pass a cell array. MATLAB automatically converts a cell array into the appropriate .NET array. For more information, see “Pass Cell Arrays”.

## Support for Auto-Conversion of Multidimensional Arrays

You can pass MATLAB arrays directly to .NET without explicitly converting them into .NET arrays. MATLAB also converts an array of a lower dimensionality to a higher dimensionality .NET array. For more information, see “Pass Arrays”.

**Compatibility Considerations.** In most cases, you no longer need to use the `NET.convertArray` function. Review your MATLAB code to update the use of this function. If you continue to use `NET.convertArray`, note the following change of behavior for empty matrices:

- If you call `NET.convertArray` with an N-D empty matrix and try to convert it to 1-D .NET array, MATLAB throws the following error:

```
Source and destination array dimension sizes do not match.
```

- Different results for:

```
NET.convertArray(rand(0,1,1))
```

As of R2011a, MATLAB creates a `System.Double[, ]`. In R2011b, MATLAB creates a `System.Double[]`.

## COM Automation Server Error Message Formatting

Although some MATLAB Command Window messages have been reformatted (see “Error Messages Reformatted for Improved Readability and Navigation” on page 7), error messages from the `Execute` function can still be identified with leading ??? characters.

# Version 7.12 (R2011a)

## MATLAB Software

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This table summarizes what's new in Version 7.12 (R2011a).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized under these topics:

- “Desktop Tools and Development Environment, MATLAB Version 7.12 (R2011a)” on page 28
- “Mathematics, MATLAB Version 7.12 (R2011a)” on page 36
- “Programming, MATLAB Version 7.12 (R2011a)” on page 39
- “Graphics and 3-D Visualization, MATLAB Version 7.12 (R2011a)” on page 47
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.12 (R2011a)” on page 50
- “External Interfaces/API, MATLAB Version 7.12 (R2011a)” on page 52

## **Desktop Tools and Development Environment, MATLAB Version 7.12 (R2011a)**

New features and changes introduced in this version are:

- “Desktop” on page 28
- “Help Browser” on page 28
- “Managing Files” on page 30
- “Editing and Debugging MATLAB Code” on page 32
- “Publishing MATLAB Code” on page 34
- “MATLAB Notebook Menu Labels” on page 35

### **Desktop**

New features and changes introduced in Version 7.12 (R2011a) are:

#### **MATLAB Menus Display at the Top of the Apple Mac Screen**

Previously when running on Apple Mac, menus displayed at the top of the MATLAB desktop. In addition, if a tool was undocked from the desktop, the menu displayed at the top of that tool. Now, to be consistent with the behavior of most Mac applications, MATLAB menus display at the top of the Mac screen.

### **Help Browser**

- “New Location and Archived Content for Product Documentation” on page 28
- “Submit Support Requests Directly from MATLAB” on page 29

#### **New Location and Archived Content for Product Documentation**

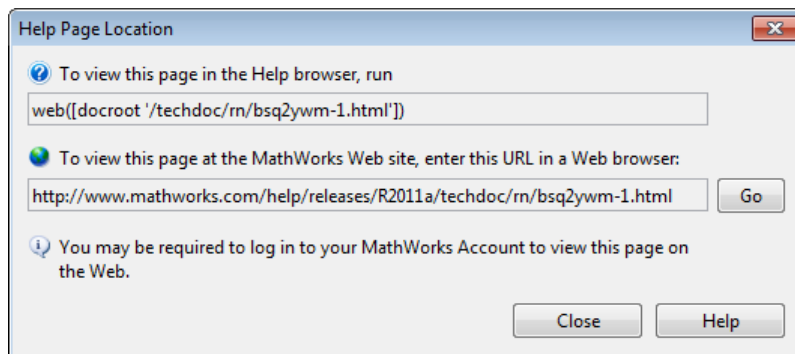
The new MathWorks Web site location for product documentation is <http://www.mathworks.com/help/>. Accessing the old URL, <http://www.mathworks.com/access/helpdesk/help/helpdesk.html>, redirects you the new location.



In addition to all current product documentation, the new location provides archived product documentation from all releases going back to R13sp2 (including Japanese, when available). To go to the archive, click the View documentation for other releases link. The archived release documentation is available only at the MathWorks Web site, and not via the Help browser.

To view some documentation you must log on to [www.mathworks.com](http://www.mathworks.com) with your MathWorks user name and password. For example, you need to log in to view current PDF files and documentation from prior releases.

The **View > Page Location** dialog box in the Help browser now links to documentation at the MathWorks Web site that accompanies the release you are currently running. For example, when you run R2011a, the dialog box looks like this.



As of R2011a, the Help Browser **View > Page Location** dialog box (shown above) is available on Japanese language systems.

## Submit Support Requests Directly from MATLAB

As of this release, if you need assistance from MathWorks product support, you can request it directly from the MATLAB desktop. Selecting the **Submit a MathWorks Support Request** option from the **Help** menu opens a login dialog for you to provide the e-mail address and password for your MathWorks account. After you log in, a form displays for you to create a service request. Select the product for which you want help, explain the issue you are having, give the request a meaningful title, describe the issue you are having, provide

reproduction steps, and attach files that enable Technical Support to follow the steps.

If you do not have a MathWorks account, the login form enables you to create one. MathWorks accounts are free and without obligation. You can also use the account login form to obtain a forgotten MathWorks password. You can log out before submitting your request or remain logged in.

If you are not connected to the Internet or if you are connected to the Internet via a proxy server when you attempt to create a help request, you are prompted to save your form to a text file. You can then send the file as e-mail to [support@mathworks.com](mailto:support@mathworks.com). You can also upload the description and supporting files directly to the MathWorks FTP site.

For an example of submitting a support request, see this video demo. For further details about requesting service requests from MATLAB, see “Technical Support”.

## Managing Files

New features and changes introduced in Version 7.11 (R2011a) are:

- “Renaming Files and Folders in the Current Folder Browser Now Reflected in the Editor” on page 30
- “Options Names Changed for Locating and Opening Files and Folders Outside the MATLAB Desktop” on page 31
- “Comparison and Merging of MAT-file Variables” on page 31
- “Filter Results in Folder Comparisons” on page 32
- “Showing Differences Only in Text Comparisons” on page 32

### Renaming Files and Folders in the Current Folder Browser Now Reflected in the Editor

If a file is open in the Editor and you:

- Rename that file in the Current Folder browser, then the file name updates in the Editor

- Rename the folder containing that file in the Current Folder Browser, then MATLAB updates the file specification for all open Editor documents in the renamed folder
- Delete that file from the Current Folder browser, then MATLAB deletes the file from disk and renames the Editor document to `Untitled*`

If more than one unnamed document is open in the Editor, then MATLAB renames the deleted document `Untitledn*`, where `n` is an integer.

However, modifying file and folder names from either of the following does not update names for open documents in the Editor:

- The operating system file manager — such as Windows Explorer
- The MATLAB Command window — using `movefile`, for instance

### **Options Names Changed for Locating and Opening Files and Folders Outside the MATLAB Desktop**

To locate a file or folder in Windows Explorer or Apple Mac Finder, you previously used the Current Folder browser context-menu option, **Locate on Disk**. Now the option is one of the following:

- On Microsoft Windows systems—**Show in Explorer**
- On Macintosh® systems—**Show in Finder**

In addition, from the Current Folder browser, you can open the current folder in Explorer or Finder. Right-click in white space, and then select **Open Current Folder in Explorer** or **Open Current Folder in Finder**.

### **Comparison and Merging of MAT-file Variables**

When comparing MAT-files, you now can view details of differences between variables to see which fields of a structure are different and to view differences in individual elements of an array. You can merge changes between files by copying variables from one file to another. For details, see “Comparing MAT-Files”.

## Filter Results in Folder Comparisons

You now can define filters to exclude unimportant differences when comparing folders. For example, you can exclude backup files or files created by a revision control system. Filters can save time when reviewing differences, especially when comparing many subfolders. For details, see [Comparing Folders and Zip Files](#).

## Showing Differences Only in Text Comparisons

When comparing text files, you now can specify whether to show only differences. Use the new toolbar button in the Comparison Tool to hide sections of the report that do not include any differences. It can be useful to hide unmodified lines in large text comparison reports. For details, see [“Comparing Text Files”](#).

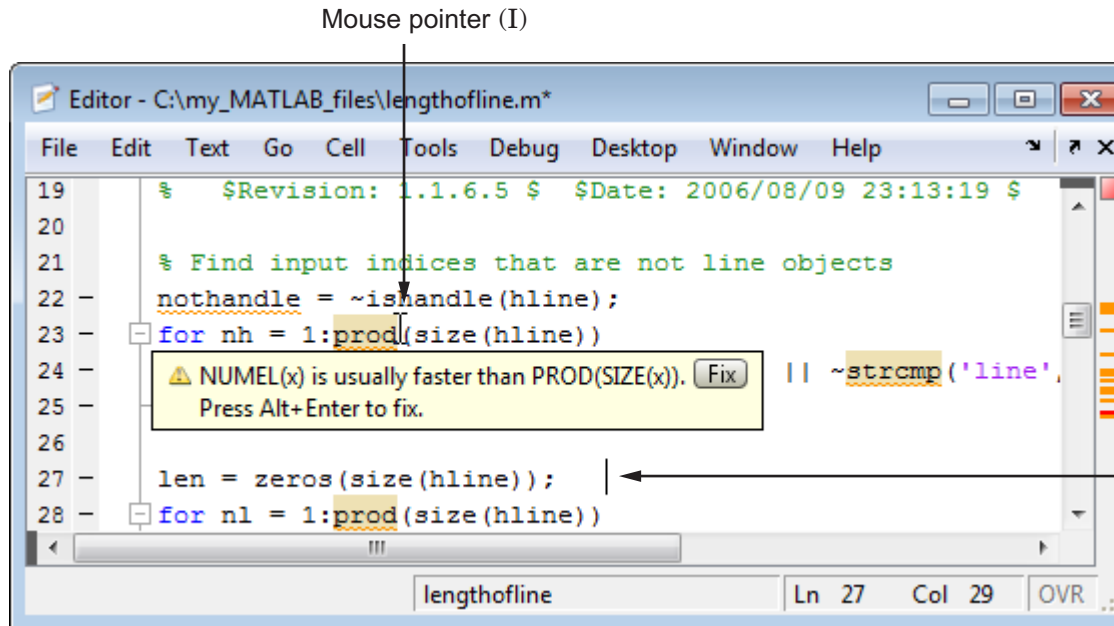
## Editing and Debugging MATLAB Code

New Desktop features and changes introduced in Version 7.11 (R2011a) are:

- “Change to Tooltip and Behavior for M-Lint Messages” on page 32
- “Changed Default Preference for Deleting Autosaved Files” on page 33
- “Shared Scope Color Preferences Apply to Persistent and Global Variables” on page 34

### Change to Tooltip and Behavior for M-Lint Messages

Previously, when you hovered the *mouse pointer* over code in the Editor that has an autofixable M-Lint warning message, a tooltip opened that included the phrase, **Press Alt + Enter to fix**, as shown in this image.



Now, this phrase is removed from the M-Lint tooltip. You can still use the keyboard shortcut, **Alt+Enter**, to apply the autofix, but your *cursor* must be within the code to which the autofix will be applied.

**Compatibility Considerations.** When an M-Lint tooltip is open and you want to apply the autofix for that warning, click the **Fix** button. To apply the same autofix using a keyboard shortcut, move the cursor within the code that generates the warning, and then click **Alt+Enter**.

### Changed Default Preference for Deleting Autosaved Files

Previously, the **Automatically delete autosave files** preference for the Editor was disabled by default. Now, it is enabled by default. However, as usual, MATLAB retains settings you set explicitly in a previous release (unless you delete `matlab.prf.` )

For more information, see “Autosaving Files” and “Where MATLAB Stores Preferences”.

## Shared Scope Color Preferences Apply to Persistent and Global Variables

Previously, the preference for **Variables with shared scope** was labeled **Nonlocal variables** and it affected the color of variables within nested functions only. Now, the Editor also applies this color preference to variables you declare as global or persistent.

This feature makes it easier to find reuses of a variable, which sometimes indicate variable scoping problems. For details, including information on how to disable or change the colors that the Editor uses for variables with shared scope, see “Avoid Variable and Function Scoping Problems”.

## Publishing MATLAB Code

New Desktop features and changes introduced in Version 7.11 (R2011a) are:

- “Change to Menu Option for Including Blocks of LaTeX Code” on page 34
- “Menu Option to Include Inline LaTeX Math in Published MATLAB Code” on page 34

### Change to Menu Option for Including Blocks of LaTeX Code

Previously, if you wanted to include blocks of LaTeX code within your MATLAB code intended for publishing, you selected **Cell > Insert Text Markup > LaTeX Equation**. Now you select **Cell > Insert Text Markup > LaTeX Display Math**. The name of the option was changed to better distinguish it from a new publishing option that enables you to include inline LaTeX equations in your published code.

For details see “Including LaTeX Display Math in MATLAB Files for Publishing”.

### Menu Option to Include Inline LaTeX Math in Published MATLAB Code

The Cell menu now provides an option for including inline LaTeX equations. Position the cursor within the comment line where you want the LaTeX equation to appear, and then select **Cell > Insert Text Markup > LaTeX Inline Math**.

For details see “Including Inline LaTeX Math Equations in MATLAB Files for Publishing”.

## **MATLAB Notebook Menu Labels**

Menu labels for MATLAB Notebook are changed. To ensure your menu options are up to date, and match those presented in the documentation, run the following command:

```
notebook -setup
```

MathWorks recommends you run this command whenever you install a new version of MATLAB.

## Mathematics, MATLAB Version 7.12 (R2011a)

New features and changes introduced in this version are:

- “New Function `rng`” on page 36
- “New Function `ichol`” on page 36
- “New Option for `gammainc`” on page 36
- “Performance Enhancement” on page 36
- “Changes to `qr`” on page 37
- “Functionality Being Removed” on page 37

### New Function `rng`

The new `rng` function controls the random number generator used by `rand`, `randi`, and `randn`. For a demonstration, see this instructional video.

`rng` is the recommended alternative to former `rand` and `randn` input syntaxes `'seed'`, `'state'` and `'twister'`. `rng` is a simpler alternative to the `RandStream` class. To use `rng`, see the documentation on “Updating Your Random Number Generator Syntax”.

### New Function `ichol`

The new `ichol` function performs incomplete Cholesky factorization and is the recommended alternative to `cholinc`.

### New Option for `gammainc`

The new options `gammainc(X,A,'scaledlower')` and `gammainc(X,A,'scaledupper')` now return scaled versions of the incomplete gamma function `gammainc`.

### Performance Enhancement

- Matrix transpose
- Element-wise single precision functions



- Sparse matrix indexed assignment
- Many linear algebra functions
- Convolution for long vectors and large matrices with `conv` and `conv2`

## Changes to `qr`

In R2010a and R2010b, the upper triangular output `R` from the full `qr` function was guaranteed to have real and nonnegative diagonal elements. In this release, the behavior reverts to that of R2009b and prior releases. That is, the diagonal of `R` may contain complex and negative elements, and will affect the unitary output `Q` correspondingly.

## Compatibility Considerations

Since the QR factorization is not unique, these different results are still correct. Ensure that your code does not depend on the values of the elements of the factors `Q` and `R`.

## Functionality Being Removed

Function Name	What Happens When You Use This Function	Use This Function Instead	Compatibility Considerations
<code>bessel</code>	Errors	<code>besselj</code>	Replace all instances of <code>bessel</code> with <code>besselj</code> .
<code>intwarning</code>	Errors	None	Remove all instances of <code>intwarning</code> from your code.
<code>luinc</code>	Warns	<code>ilu</code>	Replace instances of <code>luinc</code> with <code>ilu</code> .
<code>cholinc(X, 'inf')</code>	Warns	None	Remove all instances of <code>cholinc(X, 'inf')</code> from your code.

<b>Function Name</b>	<b>What Happens When You Use This Function</b>	<b>Use This Function Instead</b>	<b>Compatibility Considerations</b>
All other syntaxes of cholinc except cholinc(X, 'inf')	Warns	ichol	Replace these instances of cholinc with ichol.
RandnAlg property of RandStream class	Still runs	NormalTransform property of RandStream class	Replace all existing instances of RandnAlg with NormalTransform.
setDefaultStream method of RandStream class	Still runs	setGlobalStream method of RandStream class	Replace all existing instances of RandStream.setDefaultStream with RandStream.setGlobalStream.
getDefaultStream method of RandStream class	Still runs	getGlobalStream method of RandStream class	Replace all existing instances of RandStream.getDefaultStream with RandStream.getGlobalStream.
rand or randn with the 'seed', 'state' or 'twister' inputs	Still runs	rng	See “Updating Your Random Number Generator Syntax” in the MATLAB Mathematics documentation.

## Programming, MATLAB Version 7.12 (R2011a)

New features and changes introduced in this version are

- “Regenerate P-code Files Built Before Version 7.5 ” on page 39
- “VideoWriter Supports Motion JPEG 2000 Files” on page 40
- “audioplayer and audiorecorder Support Device Selection on All Platforms” on page 40
- “New Class Forms the Basis for Heterogeneous Hierarchies” on page 41
- “New Class Provides the Basis for Customizable Handle Object Copy Method” on page 41
- “MATLAB Meta-Classes Can Now Form Heterogeneous Arrays” on page 41
- “New High-Level NetCDF Functions” on page 41
- “New High-Level HDF5 Functions” on page 42
- “Two New Functions Added to CDFLIB Package” on page 42
- “HDF4 Functions Grouped into Packages” on page 43
- “FITSREAD Function Now Supports Data Subsetting” on page 43
- “Unrecognized Name Warning Changed to Error” on page 43
- “Regular Expressions Support Zero-Length Matching” on page 44
- “Growing Arrays Is Faster” on page 45
- “Error Checking Improved” on page 45
- “Functions and Function Elements Being Removed” on page 46

### Regenerate P-code Files Built Before Version 7.5

To enable the MATLAB software to take advantage of significant performance improvements planned for a future release, MathWorks recommends that you begin to regenerate any P-code files you use that were generated prior to MATLAB 7.5 (release R2007b). P-code files generated in releases earlier than R2007b will not run in this future release with the new performance features enabled.

## Compatibility Considerations

Using MATLAB 7.5 or later, rebuild any P-code files that you expect to need in the future.

## VideoWriter Supports Motion JPEG 2000 Files

VideoWriter now creates Motion JPEG 2000 (.mj2) files, which support logging data with these features:

- Multi-byte precision, such as 10, 12, or 16 bits
- Signed data values
- Lossless compression

For more information, see the VideoWriter reference page.

## audioplayer and audiorecorder Support Device Selection on All Platforms

audioplayer and audiorecorder now allow you to specify the input or output device on all supported platforms. In previous releases, you could only specify devices on Microsoft Windows systems.

## Compatibility Considerations

- audioplayer, audiorecorder, and audiodevinfo now use different technology for enumerating system input and output devices. If your existing code specifies a device ID (other than the default, -1), check whether you need to change the ID. To determine your device IDs, call audiodevinfo.
- audioplayer does not support overlapping playback. For example, in this code, the second call to play returns an error:

```
chirpData = load('chirp.mat');
chirpObj = audioplayer(chirpData.y, chirpData.Fs);

gongData = load('gong.mat');
gongObj = audioplayer(gongData.y, gongData.Fs);
```

```
play(chirpObj);  
play(gongObj);
```

## **New Class Forms the Basis for Heterogeneous Hierarchies**

The `matlab.mixin.Heterogeneous` class enables you to form heterogeneous arrays containing instances of classes derived from this class. You can create heterogeneous hierarchies of both handle and value classes.

## **New Class Provides the Basis for Customizable Handle Object Copy Method**

The `matlab.mixin.Copyable` class enables you to define handle classes that inherit a copy method whose behavior you can modify in subclasses.

## **MATLAB Meta-Classes Can Now Form Heterogeneous Arrays**

All MATLAB meta-classes are now defined in a heterogeneous hierarchy, which enables the formation of heterogeneous arrays of meta-class objects. This capability enables functions like `findobj` and `findprop` to return heterogeneous arrays containing instances of meta-classes of different specific types. The hidden class `meta.MetaData` forms the root of the heterogeneous hierarchy.

## **New High-Level NetCDF Functions**

MATLAB now includes several new functions that provide a high-level interface to NetCDF files. These functions let you read and write to NetCDF files, without having to use the programming paradigm required by the low-level functions in the `netCDF` package. Using these functions, you can create a new NetCDF file based on the schema of an existing file, convert files between NetCDF formats, and create a new NetCDF file by merging together two existing NetCDF files.

- `nccreate` — Create variable in NetCDF file
- `ncdisp` — Display contents of netCDF file
- `ncinfo` — Return information about netCDF file

- `ncread` — Read data and attributes from netCDF file
- `ncreadatt` — Read global attribute or attribute associated with variable from netCDF file.
- `ncwrite` — Write data to netCDF file
- `ncwriteatt` — Write attribute to netCDF file
- `ncwriteschema` — Add netCDF schema definitions to a NetCDF file

## **New High-Level HDF5 Functions**

MATLAB now includes several new high-level functions for working with HDF5 files. These functions let you read and write to HDF5 files, without having to use the programming paradigm required by the low-level functions in the HDF5 package.

- `h5create` — Create HDF5 data set
- `h5disp` — Display contents of HDF5 file
- `h5info` — Return information about HDF5 file
- `h5read` — Read data from HDF5 data set.
- `h5readatt` — Read attribute from HDF5 group or data set
- `h5write` — Write to HDF5 data set
- `h5writeatt` — Write HDF5 attribute to group or data set

## **Compatibility Considerations**

The new high-level HDF5 functions have the following compatibility considerations with the existing high-level HDF5 functions.

- `hdf5read` is not recommended. Use `h5read` instead.
- `hdf5write` is not recommended. Use `h5write` instead.
- `hdf5info` is not recommended. Use `h5info` instead.

## **Two New Functions Added to CDFLIB Package**

The MATLAB interface to the CDF library now includes the following new functions.

- `cdflib.setFileBackward` — Sets the backward compatibility mode. If the backward mode is set to on, files created can be read by clients using version 2.7 of the library
- `cdflib.getFileBackward` — Return the current backward compatibility mode setting.

## HDF4 Functions Grouped into Packages

The MATLAB HDF4 low-level functions and HDF EOS functions are now grouped into three new packages:

- `matlab.io.hdf4.sd` — access to more than 50 functions in the HDF library SD interface
- `matlab.io.hdfeos.grid` — access to more than 50 functions in the HDF-EOS library grid interface
- `matlab.io.hdfeos.swath` — access to more than 50 functions in the HDF-EOS library swath interface

For example, MATLAB previously included one function, `hdfsd`, that you used to call all the routines in the HDF library SD interface. Now, the new package `matlab.io.hdf4.sd` contains many individual functions that correspond to routines in the HDF SD Interface C library.

## FITSREAD Function Now Supports Data Subsetting

The MATLAB `fitsread` function now supports data subsetting by using several new options: `PixelRegion`, `TableColumns`, and `TableRows`.

## Unrecognized Name Warning Changed to Error

In earlier releases of MATLAB, a statement in which an unrecognized (e.g., misspelled) name immediately follows a function name and dot (`.`) results in a warning instead of an error. Here is the format this type of statement:

```
functionname.unrecognizedname
```

The following example shows such a statement case and part of the resulting warning:

```
simulink.badname
```

```
Warning: Direct access of structure fields returned by a
function call (e.g., call to simulink) is not allowed. ...
```

In addition to being misleading, handling this case with merely a warning also allows the function (`simulink`, in this case) to execute, regardless of the fact that the name to the right of the dot is invalid.

In MATLAB version 7.12 (R2011a), this type of statement throws an error. The text of the error message is:

```
simulink.badname

??? Undefined variable "simulink" or function "simulink.badname".
```

### **Compatibility Considerations**

Any such statements in your code that have only generated a warning message in past releases will now throw an error. Any such error that is not caught and handled appropriately will terminate the function in which it occurs. MathWorks recommends that you replace the unrecognized name to the right of the dot with the correct name.

This change also affects the output of the `lasterror` function if you attempt to access any field value (`message`, `identifier`, or `stack`) directly. Earlier versions of MATLAB generate a warning:

```
lasterror.message
Warning: Direct access of structure fields returned by a
function call (e.g., call to lasterror) is not allowed. ...
```

This and future versions throw an error:

```
lasterror.message
??? Undefined variable "lasterror" or function "lasterror.message".
```

### **Regular Expressions Support Zero-Length Matching**

Regular expressions in MATLAB now support successful zero-length matching. See the documentation on Empty Match mode in the description of Command Options for the `regexp` function.



## Growing Arrays Is Faster

This release improves the performance of growing an array in the trailing dimension if that array has not been preallocated.

## Error Checking Improved

MATLAB provides more effective error checking and returns new error messages in the following cases.

### Nonstatic Method

A reference to a class method using the class name is valid only in cases where the method is static. Therefore, code of the form:

```
ClassName.ordinaryMethod
```

Where `ordinaryMethod` is not a static method of the class `ClassName`, previously returned the error: `MATLAB:class:InvalidStaticMethod`.

This code now returns the error:

```
MATLAB:subscripting:classHasNoPropertyOrMethod
```

### Nonexistent Method Name

A reference to a nonexistent method name:

```
obj.badName
```

Where `badName` is not a method defined by the class of `obj`, previously returned the error: `MATLAB:noSuchMethodOrField`.

This code now returns the error:

```
MATLAB:subscripting:classHasNoPropertyOrMethod.
```

## Compatibility Considerations

Code that checks for the specific errors previously returned must be updated to check for the new errors.

## Functions and Function Elements Being Removed

<b>Function or Function Element Name</b>	<b>What Happens When You Use the Function or Element?</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
<code>audioplayer(BufferLength)</code>	No effect (no-op)		Remove all instances of <code>BufferLength</code> .
<code>audioplayer(NumberOfBuffers)</code>	No effect (no-op)		Remove all instances of <code>NumberOfBuffers</code> .
<code>hdf5read</code>	Still runs	<code>h5read</code>	Replace with preferred function.
<code>hdf5write</code>	Still runs	<code>h5write</code>	Replace with preferred function.
<code>hdf5info</code>	Still runs	<code>h5info</code>	Replace with referred function.

## Graphics and 3-D Visualization, MATLAB Version 7.12 (R2011a)

New features and changes introduced in Version 7.12 (R2011a) are:

### Plot Catalog with a New Look, More Plots, and Diagnostics

The Plot Catalog GUI now offers a wider variety of plotting options. Its appearance and operation closely resemble the Plot Selector, with short descriptions of each graph type and a search box. It also categorizes graphs by type and by toolbox, and lets you designate personal Favorites (the top menu category). Access the Plot Catalog from the Plotting Tools Figure Palette, the bottom of the Plot Selector menu in the Workspace Browser, the Variable Editor, and various context menus. For a demonstration, see this instructional video.

This table lists the differences and similarities between the Plot Catalog and the Plot Selector.

	<b>Plot Catalog</b>	<b>Plot Selector</b>	<b>Both</b>
<b>Window Characteristics</b>	Opens in its own window, which persists until you close it	Opens in a pop-up window that closes after it loses focus	Show icons for plot types with descriptions and Favorites.
<b>Help for Plot Types</b>	Displays partial help listings from reference pages in a resizable pane within its window	Opens a popup help window with reference information when you hover	Provide the same help content and a <b>More Help</b> hyperlink to the Help Browser.

	<b>Plot Catalog</b>	<b>Plot Selector</b>	<b>Both</b>
<b>Plot Creation and Validation</b>	Provides a field in which you can type variable names or expressions to plot	Plots variables you select in the Workspace browser or Variable Editor	Validate input variables and display diagnoses of incorrect or insufficient inputs.
<b>Plot Destination</b>	Current figure or new figure	Current figure	Create figure, if none exists

Previously, the Plot Catalog did not validate input data. If you provided incorrect inputs for a plotting function, it attempted to use them, resulting in an incorrect plot or errors. Now, the Plot Catalog provides the same diagnostics as the Plot Selector. When you type workspace variable names into the Variables box on top, the tool validates variable types, sizes, and ordering. If validation fails, the Plot Selector provides a diagnostic message in its Help pane and does not let you run the plotting function.

In addition to MATLAB plots, the Plot Catalog offers the same set of choices as the Plot Selector. The choices include most types of plots from the following toolboxes (if installed):

- Control System Toolbox™
- Curve Fitting Toolbox™
- DSP System Toolbox™
- Financial Toolbox™
- Image Processing Toolbox™
- Mapping Toolbox™
- Signal Processing Toolbox™
- Statistics Toolbox™
- System Identification Toolbox™

For more information about the Plot Catalog, see “Creating Graphs with the Plot Catalog”. For information on the Plot Selector, see “Enhanced Plot Selector Simplifies Data Display” on page 150.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.12 (R2011a)

The changes introduced in this version are:

- “Do not Repopulate Menus on the Mac from Inside Their Callbacks” on page 50
- “Functions and Function Elements Being Removed” on page 51

### **Do not Repopulate Menus on the Mac from Inside Their Callbacks**

In R2011a, figures display their menus on the Mac screen menubar instead of across the top of figure windows. Prior to R2011a, GUIs could create dynamic menus using callbacks that completely deleted, and then repopulated the contents of menus. But on a Mac, running a GUI with a menu whose callback changes all items in this manner can result in the display of a blank menu (no items). The unexpected behavior only happens when a `uimenu` callback deletes all submenus (child `uimenu` components) and repopulates the menu with a new set of items at the time the menu opens.

In R2011a, on the Mac platform only, `uimenu` callbacks are no longer able to replace all submenus during menu selection. Note that repopulating some (not all) menu items does not create this issue. However, it is not good programming practice to remove and insert menu items within a menu callback routine.

For more information, see “MATLAB Menus Display at the Top of the Apple Mac Screen” on page 28.

### **Compatibility Considerations**

If you have a `uimenu` callback that *repopulates all of its menu items* when you open that menu, you must change that code if you want it to work on a Mac. For example, your code might be able to remove and install submenus from outside of the callback that handles the menu. The callback can also rename, disable, hide, and show submenus instead of deleting them and creating new ones. The Mac is the only platform impacted by this incompatibility. Menus

on Microsoft Windows, Unix, and Linux continue to behave as they did in previous releases.

## Functions and Function Elements Being Removed

<b>Function or Function Element Name</b>	<b>What Happens When You Use the Function or Element?</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
pagesetupdlg	Warns	printpreview	printpreview provides all functionality and more, except for some unit choices. Update any GUIs that call pagesetupdlg to do page setup.

## External Interfaces/API, MATLAB Version 7.12 (R2011a)

New features and changes introduced in this version are:

- “Changes to Compiler Support” on page 52
- “Changes to Shared Library Compiler Support” on page 53
- “New Support for Features in Microsoft .NET Framework” on page 53

### Changes to Compiler Support

#### New Compiler Support

MATLAB Version 7.12 (R2011a) supports these new compilers for building MEX-files:

##### Linux (64- and 32-Bit) Platforms.

- GNU® gfortran 4.3.x

##### Apple Mac 64-Bit Platforms.

- Apple Xcode 3.2 with gcc 4.2.x

#### Compiler Support To Be Phased Out

Support for the following compilers will be discontinued in a future release, at which time new versions will be supported. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

##### Microsoft Windows 32-Bit Platforms.

- Microsoft Visual Studio 2005 SP1
- Visual C++® 6.0

##### Windows 64-Bit Platforms.

- Microsoft Visual Studio 2005 SP1



## Discontinued Compiler Support

MATLAB no longer supports the following compilers:

### Windows (64- and 32-Bit) Platforms.

- Microsoft Visual Studio 2008 (9.0) Express
- Intel Visual Fortran Version 10.1

### Linux (64- and 32-Bit) Platforms.

- GNU g95 0.90

### Mac 64-Bit Platforms.

- Xcode® 3.1 with gcc 4.0.1

**Compatibility Considerations.** To ensure continued support for building your MEX-files, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

## Changes to Shared Library Compiler Support

In MATLAB Version 7.12 (R2011a), you can use the `loadlibrary` command with any supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

### Compatibility Considerations

You must run `mex -setup` before using the `loadlibrary` command. For information about selecting a compiler, see “Selecting a Compiler on Windows Platforms” or “Selecting a Compiler on UNIX® Platforms”.

## New Support for Features in Microsoft .NET Framework

### Support for .NET System.Enum Objects

MATLAB exposes .NET enumerations as native .NET classes:

- Support for non-Int32 underlying types
- Support for bit-wise `bitand`, `bitnot`, `bitor`, and `bitxor` operators
- Support for invocation of `System.Enum` methods, such as the `HasFlag` method in Framework Version 4.0
- Support for comparison and binary operators `eq`, `ne`, `ge`, `gt`, `le`, and `lt` on enumeration types

See “.NET Enumerations in MATLAB”.

**Compatibility Considerations.** MATLAB displays an error when you use the enumeration command to return arrays of .NET enumeration objects. To read enumeration members into MATLAB arrays, see “Refer to a .NET Enumeration Member”.

MATLAB enumerations no longer inherit from the MATLAB `int32` class.

You cannot create arrays of .NET enumeration objects. For example, if you type:

```
a = [EnumTest.Colors.Red EnumTest.Colors.Blue]
```

MATLAB displays:

```
??? Array formation and indexing are not allowed on .NET objects.
```

To combine members of an enumeration into a MATLAB variable, see [Combining Enumerations into a Single MATLAB Variable](#).

### **Support for Asynchronous .NET Delegate Callback Handling**

You can use delegates to call a synchronous method asynchronously. See “Calling a .NET Method Asynchronously”.

# Version 7.11.1 (R2010bSP1) MATLAB Software

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This table summarizes what's new in Version 7.11.1 (R2010bSP1) .

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	Bug Reports Includes fixes	No



# Version 7.11 (R2010b)

## MATLAB Software

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This table summarizes what's new in Version 7.11 (R2010b).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized under these topics:

- “Desktop Tools and Development Environment, MATLAB Version 7.11 (R2010b)” on page 59
- “Mathematics, MATLAB Version 7.11 (R2010b)” on page 66
- “Data Analysis, MATLAB Version 7.11 (R2010b)” on page 69
- “Programming, MATLAB Version 7.11 (R2010b)” on page 72
- “Graphics and 3-D Visualization, MATLAB Version 7.11 (R2010b)” on page 81
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.11 (R2010b)” on page 82

- “External Interfaces/API, MATLAB Version 7.11 (R2010b)” on page 84

## **Desktop Tools and Development Environment, MATLAB Version 7.11 (R2010b)**

New features and changes introduced in this version are:

- “Desktop” on page 59
- “Help Browser” on page 61
- “Managing Files” on page 62
- “Editing and Debugging MATLAB Code” on page 63

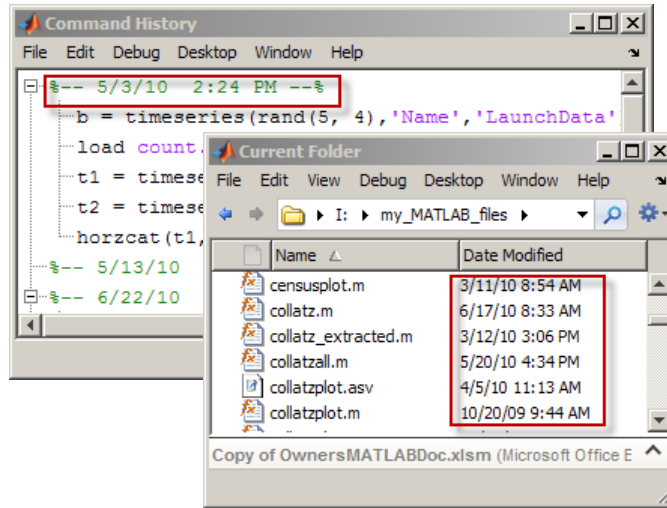
### **Desktop**

New desktop features and changes introduced in Version 7.11 (R2010b) are:

- “Ability to Customize the Date Format ” on page 59
- “Keyboard Shortcuts Preferences Integrated with File Exchange” on page 60
- “MATLAB Provides Enumeration Template” on page 60

### **Ability to Customize the Date Format**

You can now customize the date format that the Current Folder browser and the Command History window use to display dates, such as the dates indicated here:



Previously, the date format in both of these tools was M/d/yy (for instance, 6/4/90 for June 4, 1990) and you could not change it. Now, both tools use the operating system short date format. For details, see “Customizing the Column Display”.

## Keyboard Shortcuts Preferences Integrated with File Exchange

MATLAB now integrates keyboard shortcuts preferences with File Exchange. You can access File Exchange directly from the Keyboard Shortcuts Preferences panel and find:

- MATLAB keyboard shortcuts available in Version 7.9 (R2009a) and earlier releases
- Keyboard shortcuts sets created by other MATLAB users

For details, see “Download Keyboard Shortcut Settings Files from File Exchange”.

## MATLAB Provides Enumeration Template

MATLAB provides a template for classes that define enumerations. Enumeration classes enable you to define a fixed set of names representing



a particular type of value. Choose **File > New > Enumeration**. For more information, see “Enumerations”.

## Help Browser

- “New Language Preference for Help Browser” on page 61
- “Accessing Product Documentation in Japanese” on page 61

### New Language Preference for Help Browser

If your system displays documentation in Japanese, you can use the **Language** panel in the Help Preferences dialog to instruct the Help browser to display documentation in English instead of Japanese. You can toggle between languages with the preference panel, enabling you to revert to Japanese at any time. The option changes the language used in the Help Browser and for GUI context-sensitive help, but it does *not* affect the language appearing in menus or elsewhere in products.

For example, the `help` command still provides help in Japanese after you switch the Help browser to English. The **Language** preference is available only when the system locale is Japanese and the Japanese documentation is installed. If the documentation for a product is not translated, the Help Browser displays the English documentation for it no matter how you set the preference.

### Accessing Product Documentation in Japanese

MathWorks usually provides Japanese translations of product documentation about 2 months after new versions of products first ship. When you install the new version of a product, the *previous version* of translated documentation is installed in most cases.

To read the most current documentation for your release, switch the Help browser to English. After the translations of the latest documentation are available, you can download and install them in your products. At that time, you can find a link to download the latest translated documentation on the Japanese documentation start page.

## Managing Files

New features and changes introduced in Version 7.11 (R2010b) are:

- “Ability to View Zip File Contents in Current Folder Browser” on page 62
- “Details Panel of Current Folder Provides Preview of Graphic Files” on page 62
- “Current Folder Browser Indicates Whether File Is Modified in Editor” on page 62
- “Compare Zip Files and Folders” on page 63
- “Enhanced Comparison Tool” on page 63

### Ability to View Zip File Contents in Current Folder Browser

Using the Current Folder browser, you can now view the files in a zip file without having to extract them. This feature enables you to:

- Confirm the contents of a newly created zip file
- Selectively open items from a zip file
- Add or remove files from the zip file

For details, see “Creating and Managing Zip File Archives” or watch the Zip File Browsing video demo.

### Details Panel of Current Folder Provides Preview of Graphic Files

Now, when you select a JPEG, JPG, BMP, WBMP, PNG, or GIF image in the Current Folder browser, the Details panel displays a thumbnail of the image and lists its width and height in pixels. For more information, see “Viewing File Details Without Opening Files” or watch the File Preview Enhancements video demo.

### Current Folder Browser Indicates Whether File Is Modified in Editor

Now, if you modify a file in the Editor, but have not yet saved the changes, the Current Folder browser indicates the file state. An asterisk (\*) appears next to the name of such a file in the Current Folder browser. In addition,

when you select such a file in the Current Folder browser, the detail panel reflects the modified file, not the file saved on disk. This feature is useful when you are creating zip files and want to be sure that all files included in the archive are saved and up-to-date. For details see, “Viewing File Details Without Opening Files” or watch the File Preview Enhancements video demo.

## Compare Zip Files and Folders

You can now compare any combinations of zip files, folders, and Simulink Manifests with the Comparison Tool. Right-click files or folders in the Current Folder browser and choose **Compare Selected Files/Folders**, or **Compare Against > Choose**.

For details, see Comparing Folders and Zip Files.

## Enhanced Comparison Tool

The Comparison Tool now provides the following capabilities:

- Select what type of comparison to run from a list of possible comparison options, e.g., text, binary or XML comparison.
- Enhanced MAT-file comparisons now include size, data type and change summary.
- New option to ignore whitespace changes in text comparisons.

For details, see “Comparing Files and Folders”.

## Editing and Debugging MATLAB Code

New Desktop features and changes introduced in Version 7.11 (R2010b) are:

- “Ability to Save File to Backup Without Closing That File” on page 64
- “Enhanced Comment Wrapping” on page 64
- “Variable and Function Highlighting” on page 64
- “Options for Setting Current Folder and Search Path Available from Editor Context Menu” on page 65
- “Open As Text Option” on page 65

## Ability to Save File to Backup Without Closing That File

You now can save a file that is open in the Editor to a backup file. Select **File > Save Backup**, and then specify a backup file name. The file that is active in the Editor when you perform the save operation remains active. If changes to the active file prove problematic, you can use the backup file to return to a known state or to compare with the active file. This comparison can help you determine where errors exist.

For information on other save options, see “Save Files”.

## Enhanced Comment Wrapping

The enhanced ability to wrap MATLAB comments includes:

- Wrapping an entire block of comments by selecting **File > Wrap Comments**.

There is no need to select the block of comments first. For details see “Wrap Comments Manually”.

- Specifying where you want column counting to begin.

For example, if you indent comments, you can specify that you want the maximum width of comments to be 75 columns from the start of a comment, rather than from the start of a line. To set **Comment formatting** preferences, select **File > Preferences > Editor/Debugger > Language**.

## Variable and Function Highlighting

The Editor now presents variables that are not local variables in a teal blue color, by default. Also by default, when you click a function or local variable, the Editor highlights it and all other references to it in a sky blue color. As demonstrated in the Variable and Subfunction Highlighting video demo, this feature makes it easier to:

- Find unintentional reuses of a variable within a nested function  
For details, see “Avoid Variable and Function Scoping Problems”.
- Navigate through a file from function to function reference or variable to variable reference

For details, see “Navigate to a Specific Location”.

- Search a file for a particular function or variable name

For details, see “Find and Replace Functions or Variables in the Current File”.

To disable or change the colors that the Editor uses for variable and function highlighting, see “Use Automatic Function and Variable Highlighting”.

### **Options for Setting Current Folder and Search Path Available from Editor Context Menu**

When multiple documents are open and docked in the Editor, you can right-click the document tab, and then from the context menu choose:

- **Change Current Folder to *folder-name***
- **Add *folder-name* to Search Path or Remove *folder-name* from Search Path**, respectively
- **Locate on Disk**

This option locates the document in your operating system file browser. It is not available on Linux platforms.

- **Copy Full Path to Clipboard**

### **Open As Text Option**

You can use the **File > Open as Text** option to open a file in the Editor as a text file, even if the file type is associated with another application or tool. This feature is useful, for example, if you import a tab-delimited data file (.dat) into the workspace, and then you find you want to add a data point. For details, see “Open Existing Files”.

## Mathematics, MATLAB Version 7.11 (R2010b)

New features and changes introduced in this version are:

- “64-Bit Integer Arithmetic” on page 66
- “New Utility Functions: isrow, iscolumn, ismatrix” on page 66
- “Output Option for Point Distances in DelaunayTri/nearestNeighbor Method” on page 66
- “Changes to convhull and delaunay Functions” on page 67
- “Performance Enhancements” on page 67
- “Functions Being Removed” on page 67
- “optimset Errors for Optimization Toolbox Options” on page 68
- “atan Warning Being Removed” on page 68

### 64-Bit Integer Arithmetic

Core MATLAB arithmetic functions now support `int64` and `uint64` classes natively. Functions added are `plus (+)`, `minus (-)`, `uminus (-)`, `times (.*)`, `rdivide ./`, `ldivide (.\)`, `power (.^)`, `rem`, `mod`, `bitcmp`, `any`, `all`, `sum`, `diff`, `colon (:)`, `sign`, `accumarray`, and `bsxfun`.

### New Utility Functions: isrow, iscolumn, ismatrix

New functions `isrow`, `iscolumn`, and `ismatrix` provide basic information about inputs.

### Output Option for Point Distances in DelaunayTri/nearestNeighbor Method

The two-output form of `DelaunayTri/nearestNeighbor` returns the corresponding Euclidean distances between the query points and their nearest neighbors.

## Changes to convhull and delaunay Functions

The functions `convhull` and `delaunay` now support 3-D input in either multiple vector or multicolumn matrix format. In addition, the `simplify` option for `convhull` provides the option of removing vertices that do not contribute to the area or volume of the convex hull.

## Performance Enhancements

- Three-Output Form of `svd`

The three-output form of `svd` displays significantly enhanced performance.

- Sparse Column Assignment

The assignment of elements into multiple columns of a MATLAB sparse matrix displays significantly enhanced performance.

- Trigonometric Functions

All degree-based trigonometric functions (`sind`, `cosd`, `tand`, `cotd`, `secd`, `cscd`) and their inverses (`asind`, `acosd`, `atand`, `acotd`, `asecd`, `acscd`) display significantly enhanced performance.

## Functions Being Removed

Function Name	What Happens When You Use This Function	Use This Function Instead	Compatibility Considerations
<code>bessel</code>	Warns	<code>besselj</code>	Replace all instances of <code>bessel</code> with <code>besselj</code> .
<code>erfcov</code>	Errors	<code>erf</code> , <code>erfc</code> , <code>erfcx</code> , <code>erfinv</code> , or <code>erfcinv</code>	See the function reference pages for the individual functions.
<code>intwarning</code>	Errors	None	Remove all instances of <code>intwarning</code> from your code.

## **optimset Errors for Optimization Toolbox Options**

If you do not have an Optimization Toolbox™ license, and you set an `optimset` option for a solver that is only available in Optimization Toolbox, `optimset` errors. Previously, `optimset` would warn, not error, and ignore the option.

### **Compatibility Considerations**

Change your code to set only those options that apply to your solver: `fminbnd`, `fminsearch`, `fzero`, or `lsqnonneg`.

## **atan Warning Being Removed**

When you use `atan(1i)` and `atan(-1i)` you no longer get a warning.

### **Compatibility Considerations**

Remove instances of the warning ID `MATLAB:atan:singularity` from your code.



## Data Analysis, MATLAB Version 7.11 (R2010b)

### Arrays of Time Series Objects Supported

MATLAB now enables you to create arrays of `timeseries` objects. In Version 7.10 (R2010a) and before, `timeseries` objects behaved as arrays, but some array behavior was overridden.

### Compatibility Considerations

---

**Note** It is likely that this change is important to you *only* if you write code that uses `timeseries` objects.

---

In Version 7.11 (R2010b), all of the overridden behaviors for the functions listed in the table that follows are removed. The behavior of these functions on `timeseries` objects is the built-in behavior for arrays of objects. Think of a `timeseries` object as a single object that you can concatenate into an array of objects. Do not think of each `timeseries` itself as an array.

### Functions Being Modified

Function or Function Element Name	What Happens When You Use the Function or Element?	Use This Instead	Compatibility Considerations
<code>horzcat</code>	No error or warning	Not applicable	You can now use <code>horzcat</code> with <code>timeseries</code> objects.
<code>isempty</code> ( <code>timeseries</code> )	No error or warning	<code>timeseries.Length==0</code>	Replace code such as: <code>isempty(ts)</code> with: <code>ts.Length == 0</code>

Function or Function Element Name	What Happens When You Use the Function or Element?	Use This Instead	Compatibility Considerations
<code>length</code> (timeseries)	No error or warning	<code>timeseries.Length</code> property	Replace code such as: <code>length(ts)</code> with: <code>ts.Length</code>
<code>size</code> (timeseries)	No error or warning	<code>[timeseries.Length 1]</code>	Replace code such as: <code>size(ts)</code> with: <code>[ts.Length 1]</code>
<code>subsref</code>	No error or warning	<code>getsamples</code>	Replace code such as: <code>t3 = t1(1:3);</code> with: <code>getsamples(t1,1:3);</code>
<code>vertcat</code> (timeseries)	May return Index exceeds matrix dimension error	<code>append</code>	Replace code such as: <code>t3 = [t1;t2];</code> with <code>t3 = append(t1,t2);</code>

## Example of timeseries Object Concatenation

Suppose you concatenate the following two `timeseries` objects:

```
t1 = timeseries(ones(5,1),0:4);
t2 = timeseries(zeros(5,1),5:9);
```

In R2010a, the following syntax created a single `timeseries` object, `t3`, with 10 samples spanning the time range 0-9. The first 5 samples derived from `t1` and the last 5 samples derived from `t2`. The size of the `timeseries`, `t3`, was `[10 1]` and its length was 10, because `t3` has 10 samples.

```
t3 = [t1;t2]
t3 = vertcat(t1,t2)
```

Now, the same syntax creates a 2x1 array comprising the two `timeseries` objects `t1` and `t2`. Its size is `[2 1]`, and its length is 2 because the array has two rows, each a single `timeseries`.

## Programming, MATLAB Version 7.11 (R2010b)

New features and changes introduced in this version are

- “arrayfun Accepts Array of Objects” on page 72
- “Comparing Object Arrays that Contain NaNs” on page 72
- “Functions isa and islogical Now Consistent for Objects” on page 73
- “New Enumeration Classes” on page 73
- “New Functionality for Writing Video Files” on page 74
- “mmreader Renamed VideoReader” on page 74
- “New HDF4 Functions” on page 74
- “New HDF5 Low-Level Functions” on page 75
- “New netCDF Functions” on page 75
- “Upgrades to Scientific File Format Libraries” on page 76
- “New Examples in Command Line Help” on page 76
- “imread and imwrite Can Now Handle N-channel J2C JPEG 2000 Files” on page 77
- “csvread and csvwrite Will Not Be Removed” on page 77
- “sprintf and fprintf Print Null Characters in Strings” on page 77
- “Functions and Function Elements Being Removed” on page 78
- “MATLAB Did Not Pass struct to loadobj When Property Was Deleted” on page 79

### **arrayfun Accepts Array of Objects**

The `arrayfun` function now accepts an array of objects as an input. The output can also be a scalar object, as long as the `UniformOutput` flag is set to `false`.

### **Comparing Object Arrays that Contain NaNs**

In previous versions of MATLAB, calling `isequalwiththequalnans` to compare identical arrays of objects that contain one or more NaN (Not a Number)

values incorrectly returned `false`. Similarly, calling `isequal` to compare identical arrays of objects that contain NaNs incorrectly returned `true`.

In MATLAB version 7.11, these functions return the expected values (`true` for `isequalwithqualnans`, and `false` for `isequal`) when used to compare object arrays.

### **Compatibility Considerations**

Program code that compares object arrays that may contain NaNs should be examined to ensure correct behavior.

## **Functions `isa` and `islogical` Now Consistent for Objects**

In earlier releases of MATLAB, the following statements returned different results for objects with a base class of `logical`:

```
isa(obj, 'logical')
islogical(obj)
```

In MATLAB version 7.11, both of these statements return `true` if the class of `obj` is derived from `logical`, and `false` otherwise.

### **Compatibility Considerations**

If you have program code that calls either `isa` or `islogical` on objects with a base class of `logical`, it is advisable to verify that this new behavior does not adversely affect the execution of the program.

## **New Enumeration Classes**

MATLAB provides support for classes that define enumerations. Enumeration classes enable you to define a fixed set of names representing a particular type of value. See “Enumerations” for more information.

Use this link to watch a video that introduces enumerations: [Play demo](#)

## New Functionality for Writing Video Files

The new `VideoWriter` function allows you to create AVI files on all platforms. As an improvement over the `avifile` function, `VideoWriter` can create files larger than 2 GB. For more information, watch this video demo or see the `VideoWriter` reference page.

## `mmreader` Renamed `VideoReader`

For consistency with the new `VideoWriter` class, the `mmreader` class is now called `VideoReader`. A new function, `VideoReader`, replaces the `mmreader` function. `VideoReader` and `mmreader` return identical `VideoReader` objects for the same input file.

## Compatibility Considerations

Replace all instances of `mmreader` with `VideoReader`. The two functions use identical syntax. When requesting help or documentation for methods from the command line, or calling a static method such as `getFileFormats`, use the new `VideoReader` class name (such as `doc VideoReader/read`). You do not need to change any calls to the `read`, `get`, or `set` methods.

Previously, the R2010a Release Notes recommended replacing instances of `aviinfo` with `mmreader` and `get`, and instances of `aviread` with `mmreader` and `read`. Instead, replace `aviinfo` with `VideoReader` and `get`, and replace `aviread` with `VideoReader` and `read`.

## New HDF4 Functions

The MATLAB interface to the grid functions in the HDF-EOS C library, `hdfgd`, now includes three new syntaxes. These syntaxes convert grid coordinates to longitude and latitude values.

- `ij2ll`
- `ll2ij`
- `rs2ll`

To view the help for these functions, use the `help` command at the MATLAB prompt, as in the following example:

```
help hdfgd
```

## **New HDF5 Low-Level Functions**

The MATLAB interfaces to the HDF5 C library now include the following new functions.

- `H5A.open_by_idx`
- `H5A.open_by_name`
- `H5D.get_access_plist`
- `H5I.is_valid`
- `H5L.copy`
- `H5L.get_name_by_idx`
- `H5P.set_chunk_cache`
- `H5P.get_chunk_cache`
- `H5P.set_copy_object`
- `H5P.get_copy_object`

To view the help for these functions, use the `help` command at the MATLAB prompt, as in the following example:

```
help H5P.get_copy_object
```

## **New netCDF Functions**

The MATLAB interface to the netCDF C library now includes the following new functions.

- `netcdf.inqFormat`
- `netcdf.inqUnlimDims`
- `netcdf.defGrp`
- `netcdf.inqNcid`
- `netcdf.inqGrps`
- `netcdf.inqVarIDs`

- `netcdf.inqDimIDs`
- `netcdf.inqGrpName`
- `netcdf.inqGrpNameFull`
- `netcdf.inqGrpParent`
- `netcdf.defVarChunking`
- `netcdf.defVarDeflate`
- `netcdf.defVarFill`
- `netcdf.defVarFletcher32`
- `netcdf.inqVarChunking`
- `netcdf.inqVarDeflate`
- `netcdf.inqVarFill`
- `netcdf.inqVarFletcher32`

To view the help for these functions, use the `help` command at the MATLAB prompt, as in the following example:

```
help netcdf.inqVarFletcher32
```

## Upgrades to Scientific File Format Libraries

The following table lists upgrades to scientific file format libraries used by MATLAB.

Library	Version Upgrade
netCDF	3.6.2 to 4.0.1

## New Examples in Command Line Help

The MATLAB command line help for the HDF5, netCDF, and CDF low-level functions now includes hundreds of new examples.



## **imread and imwrite Can Now Handle N-channel J2C JPEG 2000 Files**

You can now use the `imread` and `imwrite` functions with n-channel J2C JPEG 2000 files.

J2C files are raw JPEG2000 codestreams that usually have the file extension `.j2c` or `.j2k`. J2C files don't contain color space, color palette, capture resolution, display resolution and vendor specific information.

In previous releases, if you use `imread` to read a 4-channel J2C file, you receive a warning that some channels may be ignored and `imread` returns a 3-channel image. Now, `imread` returns a 4-channel image and does not issue a warning.

If you try to write a 4-channel J2C file in previous releases, `imwrite` issues an error. In this release, `imwrite` creates the 4-channel J2C file.

## **csvread and csvwrite Will Not Be Removed**

The R2010a Release Notes originally stated that `csvread` and `csvwrite` would be removed in a future release. As of R2010b, there are no plans to remove these functions.

## **sprintf and fprintf Print Null Characters in Strings**

In previous releases, calls to `sprintf` or `fprintf` that printed strings using the `%s` qualifier prematurely terminated strings that contained null characters. For example, this code

```
sprintf('%s', ['foo' 0 'bar'])
```

returned

```
ans =  
foo
```

The same code now returns

```
ans =  
foo bar
```

## Compatibility Considerations

If you do not want to print the entire contents of strings that contain null characters, test the string for these characters (for example, using the `isstrprop` function).

## Functions and Function Elements Being Removed

Function or Function Element Name	What Happens When You Use the Function or Element?	Use This Instead	Compatibility Considerations
<code>fileparts</code> return argument 4 (file version)	Warns, returns empty fourth argument	No alternative; file versions are unsupported	Call <code>fileparts</code> with three return arguments: <code>[path_name file_name file_extension]</code>
<code>mmreader</code>	Still runs, creates a <code>VideoReader</code> object	<code>VideoReader</code>	Replace all existing instances of <code>mmreader</code> with <code>VideoReader</code> .
<code>wavplay</code>	Still runs	<code>audioplayer</code> and <code>play</code>	Replace all existing instances of <code>wavplay</code> with <code>audioplayer</code> and <code>play</code> .
<code>wavrecord</code>	Still runs	<code>audiorecorder</code> and <code>record</code>	Replace all existing instances of <code>wavrecord</code> with <code>audiorecorder</code> and <code>record</code> .
<code>wk1finfo</code>	Warns		Remove all instances of <code>wk1finfo</code> . Get information about Excel® spreadsheets with <code>xlsfinfo</code> .

Function or Function Element Name	What Happens When You Use the Function or Element?	Use This Instead	Compatibility Considerations
wk1read	Warns		Remove all instances of wk1read. Read Excel spreadsheets with xlsread.
wk1write	Warns		Remove all instances of wk1write. Write to Excel spreadsheets with xlswrite.

## MATLAB Did Not Pass struct to loadobj When Property Was Deleted

If you save an object having a property value equal to the property's default value, and then that property is removed from the class definition, MATLAB did not detect the fact that the property was missing. In this case, MATLAB did not build a struct to pass to loadobj. MATLAB now returns a struct in this case.

### Compatibility Considerations

If you rely on the following situation *not* returning a struct to loadobj, you need to update your code:

- You saved an object using the save command
- This object had a property that was set to the default value defined by the class at the time of saving
- The property set to its default value at save time is subsequently removed from the class definition
- You load the property and expect the load operation to return an object (it should return a struct because the class definition has changed in a way the load cannot create the object).

- Your `loadobj` method is not prepared to use the returned `struct` to create an object

You must implement a `loadobj` method to recreate the object using the current class definition.

See “Saving and Loading Objects” for more information.

## Graphics and 3-D Visualization, MATLAB Version 7.11 (R2010b)

New features and changes introduced in this version are:

- “Print `-dmfile` and `printdmfile` Issue Deprecation Warnings” on page 81
- “The `saveas` `'mmat'` option Issues a Deprecation Warning” on page 81
- “The `movie` Function is No Longer a Built-in Function” on page 81

### **Print `-dmfile` and `printdmfile` Issue Deprecation Warnings**

The `dmfile` `print` command option and the `printdmfile` function now issue a deprecation warning. Both option and function will be removed in a subsequent release. The `dmfile` option and the `printdmfile` function were used by GUIDE.

### **The `saveas` `'mmat'` option Issues a Deprecation Warning**

The `saveas` function now issues a deprecation warning if you use the `'mmat'` format option. This option will be removed in a subsequent release. This option was used with GUIDE.

### **The `movie` Function is No Longer a Built-in Function**

The `movie` function is no longer a built-in function. Therefore, you cannot call `movie` from the `builtin` function. `movie` syntax remains the same.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.11 (R2010b)

The changes introduced in this version are:

### Functions and Function Elements Being Removed

The `uitabgroup` and `uitab` GUI components are undocumented features that provide tabbed panels to GUIs that you create programmatically. The current method of calling these functions and some of their properties will change in a future release. MathWorks has never supported their use. However, if your MATLAB code includes these functions, read the following information:

Function or Function Element Name	What Happens When You Use the Function or Element?	Use This Instead	Compatibility Considerations
<code>uitabgroup('v0',...)</code> <code>uitab('v0',...)</code>	Warns	<code>uitabgroup(...)</code> <code>uitab(...)</code>	Using the 'v0' argument generates a warning, but the object is created.
<code>uitabgroup</code> property <code>SelectionChangeFcn</code>	Not recommended	<code>SelectionChangeCallback</code>	Event data for the callback is still a struct with fields <code>OldValue</code> and <code>NewValue</code> but those values are now <code>uitab</code> handles, not <code>uitab</code> indexes.
<code>uitabgroup</code> property <code>SelectedIndex</code>	Not recommended	<code>SelectedTab</code>	Both properties still exist, but replace instances of <code>SelectedIndex</code> (an integer tab index) with <code>SelectedTab</code> (a handle to a <code>uitab</code> object).

<b>Function or Function Element Name</b>	<b>What Happens When You Use the Function or Element?</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
uitabgroup property BackgroundColor	Not recommended	no replacement	uitabgroup now uses the default uicontrol background color.
uitabgroup event SelectionChanged	Errors	SelectionChange event	Event name changed to be consistent with other components. Event data is still a struct with fields OldValue and NewValue but those values are now uitab handles, not uitab indexes.

You should update any code that you maintain which uses the undocumented `uitabgroup` and `uitab` functions to conform to the new standards, as described in the “`uitab` and `uitabgroup` Migration Document”. Existing code for these functions is unlikely to work in R2010b going forward.

## External Interfaces/API, MATLAB Version 7.11 (R2010b)

New features and changes introduced in this version are:

- “Changes to Compiler Support” on page 84
- “-largeArrayDims Option to MEX Will Become Default in Next Release of MATLAB” on page 85
- “MEX Function -argcheck Option Removed” on page 86
- “MEX Function -inline Option Removed” on page 87
- “New Support for Features in Microsoft .NET Framework” on page 87
- “New COM Data Type Support” on page 87

### Changes to Compiler Support

#### New Compiler Support

MATLAB Version 7.11 (R2010b) supports these new compilers for building MEX-files:

#### Microsoft Windows (64- and 32-Bit) Platforms.

- Microsoft Visual Studio 2010 (10.0) Professional
- Microsoft Visual Studio 2010 (10.0) Express

#### Linux (64- and 32-Bit) Platforms.

- GNU gcc Version 4.3.x

#### Compiler Support to Be Phased Out

Support for the following compilers will be discontinued in a future release, at which time new versions will be supported. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

#### Windows (64- and 32-Bit) Platforms.

- Intel Visual Fortran Version 10.1



- Microsoft Visual Studio 2005 SP1

### **Discontinued Compiler Support**

MATLAB no longer supports the following compilers:

#### **Windows (64- and 32-Bit) Platforms.**

- Intel C++ Version 9.1

#### **Linux (64- and 32-Bit) Platforms.**

- GNU gcc Version 4.2.3

#### **Apple Macintosh (32-Bit) Platforms.**

- Apple Xcode 3.1 (gcc / g++ Version 4.0.1)
- GNU gfortran Version 4.2.2

**Compatibility Considerations.** To ensure continued support for building your MEX-files, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

### **-largeArrayDims Option to MEX Will Become Default in Next Release of MATLAB**

In the next release of MATLAB, the mex command will change to use the large-array-handling API by default. This means the `-largeArrayDims` option will become the default.

You do not need to make changes to build and run MEX-files with MATLAB Version 7.11 (R2010b).

#### **Compatibility Considerations**

Source for MEX-files built on 64-bit platforms must be updated in order to successfully build and run with the next release of MATLAB. Review your source MEX-files and mex build scripts. For information about migrating your

MEX-files to use the large-array-handling API, see “Upgrading MEX-Files to Use 64-Bit API”.

## MEX Function -argcheck Option Removed

Function Option Name	What Happens When you use the Option?	Compatibility Considerations
mex -argcheck option	Errors	Remove all existing instances of -argcheck in build scripts.

The -argcheck option was a strategy for identifying memory corruption caused by a MEX-file. When you understand the likely causes of memory corruption, you can take preventative measures in your code or use your debugger to identify the source of errors.

If a binary MEX-file causes a segmentation violation or assertion, it means the MEX-file attempted to access protected, read-only, or unallocated memory.

These types of programming errors are sometimes difficult to track down. Segmentation violations do not always occur at the same point as the logical errors that cause them. If a program writes data to an unintended section of memory, an error might not occur until the program reads and interprets the corrupted data. Consequently, a segmentation violation can occur after the MEX-file finishes executing.

One cause of memory corruption is to pass a null pointer to a function. To check for this condition, add code in your MEX-file to check for invalid arguments to MEX Library and MX Matrix Library API functions.

To troubleshoot problems of this nature, run MATLAB within a debugging environment. For more information, see “Debugging C/C++ Language MEX-Files” or “Debugging Fortran Source MEX-Files”.

## MEX Function -inline Option Removed

Function Option Name	What Happens When you use the Option?	Compatibility Considerations
mex -inline option	Errors	Remove all existing instances of -inline in build scripts.

## New Support for Features in Microsoft .NET Framework

MATLAB supports:

- Using “.NET Delegates in MATLAB”.
- “Accessing Microsoft Office Applications with .NET”.
- Using `System.Nullable`, described in “How MATLAB Handles `System.Nullable`”.
- Calling constructors or `NET.invokeGenericMethod` with `ref` or `out` type arguments.
- Calling methods with default arguments  
(`System.Reflection.Missing.Value` is supported.)

## New COM Data Type Support

Support for the following COM data type has been added. See “Handling COM Data in MATLAB Software” for a description of supported data types.

- `VT_I8` — signed `int64`
- `VT_UI8` — unsigned `int64`
- Unsigned integer



# Version 7.10 (R2010a)

## MATLAB Software

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This table summarizes what's new in Version 7.10 (R2010a).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized under these topics:

- “Desktop Tools and Development Environment, MATLAB Version 7.10 (R2010a)” on page 90
- “Mathematics, MATLAB Version 7.10 (R2010a)” on page 99
- “Data Analysis, MATLAB Version 7.10 (R2010a)” on page 105
- “Programming, MATLAB Version 7.10 (R2010a)” on page 107
- “Graphics and 3-D Visualization, MATLAB Version 7.10 (R2010a)” on page 114
- “External Interfaces/API, MATLAB Version 7.10 (R2010a)” on page 115

## Desktop Tools and Development Environment, MATLAB Version 7.10 (R2010a)

New features and changes introduced in this version are organized by these topics:

- “Desktop New Features Video for R2010a” on page 90
- “Startup and Shutdown” on page 90
- “Desktop” on page 90
- “Help Browser” on page 92
- “Managing Files” on page 95
- “Editing and Debugging MATLAB Code” on page 98

### Desktop New Features Video for R2010a

For an overview of the major new features in the MATLAB Desktop Tools and Development Environment area, watch this video demo.

## Startup and Shutdown

### **AUTOMOUNT\_MAP Environment Variable No Longer Used by MATLAB**

On UNIX systems, MATLAB no longer uses the AUTOMOUNT\_MAP environment variable, the path prefix map for automounting. Previously, MATLAB set the value of the variable in `.matlab7.rc`, but you could override this setting using the AUTOMOUNT\_MAP environment variable.

## Desktop

New Desktop features and changes introduced in Version 7.10 (R2010a) are:

- “Enhancements for Managing Keyboard Shortcuts” on page 91
- “Method for Accessing M-Lint Preferences and the M-Lint Report” on page 91
- “Preference for Java Heap Memory” on page 91

## Enhancements for Managing Keyboard Shortcuts

Keyboard shortcuts now provide the following:


- “Ability to List a Set of Keyboard Shortcuts in a Text Editor” on page 91
- “Ability to Remove Keyboard Shortcuts Sets” on page 91
- “Ability to Compare Sets of Keyboard Shortcuts” on page 91

**Ability to List a Set of Keyboard Shortcuts in a Text Editor.** You can now list all of the keyboard shortcuts for a given set in a text editor. For details, see “List All Keyboard Shortcuts in a Set”.

**Ability to Remove Keyboard Shortcuts Sets.** You can now remove keyboard shortcut sets that you created or imported. For details, see “Delete a Set of Keyboard Shortcuts”.

**Ability to Compare Sets of Keyboard Shortcuts.** You can now compare one set of keyboard shortcuts to another. This enables you, for example, to see what is different between the current Windows default keyboard shortcuts and those that were the defaults in MATLAB Version 7.8 (R2009a) and earlier. For details, see “Compare Sets of Keyboard Shortcuts”.

## Method for Accessing M-Lint Preferences and the M-Lint Report

The **M-Lint Preferences** is now renamed the **Code Analyzer Preference**. Therefore, to set preferences for analyzing MATLAB code, select **File > Preferences > Code Analyzer**. Similarly, the M-Lint Report is now renamed the Code Analyzer Report. To access this report, click the Actions button  in the Current Folder browser, and then select **Reports > Code Analyzer Report**. The names of the `mlint` and `mlintrpt` functions are unchanged.

## Preference for Java Heap Memory

A new preference setting allows you to adjust the amount of memory that MATLAB allocates for storing Java objects. Insufficient memory for these objects results in `OutOfMemory` errors. For more information, see “Java Heap Memory Preferences”.

**Compatibility Considerations.** Technical Solution 1-18I2C specifies a procedure for creating a text file named `java.opts` to set the Java heap size. Do not use both the new MATLAB preference and a `java.opts` file to adjust the heap size.

## Help Browser

- “Improved Instructions and Examples for Adding Help and Demos to the Help Browser” on page 92
- “New Search Hints” on page 93
- “Search History Persists Between Sessions” on page 93
- “Hide Search Results Previews” on page 94
- “docopt Function Removed” on page 94

For a demonstration of previous enhancements to the Help browser, watch the Help Browser Enhancements video.

## Improved Instructions and Examples for Adding Help and Demos to the Help Browser

The MATLAB documentation now includes more details about how to display your own HTML help and demos. In particular, the documentation clarifies procedures for setting up files and folders and provides three new XML file templates that you can inspect, copy, and modify.

The documentation also adds a new complete working example, called the Upslope Area Toolbox. Documentation for the toolbox includes a getting started guide, user guide, function reference pages, and release notes. The documentation set is generated entirely from MATLAB script files (also provided), using the `publish` command. The example folder includes all program files for the toolbox. However, certain routines require Image Processing Toolbox for full functionality.

You can also find the Upslope Area Toolbox on the MATLAB Central File Exchange. For more information about techniques and algorithms the toolbox uses, see the set of articles about it on this MATLAB Central blog: <http://blogs.mathworks.com/steve/category/upslope-area>.



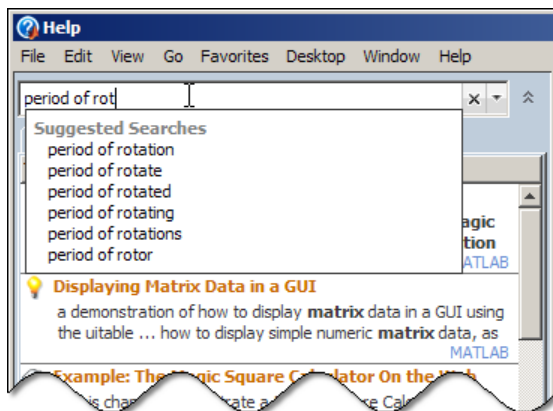
Find the updated documentation in “Create Help and Demos”. For details, XML templates, and examples, see these subsections:

- “Add Documentation to the Help Browser”
- “Add Demos to the Help Browser”

You can view the Upslope Toolbox documentation example in the Help browser now by clicking here, which places its folder on the search path.

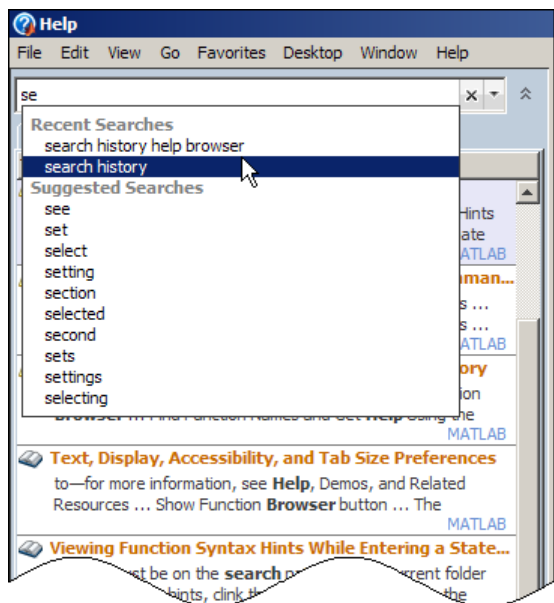
## New Search Hints

The Help Browser now provides suggestions for search terms as you type in the search field. These hints save you time and can suggest words and phrases you might not have thought of but that can be useful in making a search. The hints display as a drop-down menu that changes its contents as you type. The following illustration shows the appearance of the menu.



## Search History Persists Between Sessions

The Help browser can now recall searches you have made across MATLAB sessions. Your search history and search hints display as separate lists in a drop-down pane as you type in the search field. Select **Show Search History** from the pop-up menu to the right of the search field, or press the down arrow key in the search field when it is empty. The following illustration shows search history and search hints as they appear when you enter search terms.



## Hide Search Results Previews

You can now choose not to see the one-line descriptions of search results called *previews*. To toggle all previews off, right-click in the Search Results pane of the Help Navigator and choose **Hide Previews**. The search results listing is smaller so you can scan it quickly when you hide previews. To see previews again, right-click in the Search Results pane, and choose **Show Previews**. See “Searching for Documentation and Demos”.

## docopt Function Removed

This release obsoletes the `docopt` function, which specified which system Web browser to use on UNIX platforms. This function has been removed. You can instead specify a default system browser in your preferences. For more information, see “New System Browser Preference Instead of `docopt.m` for MATLAB on UNIX Platforms” on page 164.

**Compatibility Considerations.** If you call `docopt` in your startup file or some other program file, remove the call to avoid receiving an error.

## Managing Files

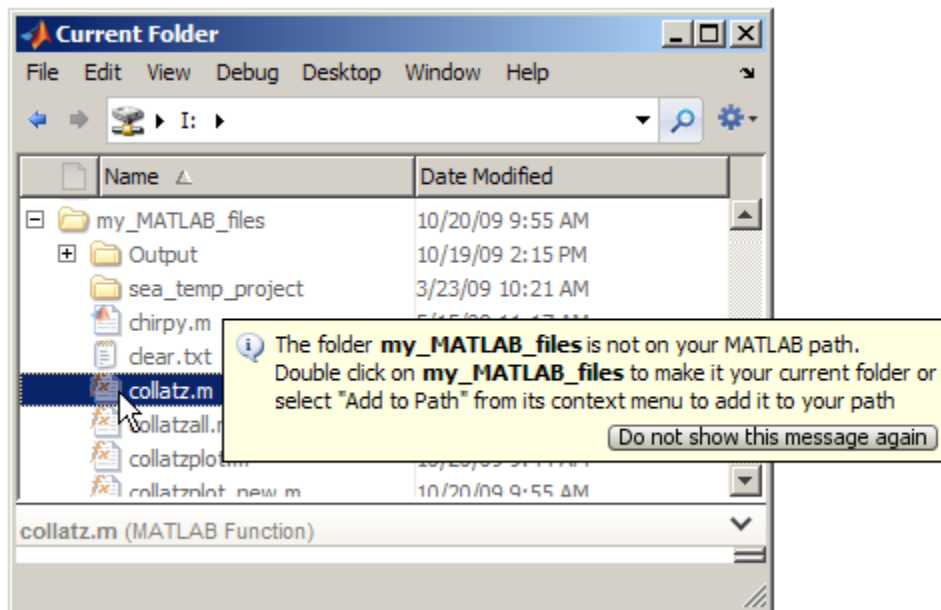
- “Create and Expand Zipped Archives from Current Folder Browser” on page 95
- “Visual Aids for Identifying Files Inaccessible to MATLAB” on page 95
- “Ability to Remove Folders and Subfolders from the Path Using the Current Folder Browser” on page 96
- “Enhancements for File and Folder Comparisons” on page 97

### Create and Expand Zipped Archives from Current Folder Browser

Effective this release, the capability to create and expand, and archive .zip files has been added to the Current Folder browser. Select files and folders in the Current Folder browser, then right click, and choose **Create Zip File** to create an archive. The archive appears in the current folder. You can expand an archive in the same way. For details, see “Creating and Managing Zip File Archives”.

### Visual Aids for Identifying Files Inaccessible to MATLAB

This release changes the default behavior of the Current Folder browser. The Current Folder browser now dims files that are inaccessible to MATLAB to indicate their unavailability. A tooltip provides an explanation.



You can also customize or disable this feature. For more information, see “Preferences for the Current Folder Browser” and “Viewing Files and Folders on the Search Path”.

## Ability to Remove Folders and Subfolders from the Path Using the Current Folder Browser

You can now remove folders from the MATLAB path as follows:

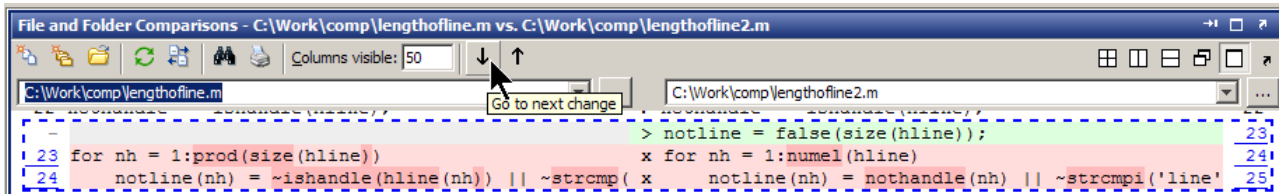
- 1 In the Current Folder browser, right-click the folder you want to remove from the path.
- 2 From the context menu, select **Remove from Path**, and then select **Selected Folders** or **Selected Folder and Subfolders**.

If the default preferences for the Current Folder **Path indication** option are set, the folders you removed now appear dimmed in the Current Folder browser. For more information, see “Preferences for the Current Folder Browser” and “Removing Folders from the Search Path”.

## Enhancements for File and Folder Comparisons

This release enhances the File and Folder Comparisons tool to improve the usability of comparisons between text files and folders.

File comparisons now highlight changes within lines and provide new toolbar buttons for stepping through differences, as the following figure shows.



Folder comparisons now provides results that are sortable by name, type, size, timestamp, or change summary. Click column headers to sort the table. Click **compare** links to explore differences between files and folders. The following example shows results sorted by **Type**.

### Comparing folder curvefitting vs. folder curvefitting2

Left file list	Contents of folder C:\Work\comp\curvefitting
Right file list	Contents of folder C:\Work\comp\curvefitting2

Click on a column header to sort the table

		In left list (folder curvefitting)		In right list (folder curvefitting2)		
Type	File Name	Size (bytes)	Last Modified Date	Size (bytes)	Last Modified Date	Change Summary
ASV file	lengthofline.asv ( <a href="#">open</a> )	(not in this list)		2403	2009-11-16 15:24:45	added
HTML file	manifest_report.html ( <a href="#">open</a> )	2410	2008-11-27 14:24:50	(not in this list)		removed
MAT file	splinetool.mat ( <a href="#">open</a> )	1720	2001-08-20 18:14:12	(not in this list)		removed
M file	csapidem.m ( <a href="#">open</a> )	(not in this list)		15038	2009-01-08 13:56:28	added
M file	lengthofline.m (open: <a href="#">left</a>   <a href="#">right</a> )	2405	2009-11-12 16:56:52	2408	2009-11-16 15:25:14	contents changed ( <a href="#">compare</a> )
TXT file	kdm.txt ( <a href="#">open</a> )	(not in this list)		1367	2008-10-03 11:13:37	added
XML file	report.xml ( <a href="#">open</a> )	(not in this list)		4868	2008-09-11 17:53:32	added
folder	curvefit	-	2009-11-16 15:18:38	-	2009-11-16 15:20:08	contents changed ( <a href="#">compare</a> )
folder	cftoolgui	-	2009-11-16 15:18:38	-	2009-11-16 15:20:04	contents changed ( <a href="#">compare</a> )
folder	demosearch	-	2009-11-16 15:19:13	-	2009-11-16 15:19:44	identical

When you compare subfolders with many files, now the tool continues analysis in the background, reporting progress. You can now skip items or cancel as you review this analysis.

For more information, see “Comparing Files and Folders”.

## **Editing and Debugging MATLAB Code**



New features and changes introduced in Version 7.10 (R2010a) are:

- “Tab Completion for Local Variables and Functions” on page 98
- “Toolbar Buttons for Stepping Through Code Cells Without Evaluating Code” on page 98

### **Tab Completion for Local Variables and Functions**

The MATLAB Editor now supports tab completion for local variable and subfunction names within MATLAB program files. For more information, see “Complete Names in the Editor Using the Tab Key”.

### **Toolbar Buttons for Stepping Through Code Cells Without Evaluating Code**

This release provides two New Cell Mode toolbar buttons, Next Cell  and Previous Cell . You can use these buttons to step through cells in the Editor without evaluating the code within the cells. By default, these buttons do not appear on the Cell Mode toolbar.

For more information, see “Navigate Among Code Cells in a File”.

## Mathematics, MATLAB Version 7.10 (R2010a)

New features and changes introduced in this version are:

- “New Multithreading Capability” on page 99
- “Performance Improvements” on page 99
- “Changes To qr” on page 100
- “Change in Indexing for Sparse Matrix Input” on page 100
- “Improved Error Checking for Sparse Functions” on page 100
- “Computational Geometry Functions Being Changed” on page 101
- “Computational Geometry Functions Being Removed” on page 101
- “lsqnonneg No Longer Uses Optional Starting Point Input” on page 101
- “Function erfcore Removed” on page 102
- “Integer Warning Messages Removed” on page 102
- “Function intwarning Being Removed” on page 102
- “atan Warning Being Removed” on page 103
- “nextpow2 Returns Output the Same Size As Input” on page 103
- “Math Libraries Not Available to Build MEX-Files with Compaq Visual Fortran” on page 117

### New Multithreading Capability

MATLAB’s new multithreading capability now includes:

- `fft` for long vectors
- The two-input form of `conv2`
- Integer conversion and arithmetic

### Performance Improvements

MATLAB features significant performance improvements for:

- Sparse matrix indexed assignment and deletion

- `bvp4c` and `bvp5c` for sparse problems
- `sortrows`
- `mrdivide (/)`
- `convn`
- `histc`

## Changes To `qr`

The factorization routine in `qr` produces an upper triangular matrix, `R`. Now this matrix always contains real and nonnegative diagonal elements. In previous releases, the diagonal of `R` could contain complex and negative elements.

## Compatibility Considerations

`R` now contains only real, nonnegative diagonal elements. The QR factorization is not unique, so the answer is still correct.

## Change in Indexing for Sparse Matrix Input

Now subscripted reference into a sparse matrix always returns a sparse matrix. In previous versions of MATLAB, using a double scalar to index into a sparse matrix resulted in full scalar output.

## Compatibility Considerations

Scalars extricated from sparse matrices are no longer full. If you previously used the output with a function that does not support sparse input, you now need to update your code. For a list of the functions that do not support sparse matrices, see “Functions That Do Not Support Sparse Matrices” in the MATLAB Mathematics documentation.

## Improved Error Checking for Sparse Functions

Functions that erroneously accepted N-D arrays and returned reshaped sparse 2-D outputs no longer accept full N-D inputs and now return an error. The functions affected are:

- `spones`, `spfun`, `sprand`, `sprandn`, and `sprandsym`



- `cat`, `horzcat`, and `vertcat`

Also, binary functions that formerly accepted both full N-D inputs along with sparse 2-D inputs and warned about the reshape, now return an error. For example, `ones(2,2,2).*sparse(3)` formerly returned a sparse 2-by-4 matrix along with a warning about the reshape. This code now returns an error.

## Computational Geometry Functions Being Changed

The computational geometry functions `delaunay`, `convhull`, `griddata`, `voronoi`, `delaunay3`, `griddata3` no longer use the options arguments.

### Compatibility Considerations

Use of the options arguments to `delaunay`, `convhull`, `griddata`, and `voronoi` now throws a warning.

## Computational Geometry Functions Being Removed

The functions `griddata3`, `delaunay3`, `dsearch`, `tsearch` will be removed in a future release. Use of these functions now throws a warning.

Function Name	Use This Method Instead
<code>griddata3</code>	<code>TriScatteredInterp</code>
<code>dsearch</code>	<code>DelaunayTri/nearestNeighbor</code>
<code>tsearch</code>	<code>DelaunayTri/pointLocation</code>
<code>delaunay3</code>	<code>DelaunayTri</code>

### Compatibility Considerations

Update your code to use the `DelaunayTri` and `TriScatteredInterp` computational geometry classes .

## lsqnonneg No Longer Uses Optional Starting Point Input

The `lsqnonneg` solver no longer uses the optional input `x0` as a starting point.

## Compatibility Considerations

If you give a starting point `x0`, MATLAB issues a warning. Also, `lsqnonneg` ignores `x0`, and instead uses a starting point of a vector of zeros.

## Function `erfc` Removed

Support for the `erfc` function has been removed. Use of `erfc` now results in the following error message:

```
ERFCORE will be removed in a future release.  
Use ERF, ERFC, ERFCX, ERFINV, or ERFCINV instead.
```

## Compatibility Considerations

Replace `erfc` with `erf`, `erfc`, `erfcx`, `erfinv`, or `erfcinv`. See the function reference pages for the individual error functions.

## Integer Warning Messages Removed

These warning messages for integer math and conversion have been removed:

- `MATLAB:intConvertNaN`
- `MATLAB:intConvertNonIntVal`
- `MATLAB:intConvertOverflow`
- `MATLAB:intMathOverflow`

## Compatibility Considerations

The warning messages for integer math and conversion are no longer available. Remove these warning IDs from your code.

## Function `intwarning` Being Removed

The `intwarning` function will be removed in a future release. Use of `intwarning` now throws a warning:

```
Warning: All four integer warnings are removed.  
INTWARNING will be removed in a future release.
```

## Compatibility Considerations

The warnings previously thrown when you used `intwarning` on are now removed. Remove all instances of `intwarning` from your code.

## atan Warning Being Removed

The warning thrown when you use `atan(i)` and `atan(-i)` will be removed. Currently, the warning message is:

```
Warning: Singularity in ATAN. This warning will be
removed in a future release.Consider using DBSTOP
IF NANINF when debugging.
```

## Compatibility Considerations

Remove instances of the warning ID `MATLAB:atan:singularity` from your code.

## nextpow2 Returns Output the Same Size As Input

In previous releases, `nextpow2` with a vector input `v` returned `nextpow2(length(v))`. Now `nextpow2(v)` returns a vector the same size as the input.

## Compatibility Considerations

If you require the old behavior, replace instances of `nextpow2` with `nextpow2(length(v))`.

## Math Libraries Not Available to Build MEX-Files with Compaq Visual Fortran

MATLAB no longer provides the `libdflapack.dll` and `libdfblas.dll` math libraries for building Fortran MEX-files with a Compaq® Visual Fortran compiler.

## **Compatibility Considerations**

If you distribute MEX-files that call BLAS or LAPACK functions built on a Compaq Visual Fortran compiler, you must also distribute the `libdflapack.dll` and `libdfblas.dll` library files.

If MATLAB displays errors when loading a MEX-file and the Dependency Walker indicates missing `libdflapack.dll` and/or `libdfblas.dll` libraries, contact the MEX-file vendor for copies of the libraries. The third-party product, Dependency Walker, is available from the Web site <http://www.dependencywalker.com/>.

## Data Analysis, MATLAB Version 7.10 (R2010a)

New features and changes introduced in this version are:

- “Operations on Timeseries Objects Sometimes Warn About the `isTimeFirst` Property” on page 105
- “Time Series Time Vectors Can Now Contain Duplicate Sample Times” on page 106

### Operations on Timeseries Objects Sometimes Warn About the `isTimeFirst` Property

In a future release, the `timeseries` Boolean property `isTimeFirst` will behave differently. If the value is `true`, this property indicates that the time vector is the *first* dimension of a time series. If the value is `false`, the time vector is the *last* dimension of a time series. In this release, you receive a warning that certain settings of `isTimeFirst` will not be valid in a future release. The warning indicates that for 3-D or N-D data, time must be the *last* dimension, while 2-D time series data can have time as the first dimension.

### Compatibility Considerations

You can receive a warning when:

- Constructing a time series object with three or more dimensions without specifying a time vector. In a future release, MATLAB will calculate a value of the `isTimeFirst` property that can differ from the value it currently calculates.
- Changing the data of a time series to data of a different dimensionality. In a future release MATLAB will calculate a value of the `isTimeFirst` property that differs from the value it currently calculates.
- Directly setting the `isTimeFirst` property for a time series to a value that will be invalid in a future release.

The warning does not affect how you can use time series data in this release. It is intended to inform you that the behavior of `isTimeFirst` will change in a future release. If you receive a warning about `isTimeFirst`, you can use the `timeseries` method `migrateistimefirst` to correct the problem. For information type

`help timeseries/migrateistimefirst`

in the Command Window.

## **Time Series Time Vectors Can Now Contain Duplicate Sample Times**

Starting with this release, a vector containing sample times can have duplicate times in contiguous positions. Previously, time vectors needed to increase monotonically and duplicated time values generated errors. This condition is now relaxed, such that time vectors must be *nondecreasing*. Interpolation of time series can produce duplicated times if the input to the interpolation method contained duplicate time samples. For more information, see the `timeseries` reference documentation.

## Programming, MATLAB Version 7.10 (R2010a)

New features and changes introduced in this version are

- “Subscribing Into Function Return Values” on page 107
- “New Constructor for Map Containers” on page 108
- “Function Handle Access to Private and Protected Methods” on page 108
- “Listing Video File Formats Supported by mmreader” on page 108
- “unzip Preserves Write Attribute of Files” on page 109
- “New Package Provides Access to low-level CDF API Routines” on page 109
- “Upgrades to Scientific File Format Libraries” on page 109
- “Tiff Class Enhancements” on page 109
- “MATLAB Adds Support for Creating JPEG 2000 Files” on page 110
- “Sealed No Longer Listed as meta.property Class Property” on page 110
- “Functions and Function Elements Being Removed” on page 110

### Subscribing Into Function Return Values

If you have a function, such as the following, that returns a struct array:

```
function structOut = getStruct
    structOut = struct('fieldA', 5, 'fieldB', 10);
```

it is no longer valid to access fields of the structure by directly dot indexing the function's return value, as shown here:

```
getStruct.fieldA
```

Instead, you should first assign the returned structure to a variable, and then dot index the variable:

```
s = getStruct;
s.fieldA
ans =
    5
```

This type of field access has never been allowed within function code, and this change causes scripts and command line statements to be in agreement with function rules.

### **Compatibility Considerations**

If you have scripts that employ this type of dot indexing, they will now throw an error. Replace this unsupported style of dot indexing with the style shown above.

### **New Constructor for Map Containers**

The following command constructs an empty `containers.Map` object that uses a key type of `kType`, and a value type of `vType`:

```
M = containers.Map('KeyType', kType, 'ValueType', vType)
```

See the `containers.Map` function reference page for more information.

### **Function Handle Access to Private and Protected Methods**

When creating a function handle inside a method of a class, the function is resolved using the permissions of that method. When MATLAB invokes the function handle, it does so using the permissions of the class. This gives MATLAB the same access as the locations where the function handle was created, including access to private and protected methods accessible to that class.

See “Function Handle Access to Private and Protected Methods” on page 108 for more information.

### **Listing Video File Formats Supported by `mmreader`**

The new `mmreader.getFileFormats` method returns a list of the formats that `mmreader` supports. The list of formats is static for Windows and UNIX systems, but dynamic on Macintosh systems. For more information, see the `getFileFormats` reference page.



## unzip Preserves Write Attribute of Files

In previous releases, for files archived using WinZip® software, the unzip function set the file write attribute of extracted files to read only. Starting with R2010a, unzip preserves the original attribute.

## New Package Provides Access to low-level CDF API Routines

MATLAB has included high-level routines for accessing Common Data Format (CDF) files: `cdfread`, `cdfwrite`, and `cdfinfo`. However, the CDF API is so large, these functions cannot satisfy every need. To solve this, MATLAB now includes a new package, called `CDFlib`, that provides access to dozens of the functions in the CDF API. Using these low-level functions, you can create CDF files and populate them with variables and attributes using the CDF library, version 3.3.0.

## Upgrades to Scientific File Format Libraries

The following table lists upgrades to several scientific file format libraries used by MATLAB.

Library	Version Upgrade
CDF	3.2.1 to 3.3.0
HDF5	1.8.1 to 1.8.3
HDF4	4.2.r1 to 4.2.r4
HDF-EOS2	2.8 to 2.16
PNG	1.2.8 to 1.2.39

## Tiff Class Enhancements

The Tiff class includes the following enhancements.

### Tiff Class Now Excludes Reading OJPEG Format Image Data

You can no longer read YCbCr OJPEG ("old-style" JPEG compression) TIFF images. The Tiff object was not intended to work with OJPEG data but

some TIFF files contain data in this format. Reading this data could cause LibTIFF to terminate.

**Compatibility Considerations.** To read OJPEG image data, use the `imread` function. Note that the `imread` function transforms the image data into the RGB colorspace.

### Additional Reading and Writing Capabilities

The `Tiff` class includes the following additional capabilities:

- Writing image data that use 16-bit colormaps (palettes)
- Reading and writing LogL and LogLUV High Dynamic Range (HDR) images. To write a LogL or LogLUV image, you must use the new `SGILogDataFmt` property.

### MATLAB Adds Support for Creating JPEG 2000 Files

You can now use the `imwrite` function to create a JPEG 2000 file and write data to the file. The `imwrite` function supports format-specific parameters that let you specify the mode, compression ratio, and other characteristics.

### Sealed No Longer Listed as meta.property Class Property

While class properties do not have a `Sealed` attribute, the `meta.property` class listed `Sealed` as a property. `Sealed` is no longer listed as a `meta.property` class property.

### Functions and Function Elements Being Removed

Function or Function Element Name	What Happens When You Use the	Use This Instead	Compatibility Considerations

	<b>Function or Element?</b>		
aviread	Warns	mmreader and read	Replace all existing instances of aviread with mmreader and read.
aviinfo	Warns	mmreader and get	Replace all existing instances of aviinfo with mmreader and get.
exifread	Warns	imfinfo	Replace all existing instances of exifread with imfinfo
fileparts	Still runs, <i>versn</i> output is always empty ('')		Remove all references to a fourth output ( <i>versn</i> ) from fileparts.
intwarning	Warns	warning	If you use intwarning, you can implement the same warnings using the warning function.
isstr	Still runs	ischar	Replace all existing instances of isstr with ischar.
mmreader.isPlatformSupported	Warns, always returns true		For a platform-specific list of supported video file formats, use getFileFormats.
setstr	Still runs	char	Replace all existing instances of setstr with char.
str2mat	Still runs	char	Replace all existing instances of str2mat with char.

Function or Function Element Name	What Happens When You Use the Function or Element?	Use This Instead	Compatibility Considerations
stread	Still runs	textscan	<p>Replace all existing instances of <code>stread</code> with <code>textscan</code>. For example, replace</p> <pre>[a,b,c] = stread(...) with</pre> <pre>C = textscan(...)</pre> <pre>[a,b,c] = deal(C{:})</pre> <p>Unlike <code>stread</code>, the <code>textscan</code> function converts numeric values to the specified data type, allowing preservation of integer types.</p>
strvcat	Still runs	char	<p>Replace all existing instances of <code>strvcat</code> with <code>char</code>. Unlike <code>strvcat</code>, the <code>char</code> function does <i>not</i> ignore empty strings.</p>
textread	Still runs	textscan	<p>Replace all existing instances of <code>textread</code> with <code>textscan</code>, similar to <code>stread</code>. Open and close files with <code>fopen</code> and <code>fclose</code>.</p>
wk1finfo	Still runs		<p>Remove all instances of <code>wk1finfo</code>. Get information about Excel spreadsheets with <code>xlsfinfo</code>.</p>

<b>Function or Function Element Name</b>	<b>What Happens When You Use the Function or Element?</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
<code>wk1read</code>	Still runs		Remove all instances of <code>wk1read</code> . Read Excel spreadsheets with <code>xlsread</code> .
<code>wk1write</code>	Still runs		Remove all instances of <code>wk1write</code> . Write to Excel spreadsheets with <code>xlswrite</code> .

## **Graphics and 3-D Visualization, MATLAB Version 7.10 (R2010a)**

New features and changes introduced in this version are:

### **Plot Selector Supports Additional Toolboxes**

The Plot Selector, which was upgraded in Version 7.9 (R2009b), now also generates plots for display functions in the following toolboxes:

- Curve Fitting Toolbox
- DSP System Toolbox
- Image Processing Toolbox
- Signal Processing Toolbox

The Plot Selector continues to support display functions for Control System Toolbox, Financial Toolbox, and Statistics Toolbox. You must have installed a toolbox to display data using its plotting functions. For more information about the Plot Selector, see “Enhanced Plot Selector Simplifies Data Display” on page 150.

## External Interfaces/API, MATLAB Version 7.10 (R2010a)

New features and changes introduced in this version are:

- “Changes to Compiler Support” on page 115
- “Changes to Libraries on Linux with Debian Systems” on page 117
- “Math Libraries Not Available to Build MEX-Files with Compaq Visual Fortran” on page 117
- “Cannot Create MEX-Files with DLL File Extension” on page 117
- “-largeArrayDims Option to MEX Will Become Default in Next Release of MATLAB” on page 118

### Changes to Compiler Support

#### New Compiler Support

MATLAB Version 7.10 (R2010a) supports these new compilers for building MEX-files:

#### Windows (32-Bit) Platforms.

- Intel C++ Version 11.1
- Intel Visual Fortran Compiler Professional Edition for Windows Version 11.1, installed with Microsoft Visual Studio 2008 Shell. This product is bundled.
- Intel Visual Fortran Compiler Professional Edition for Windows Version 11.1 and Microsoft Visual Studio 2008 SP1 Professional Edition. Separate products.
- Open Watcom Version 1.8

#### Windows (64-Bit) Platforms.

- Intel C++ Version 11.1
- Intel Visual Fortran Compiler Professional Edition for Windows Version 11.1, installed with Microsoft Visual Studio 2008 Shell. This product is bundled.

- Intel Visual Fortran Compiler Professional Edition for Windows Version 11.1 and Microsoft Visual Studio 2008 SP1 Professional Edition. Separate products.

### **Compiler Support to Be Phased Out**

Support for the following compilers will be discontinued in a future release, at which time new versions will be supported. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

#### **Windows (32-Bit) Platforms.**

- Intel Visual Fortran Version 10.1
- Intel C++ Version 9.1

#### **Windows (64-Bit) Platforms.**

- Intel Visual Fortran Version 10.1
- Intel C++ Version 9.1

### **Discontinued Compiler Support**

MATLAB no longer supports the following compilers:

#### **Windows (32-Bit) Platforms.**

- Open Watcom Version 1.7
- Microsoft Visual Studio .NET 2003 Version 7.1

#### **Solaris™ SPARC® (64-Bit) Platforms.**

- Sun™ Studio 11 cc / CC Version 5.8
- Sun Studio 11 f90 Version 8.2

**Compatibility Considerations.** To ensure continued support for building your MEX-files, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.



## Changes to Libraries on Linux with Debian Systems

If you run MATLAB Version 7.10 (R2010a) on a Linux with Debian® system, you must use Debian 5, as indicated on the Platforms & Requirements Web page.

MEX-files created with MATLAB Version 7.2 (R2006a) or earlier depend on the `libstdc++.so.5` library. Debian 5 does not include this library. MATLAB running on Linux platforms with Debian 5 cannot load these pre-R2006a MEX-files.

### Compatibility Considerations

You cannot run MEX-files created with MATLAB R2006a or earlier on Linux with Debian 5. Recompile these files on a system with Debian 5.

## Math Libraries Not Available to Build MEX-Files with Compaq Visual Fortran

MATLAB no longer provides the `libdflapack.dll` and `libdfblas.dll` math libraries for building Fortran MEX-files with a Compaq Visual Fortran compiler.

### Compatibility Considerations

If you distribute MEX-files that call BLAS or LAPACK functions built on a Compaq Visual Fortran compiler, you must also distribute the `libdflapack.dll` and `libdfblas.dll` library files.

If MATLAB displays errors when loading a MEX-file and the Dependency Walker indicates missing `libdflapack.dll` and/or `libdfblas.dll` libraries, contact the MEX-file vendor for copies of the libraries. The third-party product, Dependency Walker, is available from the Web site <http://www.dependencywalker.com/>.

## Cannot Create MEX-Files with DLL File Extension

On Windows 32-bit platforms, support for MEX-files with a `.dll` file extension is being phased out. Use the `.mexw32` extension instead.

MATLAB Version 7.10 will continue to execute .dll MEX-files, but future versions of MATLAB will not support the .dll extension. You can no longer use the `mex` function `-output` switch to create MEX-files with a .dll extension. If you enter a command such as:

```
mex myfile.c -output newfile.dll
```

MATLAB creates the MEX-file `newfile.mexw32` and displays a warning message.

For more information about MEX-files with .dll extensions, see “Running MEX-Files with .DLL File Extensions on Windows 32-bit Platforms”.

### **Compatibility Considerations**

Recompile MEX-files with .dll file extensions. Update MATLAB scripts or `makefiles` that explicitly specify .dll extensions for compiled MEX-files.

If you use MEX-files with a .dll extension from a third-party source, contact that vendor to get a recompiled version, referring to these release notes.

### **-largeArrayDims Option to MEX Will Become Default in Next Release of MATLAB**

In the next release of MATLAB, the default `mex` command will change to use the large-array-handling API. This means the `-largeArrayDims` option will become the default.

You do not need to make changes to build and run MEX-files with MATLAB Version 7.10 (R2010a).

### **Compatibility Considerations**

Source for MEX-files built on 64-bit platforms must be updated in order to successfully build and run with the next release of MATLAB. Review your source MEX-files and `mex` build scripts. For information about migrating your MEX-files to use the large-array-handling API, “Upgrading MEX-Files to Use 64-Bit API”.

# Version 7.9.1 (R2009bSP1) MATLAB Software

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This table summarizes what's new in Version 7.9.1 (R2009bSP1).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are as follows:

The version number of the MATLAB® Compiler™ Runtime (MCR) in release R2009bSP1 is different from the MCR version number in release R2009b. For details about MCR version numbers and corresponding MATLAB releases, see <http://www.mathworks.com/support/solutions/en/data/1-4GSNCF/?solution=1-4GS>



# Version 7.9 (R2009b)

## MATLAB Software

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This table summarizes what's new in Version 7.9 (R2009b).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized under these topics:

- “Desktop Tools and Development Environment, MATLAB Version 7.9 (R2009b)” on page 123
- “Mathematics, MATLAB Version 7.9 (R2009b)” on page 138
- “Data Analysis, MATLAB Version 7.9 (R2009b)” on page 141
- “Programming, MATLAB Version 7.9 (R2009b)” on page 142
- “Graphics and 3-D Visualization, MATLAB Version 7.9 (R2009b)” on page 150
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.9 (R2009b)” on page 155

- “External Interfaces/API, MATLAB Version 7.9 (R2009b)” on page 157

## Desktop Tools and Development Environment, MATLAB Version 7.9 (R2009b)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 123
- “Desktop” on page 124
- “Help Browser” on page 126
- “Workspace and Variable Editor” on page 131
- “Managing Files” on page 131
- “File Exchange Desktop Tool — Find and Get Files Created by Other Users” on page 134
- “Editing and Debugging MATLAB Code Files” on page 135
- “Publishing MATLAB Code Files to PDF Output Format” on page 136
- “Internationalization” on page 136

### Startup and Shutdown

#### Changes to `-nodisplay` and `-noFigureWindows` Startup Options

When you start MATLAB using `-nodisplay` (UNIX) or `-noFigureWindows` (Microsoft Windows) startup options, running a built-in GUI (predefined dialog boxes) generates this warning:

```
This functionality is no longer supported under  
the nodisplay and -noFigureWindows startup options.
```

If the GUI is modal, MATLAB execution suspends, and you need to type **Ctrl+C** for the Command Window prompt to reappear.

This change affects predefined dialog boxes, such as `dialog`, `msgbox`, `printpreview`, `uigetfile`, `uisetcolor`, `waitfor`, `waitbar`, and more. For a list of predefined dialog boxes, see [Predefined Dialog Boxes](#). For more information on startup options, see the `matlab` (UNIX) and `matlab` (Windows) reference pages, respectively.

In a future release, instead of a warning, MATLAB will generate an error when you use such a dialog box under the `-nodisplay` or `-noFigureWindows` options.

**Compatibility Considerations.** To avoid generating the warning, start MATLAB without the `-nodisplay` or `-noFigureWindows` startup options. To avoid warnings while continuing to use these startup options, remove the code that is now producing the warnings.

### **Changes to Memory Manager Startup Options**

Version 7.9 removes support for the `-memmgr` and `-check_malloc` command line arguments and the `MATLAB_MEM_MGR` environment variable.

**Compatibility Considerations.** MATLAB ignores any memory manager options.

## **Desktop**

New features and changes introduced in Version 7.9 (R2009b) are:

- “Ability to Customize Keyboard Shortcuts” on page 124
- “Ability to Set Fonts Preferences for Extended M-Lint Messages and Function Browser” on page 126
- “Save Files from MATLAB Web Browser” on page 126

### **Ability to Customize Keyboard Shortcuts**

MATLAB supports customizing keyboard shortcuts for desktop tools. Press combinations of keyboard keys to perform a desktop action, instead of using the mouse to select items from menus. For example, press **Ctrl+N** to open a blank file in the Editor.

The ability to customize keyboard shortcuts enables you to:

- Modify keyboard shortcuts across desktop tools on an action-by-action basis.
- Modify keyboard shortcuts to match other applications you use or to match your personal preferences.



- Share your keyboard shortcuts with others, or use shortcuts created by someone else.
- Create keyboard shortcuts for some actions that currently have no shortcut.
- Use your preferred keyboard shortcuts when you use MATLAB on a different system than you typically use.

To customize keyboard shortcuts, choose **File > Preferences > Keyboard > Shortcuts**.

MATLAB does not support customizing keyboard shortcuts for Figure Windows, dialog boxes, or toolboxes. For details, see “Customize Keyboard Shortcuts”. For a video demo, see Customizable Keyboard Shortcuts.

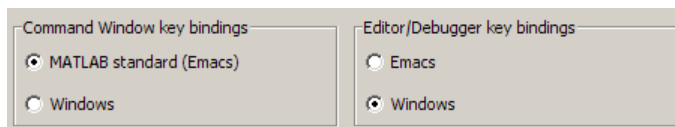
### Compatibility Considerations.

- The method for specifying keyboard shortcuts differs from previous versions.

In previous versions, you chose **File > Preferences > Keyboard**, and then chose a set of key bindings. MATLAB no longer limits your choices to either platform-specific settings or Emacs settings.

- Some default keyboard shortcuts differ from the previous defaults.

Defaults changed in Version 7.9 (R2009b) to be more consistent across the MATLAB desktop. Previously, you could specify keyboard shortcut preferences for the Command Window and Editor/Debugger only. For instance, on Windows, default keyboard shortcut preferences appeared as follows:



To restore keyboard shortcuts that were the default before Version 7.9 (R2009b):

- 1 Choose **File > Preferences > Keyboard > Shortcuts**.

- 2 From the **Active settings** drop-down menu, choose **R2009a Windows Default Set**, **R2009a Macintosh Default Set**, or **R2009a UNIX Default Set**, depending on the platform on which MATLAB is installed.

## Ability to Set Fonts Preferences for Extended M-Lint Messages and Function Browser

MATLAB now supports setting the font size and type for extended M-Lint messages and the function browser. In previous releases, changes to **HTML Proportional Text** affected only the display in the MATLAB Web browser, the Profiler, and Help topics. To set font preferences:

- 1 Choose **File > Preferences > Fonts > Custom**.
- 2 Under **Desktop tools**, select **HTML Proportional Text**, and then specify the font size and type you want to use.

For more information, see “Fonts”.

## Save Files from MATLAB Web Browser

To save a file being displayed in the MATLAB Web Browser, select **File > Save As**.

## Help Browser

For a demonstration of enhancements to the Help browser, watch the Help Browser Enhancements video.

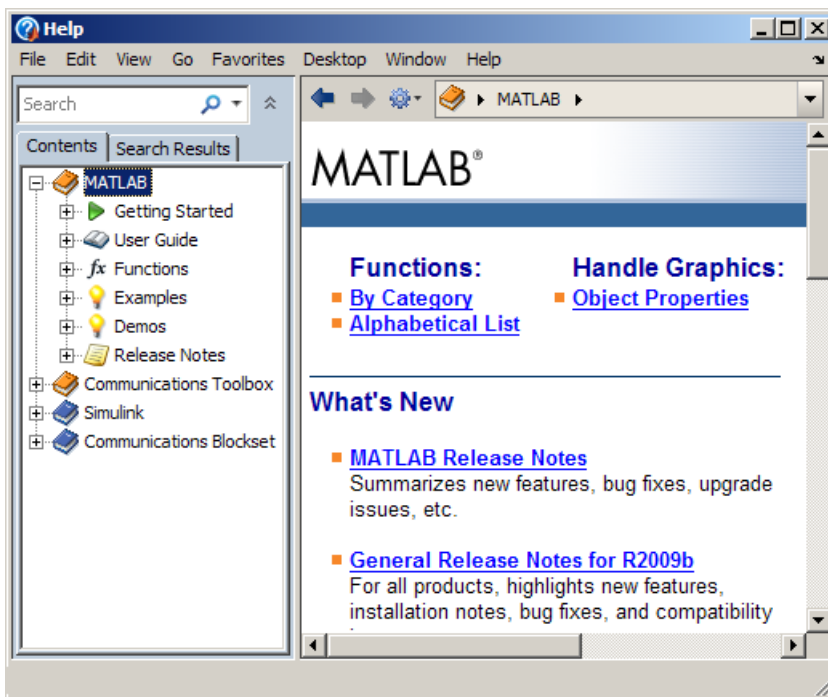
## Improved Contents Listing

When you expand a product in the **Contents** pane, you now can view the following:

- Function and block names with brief descriptions — Expand **Functions** or **Blocks**, and then expand a category to see the list and descriptions. Select a function or block to view its reference page.

If you provide your own HTML help files for use in the Help browser, you now can include **Functions** and **Blocks** entries for your toolbox.

- Demos — Expand **Demos**, and then select a demo from the list to view or run it.



## Enhanced Presentation of Search Results

Each search result includes:

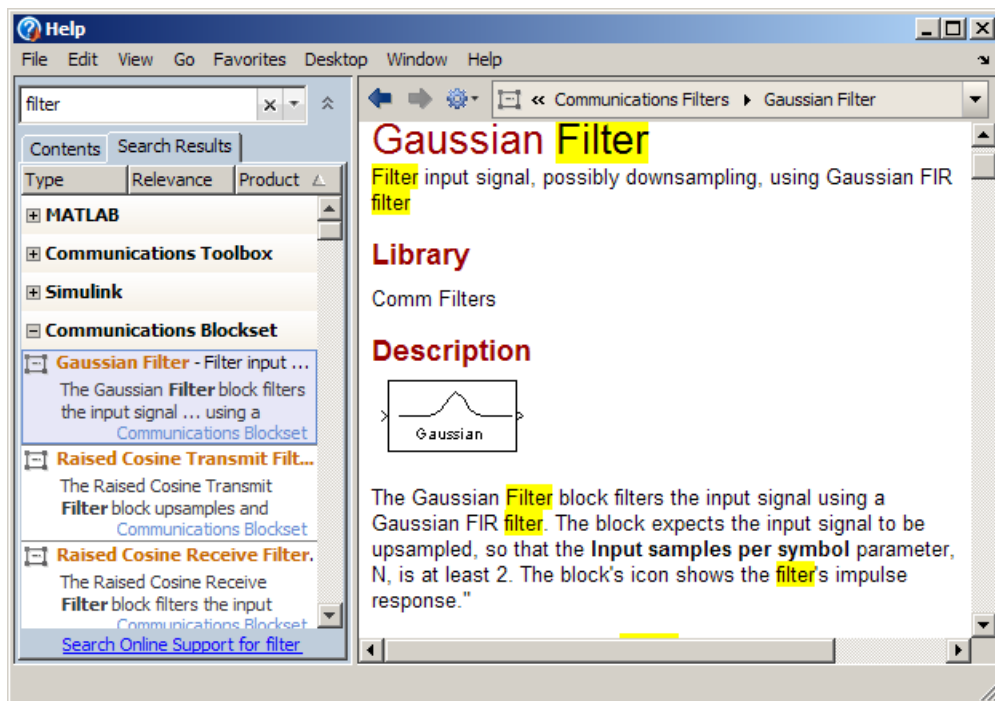
- A preview of where the search words were found within the page.
- An icon representing the type of document, such as a reference page or demo.

Use new sorting and grouping features to arrange results:

- Sort results by **Relevance**, in addition to sorting by **Type** and **Product**, which were available in previous versions.

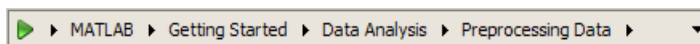
- After sorting by **Type** or **Product**, you now can collapse and expand results for each type or product. To expand or collapse all groups, right-click in the results pane and select the option you want from the context menu.


The following example of **Search Results** in the Help browser illustrates grouping, previews, and the block reference page icon.

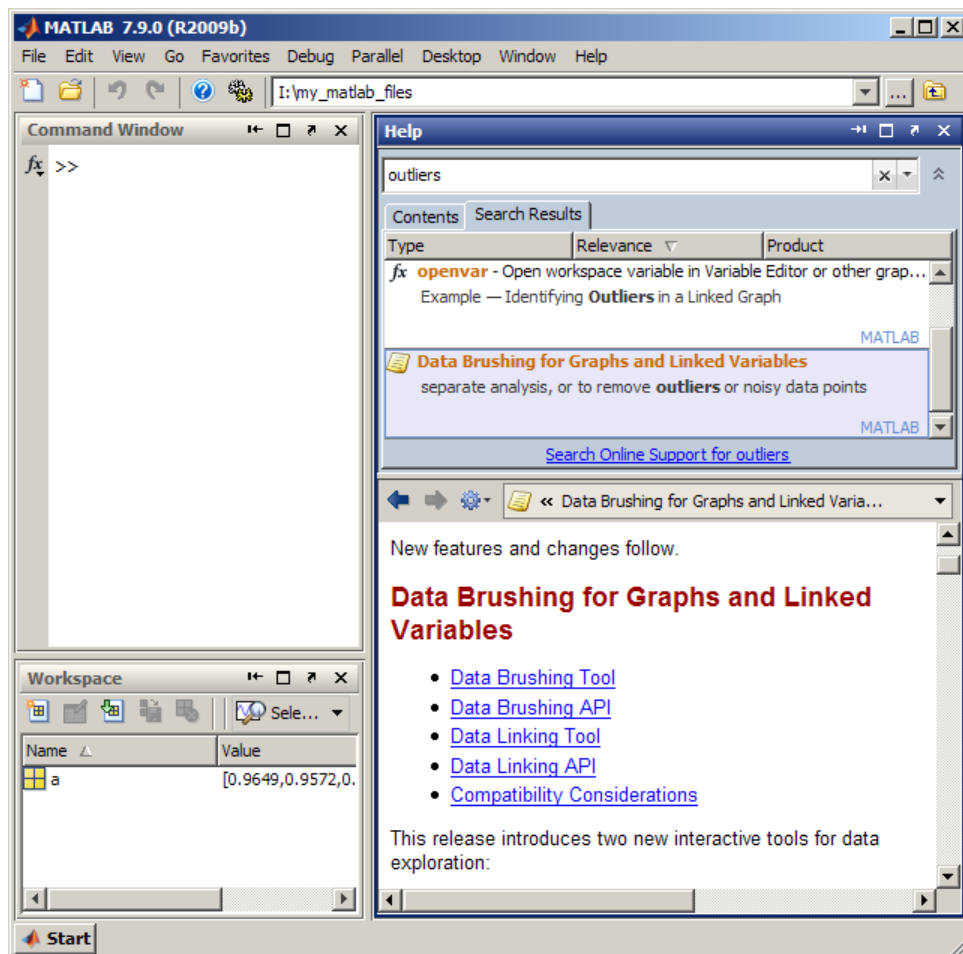


## Viewing Pages

- To see where the current page is located within the documentation, use the navigation bar at the top of the display pane. To go to another topic in the documentation, select an entry from the navigation bar.



- Use the new Actions button  on the display pane toolbar to access features such as Refresh, which clears the search results highlighting for the current page.
- Get links to reference pages for overloaded functions. When you run `doc foo`, if `foo` is an overloaded function, a message appears at the top of the display pane that provides links to the other `foo` reference pages.
- To use the Help browser alongside other tools, dock it in the desktop. When docked in a narrow area of the desktop, the pane for **Contents** and **Search Results** moves above the display pane.



## Compatibility Considerations

The **Index** and **Demos** tabs are no longer in the Help browser:

- To find terms that were in the **Index**, use the search feature instead.
- To access demos for a product, go to the **Contents** pane and expand the **Demos** entry for the product.

The Actions button on the toolbar provides access to features for the displayed page. Previously, some of these features were available on individual toolbar buttons. To add individual toolbar buttons, right-click the toolbar and select **Customize**.


If you provide your own files for use in the Help browser:

- Remove the `helpindex.xml` entry from the `info.xml` file for your toolbox. MATLAB no longer supports the **Index**.
- Demos you add now appear in the **Contents** pane under **Other Demos**, which is after the entries for all MathWorks products.

For more information about the new Help browser features, see “Help and Product Information”.

## Workspace and Variable Editor

### Improved Workspace Plotting Tool

The Plot Selector button on  the Workspace Browser and Variable Editor toolbars has a new look and added capabilities, options, and help. The tool now displays larger icons, includes many more graphing functions, summarizes each function, and displays pop-up windows with syntax descriptions (function hints). You can customize the tool by rearranging and categorizing functions, and by creating a list of “favorites”.






For further details, see this video demo and the release note “Enhanced Plot Selector Simplifies Data Display” on page 150.

## Managing Files

### Enhanced Current Folder (Directory) Browser

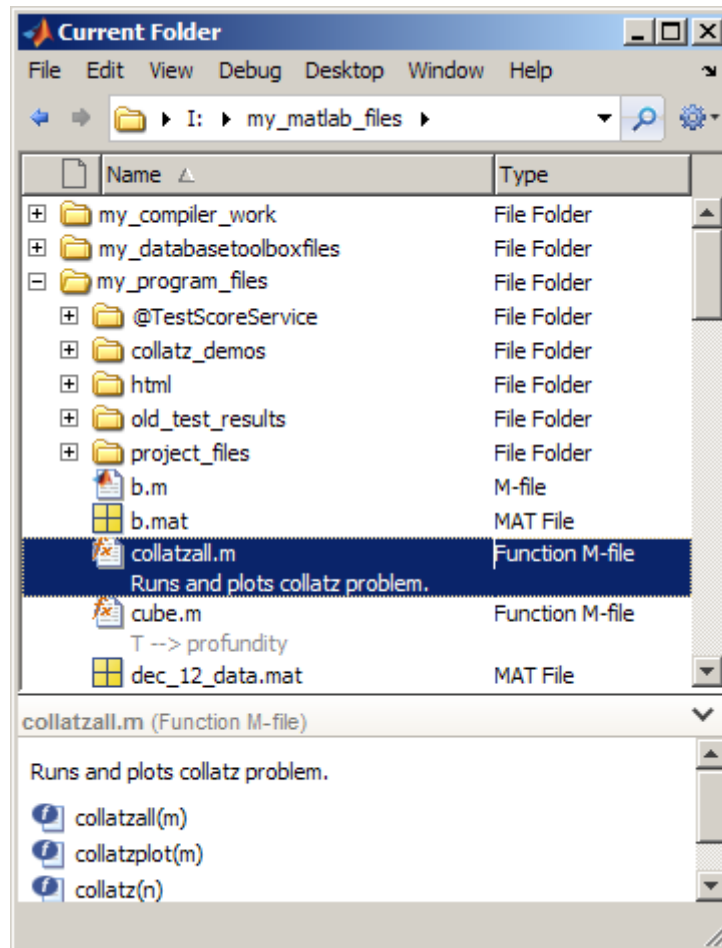
The Current Directory browser is now the Current Folder browser.

For an overview of the enhancements, watch this video, Current Folder Browser Enhancements, or review the following summary:

- Use the expandable tree structure to view the contents of the current folder. Double-click a subfolder to make it the current folder.
- Display the file type in a column.
- Distinguish types of MATLAB program files using new icons:
  -  class
  -  function
  -  script
- View file descriptions below file names. To show or hide descriptions, select **View > Show > Description**.
- Display hidden files a new way:
  - On Windows platforms, MATLAB follows your Windows preference for hidden files.
  - On other platforms, MATLAB uses the new setting in Current Folder preferences.
- Find files and folders within the current folder and its subfolders:
  - To access the search feature, click the Search button  on the address bar, and then enter the string you want to find.
  - To clear the results and display all files and folders in the current folder, click the Clear button .

The following illustration shows the new Current Folder browser, including the tree view, new icons for program files, and the search button.





### Compatibility Considerations.

- With the new tree structure, you now see all files, including those in subfolders. You might not be able to run the files you see in the subfolders. To run a file from a subfolder, the subfolder must be on the search path or the subfolder must become the current folder. In previous versions, you could only see files in the current folder, so you could run every file you could see.

- You now search for files by clicking the search button in the address bar. In previous versions, the search feature, referred to as the filter field, appeared if your preference was set to display it.
- File descriptions now appear below the file name. In previous versions, they displayed in a column.

For more information about the new features, see “Managing Files in MATLAB”.

## **File Exchange Desktop Tool – Find and Get Files Created by Other Users**

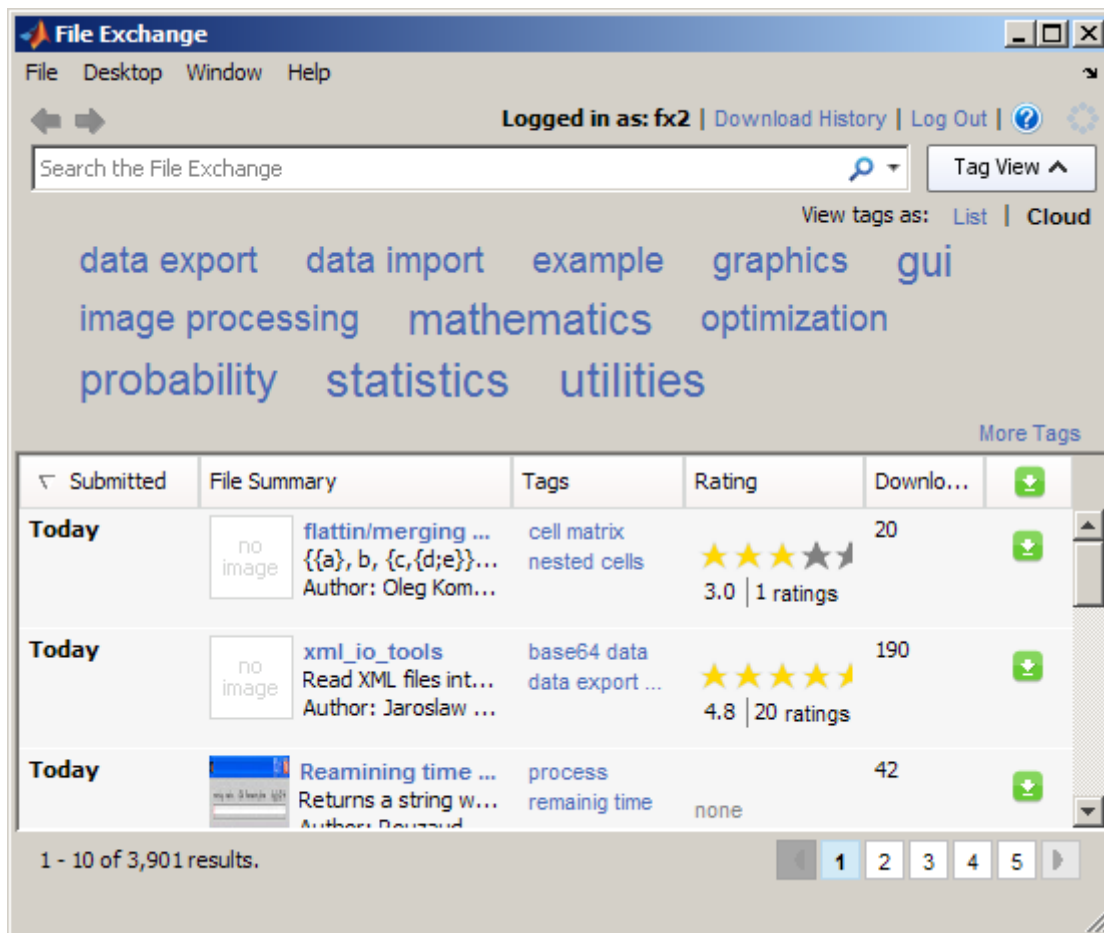
Watch this video, MATLAB File Exchange Access, or review the following summary of what you can do with the new File Exchange desktop tool:


- Access user-created files from the File Exchange repository. The files are at MATLAB Central, the community area of the MathWorks Web site.
- Use the files in your own work to save time and get new ideas.
- Work with the file repository from within the MATLAB desktop.
- Use features like those found in the Web site interface to the File Exchange repository.

The File Exchange desktop tool offers these main features:

- Find files by searching and by selecting tags (keywords associated with files).
- Sort results. For example, show the most highly rated or the most recent files first.
- View details about a file.
- Download files to use in MATLAB.
- Provide feedback about files.

To open the File Exchange tool, select **Desktop > File Exchange**.



If you have questions while you work, access the File Exchange FAQ by clicking the Help button . For full documentation, see “File Exchange — Finding and Getting Files Created by Other Users”.

## Editing and Debugging MATLAB Code Files

New features and changes introduced in Version 7.9 (R2009b) are:

- “Syntax Highlighting for VHDL and Verilog Code” on page 136

- “File and Folders Comparison Tool Enhanced” on page 136

## Syntax Highlighting for VHDL and Verilog Code

The MATLAB Editor now supports syntax highlighting for VHDL and Verilog code. For details see, “Highlight Syntax to Help Ensure Correct Entries in the Editor”.

## File and Folders Comparison Tool Enhanced

When you use the File and Folders Comparisons tool to compare folders, it now includes the following information about each file in each folder:

- The file size, in bytes
- The date the file was last modified

In addition, the File and Folders Comparisons tool enables you to reload the information by clicking the refresh button  or selecting **File > Refresh**. For details see, “Comparing Files and Folders”.

## Publishing MATLAB Code Files to PDF Output Format

MATLAB now supports PDF as the output format for publishing MATLAB code files. For instructions on how to publish to .pdf files, watch the Publishing Features video demo. For details, see “Steps for Publishing sine\_wave\_f.m to PDF”.

## Internationalization

### How MATLAB Reads Customized Locale Settings on Macintosh OS X Platforms

If you use the **Customize** option to modify the locale setting, MATLAB ignores the customized portion. For example, if you select the euro currency symbol for a locale set to the United Kingdom, the locale name is:

```
en_GB@currency=EUR
```

MATLAB uses the locale name:

en\_GB

## Mathematics, MATLAB Version 7.9 (R2009b)

New features and changes introduced in this version are:

- “Computational Geometry Functions Being Changed” on page 138
- “Computational Geometry Functions Being Removed” on page 138
- “New Sparse Matrix Functionality In qr and mldivide Functions” on page 139
- “Support for Large-Sized Dimensions In fft” on page 139
- “Performance Improvement For Large Data Sets” on page 139
- “erfcov Being Removed” on page 139
- “New Multithreading Capability” on page 140
- “New Test Matrices in gallery Function” on page 140

### Computational Geometry Functions Being Changed

2- and 3-D computational geometry functions (`delaunay`, `convhull`, `griddata`, `voronoi`, `delaunay3`, `griddata3`) no longer use `QHULL` or the `QHULL` options arguments. The N-D functions `gridatan`, `delaunayn`, `convhulln`, and `voronoin` still use `QHULL`.

### Compatibility Considerations

The `QHULL` options arguments to `delaunay`, `convhull`, `griddata`, and `voronoi` are no longer required and are currently ignored. Support for these options will be removed in a future release.

### Computational Geometry Functions Being Removed

A future release will remove the `griddata3`, `dsearch`, `tsearch`, and `delaunay3` functions. See the table below for alternatives.

Function Name	Use This Method Instead
<code>griddata3</code>	<code>TriScatteredInterp</code>
<code>dsearch</code>	<code>DelaunayTri/nearestNeighbor</code>

Function Name	Use This Method Instead
tsearch	DelaunayTri/pointLocation
delaunay3	DelaunayTri

### Compatibility Considerations

Update your old code to use the new computational geometry classes `DelaunayTri` and `TriScatteredInterp`.

### New Sparse Matrix Functionality In `qr` and `mldivide` Functions

`mldivide` supports complex rectangular sparse input matrices. `qr` supports complex sparse input matrices. `qr` for sparse matrix input now supports a third output argument that contains a fill-reducing permutation.

### Support for Large-Sized Dimensions In `fft`

MATLAB functions `fft`, `fft2`, and `fftn` (and their inverses `ifft`, `ifft2`, and `ifftn`) can now handle input arrays with a size in 1 dimension greater than  $2^{31} - 1$  on 64-bit platforms.

### Performance Improvement For Large Data Sets

- MATLAB includes improved sparse matrix performance for indexing, basic math, binary and relational operators, and exponential functions.
- There are significant performance improvements to `conv2`.

### `erfc` Being Removed

Use of `erfc` will produce a warning:

```
ERFCORE will be removed in a future release.
Use ERF, ERFC, ERFCX, ERFINV, or ERFCINV instead.
```

### Compatibility Considerations

Replace all instances of `erfc` with `erf`, `erfc`, `erfcx`, `erfinv`, or `erfcinv`.

## **New Multithreading Capability**

Many MATLAB functions are now multithreaded:

- `sort`
- `bsxfun`
- `mldivide` for sparse rectangular matrix input
- `qr` for sparse matrix input
- `filter` for matrices and higher-dimensional arrays
- `gamma`, `gamma1n`
- `erf`, `erfc`, `erfcx`, `erfinv`, `erfcinv`

## **New Test Matrices in gallery Function**

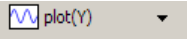
The gallery suite of test matrices includes new options `integerdata`, `normaldata`, and `uniformdata`.



## Data Analysis, MATLAB Version 7.9 (R2009b)

New features and changes introduced in this version are:

### Improved Plot Selector Makes Graphic Data Exploration Easier

The Plot Selector button on the Workspace Browser and Variable Editor toolbars has a new look and added capabilities, options, and help. Now the Plot Selector button  changes its appearance to reflect the variable or variables you select. Now it suggests a plot type and indicates its calling argument sequence. You can also make the Plot Selector list the types of graphs you use most often at the top of its drop-down menu. The tool provides descriptions and hints to help you discover data graphing functions and learn to use them more effectively.

For further details, see this video demo and the release note “Enhanced Plot Selector Simplifies Data Display” on page 150.

## Programming, MATLAB Version 7.9 (R2009b)

New features and changes introduced in this version are

- “Ignore Selected Arguments on Function Calls” on page 142
- “Internal Packages Make Reserved Functions Easy to Identify” on page 143
- “Use of lasterror, lasterr, rethrow(errStruct) Not Recommended” on page 144
- “Use of maxNumCompThreads No Longer Recommended” on page 145
- “Excel Worksheet Selection in the Import Wizard” on page 145
- “Motion JPEG 2000 Files Supported by mmreader” on page 145
- “Minimum Sample Rate for audioplayer” on page 146
- “Documentation Changes: File I/O and Data Import and Export” on page 146
- “Object Array Property Indexing” on page 146
- “Equality of Objects Using isequal Now Ignores Numeric Class” on page 147
- “Class Defining Private/Abstract Property Now Errors” on page 147
- “Subclasses of Built-in Classes and numel” on page 147
- “Array Expansion with Indexed Assignment” on page 147
- “New Tiff Object Enables Writing of Tiled Data and Broader Metadata Support” on page 148
- “Ambiguity Error Now Reported” on page 148

### Ignore Selected Arguments on Function Calls

This version of MATLAB introduces a new usage for the tilde (~) operator. As in earlier releases, tilde signifies a logical NOT. In the 9b release, you can also use the tilde operator to specify unused outputs in a function call, or unused inputs in a function definition. See “Ignoring Selected Outputs or Input Arguments” in the Programming Fundamentals documentation for more information on this feature.

## Replacing Output Variables with Tilde

This feature enables you to replace this type of function call:

```
[val1, ignoreThisOutput, val3] = myTestFun;
```

with the following:

```
[val1, ~, val3] = myTestFun;
```

MATLAB ignores any values returned by a function that have a corresponding tilde in the output list. This new syntax can help you avoid confusion in your program code and unnecessary clutter in your workspace. It also avoids wasting memory to store unused outputs returned from the called function.

## Replacing Input Arguments with Tilde

You can also use the tilde operator to specify unused inputs when you are creating a function. You can replace this type of function definition:

```
function myTestFun(arg1, ignoreThisInput, arg3)
```

with the following

```
function myTestFun(arg1, ~, arg)
```

Whenever this function is called, MATLAB ignores any inputs passed to the function that have a tilde in the corresponding position in the input argument list. You are likely to find the tilde operator most useful when writing callback functions and subclass methods that must match a predefined function interface.

## Internal Packages Make Reserved Functions Easy to Identify

The MathWorks® reserves the use of packages named `internal` for utility functions used by internal MATLAB code. Functions that belong to an `internal` package are intended for The MathWorks use only. Using functions that belong to an `internal` package is strongly discouraged. These functions are not guaranteed to work in a consistent manner from one release to the next. In fact, any of these functions and classes may be removed from the

MATLAB software in any subsequent release without notice and without documentation in the product release notes.

See “Internal Utility Functions” in the Programming Fundamentals documentation for more information.

## **Use of `lasterror`, `lasterr`, `rethrow(errStruct)` Not Recommended**

In version 7.5, The MathWorks introduced a new class called `MException` for use in error handling. Prior to this change, the `lasterr` and, more recently, `lasterror` functions kept track of only the one most recently thrown error. The state of any errors thrown before that was overwritten by newer errors. Also, this error state was globally accessible, which means that it could be unintentionally modified or destroyed either during an interactive session or by another function.

When using the newer, object-based error mechanism, every error generated by a MATLAB function stores information about what caused the error in a separate `MException` object. This enables MATLAB to store information about multiple errors, adds the capacity to store new fields of information including links to related errors, and also resolves the problem of being globally accessible.

The MathWorks now discourages the use of the `lasterr` and `lasterror` functions because the information they return is global and thus has the potential to be corrupted. You should replace the use of these two functions with the new style of `try-catch` statement that captures an `MException` object to represent the error. When entering commands at the MATLAB command line, you can also use the static method `MException.last` to retrieve information on the most recent error. For more information on this method of error handling, see “The `MException` Class”.

This change also affects which form of the `rethrow` function to use when reissuing an exception. The original `rethrow` function, in use since before version 7.5, accepts only a structure as input. Because this structure is typically obtained using the `lasterror` function, this form of `rethrow` should be avoided. The later form of `rethrow(MException)`, introduced in version 7.5, accepts an `MException` object as input, and is the recommended form.

## Compatibility Considerations

It is strongly recommended that you discontinue the use of `lasterror` and `lasterr`, and that you replace the use of these functions in your program code with the MException-based style of error handling described above.

## Use of `maxNumCompThreads` No Longer Recommended

Invoking the function `maxNumCompThreads` now returns the following warning:

```
Warning: maxNumCompThreads will be removed in a future release.  
Please remove any instances of this function from your code.
```

`maxNumCompThreads` continues to operate the same in this release of MATLAB. However, the function will be discontinued in a future release of the product.

## Compatibility Considerations

It is recommended that you discontinue the use of `maxNumCompThreads`. However, if you do have any program code that invokes this function, you should make sure that such programs are not affected by this new warning.

## Excel Worksheet Selection in the Import Wizard

In previous releases, the Import Wizard imported only the first populated worksheet in an Excel file. The Import Wizard now allows you to specify the worksheet to import. To start the Import Wizard, use one of the following methods:

- Select **File > Import Data**.
- Call `uiimport`.
- Double-click a file name in the Current Folder browser.

## Motion JPEG 2000 Files Supported by `mmreader`

`mmreader` now imports Motion JPEG 2000 (`.mj2`) files on Windows, Macintosh, and Linux platforms.

## Compatibility Considerations

Because `mmreader` imports Motion JPEG 2000 files, the function `mmreader.isPlatformSupported` always returns `true` on Windows, Macintosh, and Linux platforms. For a list of file formats that `mmreader` supports, and the requirements to read these formats on each platform, see the `mmreader` reference page.

## Minimum Sample Rate for audioplayer

If you specify a sample rate less than 80 samples per second, `audioplayer` generates an error with the following ID:

```
MATLAB:audioplayer:positivesamplerate
```

## Compatibility Considerations

In previous releases, the error ID on Windows platforms for low sample rates was:

```
MATLAB:audioplayer:negativesamplerate
```

Change any references to this identifier to:

```
MATLAB:audioplayer:positivesamplerate
```

## Documentation Changes: File I/O and Data Import and Export

The function category “File I/O” is renamed “Data Import and Export.” It appears immediately below the category “Desktop Tools and Development Environment.”

In the MATLAB User Guide, Data Import and Export content previously appeared in the Programming Fundamentals documentation. The User Guide now includes a stand-alone topic for Data Import and Export.

## Object Array Property Indexing

Object array indexing operations on properties now return an error for improper array references. Before MATLAB 7.9, an expression such as:

```
obj.Prop(n) % for non-scalar obj is invalid if Prop is a property
```

did not return an error. MATLAB 7.9, you can reference or assign properties from scalar objects only by entering:

```
obj(int).Prop(n)
```

where `int` is a positive integer.

## Equality of Objects Using `isequal` Now Ignores Numeric Class

Before MATLAB 7.9, an expression such as:

```
isequal(a,b)
```

returned false in cases where `a` and `b` are objects of the same class that have properties set to numeric values which are mathematically equivalent, but of different classes (for example, `double` and `single`),

The behavior of `isequal` in MATLAB 7.9 is consistent with the documented behavior (see `isequal`). `isequal` does not consider class when comparing numeric values.

## Class Defining Private/Abstract Property Now Errors

MATLAB 7.9 returns an error when it loads a class that defines a property as both `Abstract` and `Private`.

## Subclasses of Built-in Classes and `numel`

Before MATLAB 7.9, the `numel` function did not return the same results for built-in classes and subclasses of built-in classes. In MATLAB 7.9, the behavior of `numel` is consistent with built-in classes and subclasses of built-in classes. See “Understanding size and `numel`” for a discussion of the current behavior.

## Array Expansion with Indexed Assignment

Before MATLAB 7.9, initializing a handle object array by specifying the last element in the array to create it:

```
obj(10) = MyClass;
```

resulted in the same handle being assigned from the second to the penultimate elements of the array. With MATLAB 7.9, all elements in the handle object array have unique handles. See “Creating Object Arrays” for more information on the current behavior.

## **New Tiff Object Enables Writing of Tiled Data and Broader Metadata Support**

Using the new `Tiff` object, you can now write portions of a TIFF file and update the values of individual metadata tags in an image. MATLAB has long offered the capability of reading and writing TIFF files, using the `imread` and `imwrite` functions. However, if you wanted to update any part of the image, you had to write the entire image to the file. Similarly, if you just wanted to update a tag, you had to write the entire image. By providing access to functions in the `LibTIFF` library, the `Tiff` object offers more flexibility in creating and editing TIFF images. You can write data to specific tiles in an image and update individual tags in a file, without having to write the entire image.

## **Ambiguity Error Now Reported**

Due to a bug, versions of MATLAB prior to Version 7.9 did not report an error in functions such as the following, even though it cannot be determined in the last line whether `U` is a variable or a function:

```
function r = testMfile1(A)
A = 1;
eval('U = 1;');
r = A(logical(end), U(end));
```

However, if you replace the last line with

```
r = A(U(end));
```

MATLAB reports an ambiguity error and has done so since Version 7.0. Starting in Version 7.9, MATLAB reports an ambiguity error for either statement.



## **Compatibility Considerations**

In certain circumstances, it is possible that you will see ambiguity errors generated in code that did not report this error in previous releases. If you do get such an error, examine your code and resolve the ambiguous statements.

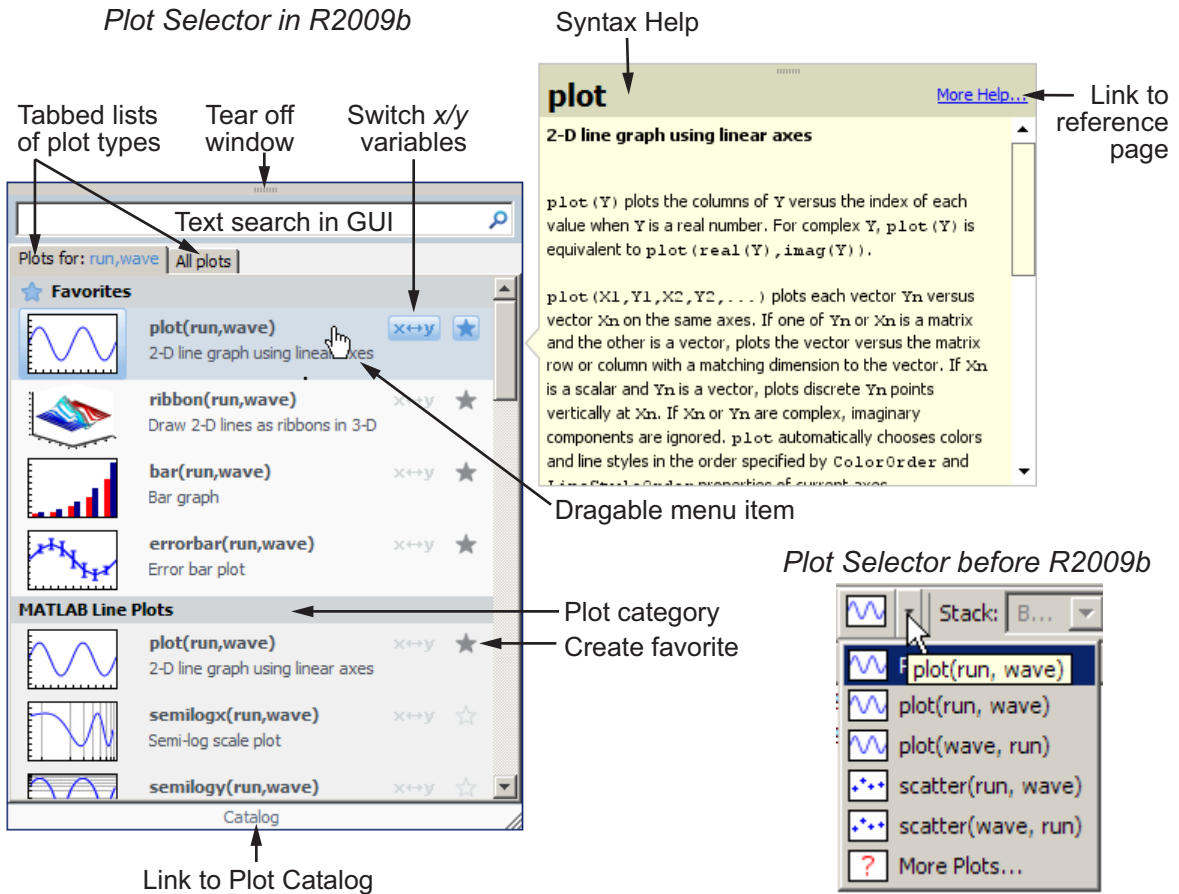
## **Graphics and 3-D Visualization, MATLAB Version 7.9 (R2009b)**

New features and changes introduced in this version are:

- “Enhanced Plot Selector Simplifies Data Display” on page 150
- “Certain Print Options and Devices Now Warn When Used” on page 153
- “The view Function No Longer Supports 4-by-4 Transformation Matrices as Input” on page 154

### **Enhanced Plot Selector Simplifies Data Display**


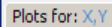

The Plot Selector workspace tool creates graphs of workspace variables. As this video demo shows, the tool lets you access more types of data display functions and provides help about each one. It also categorizes display functions and lets you organize them within its drop-down menu. The following illustration shows the old and new versions of the Plot Selector and calls out new features.




Use the Plot Selector tool to instantly generate graphs of workspace variables. You can choose from more than 40 two-dimensional, three-dimensional, and volumetric MATLAB data display types. It also constructs graphs using Control System Toolbox, Financial Toolbox, and Statistics Toolbox functions if your installation includes those products.

The Plot Selector button displays a graph icon and the names of selected variables in the Workspace browser or the Variable Editor. Until you select one or more variables, the button reads **Select to plot** .

The graphing function for one or two data vectors still defaults to `plot`, but the tool now gives you additional options and information, including the following:


- The grouping of menu items into categories of graph types, such as **Stem and Stair Plots**, **3-D Surface Plots**, and **Analytic Plots**. You can rearrange categories and items within a category by dragging them.
- A **Favorites** category at the top of the menu, where you can collect the types of graphs you use most often. Your collection of favorites persists across MATLAB sessions.
- A star-shaped button  on menu items that adds a graph type to or removes one from your Favorites collection.
- Two tabs   for toggling the scope of the menu:
  - **Plots for <variable names>** — The set of graphs you can generate with the currently selected variables
  - **All plots** — A master list of graphing functions available on your system

On the **All plots** tab, graphing functions that are not compatible with the selected variables display in gray and do not plot. Incompatible plot types do not appear on the first-tab menu.

- A button  to interchange the axes positions of two selected variables
- Pop-up descriptions of function syntax when your mouse pointer lingers over a menu item
- Direct access to your Favorites from context menus in the Workspace Browser and the Variable Editor

For more information, see “Creating Plots from the Workspace Browser”.

## Compatibility Considerations

- In previous versions, the Plot Selector automatically assigned variables named `t` and `time` to the  $x$ -axis. Now, the variable you select first always plots on the  $x$ -axis. Use the switch variable input order button  to interchange the  $x$  and  $y$  variables before plotting them.

- In previous versions, clicking **Plot Selector > More Plots** opened the Plot Catalog tool. Now, you click **Catalog** at the bottom of the Plot Selector GUI to open the Plot Catalog tool. The Plot Catalog has not changed.

## Certain Print Options and Devices Now Warn When Used

The following print command option and device now throw warnings when used and will be removed in a future release:

Option/ Device	Warning ID	Warning Text
'-adobecset print option	'MATLAB:print: adobecset:DeprecatedOption'	The -adobecset option will be removed in a future release.
'-dill' print device (native support for Adobe Illustrator)	'MATLAB:print: Illustrator:DeprecatedDevice'	The '-dill' print device will be removed in a future release. Use Encapsulated PostScript ('-depsc') instead.

If you wish to prevent these warnings from displaying, use the warning command.

- To disable the warning generated by using the `adobecset` print option:

```
warning('off', 'MATLAB:print:adobecset:DeprecatedOption');
```

- To disable the warning generated by using the `dill` print device:

```
warning('off', 'MATLAB:print:Illustrator:DeprecatedDevice');
```

## Compatibility Considerations

If you have developed code that uses the previous option or device, in the future you must remove such calls or replace them with other code.

## **The view Function No Longer Supports 4-by-4 Transformation Matrices as Input**

The `view` function no longer supports 4-by-4 transformation matrices as input arguments. Previously, you could create a 4-by-4 transformation matrix and use it with `view`.

### **Compatibility Considerations**

If you have code that calls `view(T)`, explore using `view([az el])` instead.

# Creating Graphical User Interfaces (GUIs), MATLAB Version 7.9 (R2009b)

New features and changes introduced in this version are:

- “Expanded Documentation on Techniques for Programmatic GUI Design” on page 155
- “Previous Change to How UI Components Set the Figure SelectionType Property” on page 155

## Expanded Documentation on Techniques for Programmatic GUI Design

The section “Lay Out a Programmatic GUI” of the Creating Graphic User Interfaces documentation has been expanded. The updated section, formerly called “Aligning Components,” now has the title “Compose and Code GUIs with Interactive Tools”.

The renamed section describes techniques, functions, and predefined dialog boxes you can use to accelerate programmatic construction of GUIs (that is, those you create without using GUIDE).

The section includes examples of setting component positions, colors, and font properties interactively. Also included is an example function that generates a `set` statement for a specified property of any GUI component. By running this function and pasting its output into your GUI code file, you can save time and avoid making typographical errors.

## Previous Change to How UI Components Set the Figure SelectionType Property

The MATLAB `SelectionType` figure property had an undocumented change in V. 7.6 (R2008a). That change modified how the property is set in response to single-clicking and double-clicking objects, particularly `uicontrols`, with and without key modifiers.

For information about this change, including potential incompatibilities, see “Changes to How `uicontrols` Set Figure `SelectionType`” on page 289. The

table in that release note specifies the `SelectionType` setting resulting from clicking a UI component in both enabled and disabled states.



## External Interfaces/API, MATLAB Version 7.9 (R2009b)

New features and changes introduced in this version are:

- “Changes to Compiler Support” on page 157
- “Run-Time Libraries Required for Applications Built with Microsoft® Visual Studio 2008 Compiler” on page 158
- “Changes to Building MEX-Files” on page 159
- “New Features for Interface to Microsoft .NET Framework” on page 159

### Changes to Compiler Support

#### Support for Apple Macintosh (64-bit) Platforms

MATLAB Version 7.9 (R2009b) supports these new compilers for building MEX-files:

- Apple Xcode 3.1 (gcc / g++ Version 4.0.1)
- GNU gfortran Version 4.3

#### Compiler Support to Be Phased Out

MATLAB Version 7.9 (R2009b) supports the following compilers but will not support them in a future version.

#### Windows (32-bit) Platforms.

- Intel Visual Fortran Version 10.1
- Intel C/C++ Version 9.1
- Microsoft Visual Studio .NET Version 7.1

#### Windows (64-bit) Platforms.

- Intel Visual Fortran Version 10.1
- Intel C/C++ Version 9.1

### **Solaris SPARC (64-bit) Platforms.**

- Sun Studio 11 cc / CC Version 5.8
- Sun Studio 11 f90 Version 8.2

### **Discontinued Support for Intel Visual Fortran Version 9.1**

MATLAB no longer supports the Intel Visual Fortran Version 9.1 compiler on the following platforms:

- Windows 32-bit
- Windows 64-bit

**Compatibility Considerations.** To ensure continued support for building your Fortran programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

### **Run-Time Libraries Required for Applications Built with Microsoft Visual Studio 2008 Compiler**

You must provide the Visual C++ run-time libraries if you distribute any of the following:

- MEX-file
- Engine application
- MAT-file application built with the Visual Studio® 2008 compiler

You need these files to run applications developed with Visual C++ on a computer that does not have Visual C++ 2008 installed. For information on locating the Microsoft® Visual C++® 2008 Redistributable Package (x86), containing `vc redistrib_x86.exe` and `vc redistrib_x64.exe`, consult your Microsoft documentation.

## Changes to Building MEX-Files

### **INLINE Option to MEX Function Deprecated**

The use of the `-inline` switch has been deprecated and will not be available in future versions of the `mex` function.

### **MEX Function No Longer Automatically Includes `mexversion.c` When Building MEX-Files**

The `mex` function no longer automatically compiles and links its own copy of `mexversion.c` when generating MEX-files.

## **New Features for Interface to Microsoft .NET Framework**

This release includes several changes that affect your use of the Microsoft .NET framework:

- The `NET.addAssembly` function returns information about the assembly in the `NET.Assembly` class. You can also add an assembly using an instance of the `System.Reflection.AssemblyName` class.
- You can access elements of a .NET array using MATLAB one-based indexing, as described in “Accessing .NET Array Elements in MATLAB”.
- To call a generic method, use the `NET.invokeGenericMethod` function.
- You can change a static property or field name using the `NET.setStaticProperty` function.
- You can use overloaded operators, such as `+` and `*`. For a complete list of supported operators, see “How MATLAB Represents .NET Operators”.



# Version 7.8 (R2009a)

## MATLAB Software

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This table summarizes what's new in Version 7.8 (R2009a).

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized under these topics:

- “Desktop Tools and Development Environment, MATLAB Version 7.8 (R2009a)” on page 163
- “Mathematics, MATLAB Version 7.8 (R2009a)” on page 175
- “Data Analysis, MATLAB Version 7.8 (R2009a)” on page 179
- “Programming Fundamentals, MATLAB Version 7.8 (R2009a)” on page 180
- “Graphics and 3-D Visualization, MATLAB Version 7.8 (R2009a)” on page 185
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.8 (R2009a)” on page 186

- “External Interfaces/API, MATLAB Version 7.8 (R2009a)” on page 187

## Desktop Tools and Development Environment, MATLAB Version 7.8 (R2009a)

New features and changes introduced in this version are organized by these topics:

- “Desktop New Features Video” on page 163
- “Startup and Shutdown” on page 163
- “Desktop” on page 163
- “Running Functions — Command Window and History” on page 165
- “Help and Related Resources” on page 165
- “Workspace, Search Path, and File Operations” on page 166
- “Editing and Debugging MATLAB Code” on page 167
- “Tuning and Managing MATLAB Code Files” on page 173
- “Publishing MATLAB Code Files” on page 173

### Desktop New Features Video

For an overview of the major new features in the MATLAB Desktop Tools and Development Environment area, watch this video demo. Another way to access the demo is by selecting the **Demos** tab in the Help browser, and then selecting **MATLAB > New Features in Version 7.8**.

### Startup and Shutdown

The `matlab` command to start MATLAB now supports the `-singleCompThread` option on all platforms. When you specify this option, you limit MATLAB to a single computational thread. By default, if you do not specify this option, MATLAB makes use of the multithreading capabilities of the computer on which it is running.

### Desktop

New features and changes introduced in Version 7.8 (R2009a) are:

- “New System Browser Preference Instead of docopt.m for MATLAB on UNIX Platforms” on page 164
- “Test Proxy Settings for Accessing the Internet from MATLAB” on page 164

### **New System Browser Preference Instead of docopt.m for MATLAB on UNIX Platforms**

On UNIX platforms (except the Apple Macintosh), MATLAB now uses the Mozilla® Firefox® browser by default to display documents or Web sites in a system browser. If you want MATLAB to use a different system browser, use the new **System Web browser** setting in Web preferences to specify it. In addition, the `web` function with the `browser` option now determines the system browser to use from the preference. For more information, click the **Help** button in the Web preference pane, or see “Web Preferences”.

**Compatibility Considerations.** In previous versions, the default system browser on UNIX platforms was Netscape Navigator®; it is now Firefox. If you do not have Firefox on your system, when MATLAB tries to use a system browser, it produces a warning. To correct the problem, use Web preferences to specify a system browser that is installed.

In previous versions, if you wanted to use a different browser, you specified it in the `docopt.m` file. Starting in R2009a, MATLAB ignores the browser specified in `docopt.m`. If you have code that relies on `docopt.m`, your code still runs, but it produces a warning. Remove the calls from your code. In future versions, the code will not run and will produce an error.

If you have your own `docopt.m` file, delete it and either use the new default, Firefox, or specify a different system browser using Web preferences.

### **Test Proxy Settings for Accessing the Internet from MATLAB**

If you want to access the Internet from MATLAB, and your network uses a firewall or another means of protection that restricts Internet access, you now can ensure your proxy server settings are working correctly. Click the new **Test Connection** button in Web preferences, and MATLAB will use the proxy settings you specified in Web preferences to attempt to access the Internet. For more information about the proxy server features, click the **Help** button in the Web preferences pane, or see “Web Preferences”.



## Running Functions – Command Window and History

### Tab Completion for Class Directories and File Names

The Command Window and Editor now support tab completion for class directories. In addition, the Command Window supports tab completion for class file names. For details, see “Complete Names in the Command Window Using the Tab Key”.

### Help and Related Resources

New features and changes introduced in Version 7.8 (R2009a) are:

- “Help Browser No Longer Reopens at Startup” on page 165
- “docsearch Accepts Multiple Words Without Parentheses” on page 165
- “View Your Platform (32-bit or 64-bit) and Architecture in the About Dialog Box” on page 166

### Help Browser No Longer Reopens at Startup

When you start MATLAB, the Help browser no longer automatically opens if you had it open when you last quit MATLAB.

**Compatibility Considerations.** In previous versions, the Help browser opened at MATLAB startup if it had been open when you last quit MATLAB. If you want the Help browser to automatically open at startup, use a startup option. For example, you can include a `helpbrowser` statement in your `startup.m` file. For more information, see “Startup Options”.

If you include a statement in a `finish.m` file that closes the Help browser automatically whenever you quit MATLAB, you now can remove that statement because MATLAB now performs the action by default.

### docsearch Accepts Multiple Words Without Parentheses

The `docsearch` function, which you can use to search the documentation, now accepts multiple words as input, without requiring the function form of the syntax. For example, in previous versions, you used `docsearch('word1 word2')`, but now you can use `docsearch word1 word2`. With the new form of the syntax, you can use all options for `docsearch`, such as wildcards (for

example, `docsearch wor*`) and exact phrases (for example, `docsearch "word1 word2"`).

## View Your Platform (32-bit or 64-bit) and Architecture in the About Dialog Box

To find out if you are currently running a 32-bit or 64-bit version of MATLAB, select **Help > About MATLAB**, and view the value in the resulting About MATLAB dialog box. You might need to know the version if you want to take advantage of the benefits of 64-bit MATLAB, or if you want to use files that depend on the version, such as MEX-files.

The About MATLAB dialog box also shows the architecture value, for example, (win32) or (win64). You use this value for the `arch` option of the `mex` function.

For more information, see “Information About your Installation”.

## Workspace, Search Path, and File Operations

### Enhancements to Current Directory Browser

These are the enhancements to the Current Directory browser:

- You can use the new **View** menu to choose the columns to display, to specify the sort order for a column, and to apply grouping for any attribute. In the previous version, you performed these actions using the column header and its context menus, which you can still do (but only on Microsoft Windows platforms). For more information, see “Sorting and Grouping Files and Folders”.
- A new **Description** column displays the brief description for files and directories in the current directory. To show the column, use **View > Choose Columns**. Descriptions include the first help line in a MATLAB program file, and a model file’s description, which is useful because you do not need to start the Simulink software to view it. The description is the same one that appears with the details for a selected file. For more information, see “Viewing Help for a MATLAB Program File”.
- If you try to rename a MATLAB program file in the Current Directory browser to an invalid name, such as `*myfile.m`, a warning appears,

notifying you about the name problem. If you want to run the file, change the file name to a valid one. For more information about what a MATLAB file name requires to be valid so you can run it, see “Naming Functions”.

- When you right-click a FIG-file in the Current Directory browser, there is a new option to open the figure in GUIDE.

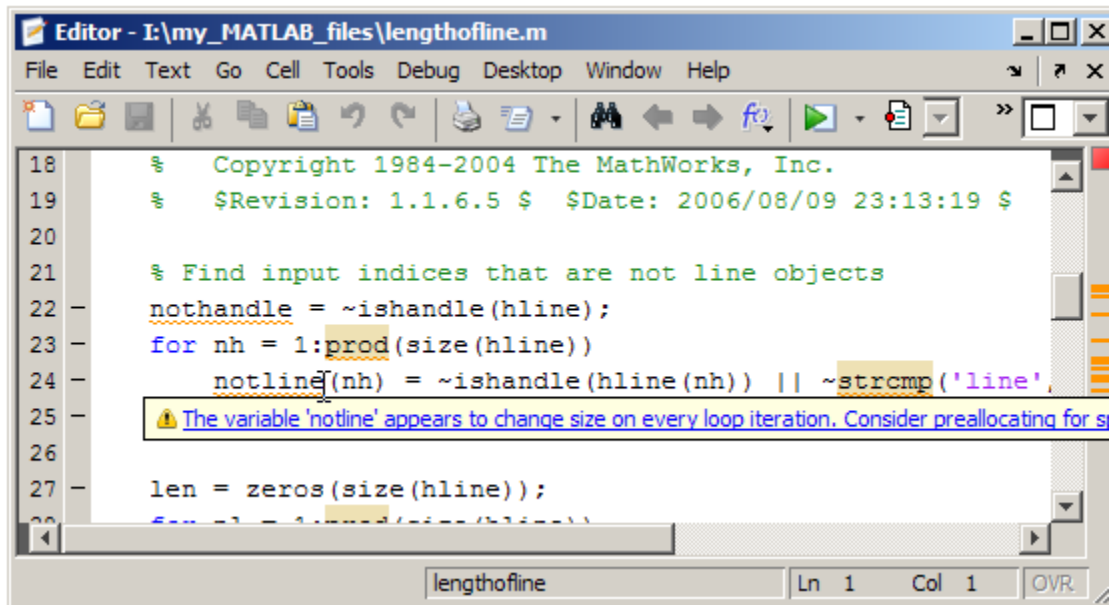
## **Editing and Debugging MATLAB Code**

New features and changes introduced in Version 7.8 (R2009a) are:

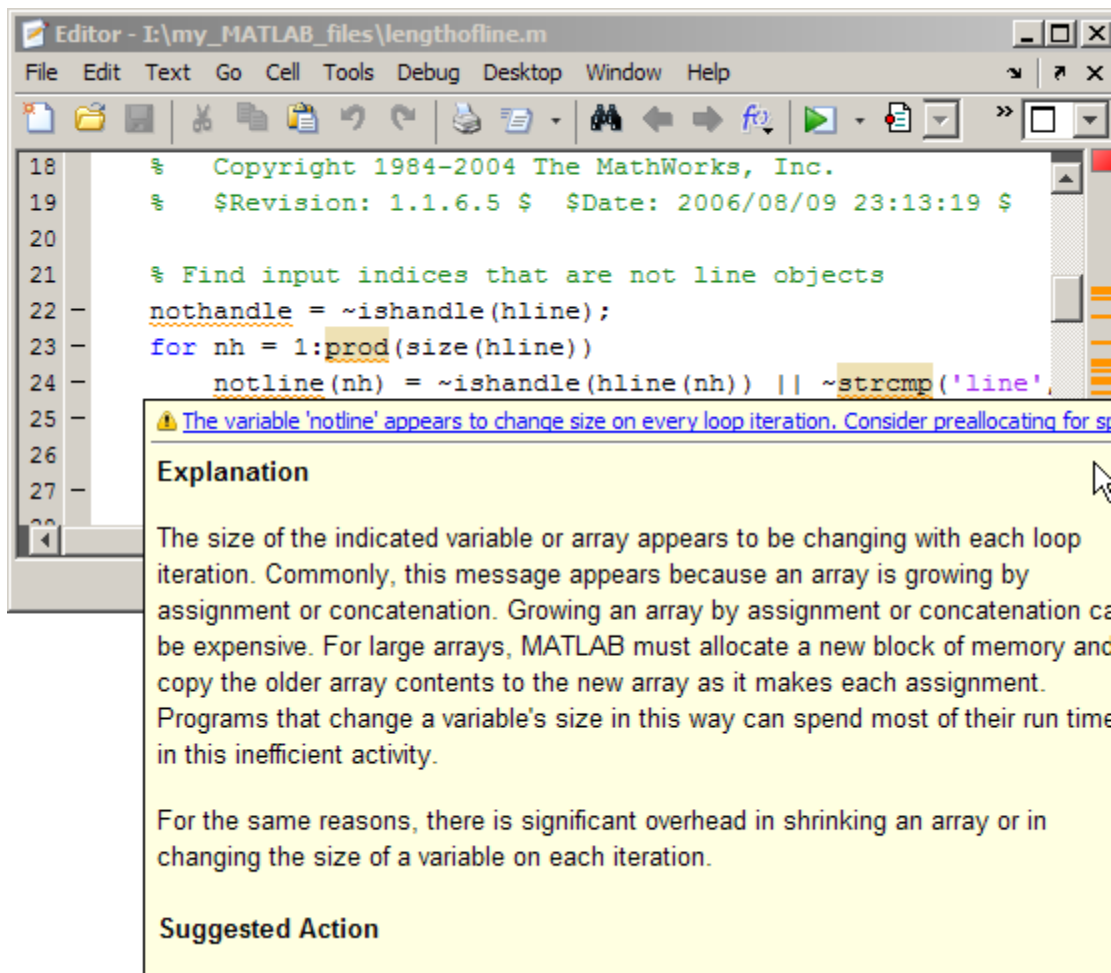
- “Many M-Lint Messages Now Extend to Provide an Explanation and Suggested Action” on page 167
- “M-Lint Messages Now Searchable in Preferences” on page 169
- “Block Indenting Option No Longer Provided” on page 172
- “Integrated Text Editor Option Removed from Editor/Debugger Preferences Panel” on page 172
- “New Navigation Aids in File and Directory Comparisons Tool” on page 172
- “Wrap Around Option for Find and Replace Now On By Default” on page 172

### **Many M-Lint Messages Now Extend to Provide an Explanation and Suggested Action**

When you create a file with integrated M-Lint warning and error messages enabled, you can get additional information about many of the messages. When you hover the pointer over an M-Lint indicator that has an extended message, the message appears as a link:



When you click the link, the message window expands to display an explanation and suggested action.



When you click a link within the extended message, the Help browser opens to provide more information.

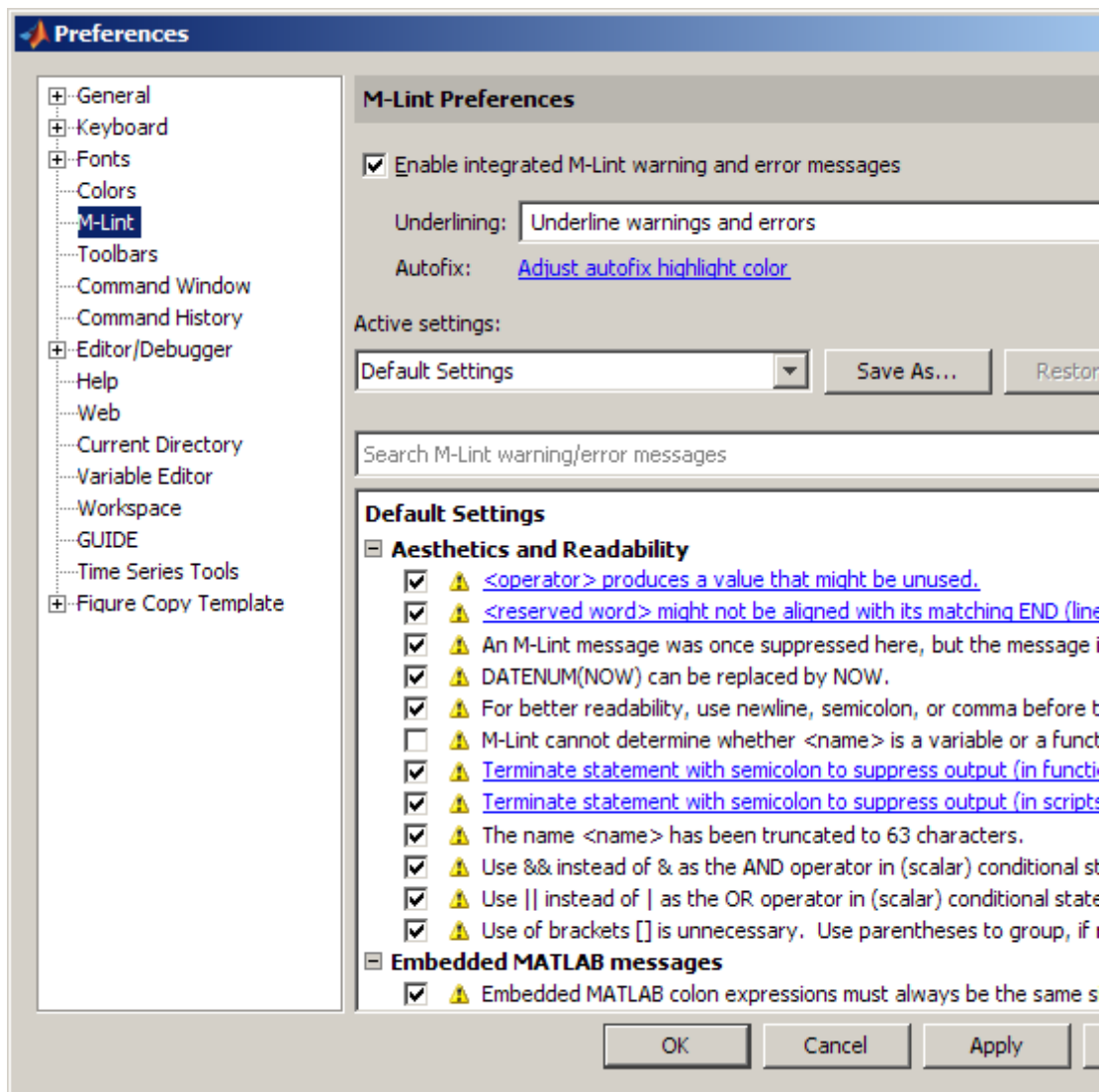
### M-Lint Messages Now Searchable in Preferences

You can now filter the list of M-Lint messages in the preferences panel (**File > Preferences > M-Lint**), to find a message of interest.

For example, you can search for a message:

- Containing a string
- Corresponding to a particular message ID
- Within a given category
- With a setting different from the default

Filtering the list of messages can help you see, for example, why certain messages are suppressed, and which messages are disabled. It can be helpful when you want to see the explanation and suggested action for a message, as described in “Many M-Lint Messages Now Extend to Provide an Explanation and Suggested Action” on page 167.



## Block Indenting Option No Longer Provided

The **Block Indent** option is no longer available. Previously, this option was available for MATLAB, Java, and C/C++ programming languages, when you selected **File > Preferences > Editor/Debugger > Language**.

---

**Note** Do not confuse the **Block Indent** option with the **Smart indenting** option, which is still provided.

---

**Compatibility Considerations.** To attain the effect of block indenting, you can use the **No indent** option and indent lines manually using the **Tab** and **space** keys.

## Integrated Text Editor Option Removed from Editor/Debugger Preferences Panel

The MATLAB Editor no longer supports EmacsLink. In previous releases, you could choose **File > Preferences > Editor/Debugger**, and then (if you correctly registered EmacsLink with MATLAB) you could select **Integrated text editor**. This option is no longer available.

## New Navigation Aids in File and Directory Comparisons Tool

The File and Directory Comparisons Tool now provides links to help you quickly navigate to the areas of differences. This is useful for large files that have too many lines to fit on the screen. At the top of the page is a link to the first difference. In addition, each set of differences has an up arrow that you click to go to the previous set of differences, and a down arrow you click to go to the next set of differences. For details, see “Stepping Through Differences”.

## Wrap Around Option for Find and Replace Now On By Default

When the **Find Next** operation for searching files in the Editor reaches the end of a file, it automatically wraps around to search from the beginning of the file for the text you specified. In previous releases, the **Wrap around** option was off by default. This meant that if you were in the middle of a file and the text you were searching for appeared before your current position, **Find Next** would not find that text.



Because it is more convenient to have this option on, it is now selected by default. To access this option, select **Edit > Find and Replace**.

For more information, see “Find and Replace Text in Files”.

## Tuning and Managing MATLAB Code Files

### Profile Summary Report Includes Information on Excluded Profiling Overhead

The bottom of the Profile Summary Report now indicates the amount of time spent in profiling overhead, when possible. For details, see “Profile Summary Report”.

## Publishing MATLAB Code Files

New features and changes introduced in Version 7.8 (R2009a) are:

- “New Options for Capturing Figures in Published Documents” on page 173
- “Dynamic Links in Published Documents” on page 174

### New Options for Capturing Figures in Published Documents

Two new options are available to specify how you want figures captured for published documents: `entireGUIWindow` and `entireFigureWindow`. The `entireGUIWindow` option is appropriate for most publishing purposes and is now the default. The `entireFigureWindow` option is appropriate when you want to capture all the details, including the title bar and other window decorations in your published document. Use this option, for example, if you are creating a tutorial on using MATLAB software. In the GUI, you can select these options from the **Figure capture method** setting in the Edit M-file Configuration dialog box. In the `publish` function, you can specify these options with `figureSnapMethod`.

For more information, see “Figure capture method” and the `publish` reference page.

## **Dynamic Links in Published Documents**

When you publish a document to HTML, you can include dynamic links. Dynamic links are links to files on the MATLAB path. They are called dynamic links because MATLAB evaluates them when the reader of your document clicks on one. To use a dynamic link, the reader must open the HTML file in the MATLAB Web browser.

For more information, see “Inserting Dynamic Hyperlinks”.

## Mathematics, MATLAB Version 7.8 (R2009a)

New features and changes introduced in this version are:

- “Upgrade to Computational Geometry” on page 175
- “Incomplete Inverse Gamma Function `gammaincinv` and Incomplete Inverse Beta Function `betaincinv`” on page 176
- “Krylov Subspace Methods `bicgstabl` and `tfqmr`” on page 176
- “New Function `quad2d`” on page 176
- “Changes To `conv`” on page 176
- “Changes To `conv2` and `convn`” on page 176
- “`nextpow2` Changing to Element-By-Element Calculation in a Future Release” on page 177
- “Function `finite` Being Removed” on page 177
- “New Multithreading Capability in MATLAB Functions” on page 177
- “64-bit Support in LAPACK and BLAS” on page 177
- “Upgrade to ACML 4.1.0” on page 178

### Upgrade to Computational Geometry

MATLAB includes a new object-oriented suite of computational geometry tools, together with a new underlying library called CGAL. The new library provides improved robustness, performance, and memory efficiency. The new tools are presented in three classes:

- New class `TriRep` provides topological and geometric queries for triangulations in 2-D and 3-D space.
- New class `DelaunayTri` provides increased functionality for Delaunay triangulation including topological and geometric queries, incremental modification, and edge constraints.
- New class `TriScatteredInterp` provides fast robust scattered data interpolation and a new natural-neighbor interpolation technique.

## **Incomplete Inverse Gamma Function `gammaincinv` and Incomplete Inverse Beta Function `betaincinv`**

MATLAB has new functions for incomplete inverse gamma and incomplete inverse beta functions. These functions, `gammaincinv` and `betaincinv`, provide the Statistics Toolbox functionality of the inverse incomplete gamma and beta functions to MATLAB.

## **Krylov Subspace Methods `bicgstabl` and `tfqmr`**

MATLAB has new iterative methods for solving systems of linear equations. `bicgstabl` provides the stabilized biconjugate gradients method. `tfqmr` provides a transpose-free implementation of the quasi-minimal residual method.

## **New Function `quad2d`**

The `quad2d` function provides additional quadrature functionality for nonrectangular areas of integration.

## **Changes To `conv`**

The `conv` function now accepts the `shape` parameter as input.

## **Changes To `conv2` and `convn`**

Use of the `conv2` and `convn` functions with one empty input now returns the matrix of the correct size as described by the `shape` input.

## **Compatibility Considerations**

Use of the `conv2` and `convn` functions with one empty input no longer returns an empty matrix. Instead, it returns the matrix of size specified by the `shape` input. For information on how to use the `shape` input, see the reference pages for the `conv` and `conv2` functions.

## **nextpow2 Changing to Element-By-Element Calculation in a Future Release**

### **Compatibility Considerations**

`nextpow2` with a nonscalar produces a warning:

```
Warning: NEXTPOW2(X) where X is non-scalar will change
behavior in future versions: it will operate on each element
of X. To retain current behavior, use NEXTPOW2(LENGTH(X)) instead.
```

This behavior will change in a future release. Replace instances of `nextpow2` with nonscalar input `X` to `nextpow2(length(X))` to maintain the current behavior.

## **Function `finite` Being Removed**

The `finite` function is obsolete. Use of the `finite` function now causes an error in MATLAB.

### **Compatibility Considerations**

Replace all instances of `finite` with `isfinite`.

## **New Multithreading Capability in MATLAB Functions**

The MATLAB functions for Fourier transforms `fft`, `fft2`, and `fftn`, and their inverses `ifft`, `ifft2`, and `ifftn` are now multithreaded. In addition, the MATLAB functions `prod`, `sum`, `max`, and `min` are multithreaded.

## **64-bit Support in LAPACK and BLAS**

MATLAB supports 64-bit integers for matrix dimensions in LAPACK, and BLAS. Linear algebra operations can now handle matrices of dimensions greater than  $2^{31} - 1$ .

### **Compatibility Considerations**

MEX files that call BLAS or LAPACK need to be updated. All integer variables passed into BLAS or LAPACK need to be of type `mwSignedIndex`. MEX files

compiled in previous versions of MATLAB that call BLAS or LAPACK could lead to undefined behaviors. If you have existing code that generates MEX files that pass variables to BLAS or LAPACK you need to update the code to use the proper data types and recompile.

### **Upgrade to ACML 4.1.0**

AMD Core Math Library (ACML) is upgraded to version 4.1.0.

## **Data Analysis, MATLAB Version 7.8 (R2009a)**

There were no new features or changes in this version. However, see the “Compatibility Considerations” on page 279 section of Version 7.6 (R2008a) Data Analysis release note “Data Brushing for Graphs and Linked Variables” on page 275. The data brushing and linked plot message bar affects the appearance of images of figure windows captured as images. This incompatibility was not recognized at the time R2008a shipped.

## **Programming Fundamentals, MATLAB Version 7.8 (R2009a)**

New features and changes introduced in this version are

- “Setting the Number of Threads Removed from Preferences Panel” on page 180
- “Timer Objects Saved in New Format” on page 181
- “mmreader Supports Linux Platforms” on page 181
- “Support of Microsoft® Excel 2007 File Formats” on page 181
- “Anonymous Functions Support str2func” on page 182
- “size and range Implemented for validateattributes” on page 182
- “isempty Supported for Map Objects” on page 182
- “Bug Fix for Misinterpreted Variables” on page 183
- “MATLAB Upgrades Support for HDF5 to Version 1.8.1” on page 184
- “Indirect Calls to Superclass Constructors Now Errors” on page 184

### **Setting the Number of Threads Removed from Preferences Panel**

The capability to adjust the number of computational threads in a single MATLAB session is no longer available as of this release. This change removes from the MATLAB preferences panel the ability to set the maximum number of computational threads. The primary reason for this change is that products that MATLAB is dependent upon have the ability to spawn threads from the currently-executing thread. This makes it infeasible to monitor and/or limit the number of computational threads at any given time in a MATLAB process.

MATLAB versions 7.8 and later require that you decide between threading and no threading at the time you launch your MATLAB session. Multithreading is enabled by default. To disable this feature, start MATLAB using the new `singleCompThread` option.



## Compatibility Considerations

If you currently use the preferences panel to enable or disable multithreading or to adjust the number of computational threads, you need to be aware that this capability is no longer available. See the “Startup Options” section in the Desktop Tools and Development Environment documentation to find out how to enable or disable multithreading when launching a new MATLAB session.

## Timer Objects Saved in New Format

The format in which MATLAB saves Timer objects has changed in MATLAB version 7.8. Any Timer objects that you create and save while running MATLAB 7.8 cannot be loaded into an earlier version of MATLAB.

## Compatibility Considerations

If you need to use a Timer object that you have constructed using MATLAB 7.8, you will have to reconstruct and save the object in an earlier version of MATLAB.

## mmreader Supports Linux Platforms

The `mmreader` object now supports Linux platforms. For more information about using `mmreader`, see the `mmreader` reference page.

## Support of Microsoft Excel 2007 File Formats

If you have installed Excel 2007 (or Excel 2003 with the Compatibility Pack) on your Windows system, the `xlswrite` function exports data to XLSX, XLSB, and XLSM formats.

To write data to an Excel file, specify the name and extension of the output file in the call to `xlswrite`. If the file already exists, `xlswrite` writes data in the existent file format. If the file does not exist, `xlswrite` creates a new file, using the format that corresponds to the file extension you specify. If you do not specify a file extension, `xlswrite` applies the XLS extension, and writes a new file in the XLS format.

The `xlsread` function imports any file format recognized by your version of Excel, including XLS, XLSX, XLSB, XLSM, and HTML-based formats. The

`importdata` function imports XLS, XLSX, XLSB, and XLSM formats. The Import Wizard imports XLS and XLSX formats.

---

**Note** Large files in XLSX format might load very slowly. For better import and export performance, Microsoft recommends that you use the XLSB format.

---

## Anonymous Functions Support `str2func`

The `str2func` which, prior to this release, converted a function name to a function handle, now also converts an anonymous function definition to a function handle. See the function reference page for `str2func` for more information.

```
N = 5;   NthPower = str2func(['@(x)x.^', num2str(N)]);
NthPower(8)
ans =
    32768
```

## size and range Implemented for `validateattributes`

The `validateattributes` function now enables you to check the size and range of the input value. The following commands validate the size and range of the values of `x` and `y` respectively:

```
x = rand(4,2,6);
y = uint8(50:10:200);

validateattributes(x, {'numeric'}, {'size', [4,2,6]});
validateattributes(y, {'uint8'}, {'>=', 50, '<=', 200})
```

## `isempty` Supported for Map Objects

MATLAB now supports the `isempty` function for containers.Map objects. This example creates a 0-by-1 Map object and runs `isempty` on it:

```
mapObj = containers.Map;
size(mapObj)
ans =
     0     1
```

```
isempty(mapObj)
ans =
    1
```

## Bug Fix for Misinterpreted Variables

The example below describes a bug in the MATLAB software that has been fixed in version 7.8. The bug was caused by misinterpretation of an unassigned variable. For certain names, MATLAB mistakenly interpreted the variable as a stem in dot indexing.

The following example illustrates the problem. The example is a bit artificial (which is why the bug went undiscovered for so long).

Suppose you have a function that is intended to perform two levels of dot-indexing:

```
function y = dotindextwice_A(j)
    y = j.lang.String;
```

Calling this function with no arguments results in an error in all versions of MATLAB, as it should.

Now modify the function slightly so that the input variable is named `java` and run it on a version of MATLAB prior to Version 7.8:

```
function y = dotindextwice_B(java)
    y = java.lang.String;
```

Now when you run the function without arguments, MATLAB misinterprets the word `java`, treating it as if it were the stem of a Java class name:

```
x = dotindextwice_B;    % Deliberately called with no arguments
```

Prior to Version 7.8, this function did not throw an error. In fact, it returned an instance of the `java.lang.String` class:

```
class(x)
ans =
    java.lang.String
```

This violates the rule that variables in functions are supposed to hide all other uses of the name. Beginning in Version 7.8, calling function `dotindextwice_B` without arguments results in an error, just as calling `dotindextwice_A` does.

## **MATLAB Upgrades Support for HDF5 to Version 1.8.1**

The R2009a release of MATLAB uses version 1.8.1 of the HDF5 library. The HDF Group has deprecated two of the HDF5 library functions, `H5Pget_cache` and `H5Pset_cache`. Their M-file counterparts, `H5P.get_config` and `H5P.set_config`, may not work as they did in prior releases of MATLAB. To replace these deprecated functions in your code, consider these four new HDF5 functions: `H5P.get_mdc_config`, `H5P.set_mdc_config`, `H5F.get_mdc_config`, and `H5F.set_mdc_config`.

### **Compatibility Considerations**

If your code uses `H5P.get_cache` or `H5P.set_cache`, your program will produce a warning message.

## **Indirect Calls to Superclass Constructors Now Errors**

You can no longer call an indirect superclass constructor from a subclass constructor. For example, suppose class B is derived from class A, and class C is derived from class B. The constructor for class C should not call the constructor for class A to initialize properties. The call to initialize class A properties should be made from class B.

### **Compatibility Considerations**

If you define classes in which subclass constructors call indirect superclass constructors, MATLAB now issues an error when you attempt to create an instance of the subclass. “Call Only Direct Superclass from Constructor” for information on how to correctly code subclass constructors.

## Graphics and 3-D Visualization, MATLAB Version 7.8 (R2009a)

New features and changes introduced in this version are:

### Functions Previously Only Available in the Image Processing Toolbox Now Available in MATLAB

The following functions have been added to MATLAB from the Image Processing Toolbox:

- `rgb2ind`: Convert RGB image to indexed image.
- `dither`: Convert image using dithering.
- `cmunique`: Eliminate unneeded colors in colormap of indexed image.
- `cmpermute`: Rearrange colors in colormap.
- `imapprox`: Approximate indexed image by one with fewer colors.

### Compatibility Considerations

- The `dither` and `imapprox` functions no longer display their output as an image via a call to `imshow` when called with no output arguments. Instead, the first output argument appears in the Command Window if no semicolon ends the line.
- Function `rgb2ind` errors when called with syntax `rgb2ind(rgb)`.
- Function `imapprox` errors when called with syntax `imapprox(x,map)`.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.8 (R2009a)

New features and changes introduced in this version are:

- “New Programmatic GUI Doc Example” on page 186
- “GUIDE Help Menu Enhanced” on page 186

### **New Programmatic GUI Doc Example**

A new example in the documentation teaches you how to code a GUI that manages multiple lists, such as to-do and shopping lists, contact information, music or video catalogs, or any set of itemizations. Among other things, it illustrates how to write MATLAB code to:

- Share callbacks among uicontrols.
- Obtain component handles from their tags.
- Create a new version of an existing GUI.
- Import and export list data.
- Edit, add, delete, and reorder list items.
- Save a list in the GUI itself.
- Concurrently run multiple GUIs containing different data that call back to the same function.

This example does not use GUIDE. To read about and run it, see “A GUI That Manages List Data” in the documentation for Creating Graphical User Interfaces.

### **GUIDE Help Menu Enhanced**

The Help menu in GUIDE now links to more topics in the documentation than previously. It also links to a set of video tutorials on the MATLAB Central Web site. For details, see “Getting Help in GUIDE” in the Opening GUIDE section of the Creating Graphical User Interfaces documentation.

## External Interfaces/API, MATLAB Version 7.8 (R2009a)

New features and changes introduced in this version are:

- “New Interface to Microsoft .NET Framework” on page 187
- “Expanded Platform Support Added for MATLAB Serial Port” on page 187
- “Changes To Compiler Support” on page 188
- “Do Not Use mxFree to Destroy mxArray” on page 189
- “Cannot Build MEX-Files Using MATLAB Version 5 API” on page 190
- “MEX-Files Calling BLAS or LAPACK Functions Must Be Updated On 64-Bit Platforms” on page 190
- “Object .o Files Saved on Macintosh Systems for Debugging” on page 191
- “Run-Time Libraries Required for Applications Built with Microsoft® Visual Studio 2008 Compiler” on page 191
- “New Features for Shared Library Interface” on page 191
- “New Java Thread Safety Functions” on page 191
- “Improved Robustness of Web Services Functions” on page 192

### **New Interface to Microsoft .NET Framework**

The interface to .NET allows you to bring .NET assemblies into the MATLAB environment, to construct objects from classes contained in the assemblies, and to call methods on these objects. For complete documentation of this feature, see “Using .NET Libraries from MATLAB”. For an overview of the .NET interface, watch this video demo.

### **Expanded Platform Support Added for MATLAB Serial Port**

MATLAB Serial Port is now supported on the following platforms:

- Microsoft Windows 64-bit
- Apple Macintosh OS X
- Macintosh OS X 64-bit

- Linux
- Linux 64-bit
- Sun Solaris 64-bit

## **Changes To Compiler Support**

### **New Compiler Support**

MATLAB Version 7.8 (R2009a) supports these new compilers for building MEX-files:

#### **Microsoft Windows (64- and 32-bit) Platforms.**

- Microsoft Visual Studio 2008 SP1

#### **Linux (64- and 32-bit) Platforms.**

- gcc Version 4.2.3

#### **Apple Macintosh (32-bit) Platforms.**

- GNU gfortran Version 4.2.2

### **Compiler Support To Be Phased Out**

The following compilers are supported in Version 7.8 (R2009a), but will not be supported in a future version of MATLAB:

#### **Windows (32-bit) Platforms.**

- Intel Visual Fortran Version 9.1
- Intel Visual Fortran Version 10.1
- Intel C/C++ Version 9.1
- Microsoft Visual Studio .NET Version 7.1



**Windows (64-bit) Platforms.**

- Intel Visual Fortran Version 9.1
- Intel Visual Fortran Version 10.1
- Intel C/C++ Version 9.1

**Solaris SPARC (64-bit) Platforms.**

- Sun Studio 11 cc / CC Version 5.8
- Sun Studio 11 f90 Version 8.2

**Discontinued Compiler Support**

MATLAB no longer supports the following compilers:

**Windows (32-bit) Platforms.**

- Open Watcom Version 1.3
- Microsoft Visual Studio 2005 Express Edition

**Windows (64-bit) Platforms.**

- Microsoft Platform SDK

**Apple Macintosh (32-bit) Platforms.**

- g95 Version 0.90

**Compatibility Considerations.** To ensure continued support for building your C/C++ programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

**Do Not Use `mxFree` to Destroy `mxArrays`**

It is improper to call `mxFree` on an `mxArray`. Previously, to remedy misleading statements in older documentation, under limited circumstances, MATLAB

issued a warning in code that made this error. MATLAB no longer issues the warning.

### **Compatibility Considerations**

The correct function to use to release memory for an `mxArray` is `mxDestroyArray`. Calling `mxFree` on an `mxArray` could cause memory corruption, which might result in a segmentation violation.

## **Cannot Build MEX-Files Using MATLAB Version 5 API**

MATLAB does not support the `-V5` option to the `mex` function.

### **Compatibility Considerations**

You are no longer able to build a MEX-file using the MATLAB Version 5 API. If you use any of the functions shown in the “Obsolete Functions: MX Array Manipulation” on page 480 table, you must replace them with functions from the Replacement column, if available. These obsolete functions were deprecated when MATLAB Version 6 was released over 5 years ago.

## **MEX-Files Calling BLAS or LAPACK Functions Must Be Updated On 64-Bit Platforms**

You must update any MEX-file that calls functions in the BLAS or LAPACK math packages on 64-bit platforms. The change occurs as a result of updated support, described in “64-bit Support in LAPACK and BLAS” on page 177. Existing MEX-files generated in previous versions of MATLAB will result in undefined behavior (likely crashes), if run in R2009a. The previous versions pass 32-bit integer arguments, but the math routines now read and write to 64 bits of memory. The results you see depend on what is stored in the subsequent 32 bits of memory.

### **Compatibility Considerations**

On 64-bit platforms, you must use 64-bit integers for all input and output variables when calling LAPACK and BLAS routines in C and Fortran source MEX-files. Use the `mwSignedIndex` type for platform-independent code.

## Object .o Files Saved on Macintosh Systems for Debugging

MATLAB saves object .o files when compiling MEX-files on Apple Mac OS Version 10.5 systems so that you can use source-level debugging.

## Run-Time Libraries Required for Applications Built with Microsoft Visual Studio 2008 Compiler

If you distribute a MEX-file, an engine application, or a MAT-file application built with the Visual Studio 2008 compiler, you must provide the Visual C++ run-time libraries. These files are required to run applications developed with Visual C++ on a computer that does not have Visual C++ 2008 installed. For information on locating the Microsoft Visual C++ 2008 Redistributable Package (x86), containing `vcredist_x86.exe` and `vcredist_x64.exe`, consult your Microsoft documentation.

## New Features for Shared Library Interface

- It is now possible to use the `char**` return value and to increment the resulting pointer to retrieve all values. See “Passing an Array of Strings”.
- Added support for accessing values exported by a library.
- All fully and partly sized arrays should now work.

## New Java Thread Safety Functions

Use the following new functions to work with Sun Java objects on the Event Dispatch Thread (EDT).

Function	Description
<code>javaObjectEDT</code>	Construct Java object on EDT
<code>javaMethodEDT</code>	Call Java method from EDT

## **Improved Robustness of Web Services Functions**

The underlying technology used in the `createClassFromWsd1` and `parseSoapResponse` functions was modified to better ensure support for WSDL and SOAP standards.

### **Compatibility Considerations**

There was no intended change to functionality or results of the `createClassFromWsd1` and `parseSoapResponse` functions, which MathWorks verified through testing. There are many variations among WSDL files and Web services and they cannot all be tested. Therefore, it is possible that your results using the `createClassFromWsd1` and `parseSoapResponse` functions in this version could differ from a previous version.

Ensure that your results using `createClassFromWsd1` and `parseSoapResponse` functions are as expected.

# Version 7.7 (R2008b)

## MATLAB Software

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This table summarizes what's new in Version 7.7 (R2008b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.7 (R2008b)” on page 195
- “Mathematics, MATLAB Version 7.7 (R2008b)” on page 218
- “Data Analysis, MATLAB Version 7.7 (R2008b)” on page 220
- “Programming Fundamentals, MATLAB Version 7.7 (R2008b)” on page 221
- “Graphics and 3-D Visualization, MATLAB Version 7.7 (R2008b)” on page 231
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.7 (R2008b)” on page 234

- “External Interfaces/API, MATLAB Version 7.7 (R2008b)” on page 237

## Desktop Tools and Development Environment, MATLAB Version 7.7 (R2008b)

New features and changes introduced in this version are organized by these topics:

- “Desktop New Features Video” on page 195
- “Startup and Shutdown” on page 195
- “Desktop” on page 199
- “Running Functions — Command Window and History” on page 200
- “Help and Related Resources” on page 203
- “Workspace, Search Path, and File Operations” on page 205
- “Editing and Debugging MATLAB Code” on page 212
- “Tuning and Managing MATLAB Code Files” on page 216
- “Publishing MATLAB Code Files” on page 216

### Desktop New Features Video

For an overview of the major new features in the MATLAB Desktop Tools and Development Environment area, watch this video demo. Another way to access this and other video demos is to select the **Demos** tab in the Help browser, and then select **MATLAB > New Features in Version 7.7**.

### Startup and Shutdown

New features and changes introduced in Version 7.7 (R2008b) are:

- “Macintosh Startup and Root Directory Enhancements and Changes” on page 196
- “Updated Version of JVM Software” on page 197
- “Specifying Address Space Protection During Startup on Windows Platforms” on page 197
- “Changes to -nojvm Startup Option” on page 197
- “Changes to matlab Memory Manager Startup Options” on page 198

## Macintosh Startup and Root Directory Enhancements and Changes

MATLAB for Apple Macintosh platforms is now installed like many other applications for Macintosh platforms, as a Macintosh .app bundle. This has resulted in some enhancements and changes to starting and using MATLAB on Macintosh platforms.

**Startup Location.** To start MATLAB on the Macintosh platform, double-click the MATLAB\_R2008b icon in the Applications folder. This differs from R2008a (V7.6), where you started MATLAB by double-clicking the MATLAB 7.6 icon in the Applications/MATLAB\_R2008a folder; there was an additional folder level in R2008a.

**Starting MATLAB from a File.** You can now start MATLAB by double-clicking a file with a file extension that has been associated with MATLAB, such as a file with a .m extension. Similarly, you can drag a file onto the MATLAB\_R2008b icon in the Applications folder or in the dock. These actions start MATLAB and open the file.

**Contents of MATLAB Root Directory.** When you use file browser GUIs to navigate in the MATLAB root directory, /Applications/MATLAB\_R2008b, (known as the *matlabroot* directory), you cannot directly view or access its contents. For example, when you select **File > Open** and navigate to Applications/MATLAB\_R2008b, no contents display. To access the contents, press **Command+Shift+G**, and enter the path to the MATLAB root directory in the resulting Go To Folder dialog box, for example, /Applications/MATLAB\_R2008b.app.

Similarly, when you select MATLAB\_R2008b in the Applications folder using the Finder, you do not see the contents. To access the contents, right-click (or **Ctrl+click**) MATLAB\_R2008b, and from the context menu, select **Show Package Contents**. For more information, see “Navigating Within the MATLAB Root Folder on Macintosh Platforms”.

**Startup Options and the Start MATLAB Settings Dialog Box.** You can no longer set startup options using the Start MATLAB Settings dialog box and you can no longer start MATLAB from any .smat files you saved using Start MATLAB Settings. The dialog box is now used only for diagnostics and only appears if MATLAB experiences a problem during startup.



To set the startup directory in MATLAB, use the `userpath` function. To instruct MATLAB to run a specified statement upon startup, start MATLAB using the `matlab` command from a shell, as you would to start MATLAB on any UNIX platform. For more information, see “Startup Options”.

**Starting MATLAB in a Shell.** In R2008b (V7.7), to start MATLAB from a shell, enter the path to the executable, `/Applications/MATLAB_R2008b.app/bin/matlab`. This differs from R2008a (V7.6), in which the path was `/Applications/MATLAB_R2008a/bin/matlab`.

**Compatibility Considerations.** The compatibility considerations are described along with the above changes.

### Updated Version of JVM Software

MATLAB is now using Sun Microsystems™ JVM™ Version 6 Update 4 software on all platforms, except the Apple Macintosh platform. If you specify a version of Java software to use with MATLAB, this change might impact your work.

### Specifying Address Space Protection During Startup on Windows Platforms

When you start MATLAB on Microsoft Windows 32-bit platforms, you can set a startup option to help ensure the largest available contiguous block of memory after startup, which is useful if you run memory-intensive operations, such as processing large data sets. You can use the new `-shield` startup option to specify different levels of protection of the address space during the MATLAB startup process. This can also help resolve problems if MATLAB fails to start. For more information, see the `matlab` (Windows) reference page.

### Changes to `-nojvm` Startup Option

When you start MATLAB with the `-nojvm` startup option, Handle Graphics® functionality will no longer be supported. (The `-nojvm` option is available for UNIX platforms; see background information at the `matlab` (UNIX) reference page.)

Some aspects of MATLAB and related products use Handle Graphics in a way that might not be obvious. This includes anything that is based on or works using figures in MATLAB. Here is a summary of the affected features:

- Creating figures and performing plotting tasks, such as using the `plot`, `axes`, `getframe`, and `gcf` functions.
- Printing figures and using related functions such as `print`, `hgexport`, and `saveas`.
- Creating GUIs in MATLAB using GUI-building functions such as `warndlg`.
- Using Simulink scopes and printing Simulink models.

In MATLAB Version 7.7 (R2008b), if you use the `-nojvm` startup option and use Handle Graphics functionality, MATLAB produces this warning:

This functionality is no longer supported under the `-nojvm` startup option

In a future release, instead of a warning, MATLAB will produce an error when you start with the `-nojvm` option and use Handle Graphics functionality.

**Compatibility Considerations.** To avoid the warning, start MATLAB without the `-nojvm` startup option:

- If you have been using the `-nojvm` startup option to work in a command line environment or because you do not use the MATLAB desktop, use the `-nodesktop` startup option instead.
- If you have been using the `-nojvm` startup option because of memory or performance benefits, look for other ways to gain those improvements when you start MATLAB without the `-nojvm` option. See the “Performance” and “Memory Usage” topics in the MATLAB Programming Fundamentals documentation.
- If you want to continue to use the `-nojvm` startup option, remove the code that is now producing the warnings.

### **Changes to matlab Memory Manager Startup Options**

The `matlab` command line arguments `-memmgr` and `-check_malloc` are deprecated and will be removed in a future release. The environment variable

MATLAB\_MEM\_MGR is also deprecated and will be removed. For information about these options, see `matlab` (Windows) or `matlab` (UNIX).

**Compatibility Considerations.** If you use these options, MATLAB generates a warning message.

## Desktop

New features and changes introduced in Version 7.7 (R2008b) are:

- “New Default Layout for Desktop” on page 199
- “Closing Document Windows Using Middle Mouse Button” on page 199
- “Preferences Opens to Last Pane Used” on page 199
- “Changes to Desktop Text Font” on page 200
- “Provide Authentication Settings for Proxy Server when Accessing the Internet from MATLAB” on page 200

### New Default Layout for Desktop

There is a new desktop layout when you select **Desktop > Desktop Layout > Default**. It includes the same components as the previous default desktop layout, however, they are arranged differently. If you prefer the previous default layout, arrange your desktop in that way and save the layout. You then can reuse the saved layout at any time.

### Closing Document Windows Using Middle Mouse Button

If you have multiple documents open, you can now close a document by clicking the middle mouse button when the pointer is in the document's button on the document bar.

### Preferences Opens to Last Pane Used

When you open the Preferences dialog box, it displays the last preference pane you viewed in the current session. In prior versions, the Preferences dialog box displayed the pane associated with the tool from which you accessed it.

## Changes to Desktop Text Font

You now can specify that the desktop text font use the system default font. To do this, select **File > Preferences > Fonts**. Then, for **Desktop text font**, select **Use system font**. For more information, click the **Help** button in the Fonts Preferences dialog box.

The default settings for the desktop text font and the HTML Proportional Text font have changed. This only affects existing users who choose to use a new preferences file (`matlab.prf`) in R2008b.

## Provide Authentication Settings for Proxy Server when Accessing the Internet from MATLAB


If you want to access the Internet from MATLAB and your network uses a firewall or another means of protection that restricts Internet access and requires you to provide a username and password, use the new proxy server authentication settings in Web preferences to specify the values. For more information, click the **Help** button in the Web preferences pane, or see “Web Preferences”.

## Running Functions – Command Window and History

- “Find Function Names and Get Help Using the New Function Browser” on page 200
- “View Syntax Hints While Entering Statements” on page 201

### Find Function Names and Get Help Using the New Function Browser

While you work, you can find the names of functions and get help for them using the new Function Browser. The Function Browser is useful if you want to find a function whose name you cannot remember, determine if there are functions that do what you want, or view the reference page for a function. The Function Browser uses a subset of the information found in the function reference pages in the Help browser for quick access while you work.

To access the Function Browser, press **Shift+F1**, or if you are in the Command Window or Editor, click the Function Browser button . The Function Browser opens. You can specify the products to look in, browse categories of

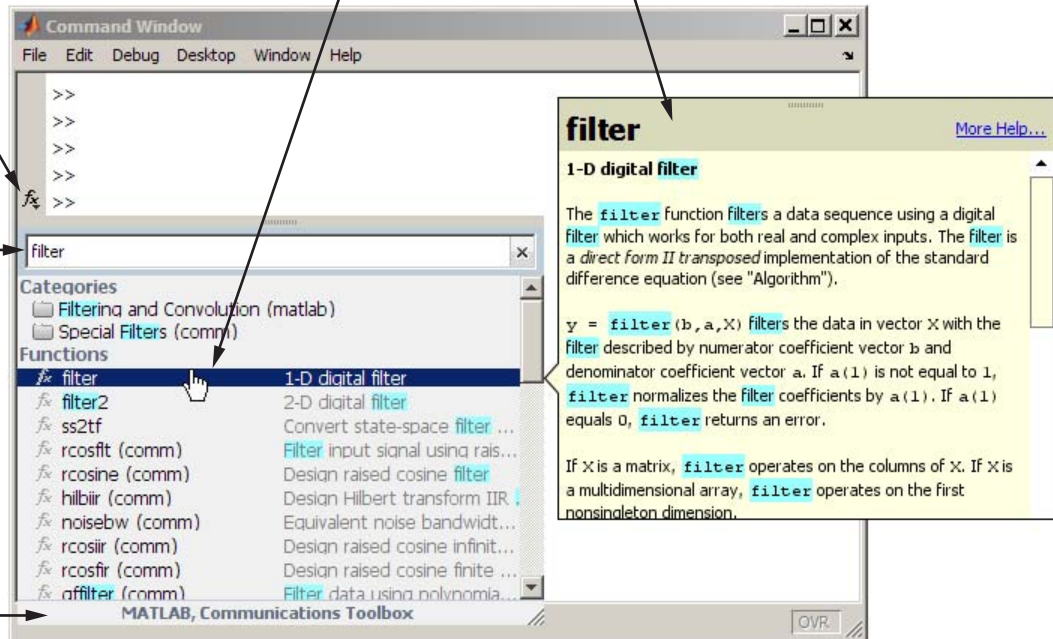
functions, and search for words that appear in function reference pages. For more information, see “Find Functions Using the Function Browser”.

1. To open the Function Browser, click its button or press **Shift+F1**.

4. Select a function to view quick help for it in a pop-up window.

2. Find categories and functions whose help contains words you specify.

3. Click to change the scope of product documentation to look in.



5. To use a function, drag it from the Function Browser to a tool, such as the Command Window.

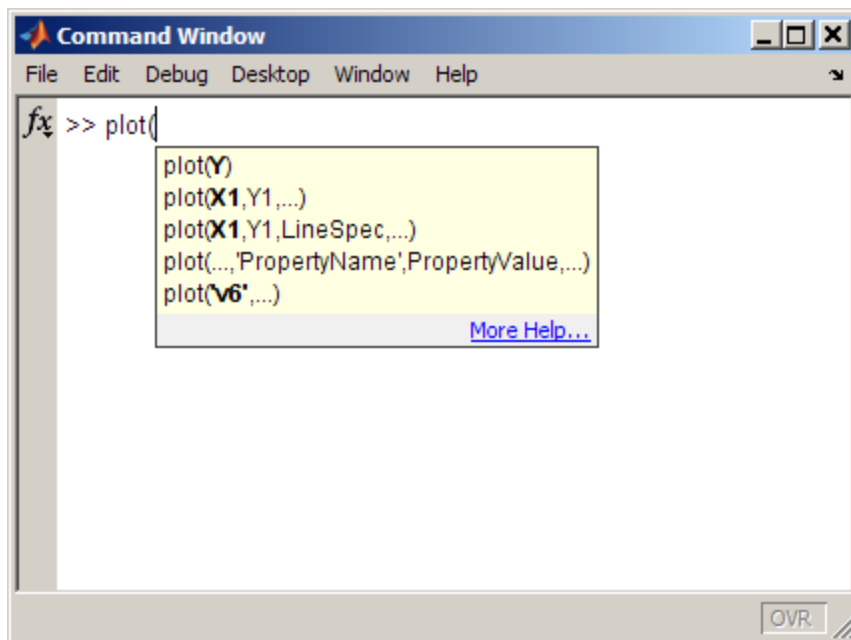
## View Syntax Hints While Entering Statements

While you enter statements in the Command Window and Editor, you can view the allowable input argument syntax for a function in a pop-up window. This feature is called *function hints*. To use function hints:

- 1 Type the function name, followed by the left parenthesis, (, and pause. The syntax for input arguments automatically displays in a pop-up window near the statement you are entering.

- 2 The arguments you can enter appear in bold. Enter your first argument and type a comma ( , ) after it. The syntax options in the pop-up window then change, based on the argument you just entered.
- 3 Continue entering arguments, using the hints as needed. You can dismiss the function hints pop-up window at any time by pressing **Esc**. When you type the closing parenthesis, ), or when there are no more arguments to enter, the pop-up window automatically closes.

The following illustration shows function hints for the `plot` function.



To turn off the function hints feature so the pop-up menu does *not* automatically display the syntax reminders when you type an opening parenthesis, use Keyboard preferences; for **Function Hints**, clear the check box that enables them.

For more information, see “View Function Syntax Hints While Entering a Statement”.

## Help and Related Resources

- “New Help Features — Function Browser and Function Hints” on page 203
- “Viewing an HTML Version of Help for Classes You Create” on page 203
- “Finding Text In Small Help Windows” on page 205
- “Changes to Search Field in Help Browser” on page 205

### New Help Features — Function Browser and Function Hints

There are two new features that provide help while you work:

- Use the new Function Browser to find function names while you work. It is most useful in the Command Window and Editor, but you can access it from any tool. For more information, see “Find Function Names and Get Help Using the New Function Browser” on page 200.
- Use function hints to help you complete syntax for statements in the Command Window or Editor. For more information, see “View Syntax Hints While Entering Statements” on page 201.

### Viewing an HTML Version of Help for Classes You Create

If you create your own class definition files in MATLAB and you provide help in the `classdef` file for the class, properties, and methods, you can conveniently view the help in the Help browser by running `doc classname`. For more information, see “Help for Classes You Create”. The following example shows class information in the Help browser for the user-created class, `sads`, displayed by running

```
doc sads
```

The screenshot shows the MATLAB Help window with the 'Help Navigator' on the left and the main content area on the right. The 'Help Navigator' has tabs for 'Contents', 'Index', 'Search Results', and 'Demos'. The 'Contents' tab is active, showing a tree view of the help structure:

- Release Notes
- Installation
- MATLAB
- Signal Processing Toolbox
- Simulink
- Signal Processing Blockset

The main content area displays the documentation for the 'sads' class. The title bar indicates 'M-File Help: sads'. The main heading is 'sads', followed by the description 'Sensor Array Data Set Class'. Below this, there are sections for 'Class Details', 'Constructor Summary', 'Property Summary', and 'Method Summary'.

**Class Details**

Sealed	false
Construct on load	false

**Constructor Summary**

[sads](#) SADS Create sensor array data set

**Property Summary**


<a href="#">Data</a>	Data - Sampled sensor data
<a href="#">SampleRate</a>	SampleRate - Sample rate (Hz)
<a href="#">Spacing</a>	Spacing - Spacing of array (m)
<a href="#">Name</a>	Name - Sensor array test run name
<a href="#">Wavelength</a>	
<a href="#">c</a>	c - Speed of wave in medium (m/s)
<a href="#">NumSensors</a>	NumSensors - Number of sensors
<a href="#">NumSamples</a>	NumSamples - Number of samples

**Method Summary**



## Finding Text In Small Help Windows

The Find dialog box is now available from the small help windows used for the Help on Selection feature and for context-sensitive help. The find feature is useful when you want to search for a specific word or phrase within one of these help windows. To access the Find dialog box:

- In a window used for the Help on Selection feature, press **Ctrl+F** on Windows and UNIX platforms or **Cmd+F** on Macintosh platforms. You can also click the **Find text**  button
- In a context-sensitive help window, press **Ctrl+F** on Windows and UNIX platforms, and **Cmd+F** on Macintosh platforms

## Changes to Search Field in Help Browser

You can quickly access the Product Filter from the search field by selecting the down arrow at the right side of the search field and from it, selecting **Filter by Product**. The Help pane of the Preferences dialog box opens. For more information about the product filter, click the **Help** button in the dialog box.

As you enter a term in the search field, a history of terms you previously entered in the current session appears. To view the full history, select the down arrow at the right side of the search field and from it, select **Show Search History**. You can select an item in the search history to rerun the search.

To execute a search, enter the search terms and press **Enter**. There is no longer a Go button.

## Workspace, Search Path, and File Operations


New features and changes introduced in Version 7.7 (R2008b) are:

- “Current Directory Browser Enhanced, Including New Navigation and Grouping Features” on page 206
- “Structure Results of dir for Nonexistent Files Now Include Empty Matrices” on page 210
- “Workspace Browser Toolbar Is Now Configurable” on page 211

- “Semicolon (;) Path Separator Character Now Used on UNIX Platforms” on page 212

## **Current Directory Browser Enhanced, Including New Navigation and Grouping Features**

The Current Directory browser includes new ways to navigate and to view the directory contents. There are also new ways to find files, including a new filter field.

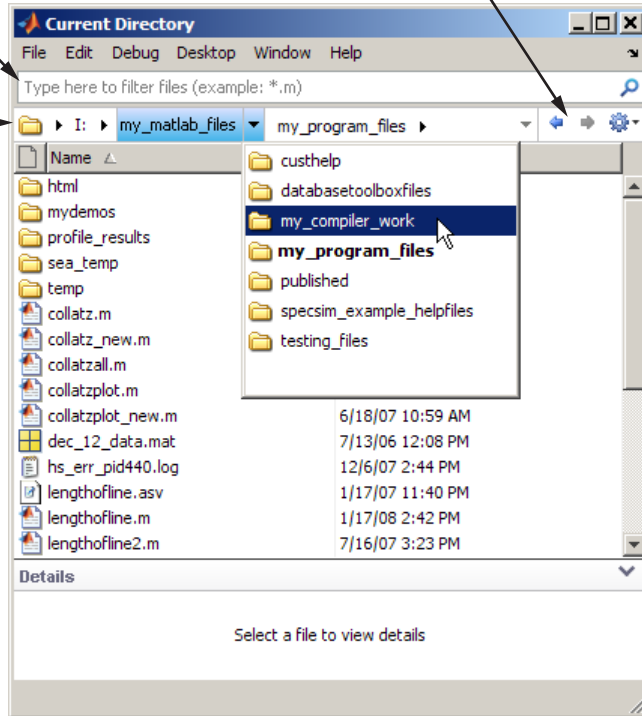
- Use the new address bar to view the current directory and to view and navigate to subdirectories within the current directory path.
- Access common features from the Actions button  on the toolbar.
- Add and remove buttons from the toolbar by right-clicking the toolbar and selecting **Customize**.
- List only files whose names contain a specified string by using the new filter field. To show the filter field, use **File > Preferences > Current Directory**.
- In the **Details** pane at the bottom of the tool, view a list of elements in the selected file, such as subfunctions in a MATLAB program file. Double-click an element to open the file at the location of the element.
- For a MAT-file, drag selected variables from the **Details** pane to the Workspace browser to load them into MATLAB. Similarly, save workspace variables to a MAT-file by dragging them from the Workspace browser to the Current Directory browser.
- Group items in the current directory, that is, view related items together. From the Actions button, select **Group By** and select the attribute you want to group by.

Some of the major changes are highlighted in the following illustrations.

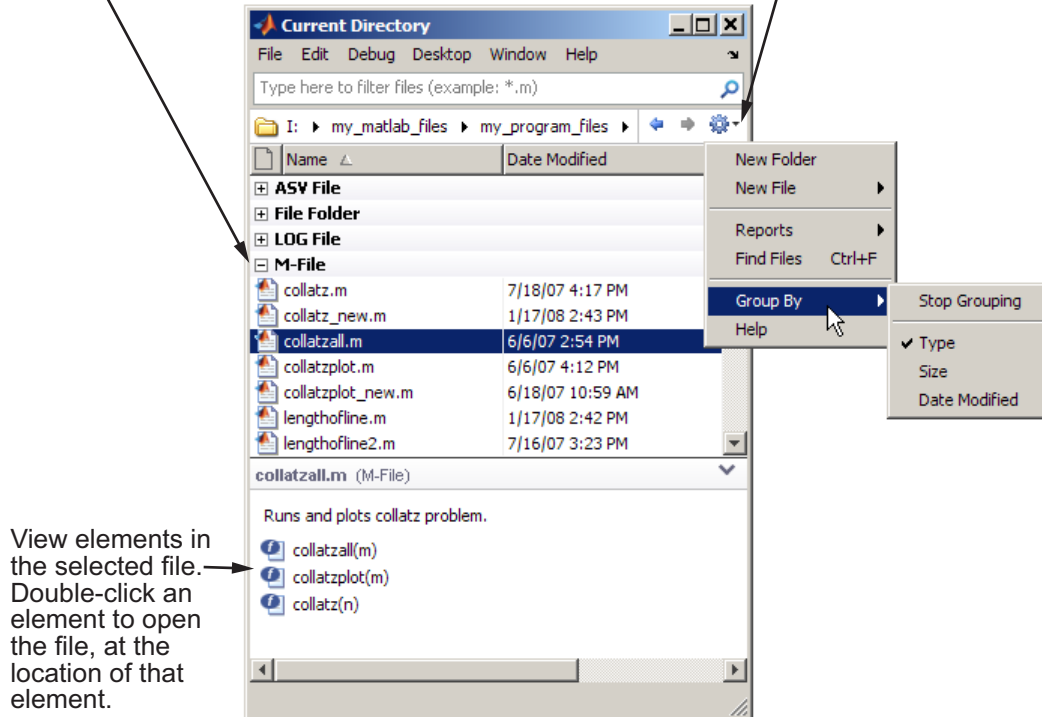
Type a string in the filter field to view only file names containing that string in the current directory. Use preferences to show the filter field.

Right-click the toolbar and select **Customize** to add and remove buttons.

View subdirectories and change the current directory using the address bar.



To group files by type, select **Group By** from the Actions button. Use the - or + button to hide or show files within a group. Here, files are grouped by type, and files for all types except those with a .m extension are hidden.



For more information, see “Managing Files in MATLAB”.

**Compatibility Considerations.** The following aspects of using the Current Directory browser are different in Version 7.7 (R2008b) than in the previous version. Following is a table of what changed and the way to perform the same action in Version 7.7.

<b>Change</b>	<b>What To Do Instead In Version 7.7 (R2008b)</b>
The toolbar no longer includes the buttons it previously included.	<p>You can now specify which buttons to include on the toolbar. You can include the toolbar buttons included in previous versions, or use these alternatives:</p> <ul style="list-style-type: none"> <li>• Go up one level button — Instead, select a directory one level up by using the address bar.</li> <li>• Find files button — Instead, select <b>Find Files</b> from the Actions button on the toolbar, or use <b>Ctrl+F</b>.</li> <li>• New folder button — Instead, select <b>New Folder</b> from the Actions button on the toolbar.</li> <li>• Directory reports — Instead, select <b>Reports</b> from the Actions button on the toolbar.</li> </ul>
The string display of the full path for the current directory has been replaced by the address bar view.	You can still access the string display, which can be useful if you want to copy it or edit it directly. To access the string, click the blank area to the right of the last subdirectory in the address bar. To return to the address bar view, press the <b>Escape</b> key.
You do not select attributes (columns) to display using Current Directory Preferences ( <b>Browser display options</b> ).	Right-click any column header to select or clear the columns to display, such as file size. You can only do this on Microsoft Windows platforms.
The file description no longer appears in a column.	View the description for a selected file in the detail pane.

<b>Change</b>	<b>What To Do Instead In Version 7.7 (R2008b)</b>
The full help for a MATLAB program file no longer appears in the detail pane.	Press <b>F1</b> to view the reference page for the selected file.
You do not elect to show details using Current Directory Preferences ( <b>Browser display options</b> ).	Use the arrow on the right side of the detail pane separator to show or hide the details.
The <b>File Filter</b> options, accessible from the context menu and the <b>View</b> menu, have been removed.	Use the new filter field (use Preferences for the Current Directory browser to show the filter field), or sort by file type (click the document icon header), or group by file type using the new grouping feature (available from the Actions button).
The <b>View</b> menu was removed.	Use the new filter field (previously described) to filter the view. For Directory Reports, select <b>Reports</b> from the Actions button on the toolbar.
When you look for items in the current directory by typing the initial letters in the name, a pop-up window no longer appears showing the letters that you typed.	As before, the first entry whose name begins with the letters you typed is selected. If you want to see what you type when finding items in the current directory, instead use the filter field.

### **Structure Results of dir for Nonexistent Files Now Include Empty Matrices**

When you run `dir` with an output argument and the results include a nonexistent file or a file that `dir` cannot query for some other reason, `dir` now returns empty matrices for the `date`, `bytes`, and `datenum` fields. The most common occurrence is on UNIX platforms when `dir` queries a file that is a symbolic link and the symbolic link points to a nonexistent target. A nonexistent target is when a target has been moved, removed, or renamed.

For example, if `my_file` in `my_dir` is a symbolic link to another file that has been deleted, then running

```
r = dir('my_dir')
```

includes this result for `my_file`:

```
r(n) =
    name: 'my_file'
    date: ''
    bytes: []
    isdir: 0
    datenum: []
```

where  $n$  is the index for `my_file`, found by searching `r` by the `name` field.

With empty matrices returned, code you write to use the results of `dir` can be simpler and more robust. For more information, see the reference page for the `dir` function.

**Compatibility Considerations.** In previous versions, `dir` returned inappropriate values for files that could not be queried:

```
r(n) =
    name: 'my_file'
    date: '18-Jan-2038 22:14:07'
    bytes: 0
    isdir: 0
    datenum: 7.4438e+05
```

If you have existing files that rely on the results of `dir` for a file that could not be queried, your code might not produce the result it used to. If you write new code that depends on the new results for `dir` and run it in a previous version of MATLAB, it might not produce the results you expect. In either case, there will probably not be a warning or error.

## Workspace Browser Toolbar Is Now Configurable

Rearrange, add, or remove buttons and other controls from the Workspace Browser toolbar using **File > Preferences > Toolbars**. Alternatively,

right-click the toolbar and select **Customize** from the context menu. By default, the Print button is not on the toolbar.

For more information on customizing the toolbar, see “Toolbar Customization”.

## **Semicolon (;) Path Separator Character Now Used on UNIX Platforms**

On UNIX platforms, MATLAB now uses a semicolon (;) as the character that separates directories in the search path file, `pathdef.m`, which is the character used on Windows platforms. This is beneficial if you work with the contents of the `pathdef.m` file programmatically on both Windows and UNIX platforms. In versions prior to Version 7.7 (R2008b), MATLAB used the colon (:) character as the path separator on UNIX platforms.

**Compatibility Considerations.** MATLAB will continue to accept the colon (:) character as a valid path separator on UNIX platforms, so any existing code you have that relies on it will still work.

You will experience a problem if you have any directories that contain a semicolon in their name. You will need to rename the directories to include them on the search path.

## **Editing and Debugging MATLAB Code**

New features and changes introduced in Version 7.7 (R2008b) are:

- “Create New Function and Class Files Using Templates” on page 213
- “View Syntax Hints, Find Function Names, and Get Quick Help” on page 213
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- “Code Fold Single Program, Multiple Data (spmd) Blocks” on page 215
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- “Accessing Contents of MATLAB Root Directory on Macintosh Platforms” on page 216

### **Create New Function and Class Files Using Templates**

When you create new functions and class definition files (`classdef`), you can start with a template that reminds you to include standard information. Select **File > New > Function M-File**, or **File > New > Class M-File**. A new file containing template information opens in the Editor.

### **View Syntax Hints, Find Function Names, and Get Quick Help**

While you enter statements in the Editor or Command Window, you can display the syntax for a function in a temporary pop-up window. For more information, see “View Syntax Hints While Entering Statements” on page 201.

You also can find the names of and get help for functions using the new Function Browser—for more information, see “Find Function Names and Get Help Using the New Function Browser” on page 200.

### **Set Color and Width of Right-Hand Text Limit**

In the Editor, where you can enable a vertical line to indicate a right-hand text limit, you now can set the width and color of the line. Note that the default color for the line is now gray, instead of light red.

Set preferences for the line by selecting **File > Preferences > Editor/Debugger > Display**, which opens the Preferences dialog box.

Click **Help** in the Preferences dialog box for more information.

## Set Cursor to First Nonwhite Character on Line

When you press the **Home** key, the cursor goes to the first nonwhite character on the current line. When you press the **Home** key twice, the cursor goes to the beginning of the line.

**Compatibility Considerations.** In versions prior to Version 7.7 (R2008b), the **Home** key always moved the cursor to the first column of the current line.

## Suppress a Specific M-Lint Message Throughout a File

You can now suppress a specific M-Lint message throughout a file by right-clicking on an M-Lint indicator that elicits the message, and then from the context menu, selecting **Suppress All Instances in this File**.

For details, see “Suppress All Instances of a Message in the Current File” in the MATLAB Desktop Tools and Development Environment documentation. For information on manually inserting the string that tells M-Lint to suppress the message throughout the file, see the documentation for the `mlint` function.

## New M-Lint Message for Suppressed Messages

An M-Lint message now appears if you previously suppressed a message using the `%#ok` directive, and that message no longer appears. This can result if the message is already suppressed using preferences (**File > Preferences > M-Lint**), and the code has changed such that the message is no longer generated, or if the rules M-Lint follows for generating the message have changed. The new message is:

```
An M-Lint message was suppressed here, but the message no longer appears
Use the context menu to fix.
```

For an example, see the *Suppressing All Messages on a Line with `mlint`* example in the `mlint` function documentation.

## View M-Lint Message in ToolTip Using the Keyboard

To open an M-Lint Message ToolTip using the keyboard, place the cursor over the marked code and press **Ctrl + M**. This feature is offered in addition to the identical behavior available when you use the mouse pointer to hover over code that is marked by M-Lint. For an example of viewing an M-Lint message

in a ToolTip, see “Check Code for Errors and Warnings” in the MATLAB Desktop Tools and Development Environment documentation.

### **Apply M-Lint Autofix Using the Keyboard**

To fix a problem marked by M-Lint as having an automatic fix available, place the cursor over the marked code, and then press **Alt + Enter**. This feature is offered in addition to the identical behavior available when you use the context menu. For an example of using the M-Lint autofix feature, see “Check Code for Errors and Warnings” in the MATLAB Desktop Tools and Development Environment documentation.

### **Code Fold Single Program, Multiple Data (spsmd) Blocks**

By default, the Editor now supports code folding for single program, multiple data (spsmd) blocks. For more information on code folding, see “Code Folding — Expand and Collapse Code Constructs” in the MATLAB Desktop Tools and Development Environment documentation.

### **File and Directory Comparisons Tool: Highlight Changes**

The File and Directory Comparisons Tool now uses shades of colors to mark differences in the contents of two directories being compared. Light colors indicate files that differ and dark colors indicate subdirectories that differ. For details and an example, see “Comparing Folders and Zip Files” in the MATLAB Desktop Tools and Development Environment documentation.

**Compatibility Considerations.** In releases prior to Version 7.7 (R2008b), the same color intensity highlighted differences in both files and directories.

### **Block Indenting Will Not Be Included in Next Version**

The **Block Indent** option will no longer be provided, starting in the next version of MATLAB. Currently, this option is available for M, Java, and C/C++ programming languages, when you select **File > Preferences > Editor/Debugger > Language**. To attain the effect of block indenting, you can use the **No indent** option and indent lines manually using the **Tab** and **space** keys.


If you have concerns about the pending removal of the **Block Indent** option, please e-mail Technical Support at [support@mathworks.com](mailto:support@mathworks.com).


## Accessing Contents of MATLAB Root Directory on Macintosh Platforms

Starting in MATLAB 7.7 (R2008b), on Macintosh platforms, you cannot use file browser GUIs to directly access contents of the MATLAB root directory. For example, when you use **File > Open** from the Editor, you cannot directly select a file located within *matlabroot*. For more information, see “Contents of MATLAB Root Directory” on page 196.

## Tuning and Managing MATLAB Code Files

### Access Directory Reports

You now access Directory Reports by navigating to the directory containing the MATLAB program files for which you want to produce reports. Then, on the Current Directory browser toolbar, click the **Actions** down arrow  and select the type of report you want to run for all of the MATLAB program files in the current directory. Note that these reports are now referred to as Reports, rather than Directory Reports.

**Compatibility Considerations.** In versions prior to Version 7.7 (R2008b), you navigated to the directory containing the MATLAB program files for which you wanted to produce reports. Then, you clicked the **Directory Reports** down arrow  on the Current Directory browser toolbar.

## Publishing MATLAB Code Files

New features and changes introduced in Version 7.7 (R2008b) are:

- “Include Figure Window Details in Published Documents” on page 216
- “Inline Math Supported in Published Documents” on page 217
- “Publish Setting: Cascading Style Sheet Is Now XSL File” on page 217

### Include Figure Window Details in Published Documents


In versions prior to Version 7.7 (R2008b), when you published a file that included a figure window, only the graph or figure was included in the published document. Using the `figureSnapMethod` option, you can now

specify that you want the window details included in the published document. For details, see the [publish](#) reference page.

### **Inline Math Supported in Published Documents**

In versions prior to Version 7.7 (R2008b), you could publish LaTeX code in a published document as a code block, separate from the rest of your comments, if any. Now, you can publish LaTeX math symbols inline with the rest of your comments. For details, see “Including Inline LaTeX Math Equations in MATLAB Files for Publishing”.

### **Publish Setting: Cascading Style Sheet Is Now XSL File**

In versions prior to Version 7.7 (R2008b), there was a **Cascading Style Sheet** setting on the Publish Configurations dialog box (which you access by clicking the Publish down-arrow button ). This setting is now called **XSL File**, to more accurately reflect the setting.

**Compatibility Considerations.** The **Cascading Style Sheet** setting on the Publish Configurations dialog box is now **XSL File**.

## Mathematics, MATLAB Version 7.7 (R2008b)

New features and changes introduced in this version are:

- “Upgrade to Random Number Generator” on page 218
- “Multipoint Boundary-Value Problems with `bvp5c`” on page 218
- “Upgrades to `lsqnonneg`” on page 219
- “Functions and Properties Being Removed” on page 219
- “Upgrade to Intel Math Kernel Libraries” on page 219

### Upgrade to Random Number Generator

- The `randn` function uses a new longer period random number algorithm as its default.
- The new function `randi` returns random integers from a uniform discrete distribution.
- The `@RandStream` class allows you to construct a random number stream object and set its properties. For more information, see “Random Numbers” in the MATLAB Mathematics documentation.

### Compatibility Considerations

The `randn` function now produces different results than in previous releases. Because the values returned by `randn` are intended to be random, this change should not affect most code.

`rand` and `randn` now draw from the same random number stream. In prior releases, `rand` and `randn` had separate independent underlying random number streams. Since `rand` and `randn` now access the same stream, using `randn` will affect subsequent values produced by `rand` and vice-versa. See “Creating and Controlling a Random Number Stream” in the MATLAB Mathematics documentation for more information.

### Multipoint Boundary-Value Problems with `bvp5c`

The solver `bvp5c` will take multipoint boundary-value problems.

## Upgrades to `lsqnonneg`

`lsqnonneg` now runs more efficiently. It accepts sparse matrices as inputs and maintains sparsity throughout its internal iterations.

## Functions and Properties Being Removed

Function or Property Name	What Happens When You Use Function or Property?	Use This Instead	Compatibility Considerations
<code>betacore</code>	Fails	<code>betainc</code>	Replace all existing instances of <code>betacore</code> with <code>betainc</code> .
<code>colmmd</code>	Fails	<code>colamd</code>	Replace all existing instances of <code>colmmd</code> with <code>colamd</code> .
<code>symmmd</code>	Fails	<code>symamd</code>	Replace all existing instances of <code>symmmd</code> with <code>symamd</code> .
<code>flops</code>	Fails	None	Remove all instances of <code>flops</code> . With the incorporation of LAPACK in MATLAB Version 6, counting floating-point operations is no longer practical.

## Upgrade to Intel Math Kernel Libraries

For Windows, Intel Mac, and Linux platforms, MATLAB software supports the Intel Math Kernel Library (MKL) version 10.0.3.

## Data Analysis, MATLAB Version 7.7 (R2008b)

### Specialized Data Tips for the hist Function

When you create a histogram display using `hist` and place data tips in the plot in data cursor mode, they now snap to the top center of the bin you attach them to. The data tip contents have changed as well, and now consist of:

- Number of observations falling into the selected bin
- The x-value of the bin's center
- The lower and upper x-values for the bin

For details, see “Using Data Cursors with Histograms” in the MATLAB Graphics documentation.

### Compatibility Considerations

Data tips for histograms no longer display the  $x$  and  $y$  coordinates of their locations and no longer snap to the four corners of the bins, as they do for `bar` plots. The data tips are also larger, to accommodate the extra information.



## Programming Fundamentals, MATLAB Version 7.7 (R2008b)

New features and changes introduced in this version are

- “Fast Key Lookup Provided with New Map Data Structure” on page 221
- “Tic and Toc Support Multiple Consecutive Timings” on page 222
- “New Options for MException getReport” on page 223
- “what Function Returns Package Information” on page 223
- “addtodate Accepts Hours, Minutes, Seconds, Milliseconds” on page 224
- “Querying Options Added to pause” on page 224
- “File Selection Restriction in Import Wizard” on page 225
- “Function Handle Array Warning Is Now An Error” on page 226
- “Two Types of issorted Warnings Are Now Errors” on page 227
- “Possible Conflict with New Keyword: SPMD” on page 227
- “Do Not Create MEX-Files with DLL File Extensions” on page 228
- “isequal Is Now Called Explicitly for Contained Objects” on page 228
- “Indexed Assignment with Objects of the Form p(:) = o Now Consistent with MATLAB Language” on page 229
- “fopen No Longer Supports VAXD, VAXG, and Cray Machine Formats” on page 229

### Fast Key Lookup Provided with New Map Data Structure

This release introduces a new MATLAB class called a *Map*. An object of the *Map* class is an array of any MATLAB data type that supports lookup table functionality. Unlike most arrays in MATLAB that only allow access to the elements by means of integer indices, indices for *Map* containers can be nearly any scalar numeric value or a character string.

The following example creates a *Map* object that is an array of strings. It is very much like any other string array except that with each *value* of this array

there is also a lookup *key* associated with it. This particular Map contains the names of capital cities in the United States. These are the values of the Map object. Associated with each capital city value is the US state that it resides in. These are the keys of the Map object. You look up values in the Map using key indices. Call the `containers.Map` constructor to create an array of six capital cities indexed by six US states. (The capital of Alaska has purposely been entered incorrectly):

```
US_Capitals = containers.Map( ...
    {'Arizona', 'Nebraska', 'Nevada', ...      % 6 States
     'New York', 'Georgia', 'Alaska'}, ...
    {'Phoenix', 'Lincoln', 'Carson City', ...  % 6 Capitals
     'Albany', 'Atlanta', 'Fairbanks'});
```

Show the capitals of three of the states by looking them up in the Map using the string indices 'Nevada', 'Alaska' and 'Georgia':

```
values(US_Capitals, {'Nevada', 'Alaska', 'Georgia'})
ans =
    'Carson City'    'Fairbanks'    'Atlanta'
```

Correct the capital city of Alaska by overwriting the entry at string index 'Alaska':

```
US_Capitals('Alaska') = 'Juneau';

US_Capitals('Alaska')
ans =
    Juneau
```

The term `containers.Map` refers to a Map class that is part of a MATLAB package called `containers`. For more information, see `Map Containers` in the `Programming Fundamentals` documentation.

## Tic and Toc Support Multiple Consecutive Timings

The `tic` and `toc` timing functions now support multiple consecutive timings. Call `tic` with an output `t0` to save the current time as the starting time for some operation. When the operation completes, call `toc` with the same `t0` as its input and MATLAB displays the time between that particular `tic` and `toc`.

In the following example, MATLAB measures the time used by each function call and, at the same time, measures the time required for the overall operation:

```
t0 = tic;
    t1 = tic;   W = myfun1(A,B);           toc(t1)
    t2 = tic;   [X,Y] = myfun2(C,W);       toc(t2)
    t3 = tic;   Z = myfun3(A,C,Y);         toc(t3)
toc(t0)
```

You can still call `tic` and `toc` without any arguments. In this case, `toc` just measures the time since the most recent `tic`.

See the function reference page for `tic` or `toc` for more information.

## New Options for MException getReport

The `MException getReport` method has several new options available in this release. You select these options when you call `getReport`. They give you more control over the content and format of the information displayed or returned by `getReport`.

See the function reference page for `getReport` for more information.

## what Function Returns Package Information

The `what` function now includes package information in its output display and a `package` field in the structure array that it returns.

List the packages used in the MathWorks Communications System Toolbox™:

```
s = what('comm');

s.packages
ans =
    'crc'
    'commdevice'
    'commsrc'
    'commgui'
    'commscope'
```

```
'commutils'
```

You can also call `what` on a specific package name to see what types of directories and files are in the package directory.

See the function reference page for `what` for more information.

## **addtodate Accepts Hours, Minutes, Seconds, Milliseconds**

In previous releases, the `addtodate` function supported modifying a date number by a specified number of years, months, or days. In this release, you can also modify the date by a specified number of hours, minutes, seconds, or milliseconds.

Add 2 hours, 45 minutes, and 17 seconds to the current time:

```
d1 = now;
datestr(d1)
ans =
    12-Jun-2008 16:15:38

d2 = addtodate(d1, 2, 'hour');
d2 = addtodate(d2, 45, 'minute');
d2 = addtodate(d2, 17, 'second');
d2 = addtodate(d2, 3000, 'millisecond');

datestr(d2)
ans =
    12-Jun-2008 19:00:58
```

See the function reference page for `addtodate` for more information.

## **Querying Options Added to pause**

There are new syntaxes for the `pause` function:

- To see whether pausing is enabled or not, use one of the following commands:

```
pause query
state = pause('query')
```

- To return the previous pause state when enabling or disabling pausing, use one of the following:

```
oldstate = pause('on')
oldstate = pause('off')
```

See the function reference page for `pause` for more information.

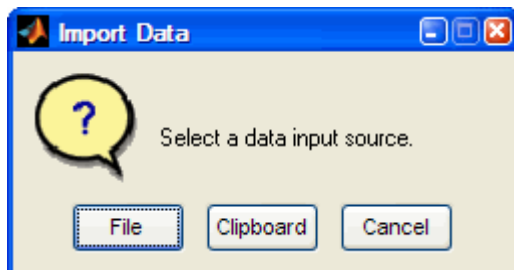
## File Selection Restriction in Import Wizard

This release introduces a change in how you select the source to import using the Import Wizard. In previous releases, you could select and view the contents of any number of files within the wizard before choosing the one to import. As of this release, if you need to import from a different source (a specific file or the system clipboard) than the one you had originally selected, you must exit and restart the Import Wizard. This change gives the Import Wizard increased flexibility in handling different types of files, removes redundancy in the import process, and also removes a potential source of unexpected behavior from the product.

## Compatibility Considerations

The user interface to the Import Wizard is very much the same as in previous versions of MATLAB. However, you should take note of the following changes:

- The panel named **Select Data Source**, that appears at the top of the Import Wizard preview dialog box in earlier releases, is no longer available. As before, you select the source file to import, or the clipboard, at the time you activate the Import Wizard. This applies whether you use **File > Import Data** from the MATLAB Command Window menu or the `uiimport` function at the command prompt. To make a new file or clipboard selection, click the **Cancel** button in any of the dialog boxes, and then restart the Wizard.
- Calling `uiimport` without a file name displays the following new dialog box. Choosing **File** opens the **Import Data** dialog box. Selecting **Clipboard** opens the wizard with the contents of the clipboard in the preview panel.



- To import from the clipboard using the MATLAB menus, use **Edit > Paste to Workspace** instead of using **File > Import Data**, and then change the source to **Clipboard**. This method is preferred because it is more direct. The capability of switching from file to clipboard within the wizard is no longer supported.

## Function Handle Array Warning Is Now An Error

The only way to make an array of function handles is to use a cell array. Attempting to create any other type of array of function handles is invalid. For the past several releases, MATLAB has issued a warning if you should attempt to put function handles into any type of array other than a cell array. As of this release, MATLAB throws an error instead of a warning when this is attempted.

Replace

```
A = [@sin @cos @tan];
??? Error using ==> horzcat
Nonscalar arrays of function handles are not allowed; use cell arrays instead.
```

with

```
A = {@sin @cos @tan};
```

## Compatibility Considerations

If any of your program code attempts to create a regular array of function handles, this code will now generate an error.

## Two Types of issorted Warnings Are Now Errors

In previous versions, the `issorted` function generated a warning for the following two cases:

- `issorted(x)`, where `x` is a complex integer, and
- `issorted(x, 'rows')`, where `x` is an ND array

### Using `issorted` on a Complex Integer

In this case, a statement such as the following

```
issorted(int8(complex(1,2)))
```

now issues the error message

```
??? Error using ==> issorted
ISSORTED on complex inputs with integer class is obsolete.
Please use ISSORTED(DOUBLE(X)) or ISSORTED(SINGLE(X)) instead.
```

### Using `issorted` on an N-D Array

In this case, a statement such as

```
issorted(ones(3,3,3), 'rows')
```

now issues the error message

```
??? Error using ==> issorted
X must be a 2-D matrix.
```

## Compatibility Considerations

If any of your program code attempts to use either of these types of statements, this code will now generate an error.

## Possible Conflict with New Keyword: `SPMD`

This release introduces a new keyword, `spmd`, that, although used solely by the Parallel Computing Toolbox (PCT), may cause conflicts with MATLAB

users as well. See “spmd Construct” in the PCT release notes for more information on this keyword.

### **Compatibility Considerations**

Because `spmd` is a new keyword, it will conflict with any user-defined functions or variables of the same name. If you have any code with functions or variables named `spmd`, you must rename them.

### **Do Not Create MEX-Files with DLL File Extensions**

In the future, on 32-bit Windows® systems, MATLAB will not support MEX-files with a `.dll` file extension. See release note “Do Not Use DLL File Extensions for MEX-Files” on page 237 for information on how this might affect you.

### **isequal Is Now Called Explicitly for Contained Objects**

When you pass two MATLAB objects to `isequal`, MATLAB dispatches to the `isequal` method of the dominant object (see “Object Precedence in Expressions Using Operators”). If the dominant object does not overload `isequal`, then MATLAB uses the built-in version.

### **Compatibility Considerations**

What is different with this release, is that MATLAB now calls `isequal` explicitly for each contained object. This means that, if any contained object overloads `isequal`, MATLAB calls the overloaded version for that object.

Previously, MATLAB compared contained objects using the built-in `isequal` functionality without regard to any special behavior programmed into overloaded `isequal` methods. The effect of this change is that, for objects that contain other objects and those contained objects overload `isequal`, the overloaded behavior establishes the basis with which MATLAB determines equality for those contained objects.



## Indexed Assignment with Objects of the Form p(:) = o Now Consistent with MATLAB Language

The behavior of indexed assignment with MATLAB objects is consistent with the behavior of all MATLAB intrinsic types and V5 MATLAB objects. For example, attempting the following assignment, where `d` does not previously exist, gives an error:

```
>> d(:) = 5;
??? In an assignment A(:) = B, the number of elements in A and B
must be the same.
```

MATLAB objects behave in the same way:

```
ts_obj = timeseries;
t(:) = ts_obj;
??? In an assignment A(:) = B, the number of elements in A and B
must be the same.
```

### Compatibility Considerations

In MATLAB Version 7.6 Release 2008a, indexed assignment of the form `p(:) = object` did not result in an error.

## fopen No Longer Supports VAXD, VAXG, and Cray Machine Formats

Calls to `fopen` with any of the following values for machine format return an error:

- 'vaxd' or 'd'
- 'vaxg' or 'g'
- 'cray' or 'c'

### Compatibility Considerations

In previous releases, calls to `fopen` with machine format values associated with VAXD, VAXG, and Cray did not result in an error.

To read files in VAXD and VAXG formats, consider the workaround available on the MATLAB Central File Exchange, file ID #22675.

## Graphics and 3-D Visualization, MATLAB Version 7.7 (R2008b)

New features and changes introduced in this version are:

- “Certain Printer Formats and Drivers Now Warn When Used” on page 231
- “Handle Graphics Not Supported Under -nojvm Startup Option” on page 233

### Certain Printer Formats and Drivers Now Warn When Used

Going forward, MathWorks is planning to leverage existing operating system (OS) support for printer drivers and devices. As a result, the ability to specify certain print devices using the `print -d` command, and certain graphics formats using the `print -d` command and/or the `saveas` command, will be removed in a future release.

Graphic Format Drivers		
-pkm	-pkmraw	-tifflzw

Printer Driver	print Command Option String
Canon® BubbleJet BJ10e	-dbj10e
Canon BubbleJet BJ200 color	-dbj200
Canon Color BubbleJet BJC-70/BJC-600/BJC-4000	-dbjc600
Canon Color BubbleJet BJC-800	-dbjc800
Epson® and compatible 9- or 24-pin dot matrix print drivers	-depson
Epson and compatible 9-pin with interleaved lines (triple resolution)	-deps9high
Epson LQ-2550 and compatible; color (not supported on HP®.700)	-depsonc
Fujitsu® 3400/2400/1200	-depsonc

<b>Printer Driver</b>	<b>print Command Option String</b>
<b>HP DesignJet 650C</b> color (not supported on Windows OS)	-ddnj650c
<b>HP DeskJet 500</b>	-ddjet500
<b>HP DeskJet 500C</b> (creates black and white output)	-dcdjmono
<b>HP DeskJet 500C</b> (with 24 bit/pixel color and high-quality Floyd-Steinberg color dithering) (not supported on Windows OS)	-dcdjcolor
<b>HP DeskJet 500C/540C</b> color (not supported on Windows OS)	-dcdj500
<b>HP Deskjet 550C</b> color (not supported on Windows OS)	-dcdj550
<b>HP DeskJet and DeskJet Plus</b>	-ddeskjet
<b>HP LaserJet</b>	-dlaserjet
<b>HP LaserJet+</b>	-dljetplus
<b>HP LaserJet IIP</b>	-dljet2p
<b>HP LaserJet III</b>	-dljet3
<b>HP LaserJet 4.5L and 5P</b>	-dljet4
<b>HP LaserJet 5 and 6</b>	-dpxlmono
<b>HP PaintJet</b> color	-dpaintjet
<b>HP PaintJet XL</b> color	-dpjx1
<b>HP PaintJet XL</b> color	-dpjetx1
<b>HP PaintJet XL300</b> color (not supported on Windows OS)	-dpjx1300

<b>Printer Driver</b>	<b>print Command Option String</b>
HP-GL® for HP 7475A and other compatible plotters. (Renderer cannot be set to Z-buffer.)	-dhpgl
<b>IBM® 9-pin Proprinter</b>	-dibmpro

### **Compatibility Considerations**

The following Web site provides more detailed information on the file types that will issue warnings and how to suppress the warnings if desired, as well as a form to provide feedback to MathWorks about your use of these options:

[http://www.mathworks.com/support/contact\\_us/dev/obsoleteprintdevices.html](http://www.mathworks.com/support/contact_us/dev/obsoleteprintdevices.html)

### **Handle Graphics Not Supported Under -nojvm Startup Option**

If you start MATLAB with `matlab -nojvm` (which disables Java) you will receive a warning when you attempt to create or load figures, open GUIs, print or capture figures using `getframe`.

### **Compatibility Considerations**

For information, see “Changes to -nojvm Startup Option” on page 197 in the Desktop Tools and Development Environment release notes.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.7 (R2008b)

New features and changes introduced in this version are:

- “Undocumented Functions Removed” on page 234
- “Handle Graphics Not Supported Under -nojvm Startup Option” on page 235
- “New Menu Options to Hide or Show GUIDE Toolbar and Status Bar” on page 235
- “GUIDE Status Bar Now Shows Tag Property of Selected Object” on page 236
- “Four New Major GUI Examples” on page 236

### Undocumented Functions Removed

The following set of deprecated functions, all of which were previously undocumented, have been removed. Alternatives to most of them exist, which are described.

- `axlimdlg` — No alternative
- `cbedit` — No alternative
- `clruprop` — Use `rmappdata` instead
- `ctlpanel` — No alternative
- `edtext` — Set text object’s `Editing` property
- `extent` — Get text object’s `Extent` property
- `getuprop` — Use `getappdata` instead
- `hidegui` — Set figure’s `HandleVisibility` property
- `hthelp` — Use `web` instead
- `layout` — No alternative
- `matq2ws` — Combine `save + load` or `uisave + uiload`
- `matqdlg` — Combine `save + load` or `uisave + uiload`

- `matqparse` — Combine `save + load` or `uisave + uiload`
- `matqueue` — Combine `save + load` or `uisave + uiload`
- `menubar` — The string 'none'
- `menuedit` — No alternative
- `pagedlg` — Use `pagesetupdlg` instead
- `setupprop` — Use `setappdata` instead
- `umtoggle` — Set `uimenu`'s `Checked` property
- `wizard` — Use `guide` instead
- `ws2matq` — Combine `save + load` or `uisave + uiload`

### Compatibility Considerations

If you have developed MATLAB code that uses any of the above undocumented functions, you must remove such calls or replace them with other code, as suggested within the above bullets.

### Handle Graphics Not Supported Under `-nojvm` Startup Option

If you start MATLAB with `matlab -nojvm` (which disables Java) you will receive a warning when you attempt to create or load figures, open GUIs, print, or capture figures using `getframe`. For more information, see “Changes to `-nojvm` Startup Option” on page 197 in the Desktop Tools and Development Environment release notes.

### New Menu Options to Hide or Show GUIDE Toolbar and Status Bar

Two new menu options in GUIDE let you hide/show the GUIDE toolbar and status bar. By default both are visible, but you can deselect **Show Toolbar**, **Show Status Bar**, or both from the **View** menu to make the layout area larger.

## Compatibility Considerations

The GUIDE Preferences option **Show Toolbar** is no longer available. Use **Show Toolbar** from the **GUIDE View** menu instead.

## GUIDE Status Bar Now Shows Tag Property of Selected Object

The GUIDE Layout Editor now shows the Tag property of any object you select, in the left corner of the status bar that runs along its bottom. This display saves you from having to open the Property Inspector to read Tag names. Information in the status bar is read-only; you still need to use the Property Inspector to change a component's Tag.

## Four New Major GUI Examples

The Creating Graphical User Interface documentation has four new extensive examples of building GUIs with GUIDE and programmatically. All of them feature uitables, a feature introduced in R2008a, and all the GUIs plot data. The new examples are:

- “A Working GUI with Many Components” (GUIDE)
- “GUI for Animating a 3-D View (GUIDE)” (GUIDE)
- “GUI to Interactively Explore Data in a Table (GUIDE)” (GUIDE)
- “GUI that Displays and Graphs Tabular Data” (programmatic)

This release includes FIG- and code files for all these examples. The documentation discusses many of their callbacks and includes hyperlinks to code in the code files.



## External Interfaces/API, MATLAB Version 7.7 (R2008b)

- “Do Not Use DLL File Extensions for MEX-Files” on page 237
- “MEX-Files Must Be Recompiled When `-largeArrayDims` Becomes Default MEX Option” on page 238
- “New Compiler Support” on page 238
- “Compiler Support to Be Phased Out” on page 238
- “Use `mxDestroyArray` to Release Memory for `mxArray`” on page 239
- “New Function Displays Information about MEX Compiler Configurations” on page 239
- “New Functions to Catch Errors in MEX-Files Replace `mexSetTrapFlag`” on page 240
- ““Duplicate dylib” Warning on Macintosh Systems” on page 240
- “Microsoft® Visual Studio "X64 Compilers and Tools" Required for 64-bit Systems” on page 240
- “Run-Time Libraries Required for Applications Built with Microsoft® Visual Studio 2008 Compiler” on page 241
- “Do Not Use `get` or `set` Function to Manage Properties of Java Objects” on page 241
- “COM Objects Might Display Different Number of Supported Events” on page 241

### Do Not Use DLL File Extensions for MEX-Files

In the future, on 32-bit Microsoft Windows systems, MATLAB will not support MEX-files with a `.dll` file extension. In MATLAB Version 7.7 (R2008b), if you run a MEX-file with a `.dll` file extension, MATLAB displays a warning.

Additionally, if you use the `mex` function with the `-output` switch to create a MEX-file with a `.dll` extension, MATLAB displays a warning. If you use the `-output` switch to name a MEX-file, you do not need to provide a file extension. MATLAB automatically appends the appropriate extension. For example, the following command creates a MEX-file named `newtest.mexw32`:

```
mex mytest.c -output newtest
```

### **Compatibility Considerations**

You must recompile MEX-files with a `.mexw32` file extension. This is the default of the `mex` command.

### **MEX-Files Must Be Recompiled When `-largeArrayDims` Becomes Default MEX Option**

In a future version of MATLAB, the default `mex` command will change to use the large-array-handling API. This means the `-largeArrayDims` option will be the default. For information about migrating your MEX-files to use the large-array-handling API, see the Technical Support solution 1-5C27B9.

### **Compatibility Considerations**

In the near future you will be required to update your code to use the new API and to recompile your MEX-files. You should review your source MEX-files and `mex` build scripts.

### **New Compiler Support**

MATLAB Version 7.7 (R2008b) supports these new compilers for building MEX-files:

#### **Microsoft Windows 64-bit and 32-bit Platforms**

- Microsoft Visual Studio 2008 Express Edition

#### **Compiler Support to Be Phased Out**

The following compilers are supported in Version 7.7 (R2008b), but will not be supported in a future version of MATLAB.

#### **Windows (32-bit) platform**

- Intel Visual Fortran Version 9.1
- Microsoft Visual Studio .NET Version 7.1
- Open Watcom Version 1.3

## Windows (64-bit) platforms

- Intel Visual Fortran Version 9.1

## Solaris SPARC (64-bit) platform

- Sun Studio 11 cc / CC Version 5.8
- Sun Studio 11 f90 Version 8.2

## Use `mxDestroyArray` to Release Memory for `mxArray`

The documentation for the `mxSetCell`, `mxSetField`, and `mxSetFieldByNumber` functions in the MATLAB C and Fortran API incorrectly instructs customers to use `mxFree` to release memory for any `mxArray` returned by `mxGetCell`, `mxGetField`, or `mxGetFieldByNumber`.

## Compatibility Considerations

The correct function to use to release memory for an `mxArray` is `mxDestroyArray`. Calling `mxFree` on an `mxArray` only frees the array header, but does not actually free the data itself and can result in a memory leak.

To help diagnose this problem, MATLAB issues a warning if calling `mxFree` on an `mxArray` could cause memory corruption. In future versions of MATLAB, this condition might result in a segmentation violation.

## New Function Displays Information about MEX Compiler Configurations

The `mex.getCompilerConfigurations` function displays information about the selected compiler and associated switches and options that MATLAB uses to build a MEX-file. The selected compiler is the one you choose when you run the `mex -setup` command. For more information, see “Building MEX-Files”.

## **New Functions to Catch Errors in MEX-Files Replace mexSetTrapFlag**

Two new MEX library functions have been added to the MATLAB C and Fortran API.

The `mexCallMATLABWithTrap` function, like `mexCallMATLAB`, lets you call MATLAB functions from within a MEX-file. In addition, `mexCallMATLABWithTrap` lets you catch, or trap, errors. Using this function for exception handling is more flexible than using `mexCallMATLAB` with the `mexSetTrapFlag` function.

Likewise, the `mexEvalStringWithTrap` function adds error handling to the `mexEvalString` function.

### **Compatibility Considerations**

In the near future you will be required to update your MEX-files to remove use of the `mexSetTrapFlag` function.

### **“Duplicate dylib” Warning on Macintosh Systems**

When compiling MEX-files on an Apple Mac OS Version 10.5 system you can ignore a warning about a duplicate library `libz.1.dylib`. The MEX-file builds properly and runs as expected. The warning message contains the following information:

```
ld: warning, duplicate dylib
```

### **Microsoft Visual Studio "X64 Compilers and Tools" Required for 64-bit Systems**

If you use Microsoft Visual Studio with MATLAB on 64-bit systems, you must choose "X64 Compilers and Tools" when you install the following products:

- Visual Studio 2008 Express Edition
- Visual Studio 2008 Professional Edition
- Visual Studio 2005 Professional Edition

## Run-Time Libraries Required for Applications Built with Microsoft Visual Studio 2008 Compiler

If you distribute a MEX-file, an engine application, or a MAT-file application built with the Visual Studio 2008 compiler, you must provide the Visual C++ run-time libraries. These files are required to run applications developed with Visual C++ on a computer that does not have Visual C++ 2008 installed. For information on locating the Microsoft Visual C++ 2008 Redistributable Package (x86), containing `vc redistrib_x86.exe` and `vc redistrib_x64.exe`, consult your Microsoft documentation.

## Do Not Use `get` or `set` Function to Manage Properties of Java Objects

If you want to read or update a property of a Sun Java object created in MATLAB using the Java class constructor, do *not* use the MATLAB `get` or `set` functions on the property. For example, if you create a Java object called `javaObject` that has a property called `PropertyName`, the following commands might cause memory leaks and will be deprecated in a future version of MATLAB:

```
propertyValue = get(javaObject, 'PropertyName');  
set(javaObject, 'PropertyName', newValue);
```

## Compatibility Considerations

In future versions of MATLAB, using `get` or `set` on Java objects to manage the properties will generate an error. The correct commands to use are:

```
propertyValue = javaObject.getPropertyName;  
javaObject.setPropertyName(newValue);
```

## COM Objects Might Display Different Number of Supported Events

If you use events from COM servers implementing event interface versioning, COM objects created with MATLAB Version 7.4 (R2007a), Version 7.5 (R2007b), or Version 7.6 (R2008a) might have a different number of supported events than COM objects created with MATLAB Version 7.7 (R2008b) or any version prior to 7.4.

## **Compatibility Considerations**

Calling the `events (COM)` function on affected types of COM server components returns a list of events for the latest [default] interface version which might be different from the list of events displayed by MATLAB Version 7.4, Version 7.5, or Version 7.6.

If an event in an older COM event interface version is no longer supported or renamed in the newer interface version, the `registerevent` function generates an error when such an event is used in an `.m` file.

# Version 7.6 (R2008a)

## MATLAB Software

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This table summarizes what's new in Version 7.6 (R2008a):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.6 (R2008a)” on page 245
- “Mathematics, MATLAB Version 7.6 (R2008a)” on page 273
- “Data Analysis, MATLAB Version 7.6 (R2008a)” on page 275
- “Programming, MATLAB Version 7.6 (R2008a)” on page 281
- “Graphics and 3-D Visualization, MATLAB Version 7.6 (R2008a)” on page 285
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.6 (R2008a)” on page 288

- “External Interfaces/API, MATLAB Version 7.6 (R2008a)” on page 292



## Desktop Tools and Development Environment, MATLAB Version 7.6 (R2008a)

New features and changes introduced in this version are organized by these topics:

- “Desktop New Features Video” on page 245
- “Startup and Shutdown” on page 245
- “Desktop” on page 249
- “Running Functions — Command Window and History” on page 251
- “Help” on page 252
- “Workspace, Search Path, and File Operations” on page 252
- “Tuning and Managing M-Files” on page 256
- “Editing and Debugging M-Files” on page 256
- “Publishing M-Files” on page 261
- “Internationalization” on page 271

### Desktop New Features Video

For an overview of the major new features in the MATLAB Desktop Tools and Development Environment area, watch this video demo. You can also access this and other video demos by selecting the **Demos** tab in the Help browser, and then selecting **MATLAB > New Features in Version 7.6**.

### Startup and Shutdown

New features and changes introduced in Version 7.6 (R2008a) are:

- “Windows Platforms — Startup Changes, Including Use of My Documents/MATLAB or Documents/MATLAB Directory” on page 246
- “UNIX Platforms — Startup Changes” on page 246
- “Macintosh Platforms — Startup Changes” on page 247
- “Macintosh Platforms — Define Startup Options Using New Dialog Box” on page 247

- “Macintosh Platforms — Run Startup Diagnostics” on page 248
- “Updated Version of JVM Software on Solaris Platform” on page 248
- “Changes to Abnormal Termination Process” on page 249

### **Windows Platforms — Startup Changes, Including Use of My Documents/MATLAB or Documents/MATLAB Directory**

On Microsoft Windows platforms, when MATLAB starts, it automatically adds the My Documents/MATLAB directory (or Documents/MATLAB on Windows Vista™) to the top of the MATLAB search path. This directory is known as the `userpath`. If you remove the My Documents/MATLAB (or Documents/MATLAB) directory from the search path and save the changes, either using the Set Path dialog box or using the `rmpath` and `savepath` functions, the MATLAB search path will not include the `userpath` directory at the next startup. On Windows platforms, the `userpath` is also the default startup directory.

Use the new function, `userpath`, to view the current value, clear the value so the directory is *not* on the search path and is *not* the startup directory, specify a different value, or reset the value to the default. For more information, see and the `userpath` reference page.

**Compatibility Considerations.** In previous versions, MATLAB automatically added the My Documents/MATLAB directory (or Documents/MATLAB on Windows Vista platforms) to the search path upon startup, even if you had removed it from the path and saved your changes during the previous session.

### **UNIX Platforms — Startup Changes**

On The Open Group UNIX platforms, when MATLAB starts, it automatically adds the `userhome/Documents/MATLAB` directory to the top of the MATLAB search path. This directory is known as the `userpath`. Use the new function, `userpath`, to view the current value, clear the value so the directory is *not* on the search path, specify a different value, or reset the value to the default. You can also specify that `userpath` be the MATLAB startup directory by setting the value for the environment variable `MATLAB_USE_USERWORK` to 1 prior to startup. For more information, see and the `userpath` reference page.

**Compatibility Considerations.** In previous versions, no directories were added to the search path upon startup.

### Macintosh Platforms – Startup Changes

On Apple Macintosh platforms, when MATLAB starts, it automatically adds the *userhome/Documents/MATLAB* directory to the top of the MATLAB search path. This directory is known as the *userpath*. Use the new function, *userpath*, to view the current value, clear the value so the directory is *not* on the search path, specify a different value, or reset the value to the default. If you start MATLAB from a shell, you can also specify that *userpath* be the MATLAB startup directory by setting the value for the environment variable `MATLAB_USE_USERWORK` to 1.

For more information, see and the *userpath* reference page.

**Compatibility Considerations.** In previous versions, no directories were added to the search path upon startup.

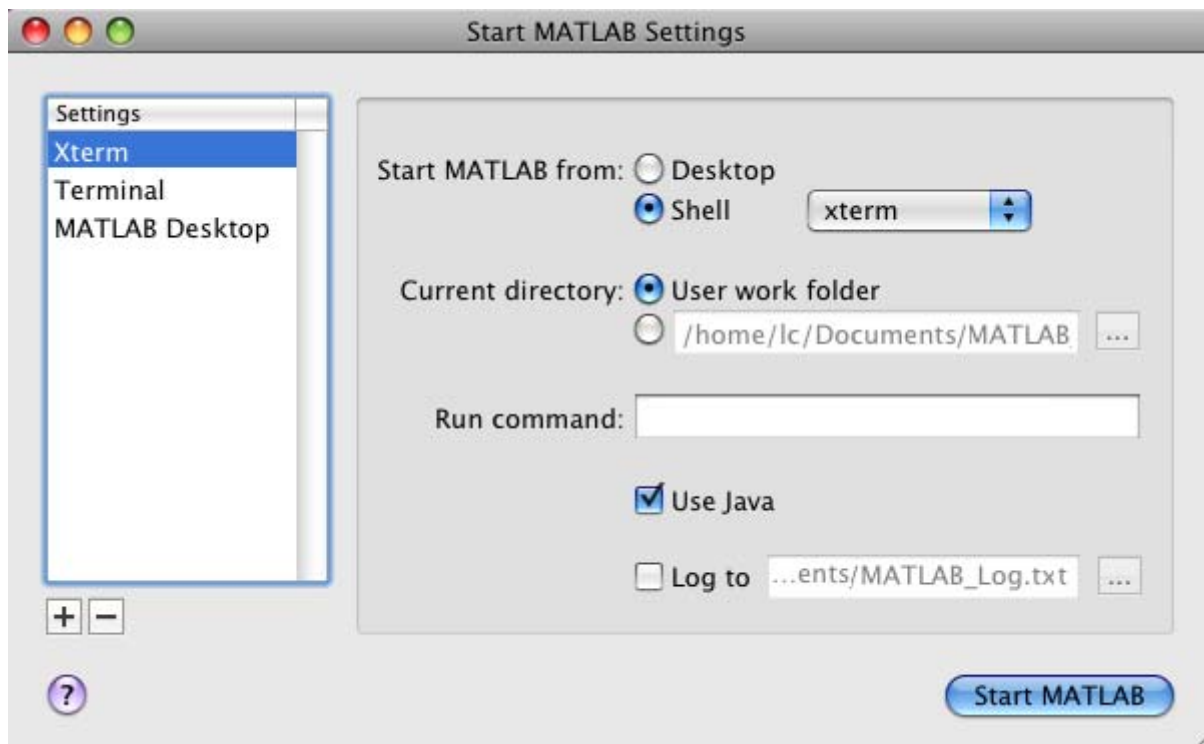
### Macintosh Platforms – Define Startup Options Using New Dialog Box

On Apple Macintosh platforms, you can specify startup options using the new Start MATLAB Settings dialog box. The first time you start MATLAB Version 7.6 (R2008a), the Start MATLAB Settings dialog box opens automatically. It does not open automatically on subsequent startups; to open the dialog box, double-click Start MATLAB Settings, located in the same directory as the MATLAB application.

You can set these options and others:

- How you will interact with MATLAB (desktop or specified shell)
- The startup directory; the default is *userhome/Documents/MATLAB*
- Statement MATLAB runs upon startup

You can create and save multiple startup options files, each with different settings. For more information, see “Startup Options”.



### Macintosh Platforms – Run Startup Diagnostics

Upon startup on Macintosh platforms, MATLAB automatically runs diagnostics to ensure your system has the required X11 and Sun Microsystems Java applications. If there are no problems, MATLAB starts as expected. If there is a problem, MATLAB displays a dialog box informing you of the problem and how to address it. You can run these diagnostics manually from the Start MATLAB Settings dialog box, using items in the **Diagnostics** menu.

### Updated Version of JVM Software on Solaris Platform

MATLAB is now using Sun Microsystems JVM Version 6 on the Sun Microsystems Solaris platform.

**Compatibility Considerations.** If you use a specific version of Sun Microsystems Java with MATLAB on the Solaris platform, this change might impact your work.

### **Changes to Abnormal Termination Process**

When MATLAB encounters a serious problem, such as a segmentation violation, a dialog box opens to notify you about the problem. From the dialog box, you can close MATLAB, or try to save your work in progress before closing.

If you try to save your work in progress, be aware that MATLAB is in an unreliable state and you should exit MATLAB as soon as you finish saving your work. The Command Window displays the message `Please exit and restart MATLAB` to the left of the prompt, which reminds you to discontinue use. For more information, see .

**Compatibility Considerations.** In previous versions, when MATLAB encountered a serious problem, an error message appeared in the Command Window that instructed you to close MATLAB.

With multithreaded computation enabled, a platform-specific dialog box appeared, from which you immediately closed MATLAB.

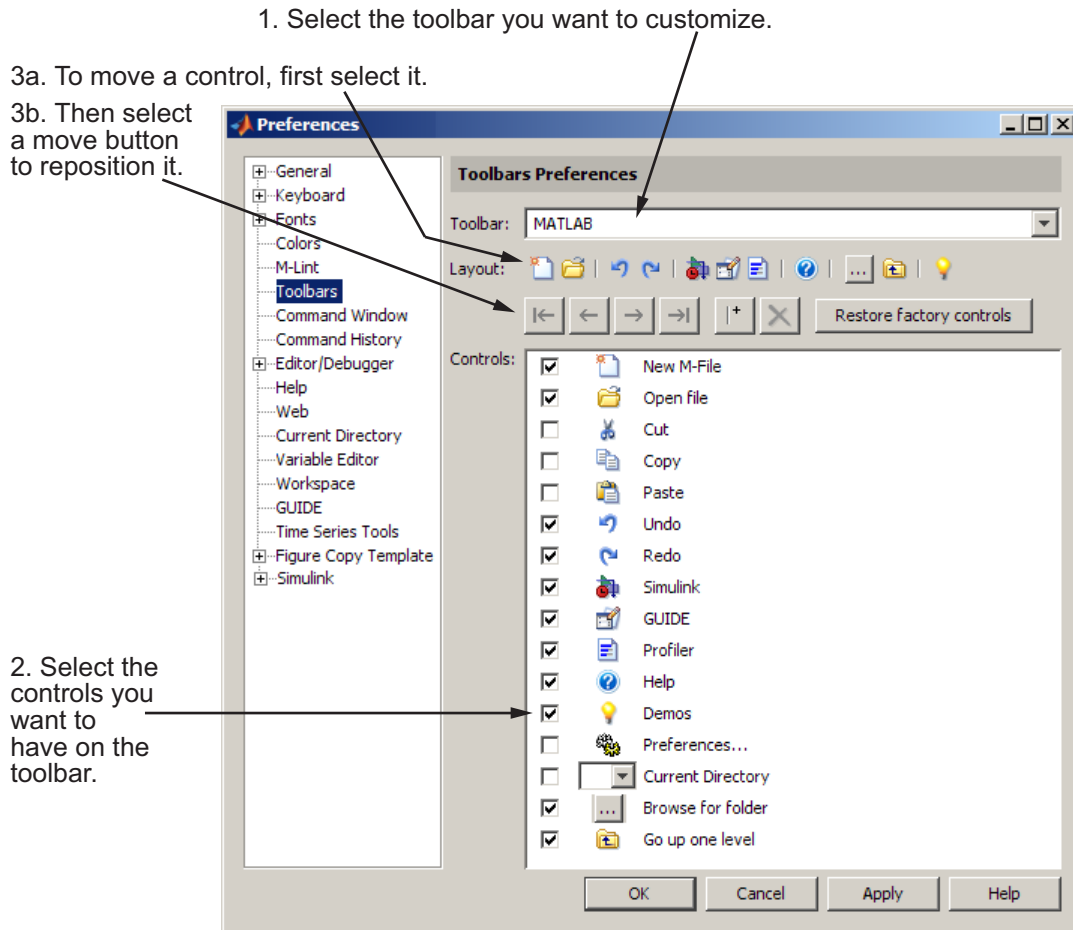
## **Desktop**

New features and changes introduced in Version 7.6 (R2008a) are:

- “Customize the MATLAB Desktop and Editor Toolbars” on page 249
- “Clear a Browser with New Method” on page 251
- “Manage Your License” on page 251
- “Check for Updates Feature Enhanced” on page 251



### **Customize the MATLAB Desktop and Editor Toolbars**



Rearrange, add, or remove buttons and other controls from the MATLAB desktop or Editor toolbars using **File > Preferences > Toolbars**. Alternatively, right-click a toolbar and select **Customize** from the context menu.



For more information, see “Toolbar Customization”.

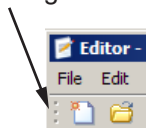
There are new buttons you can add to the MATLAB desktop toolbar:

- Preferences, , which displays the Preferences dialog box, open to the pane last used
- Demos, , which displays the listing of Demos in the Help browser

You can also add Save All  and Save As  buttons to the Editor toolbar.

You can change the position of the toolbars within a tool, for example, putting both the Editor and Editor cell mode toolbars next to each other instead of stacked. To move a toolbar, grab the anchor for a toolbar, then drag the toolbar to the new location.

Drag the toolbar anchor to move the toolbar to a different position.



## Clear a Browser with New Method

Clear an open browser in MATLAB with a new `close` method. For example, open a browser to display the MathWorks Web site by running `[stat,h1]=web('http://www.mathworks.com')`. Then `close(h1)` clears `mathworks.com` from that browser window. For more information, see the reference page for the `web` function.

## Manage Your License

You can use new licensing features to perform license management activities, such as activating your license, deactivating your license, or updating your license. You can also visit the License Center at the MathWorks Web site to perform other license-related activities. Access the features by selecting **Help > Licensing**.

## Check for Updates Feature Enhanced

When you select **Help > Check for Updates**, the dialog box now allows you to see the latest versions for all MathWorks products, or just those you install. You can also access release notes for each product from the dialog box. For more information, see “Check for Software Updates”.

## Running Functions – Command Window and History

### Command History Preference – Default Value Changed

The default value for the Command History preference, **Save after *n* commands**, is now 1. This allows you to more easily rebuild your state

in MATLAB if MATLAB terminates abnormally, such as after a power failure. For more information about this preference, see “Command History Preferences”.

**Compatibility Considerations.** Previously, the default value for the **Save after  $n$  commands** preference was 5.

## Help

### Preferences for Help on Selection

When you click a function name in the Command Window or Editor, and then press **F1** or select **Help on Selection** from the context menu, the help appears in a pop-up window by default. Now, you can specify that the help appear in the Help browser rather than in a pop-up window via the new **Help on Selection** preference. For more information, see “Specifying Where Help from the Editor and Function Browser Displays”.

### Slight Reordering of Products in Help Browser

In the Help browser, the order of some documentation names in the **Contents** pane and the Product Filter preference dialog box has changed slightly. Documentation now appears in this order:

- Release Notes (general)
- Installation
- MATLAB
- Toolboxes and other products based on MATLAB, arranged alphabetically
- Simulink
- Blocksets and other products based on Simulink, arranged alphabetically
- Link and target products, arranged alphabetically

### Workspace, Search Path, and File Operations

New features and changes introduced in Version 7.6 (R2008a) are:



- “Array Editor Renamed to Variable Editor; Offers Enhanced Support for Structures and Classes” on page 253
- “Search Path — Changes to User Portion” on page 254
- “New Context Menu Options in Current Directory Browser” on page 255
- “File and Directory Comparisons Tool” on page 255

## Array Editor Renamed to Variable Editor; Offers Enhanced Support for Structures and Classes

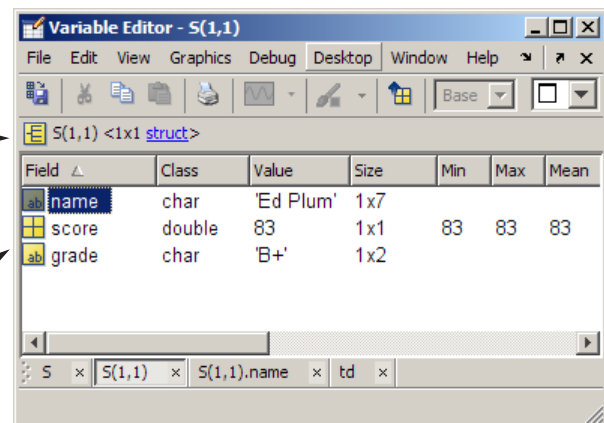
The Array Editor has been renamed to the Variable Editor, which better reflects its support for non-array data such as structures and properties.


The Variable Editor now reports, just below the toolbar, the class and size of the selected variable. For many classes, there is also a link to help for the class. To view a structure in the Variable Editor, double-click one of its elements. The resulting display is much like the display of that element in the Workspace browser, showing the Class, Value, Size, Min, Max, and other information. For more information about the Variable Editor, see “Viewing and Editing Workspace Variables with the Variable Editor”.

The class for the selected element is shown (struct in this example), and includes a link to help for that class.

Double-click an element in a structure in the Variable Editor (S(1,1) in this example).

The element opens in its own tab, displaying information about the data, as is done in the Workspace browser.



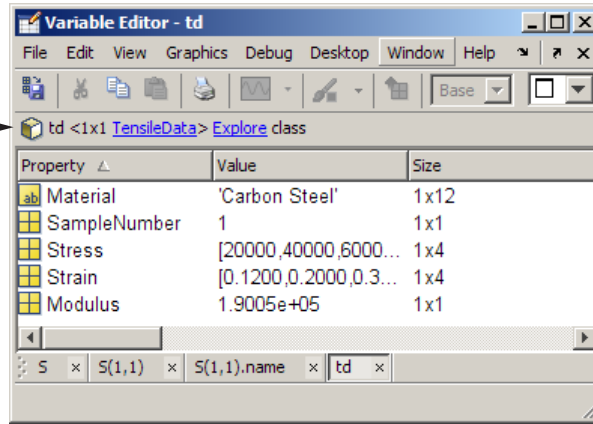
Use the data brushing button on the Variable Editor toolbar  to mark observations on graphs and then remove or save them to new variables. For more information, see “Data Brushing for Graphs and Linked Variables” on page 275.

The Variable Editor supports the new MATLAB class system. Double-click an object in the Workspace browser, and it opens in the Variable Editor. The Variable Editor displays the object, the class, and the properties of the object.

Double-click an object in the Workspace browser and it displays the object's properties in the Variable Editor.

Object and class.

Properties.



**Compatibility Considerations.** In previous versions, the Variable Editor was called the Array Editor. Starting in R2008a, MATLAB Version 7.6, the tool will be referred to as the Variable Editor.

### Search Path — Changes to User Portion

By default, MATLAB adds a directory to the top of the search path upon startup, known as the `userpath` directory. By default, its value is `Documents/MATLAB` on Windows platforms, or `My Documents/MATLAB` on Windows Vista platforms. On UNIX and Macintosh platforms, the default directory is `userhome/Documents/MATLAB`. Use the new function, `userpath`, to specify a different directory, clear the `userpath` value, or reset it to the default value. On UNIX and Macintosh platforms, you can specify additional directories for MATLAB to add to the top of the search path upon startup using the `MATLABPATH` environment variable. When you remove the `userpath` portion of the search path, it clears the value for `userpath` and might impact the startup directory. For related information, see “Startup and Shutdown” on page 245. For details see “Locations for Storing Your Files” and the `userpath` reference page.

**Compatibility Considerations.** In previous versions, on Windows platforms, MATLAB added the default directory to the search path upon startup, even if you removed it and saved the changes to the path. On UNIX and Macintosh platforms, MATLAB did not add a directory to the search path on startup.

### **New Context Menu Options in Current Directory Browser**

The context menu, which you access by right-clicking anywhere within the Current Directory browser, provides these three new options for creating M-files in the current directory:

- **New > Blank M-File**  
Creates an empty M-file
- **New > Function M-File**  
Creates an M-file with a template for writing an M-file function
- **New > Class M-File**  
Creates an M-file with a template for writing an M-file class definition

**Compatibility Considerations.** The **New > M-File** option is replaced by the **New > Function M-File** option, which has the same effect.

### **File and Directory Comparisons Tool**

The File Comparisons tool is now called the File and Directory Comparisons Tool. In addition to enabling you to compare lines in two text files, it now enables you to:

- Compare variables in two MAT files
- Determine whether the contents of two binary files are the same
- Compare two directories to determine which file names are unique to each directory
- Compare two directories to determine if files with the same name in each directory have the same content

See “Comparing Files and Folders” for details.

## Tuning and Managing M-Files

### Profiling – Setting Intel Multi-Core Processors

If your system uses Intel multi-core chips, and you plan to profile using CPU time, set the number of active CPUs to 1 before you start profiling. See “Intel Multi-Core Processors — Setting for Most Accurate Profiling on Windows Systems” for details.

### Editing and Debugging M-Files

New features and changes introduced in Version 7.6 (R2008a) are:

- “Stand-Alone Editor No Longer Provided” on page 256
- “Run/Continue Button Now Two Separate Buttons” on page 257
- “Evaluate Entire File Button Off Toolbar by Default” on page 257
- “TLC and XML Syntax Highlighting Supported” on page 257
- “Code Folding Enhanced to Support More Language Constructs” on page 258
- “mlint Function Uses Preference Settings when Java Software is Available” on page 258
- “New M-Lint Warning Related to the MException Class” on page 259
- “dbstop and dbclear Functions — Option to Specify File Not on Path” on page 260
- “edit Function Can Create New File in Existing Subdirectory” on page 261
- “Nest Cells for Rapid Code Iteration; Includes Changes to Cell Highlighting” on page 261

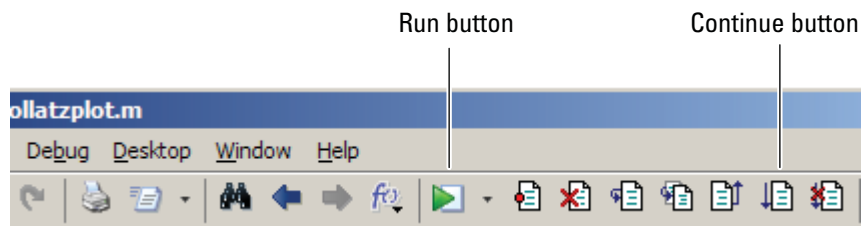
### Stand-Alone Editor No Longer Provided

The MATLAB stand-alone Editor (`meditor.exe`) is no longer provided. Instead of the stand-alone Editor, you can use the MATLAB Editor.

**Compatibility Considerations.** Some users have preferred the stand-alone Editor to the MATLAB Editor because of slightly better startup performance and because it does not require a MATLAB software license. For those situations, you can use any text editor you have, such as UltraEdit or Emacs.


### Run/Continue Button Now Two Separate Buttons

The Continue button is now separate from the Run button. Previously, the Run button served as both the Run and Continue button.



**Compatibility Considerations.** You now use the Run button to execute a run configuration and the Continue button to continue execution of an M-file after a breakpoint during debugging. See “Run MATLAB Files in the Editor” and “Step Through a File” for details.

### Evaluate Entire File Button Off Toolbar by Default

The Evaluate Entire File button, , is no longer on the Editor Cell Mode toolbar by default.

**Compatibility Considerations.** Previously, the Evaluate Entire File button was on the Editor Cell Mode toolbar by default. You can put the Evaluate Entire File button back on the toolbar by customizing it. See “Customize the MATLAB Desktop and Editor Toolbars” on page 249 for more information.

### TLC and XML Syntax Highlighting Supported

You can specify preferences for TLC and XML syntax highlighting in the Editor/Debugger Language Preferences panel by selecting **File > Preferences > Editor > Language** and then, in the **Language** drop-down menu choosing **TLC** or **XML/HTML**.

Click **Help** in the Preferences dialog box for more information.

## Code Folding Enhanced to Support More Language Constructs

You can enable code folding for all these programming constructs:

- Blocks of comments
- Cells used for rapid code iteration and publishing
- Class code
- Class enumeration blocks
- Class event blocks
- Class method blocks
- Class properties blocks
- For and parfor blocks
- Function and class help
- Function code
- If/else blocks
- Switch/case blocks
- Try/catch blocks
- While blocks

Prior to MATLAB Version 7.6 (R2008a), code folding was supported for function code and function help only.

See “Code Folding — Expand and Collapse Code Constructs” for details.

### **mlint Function Uses Preference Settings when Java Software is Available**

When Sun Microsystems Java software is available, the `mlint` function honors the M-lint preferences that you specify using the M-Lint Preferences dialog box (**File > Preferences > M-Lint**).

In addition, the `' config=settings.txt '` option to the `mlint` function enables you to override the current default M-Lint preferences settings with a settings file that you previously created and saved using the M-Lint

Preferences dialog box. If you use the ' config=settings.txt' option, you must specify the full path to the file. If you prefer that m-lint ignore all M-Lint preferences and use the factory default settings instead, specify the ' config=factory' flag. See m-lint for details.

**Compatibility Considerations.** Previously, the mlint function always used the factory default settings, regardless of the M-Lint preferences that you set. To restore that behavior, use the ' config=factory' flag on the mlint function.

### New M-Lint Warning Related to the MException Class

MATLAB Version 7.6 (R2008a) adds a new M-Lint warning related to the MException class. This warning, along with two M-Lint warnings added in MATLAB Version 7.5 (R2007b), intentionally make it difficult for you to completely ignore an error without receiving an M-Lint warning. It is a best practice to check error information even when an error is expected or frequent, so that you can rule out unexpected situations.

The three messages are as follows—the first is the one added in MATLAB Version 7.6 (R2008a):

- LASTERR and LASTERROR are better replaced by an identifier on the CATCH block. See doc CATCH.
- The value assigned here to variable 'x' might never be used.  
This message appears when the code contains a catch statement that is never used.
- TRY statement without a CATCH.

For example, suppose you want to read options from a file, options.txt, but it is acceptable if that file is not present. You might write the following code, expecting the read\_options program to throw an error if the file is not present:

```
options = {};  
try  
    options = read_options( 'options.txt' );  
end
```

The problem with the preceding code is that the file might be present, but its permissions may prevent the program from reading it. The program ignores the file, and potentially confuses the user, who knows the file is there. Better code for accomplishing the task is as follows, which assigns a structure value to the variable `err` if an error is thrown in the `try` block. The structure value contains information about the error that was thrown.

```
try
    options = read_options( 'options.txt' );
catch err
    if strcmp( err.identifier, 'Program:ReadOptions:NoOptionsFile' )
        options = {};
    else
        rethrow( err );
    end
end
```

Using this code, if a problem other than the “file is missing” error occurs, MATLAB reports the error to the user. For instance, MATLAB reports an error if the file format is incorrect, or if the file has the wrong permissions.

If you feel comfortable ignoring the errors completely, it is probably best to use the `try` statement with no `catch` statement, and suppress the M-Lint warnings that result. You can suppress the warnings through the M-Lint preferences or by placing the `%#ok` pragma at the end of the line that triggers the message. However, The MathWorks suggests that if you suppress an M-Lint message, you include a comment in your code indicating why you think it is appropriate to ignore the message.

For more information about the `MException` class, see the “Error Handling” section in the MATLAB Programming Fundamentals documentation.

### **dbstop and dbclear Functions – Option to Specify File Not on Path**

The `completenames` option to the `dbstop` and `dbclear` functions enables you to set and clear breakpoints, respectively, for M-files that are not on the search path in MATLAB. See `dbstop` and `dbclear` for details.



## **edit Function Can Create New File in Existing Subdirectory**

The edit function now allows you to specify a file that is not in the current directory. If the file does not exist, the edit function creates it in the directory you specify. However, the directory, must exist; the edit function will not create a directory for you. See `edit` for details.

## **Nest Cells for Rapid Code Iteration; Includes Changes to Cell Highlighting**

You can nest cells in an M-file, including within functions and control statements, such as `for` loops and `if-then` blocks. This gives you greater control over how a published document appears. This nesting ability also enables you to evaluate subsections of code on a finer grain. See “Nest Cells for Finer Control” on page 264 for details.

**Compatibility Consideration.** With the introduction of nested cells, cells definitions result in cell highlighting that looks different from previous releases. See “Define Code Cells” for details.

## **Publishing M-Files**

New features and changes introduced in Version 7.6 (R2008a) are:

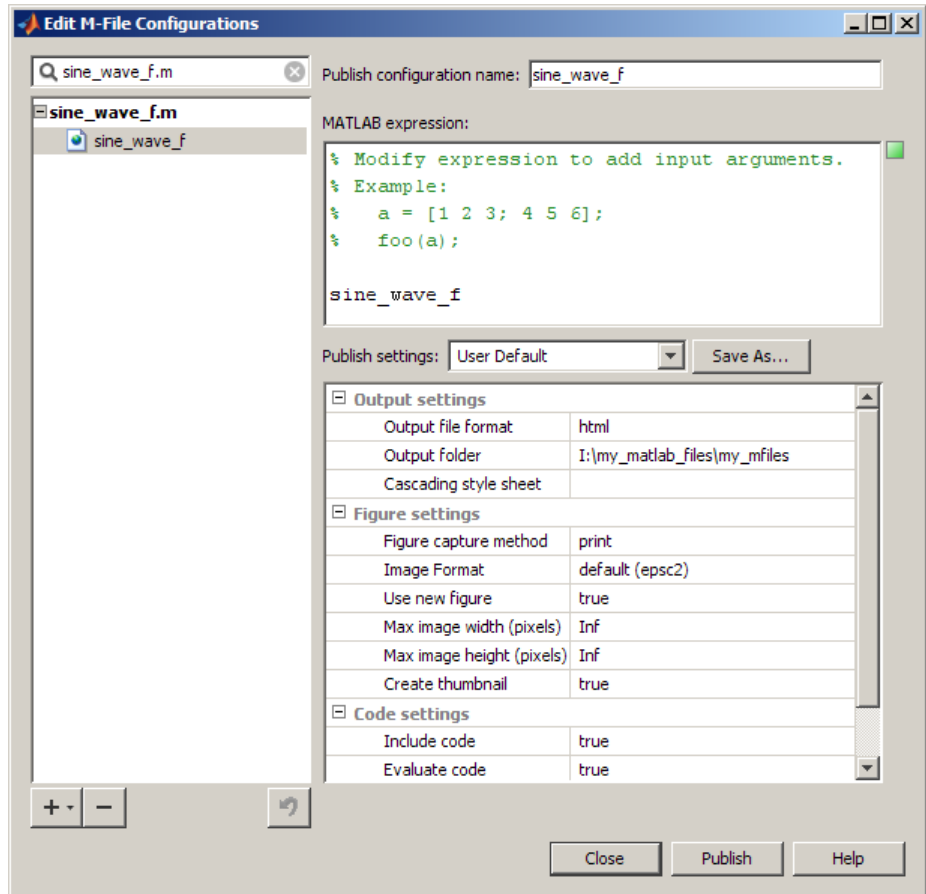
- “Publish Functions and Scripts Using Publish Configurations; Includes Replacement of Publishing Preferences” on page 262
- “Nest Cells for Finer Control” on page 264
- “Publish Button Moved” on page 270
- “Publish Trademark Symbols” on page 270
- “Specifying Code for MATLAB Software to Evaluate with the publish Function” on page 270
- “stopOnError Option No Longer Available with publish Function” on page 270
- “Include Snapshot of M-file Output in Published Document” on page 270

## **Publish Functions and Scripts Using Publish Configurations; Includes Replacement of Publishing Preferences**

In the Editor, you can now do the following when publishing M-file code:

- Specify code that you want MATLAB to evaluate before publishing the code, including input arguments for functions
- Specify publishing settings, such as an output directory and file format, that you can save and reuse as a group

To create a publish configuration, first open an M-file in the Editor. Then, select **File > Publish Configurations for *filename* > Edit Publish Configurations for *filename***. In the resulting Edit M-File Configurations dialog box, modify the **MATLAB expression**, specify **Publish settings**, and name the publish configuration. For more information, see “Creating a Publish Configuration for a MATLAB File”.



**Compatibility Considerations.** Previously, preferences for publishing and publishing images were available on the Preferences dialog box, which you accessed by selecting **File > Preferences > Editor/Debugger** and then choosing the **Publishing** or **Publishing Images** node. Now you set these preferences when you create or update a publish configuration by using the **Publish settings** options on the Edit M-file Configurations dialog box.

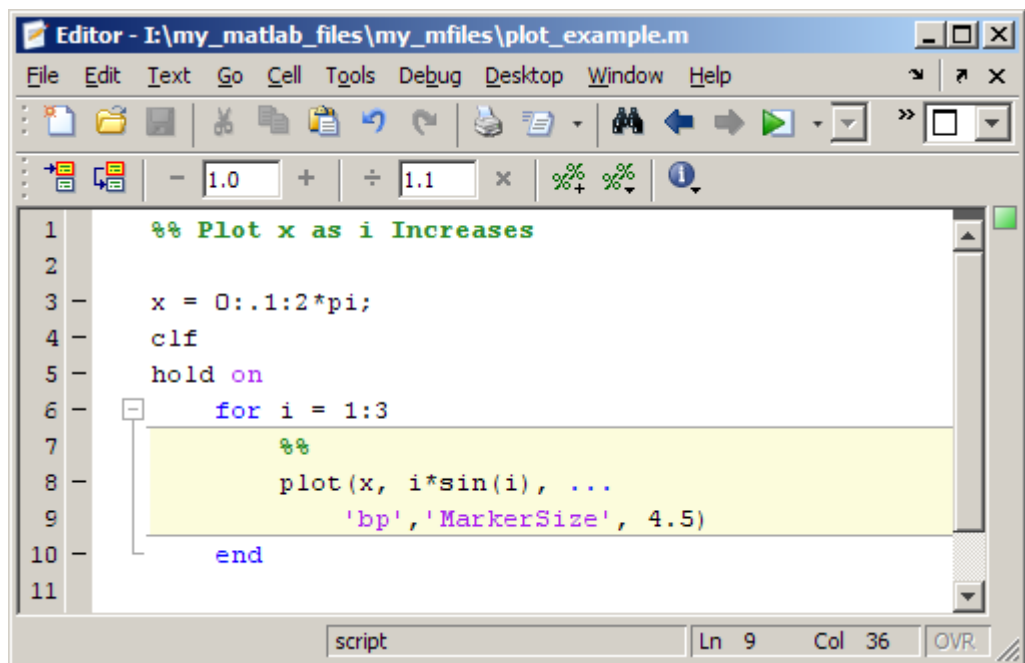
The Edit M-file Configurations dialog box continues to provide support for creating configurations that enable you to run an M-file. These are now called run configurations to differentiate them from publish configurations.

## Nest Cells for Finer Control

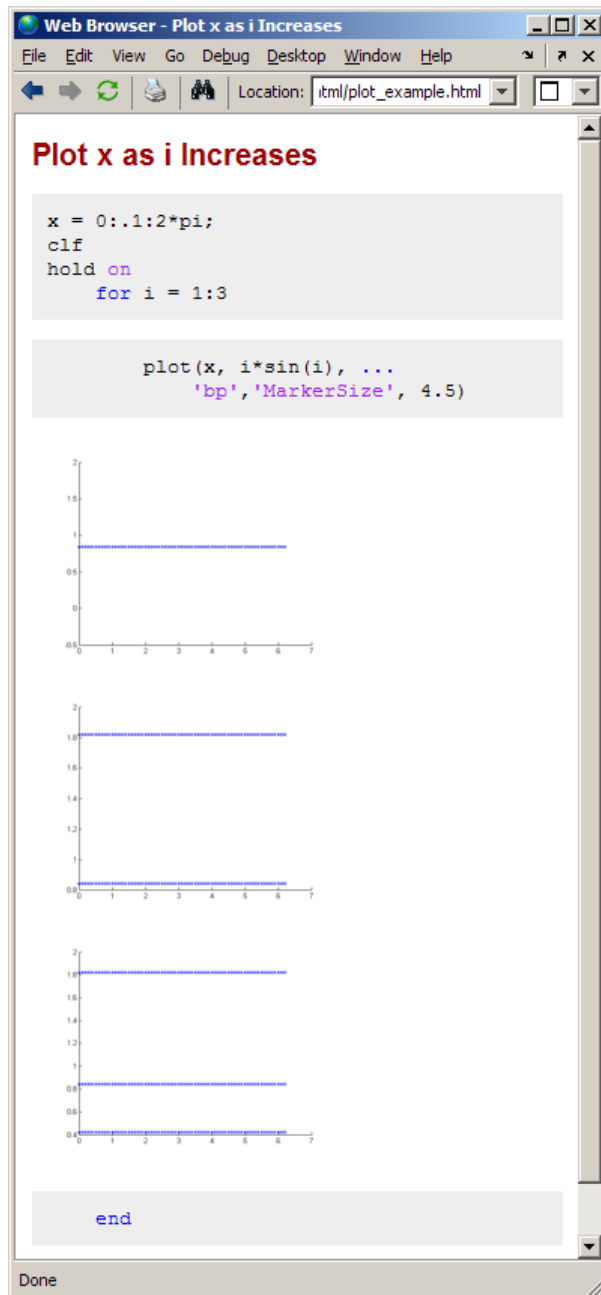
You can nest cells in an M-file, including within functions and control statements, such as `for` loops and `if-then` blocks. This gives you greater control over how a published document appears. This nesting ability also enables you to evaluate subsections of code on a finer grain when using rapid code iteration.

You can insert white space before the double percent (`%%`) characters that specify a cell break (which is also referred to as a cell divider). This helps to improve readability of the M-file when the cell break is within indented code. In prior releases, the `%%` characters had to be in the first column of the code.

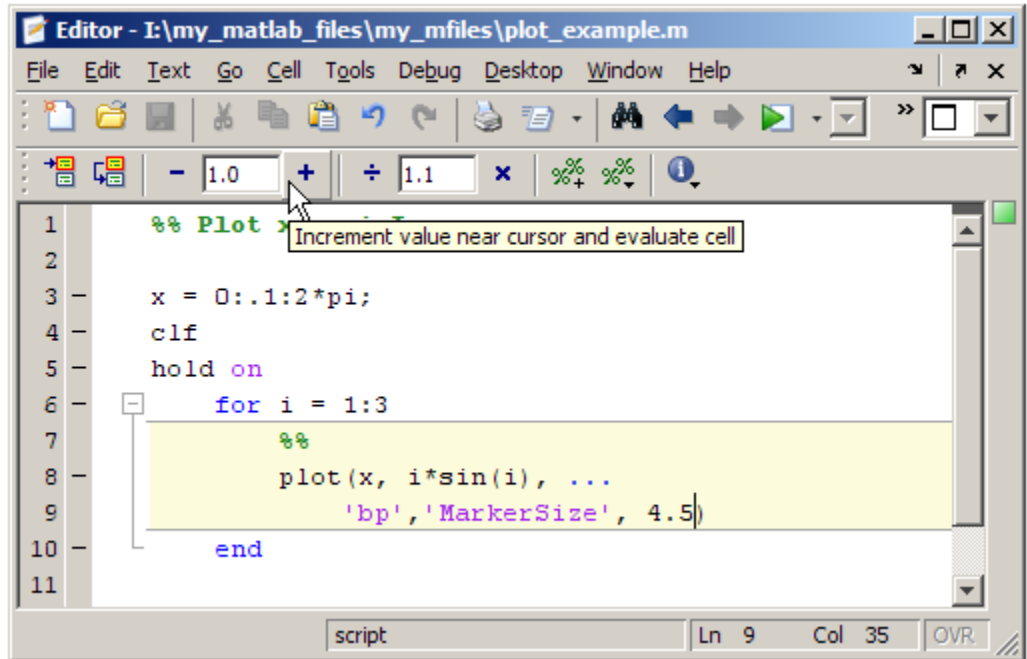
The following image shows a simple example of an M-file with nested cells.



If you publish the file to HTML (reducing the size of the images), the cell break nested within the `for` loop causes MATLAB to publish each iteration of the `for` loop as it evaluates the code in the loop:



Similarly, the cell break within the for loop enables you to run the M-file and experiment with the marker size value without the need to save the file between adjustments:



For more information see “Marking Up MATLAB Code for Publishing” and “Evaluate Subsections of Files Using Code Cells”.

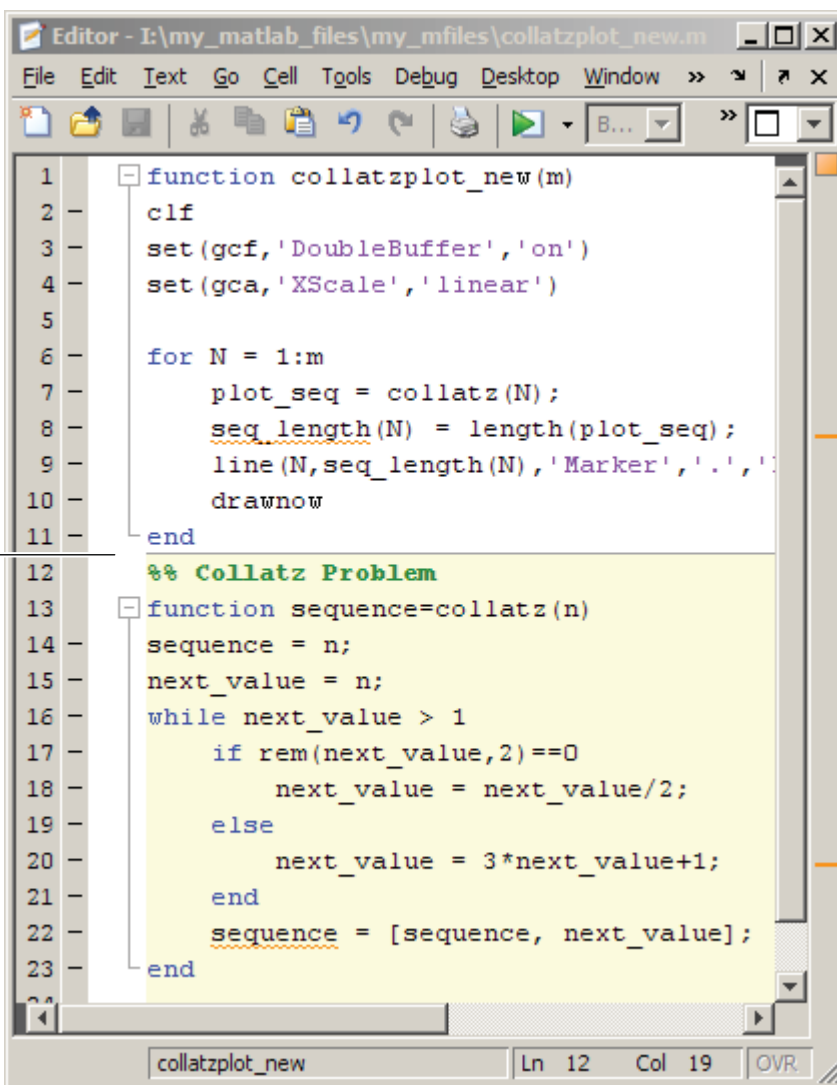
**Compatibility Consideration.** In prior releases, the cell break characters (%%) had to be in the first column of the code for the Editor to recognize the characters as a cell break. This is no longer true, the Editor now recognizes these characters as a cell break regardless of the amount of white space that precedes them.

Furthermore, with the introduction of nested cells, inserting cell breaks in this release has different effects than in the previous release. In the previous release, if you inserted a cell break before a subfunction declaration, MATLAB created two cells; one above the cell break and one below it. Now, if you insert a cell break, MATLAB also inserts implicit cell breaks.

In the example shown, it inserts two implicit cell breaks in the subfunction where you inserted the explicit cell break; one on the first line of the subfunction and one on the last line of the subfunction. This results in three cells: one containing the entire file, one containing the `collatzplot_new` function, and one containing just the Collatz Problem cell title.

Nested cells are introduced to support function publishing.

Version 7.5 (R2007b)



```
1 function collatzplot_new(m)
2     clf
3     set(gcf,'DoubleBuffer','on')
4     set(gca,'XScale','linear')
5
6     for N = 1:m
7         plot_seq = collatzz(N);
8         seq_length(N) = length(plot_seq);
9         line(N,seq_length(N),'Marker','.',':');
10        drawnow
11    end
12    %% Collatz Problem
13    function sequence=collatzz(n)
14        sequence = n;
15        next_value = n;
16        while next_value > 1
17            if rem(next_value,2)==0
18                next_value = next_value/2;
19            else
20                next_value = 3*next_value+1;
21            end
22            sequence = [sequence, next_value];
23        end
```

Explicit cell break

collatzplot\_new Ln 12 Col 19 OVR



Version 7.6 (R2008a)

The screenshot shows the MATLAB Editor window titled "Editor - I:\my\_matlab\_files\my\_mfiles\collatzplot\_new.m". The script content is as follows:

```

1  function collatzplot_new(m)
2      clf
3      set(gcf,'DoubleBuffer','on')
4      set(gca,'XScale','linear')
5
6      for N = 1:m
7          plot_seq = collatz(N);
8          seq_length(N) = length(plot_seq);
9          line(N,seq_length(N),'Marker','.', 'M
10         drawnow
11     end
12     %% Collatz Problem
13     function sequence=collatz(n)
14         sequence = n;
15         next_value = n;
16         while next_value > 1
17             if rem(next_value,2)==0
18                 next_value = next_value/2;
19             else
20                 next_value = 3*next_value+1;
21             end
22             sequence = [sequence, next_value];
23         end
24

```

Annotations on the left side of the editor:

- "Implicit cell break" points to the end of line 11.
- "Explicit cell break" points to the end of line 11.
- "Implicit cell break" points to the end of line 23.

The status bar at the bottom indicates "collatzplot\_new", "Ln 12", "Col 19", and "OVR".

See “Nested Code Cells” for details.

## Publish Button Moved

The Publish button, , is now located on the Editor toolbar.

**Compatibility Considerations.** Previously, the Publish button was located on the Editor Cell Mode toolbar. Now you find it on the Editor toolbar.

## Publish Trademark Symbols

If the comments in your M-file include trademarked terms, you can format the comment to produce a trademark symbol (™) or registered trademark symbol (®) in the published output. See “Including Trademarks in MATLAB Files for Publishing” for details.

## Specifying Code for MATLAB Software to Evaluate with the publish Function

Use the `codetoEvaluate` option to the `publish` function to specify code that you want MATLAB software to evaluate when it publishes an M-file. By default, this is the code in the M-file. However, if you want, you can use this option to specify additional code or alternative code for MATLAB to evaluate. For example, you might want MATLAB to evaluate code that calls the M-file that you are publishing.

## stopOnError Option No Longer Available with publish Function

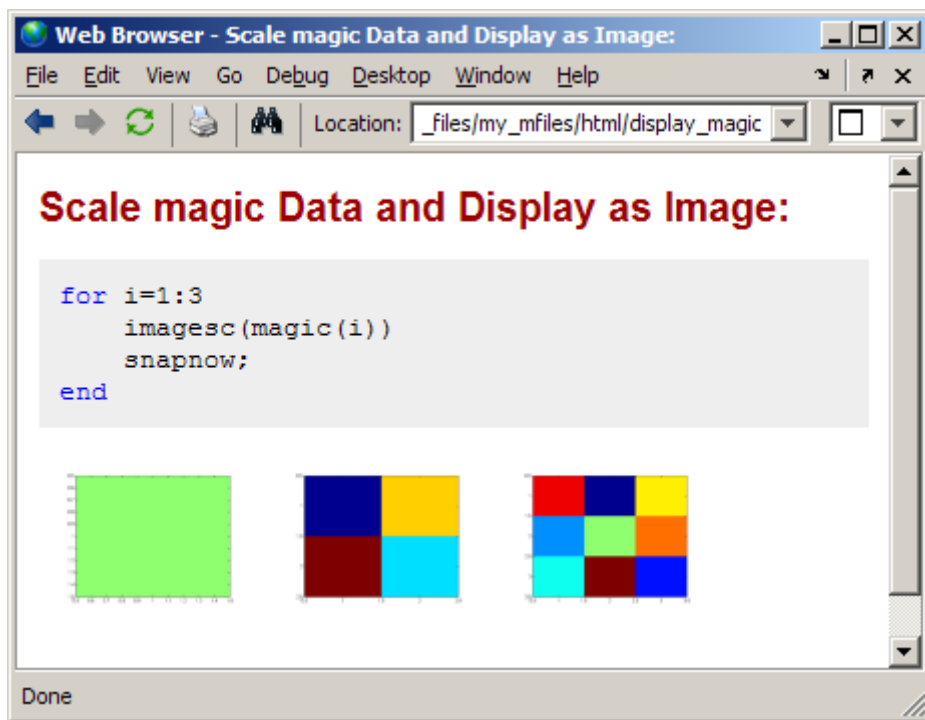
The `stopOnError` option is no longer available for the `publish` function. MATLAB software will always stop when an error occurs, unless you add code to handle the error.

**Compatibility Considerations.** To have MATLAB continue processing code when an error occurs, handle the error using a try-catch statement. For more information, see “The try-catch Statement”.

## Include Snapshot of M-file Output in Published Document

You can include snapshots of output that an M-file generates within a published document. Select **Cell > Insert Text Markup > Force Snapshot**. This menu option inserts the `snapshot` function into your M-file code. This is particularly useful when you have code that generates numerous images that you want to include in the published document. See “Forcing a Snapshot of Output in MATLAB Files for Publishing” for details.

The following image, for example, shows a published document that uses this feature (with the size of the images reduced). Notice that the published images appear after the for loop that generates them.



## Internationalization

### Locale Information Added to MATLAB Documentation

Information about using locale in MATLAB can be found in "Internationalization" in the Desktop Tools and Development Environment documentation.

## Changes to Locale Database

**Windows Platform Changes.** On Microsoft Windows systems, users can select the Pashto language with the Afghanistan country code. This locale setting is `ps_AF.1256`.

**Macintosh OS X Platform Changes.** On Apple Macintosh OS X systems, for users selecting the Chinese language and the China country code, the locale setting is `zh_CN.gb2312`. The previous setting was `zh_CN.GBK`.

## Mathematics, MATLAB Version 7.6 (R2008a)

New features and changes introduced in this version are:

- “Upgrade to BLAS Libraries” on page 273
- “Upgrade to LAPACK Library” on page 273
- “More Multithreaded Support For Elementwise Math Functions With Warnings ” on page 273
- “New Algorithms for `ldl`, `logm`, and `funm` Functions” on page 273
- “Functions and Properties Being Removed” on page 274

### Upgrade to BLAS Libraries

MATLAB software now uses new versions of the Basic Linear Algebra Subroutine (BLAS) libraries. For Windows, Intel Mac, and Linux platforms, MATLAB software supports the Intel Math Kernel Library (MKL) version 9.1. For the Solaris platform, MATLAB software uses the Sun Performance Library from Sun Studio 12.

### Upgrade to LAPACK Library

MATLAB software now uses Version 3.1.1 of the Linear Algebra Package (LAPACK) library.

### More Multithreaded Support For Elementwise Math Functions With Warnings

Multithreaded support has been added to elementwise math functions that may generate warnings: `rdivide`, `ldivide`, `log`, `log2`, and `rem`.

### New Algorithms for `ldl`, `logm`, and `funm` Functions

The `ldl`, `logm`, and `funm` functions include new algorithms based on recent numerical methods research.

## Functions and Properties Being Removed

Function or Property Name	What Happens When You Use Function or Property?	Use This Instead	Compatibility Considerations
betacore	Errors	betainc	Replace all existing instances of betacore with betainc.
colmmd	Errors	colamd	Replace all existing instances of colmmd with colamd.
flops	Errors	None	Remove all existing instances of flops. With the incorporation of LAPACK in MATLAB version 6, counting floating-point operations is no longer practical.
symmmd	Errors	symamd	Replace all existing instances of symmmd with symamd.
quad8	Errors	quad1	Replace all existing instances of quad8 with quad1.
table1	Errors	interp1 or interp1q	Replace all existing instances of table1 with interp1 or interp1q.
table2	Errors	interp2	Replace all existing instances of table2 with interp2.
bessela	Errors	besselj	Replace all existing instances of bessela with besselj.
beta using three input arguments	Errors	betainc using three input arguments	Replace all existing instances of beta using three input arguments with betainc using three input arguments.

## Data Analysis, MATLAB Version 7.6 (R2008a)

New features and changes follow.

### Data Brushing for Graphs and Linked Variables

- “Data Brushing Tool” on page 277
- “Data Brushing API” on page 278
- “Data Linking Tool” on page 278
- “Data Linking API” on page 279
- “Compatibility Considerations” on page 279

This release introduces two new interactive tools for data exploration:

- **Data brushing** — For marking observations on graphs, allowing you to remove or save them to new variables
- **Data linking** — For connecting graphs with data sources (workspace variables) to automatically and interactively update them

In addition, figure windows have a new banner, called the *linking and brushing message bar*. By default, when you plot data into a figure (i.e., add axes), an informational banner appears across top of the figure that looks like this.



In the figure’s message bar, click the first two links to read about these new tools. Click the **Play video** link to open a nine-minute video tutorial about the tools in a browser window (the video also describes new GUI-building features.) To dismiss the banner, click the **X**. Once you do, the banner only reappears on subsequent plots if you select **Show linking and brushing message bar** in the MATLAB Preferences Confirmation Dialogs panel.

---

**Note** The linking and brushing message bar can obscure a plot's title. Also, if you do not dismiss the message bar, it is visible in images of figures captured with `getframe`, but it does not print. See “Compatibility Considerations” on page 279 for details.

---

Use data brushing when you want to isolate observations in a 2-D or 3-D graph for separate analysis, or to remove outliers or noisy data points. Data brushing can be applied to most graphs (some plot types do not support brushing). Data brushing is an exclusive, persistent mode. That is, when using it, you cannot use other figure tools, but the results of brushing data persist when you select a different tool or no tool.

Use data linking to make plots dynamically respond to changes in the variables they plot. Data linking applies to most graphs with identifiable data sources and operates at the figure level. Data linking is not modal and persists until you toggle it off or the connection between a plot and its data sources is broken.

The two tools work smoothly together and with the Variable Editor to visually highlight brushed observations and the data values they represent:


- Brushing data-linked observations on a graph highlights them on other graphs that display them.
- Brushing highlights values in the Variable Editor when a brushed variable is displayed there.
- Using the Brush tool in the Variable Editor highlights values you brush that appear in linked plots.
- Changing values of variables causes linked graphs displaying them to update with the changes.
- Clearing variables disconnects them from all linked figures displaying graphs of them

You can modify variables from the command line, the Variable Editor, or with M-files. When used within functions, data linking operates in the function's workspace, not the base workspace. This is also the case when debugging.

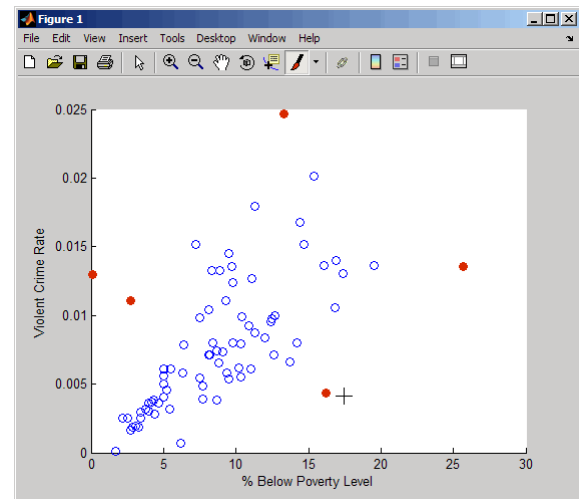
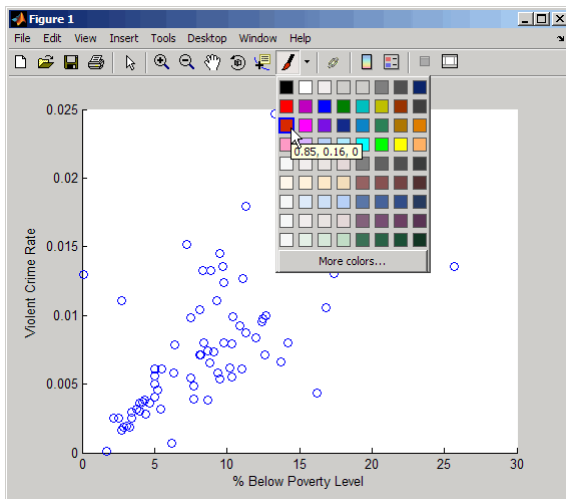


## Data Brushing Tool

All figure windows that contain axes now include a data brushing tool (the

Brush/Select data icon ) that lets you enter and exit brushing mode and select a color with which to brush observations. The tool draws selection rectangles (in 2-D plots) or prisms (in 3-D plots) and permits you to select discontinuous regions and negate previously brushed observations. Undo is also supported.

The Brush/Select data tool is a “split button” control with a brush icon on the left and a drop-down color palette on the right. When you depress the brush icon, you are in brushing mode; all data observations you select are highlighted with the current brush color. The figures below illustrate these operations.




If you leave data brushing mode to zoom, pan, or edit the plot, all brushed observations remain highlighted. You can then reenter brushing mode and pick up where you left off. Brush marks are not preserved when you save a figure and reopen it from the FIG-file, however.

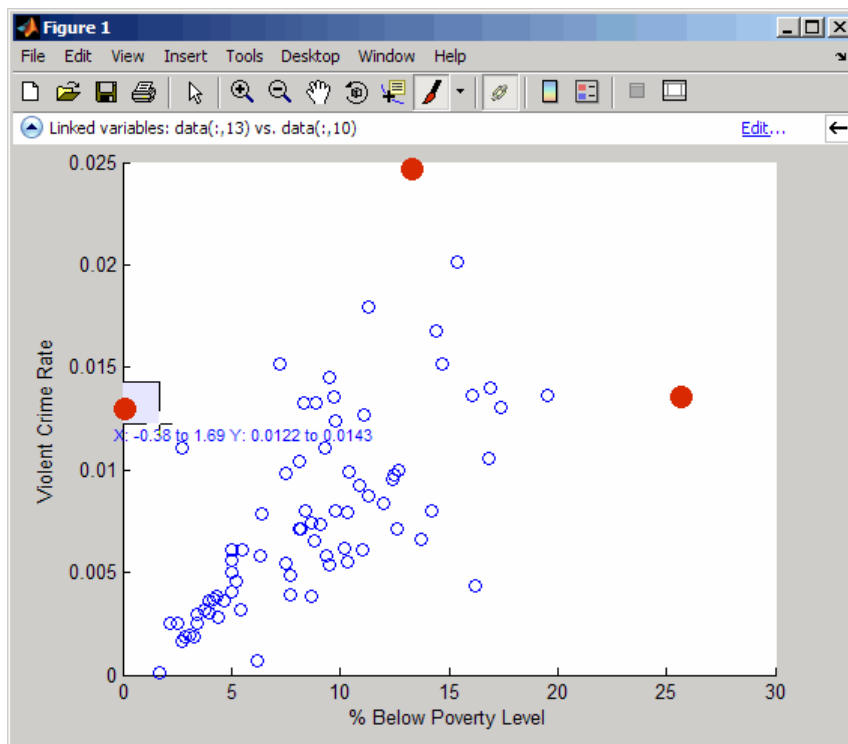
## Data Brushing API


Use the brush function to turn brushing on and off, and to select a color for brushing graphs. You can change brush colors on the fly with either the API or with the Brush tool.

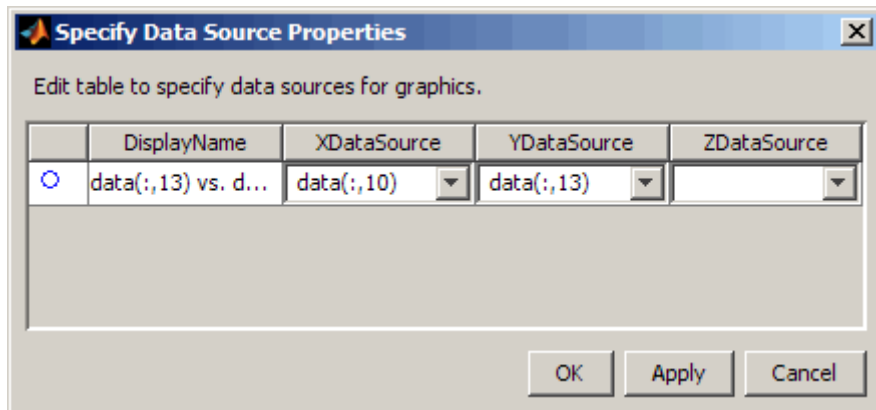
## Data Linking Tool

All figure windows that contain axes now include a data linking tool (the

Linked Plots button ) to toggle linked mode on and off (the default). When you toggle it on, an information bar appears underneath the lowest toolbar on the figure, as shown below. It displays what variables are linked to each series (data sources for  $x$ -,  $y$ -, and  $z$ - data in the graphs).



On the left side of the information bar is a drop-down menu  that displays the symbolism and identifies the data source for each series currently linked. On the right side is an **Edit** button that opens the Data Source Properties dialog box in which you can set display names and data sources. Usually it is possible to unambiguously determine what data sources a graph has, but sometimes you need to indicate what data source to use, for example, when you plot a subrange of a data array. The information bar explains that you need to do this as soon as you turn on data linking; then, you can open the Data Source Properties dialog box to identify your data source(s).



## Data Linking API

Use the `linkdata` function to turn data linking on or off for the current figure or for a figure for which you supply a handle.

## Compatibility Considerations

If you capture figure windows with the `getframe` function, their images will include the message bar if the figures being captured possess them. To prevent this from happening, click the **X** on the right side of the message bar to dismiss it before calling `getframe`. Subsequent figures will not display a message bar. If you want to restore the message bar at a later time, select **Show linking and brushing message bar** in the MATLAB Preferences Confirmation Dialogs panel.

If the figure has a title, its Linked Plots/Data Brushing message bar can obscure it. This is the case for figures at the default size. Remove the message bar if you want a title to display.

## Programming, MATLAB Version 7.6 (R2008a)

New features and changes introduced in this version are

- “Multithreaded Computations Enabled” on page 281
- “Enhancements to Object-Oriented Programming Capabilities” on page 281
- “Packages for Classes and Functions” on page 282
- “Clear Variables with Exceptions” on page 282
- “Information on the State of Memory” on page 282
- “Define Your Own Function Cleanup Tasks” on page 283
- “New Functions” on page 283
- “Extended JIT Support” on page 283
- “Enhancements to Image Information and Writing Functions” on page 283
- “Compression of -v7.3 MAT-Files” on page 284
- “Changes to Programming Documentation” on page 284

### Multithreaded Computations Enabled

Multithreaded computations, introduced in R2007a, are now on by default.

#### Compatibility Considerations

To disable multithreaded computations, open the Preferences dialog, choose Multithreading, and then disable it explicitly.

### Enhancements to Object-Oriented Programming Capabilities

Major enhancements to object oriented programming capabilities enables easier development and maintenance of large applications and data structures.

New features include:

- The new `classdef` keyword enables you to define properties, methods, and events in a class definition file. See “User-Defined Classes”.
- A new `handle` class with reference behavior enables you to create more sophisticated data structures, such as linked lists and to manage external resources, such as files. See “Comparing Handle and Value Classes”.
- Events and listeners enable you to monitoring object property changes and other actions. See “Events — Sending and Responding to Messages”.
- Packages enable scoping of classes and functions. See “Scoping Classes with Packages”.
- Meta-classes provide support for class introspection. See “Information from Class Metadata”.
- JIT/Accelerator support provides significantly improved performance over the previous object oriented-programming system.

For a full description of object-oriented features, see *Object-Oriented Programming*.

## **Packages for Classes and Functions**

This release provides the capability to manage name space by placing classes and functions in packages.

## **Clear Variables with Exceptions**

With the new `clearvars` function, you can specify which variables you do not want cleared from memory.

## **Information on the State of Memory**

The new `memory` function provides memory usage information such as largest block available, allowing you to diagnose memory problems on Microsoft Windows platforms.

## **Compatibility Considerations**

The `memory` function existed in previous versions of MATLAB, but its purpose has changed. Previously, `memory` provided help text on how to free additional memory space for your MATLAB application. The function now

returns information on the current state of memory use and availability in your system.

## Define Your Own Function Cleanup Tasks

With the new `onCleanup` function, you can specify one or more tasks for MATLAB to perform just before exiting the current function.

## New Functions

Name	Description
<code>clearvars</code>	Clear variables from memory
<code>memory</code>	Display memory information
<code>onCleanup</code>	Cleanup tasks at function completion

## Extended JIT Support

JIT/Accelerator support now extends to statements executed at the MATLAB Command Line and in cell mode in the MATLAB Editor. This provides improved performance in these environments.

## Enhancements to Image Information and Writing Functions

The image information and writing functions have the following enhancements:

- `imfinfo` can now return Exif data for JPEG or TIFF format image files. Information specific to the digital camera can be found in the `'DigitalCamera'` field, while any global positioning system information can be found in the `'GPSInfo'` field.
- `imwrite` now supports the `'RowsPerStrip'` parameter that you can use to specify how many image rows to include in a strip when writing TIFF files. By default, `imwrite` limits the number of rows included in a strip so that the size of the strip does not exceed 8 KB. Now you can specify strips of larger size.

## **Compression of -v7.3 MAT-Files**

You can store data items that are over 2 gigabytes in size in a MAT-file using the `-v7.3` option for the `save` function. This option was introduced in MATLAB R2006b. With MATLAB R2008a, `save` now compresses these MAT-files.

## **Changes to Programming Documentation**

Some of the chapters in the MATLAB Programming documentation have been moved or renamed in this release. Also the title of the Programming documentation has been changed to Programming Fundamentals in order to differentiate this part of the MATLAB help from the new documentation on Developing MATLAB Classes.



## Graphics and 3-D Visualization, MATLAB Version 7.6 (R2008a)

New features and changes introduced in this version are:

- “New Figure Toolbar Buttons” on page 285
- ““v6” Plotting Option Update — Affected Functions” on page 285

### New Figure Toolbar Buttons

Two new toolbar buttons and an information bar have been added in this release that control the new *Data Brushing* and *Data Linking* tools. Brushing and linking let you interactively explore and analyze data.

By default, now when you create axes or plot something into a blank figure, an informational banner appears across top of the figure with links to documentation for data brushing and linking capabilities. You can dismiss it by clicking the **X** button on right-hand side of the message bar. Once you dismiss it, subsequent figures will not display the banner unless you select **Show linking and brushing message bar** in the MATLAB Preferences Confirmation Dialogs panel.

For more information, see “Data Brushing for Graphs and Linked Variables” on page 275 in the Data Analysis release notes and “Interactive Data Exploration” in the Data Analysis documentation. Also view the video tutorial that describes these and other new features.

### “v6” Plotting Option Update — Affected Functions

The Version 7.5 (R2007b) release note “The “v6” Option for Creating Plot Objects is Obsolete” on page 338 identified plotting functions that accept the v6 option, which is now obsolete and will be removed in a future version of MATLAB. There is no change to the status of these functions in R2008a. However, the list of affected functions in the R2007b release note had errors and omissions. Below is the correct list of functions that support the option in their syntax and now warn when it is used:

- area
- bar

- `barh`
- `colorbar`
- `contour`
- `contourf`
- `errorbar`
- `legend`
- `loglog`
- `mesh`
- `plot`
- `plot3`
- `quiver`
- `quiver3`
- `scatter`
- `scatter3`
- `semilogx`
- `semilogy`
- `stairs`
- `stem`
- `stem3`
- `subplot`
- `surf`

Note that the updated list adds functions `plot3` and `quiver3`.

In the earlier release note, the following functions were incorrectly identified as accepting the `v6` option:

- `meshc`
- `meshz`

- `surf`

These functions do not call v6 code and are not affected by it becoming obsolete.

### **Compatibility Considerations**

Specifying the v6 flag to any plotting function now results in a warning that the option is being removed, but the option still functions. To generate a FIG-file for a plot created with the v6 option, you still need to use the -v6 option to the `hgsave` command in order to save it in a form that a previous version of MATLAB can read. Figures containing annotations (such as textboxes, arrows, ovals, and rectangles) that are saved this way open in previous versions, but the annotations do not display because different objects are used to contain them in Version 7 than before. That is, the annotation objects have never been backward compatible.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.6 (R2008a)

New features and changes introduced in this version are:

- “New GUI Table Component ” on page 288
- “Event Data Input to GUIDE Callbacks” on page 288
- “uigetfile and uiputfile Support of '.', '..', and '/'” on page 289
- “hidegui Function Being Obsoleted” on page 289
- “Changes to How uicontrols Set Figure SelectionType” on page 289

### New GUI Table Component

The new `uitable` component allows you to show data in a table. This component replaces the undocumented MATLAB `uitable` implementation. If you are using the old `uitable` component, please refer to the “uitable Migration Document” for help migrating to the supported `uitable` component.

### Event Data Input to GUIDE Callbacks

Auto-generated callbacks of GUIDE GUIs can now access event data for Handle Graphics callbacks. The following Handle Graphics callbacks provide event data when triggered:

- `KeyPressFcn` in `uicontrol` and `figure`
- `KeyReleaseFcn` in `figure`
- `SelectionChangeFcn` in `uibuttonGroup`
- `WindowKeyPressFcn` in `figure`
- `WindowKeyReleaseFcn` in `figure`
- `WindowScrollWheelFcn` in `figure`
- `CellEditCallback` in `uitable`
- `CellSelectionCallback` in `uitable`

For example, the event data for `keypress` provides information on the key that is pressed. See the `Callback Templates` documentation for more information.

## **uigetfile and uiputfile Support of '.', '..', and '/'**

Starting in R2007b, the `uigetfile` and `uiputfile` functions interpret '.', '..', and '/' the same way as does the `cd` command. '.' is interpreted as the current directory, '..' is the directory above the current directory, and '/' is the top level directory. When specifying a directory rather than a filename for either the `Filterspec` or `DefaultName` argument, you no longer need to end the string with a '/'. However, such strings ending with a '/' are interpreted as they were in previous releases.

## **hidegui Function Being Obsoleted**

The `hidegui` function is being obsoleted and will be removed in a future version. Instead of this function use the `set` function to set the figure handle's `handlevisibility` property to `on` or `off`:

```
set(figurehandle, 'handlevisibility', 'on')
```

## **Changes to How uicontrols Set Figure SelectionType**

`SelectionType` is a figure property that user interface components set when you click them. It is a read-only property that describes the gesture used when clicking the most recently selected object. For single mouse clicks, components no longer set the figure `SelectionType` property to anything but `'normal'` when they are enabled. By default, all components are enabled (their `Enable` property is `'on'`). Previously, enabled components responded to modifier keys (**Ctrl**, **Alt**, **Shift**, and **Cmd**) by setting `SelectionType` to `'alt'` or `'extend'`. Now all key modifiers set `SelectionType` to `'normal'` for UI components.

*Disabled* components (those with their `Enable` property set to `'off'`) set `SelectionType` to `'alt'` or `'extend'` in response to modifier keys.

When `Enable` is `'on'`, the control is active and your `Callback` responds to clicks. When `Enable` is `'off'`, the control is not active, and your `ButtonDownFcn` responds to clicks. You can provide components with a `ButtonDownFcn` to detect changes in `SelectionType`.

An additional change affects how *list box* `uicontrol` components respond to double-clicking. The second of two successive clicks sets the `SelectionType` property of an enabled list box to 'open'. Other types of `uicontrols` set their `SelectionType` to 'normal' after both the first and the second clicks unless key modifiers were used.

The following table describes the click responses for `uicontrol` components.

<b>Enable Status</b>	<b>Mouse Button Pressed</b>	<b>Key Modifier Pressed</b>	<b>SelectionType on First Click</b>	<b>SelectionType on Second Click</b>
on	left		'normal'	'normal' *
on	right		'alt'	'open'
on	left	<b>Ctrl</b>	'normal'	'normal' *
on	right	<b>Ctrl</b>	'alt'	'open'
on	left	<b>Shift</b>	'normal'	'normal' *
on	right	<b>Shift</b>	'extend'	'open'
off	left		'normal'	'open'
off	right		'alt'	'open'
off	left	<b>Ctrl</b>	'alt'	'open'
off	right	<b>Ctrl</b>	'alt'	'open'
off	left	<b>Shift</b>	'extend'	'open'
off	right	<b>Shift</b>	'extend'	'open'

\* Double-click result is 'open' for list boxes.

For a two-button mouse, pressing the left and right buttons together (without key modifiers) can set `SelectionType` to either 'normal' or 'extend'; the results are unpredictable, possibly depending on which button you actually depressed first.

`uipushtool` and `uitoggletool` toolbar buttons do not set `SelectionType` at all, no matter what keys or mouse buttons you press. When they are disabled, `uipushtool` and `uitoggletool` controls do not execute their `ClickedCallback` (or `OnCallback/OffCallback`), nor does using them trigger a `WindowButtonDownFcn` callback.

### **Compatibility Considerations**

If your callback code depends on the value for `SelectionType`, be aware that for the left mouse button, pressing **Ctrl** no longer sets it to 'alt' and that **Shift**-clicking no longer sets it to 'extend'.

The `SelectionType` behavior for the right mouse button has not changed.

## External Interfaces/API, MATLAB Version 7.6 (R2008a)

- “Interface to Generic DLLs Supported on 64-bit Platforms” on page 292
- “Changes to Compiler Support” on page 292
- “New Version of Perl on Windows Platforms” on page 294
- “Rebuild MEX-Files Created on Linux Platforms” on page 294
- “Use mxDestroyArray to Release Memory for mxArray” on page 295
- “Do Not Use get or set Function to Manage Properties of Java Objects” on page 295
- “New mxArray Functions for Use with MATLAB Class Objects” on page 296
- “mex.bat File Removed from matlabroot\bin\\${ARCH}” on page 296
- “Run-time Libraries Required for Applications Built with Microsoft® Visual Studio 2008 Compiler” on page 296
- “Environment Variables Required with Intel Visual Fortran 9.0” on page 297
- “-largeArrayDims Option to MEX Will Become Default” on page 297
- “Changes to Dynamic Data Exchange (DDE) Documentation” on page 298

### Interface to Generic DLLs Supported on 64-bit Platforms

The ability to load a generic DLL on 64-bit platforms using `loadlibrary` is available in MATLAB Version 7.6 (R2008a).

### Compatibility Considerations

You must install a C compiler and Perl to use this feature. For a list of supported compilers and how to install them, see “Using `loadlibrary` on 64-Bit Platforms”.

### Changes to Compiler Support

The set of compilers that MATLAB supports has changed in MATLAB Version 7.6 (R2008a). For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.



- “New Compiler Support” on page 293
- “Discontinued Compiler Support” on page 293
- “Compiler Support to Be Phased Out” on page 294

## **New Compiler Support**

MATLAB Version 7.6 (R2008a) supports new compilers for building MEX-files.

### **Microsoft Windows (64-bit) platform.**

- Microsoft Visual Studio 2008
- Windows SDK for Vista
- Intel Visual Fortran 10.1

### **Windows (32-bit) platform.**

- Microsoft Visual Studio 2008
- Open Watcom Version 1.7
- Intel Visual Fortran 10.1

### **Sun Solaris SPARC (64-bit) platform.**

- Sun Studio 12 cc / CC Version 5.9

### **Macintosh (Intel-based 32-bit) platforms.**

- Apple Xcode 3.0 (gcc / g++ Version 4.0.1)

## **Discontinued Compiler Support**

The following compilers are no longer supported.

### **Windows platforms.**

- Intel C++ Version 7.1
- Intel Visual Fortran Version 9.0

- Borland® C++Builder® 6 Version 5.6
- Borland C++Builder 5 Version 5.5
- Borland® C++ Compiler Version 5.5
- Compaq Visual Fortran Version 6.1
- Compaq Visual Fortran Version 6.6

**Compatibility Considerations.** To ensure continued support for building your C/C++ programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

### **Compiler Support to Be Phased Out**

The following compilers are supported in Version 7.6 (R2008a), but will not be supported in a future version of MATLAB.

#### **Windows (32-bit) platform.**

- Open Watcom Version 1.3

#### **Solaris SPARC (64-bit) platform.**

- Sun Studio 11 cc / CC Version 5.8

### **New Version of Perl on Windows Platforms**

MATLAB Version 7.6 (R2008a) includes Perl on Windows Version 5.8.8.

### **Compatibility Considerations**

Prior to this release, MATLAB contained Perl Version 5.005. Consult your Perl documentation for details on the changes between Perl versions.

### **Rebuild MEX-Files Created on Linux Platforms**

MATLAB V7.6 (R2008a) on Linux platforms is built with a compiler that utilizes glibc Version 2.3.6.

## Compatibility Considerations

To work with MATLAB V7.6 (R2008a), MEX-files compiled on a Linux platform must be rebuilt.

## Use `mxDestroyArray` to Release Memory for `mxArray`

The documentation for the `mxSetCell`, `mxSetField`, and `mxSetFieldByNumber` functions in the MATLAB C and Fortran API incorrectly instructs customers to use `mxFree` to release memory for any `mxArray` returned by `mxGetCell`, `mxGetField`, or `mxGetFieldByNumber`.

## Compatibility Considerations

The correct function to use is `mxDestroyArray`. Calling `mxFree` on an `mxArray` only frees the array header, but does not actually free the data itself and can result in a memory leak.

To help diagnose this problem, MATLAB issues a warning if calling `mxFree` on an `mxArray` could cause memory corruption. In future versions of MATLAB, this condition may result in a segmentation violation.

## Do Not Use `get` or `set` Function to Manage Properties of Java Objects

If you want to read or update a property of a Sun Java object created in MATLAB using the Java class constructor, do not use the MATLAB `get` or `set` functions on the property. For example, if you create a Java object called `javaObject` that has a property called `PropertyName`, the following commands may cause memory leaks and will be deprecated in a future version of MATLAB:

```
propertyValue = get(javaObject, 'PropertyName');  
set(javaObject, 'PropertyName', newValue);
```

## Compatibility Considerations

The correct commands to use are:

```
propertyValue = javaObject.getPropertyName;  
javaObject.setPropertyName(newValue);
```

In future versions of MATLAB, using `get` or `set` on Java objects to manage the properties will generate an error.

## **New mxArray Functions for Use with MATLAB Class Objects**

You can read and modify properties of MATLAB class objects using the `mxGetProperty` and `mxSetProperty` functions.

## **mex.bat File Removed from matlabroot\bin\ARCH**

Beginning with MATLAB Version 7.3 (R2006b), the Windows script `mex.bat` is located in the directory `matlabroot\bin`. Copies of this file were also in the directory `matlabroot\bin\ARCH`. In MATLAB Version 7.6 (R2008a), `mex.bat` is only located in `matlabroot\bin`.

## **Compatibility Considerations**

If you did not make the updates described in “Location of `mex.bat` File Changed” on page 443, you may need to make changes now.

## **Run-time Libraries Required for Applications Built with Microsoft Visual Studio 2008 Compiler**

If you distribute a MEX-file, an engine application, or a MAT-file application built with the Visual Studio 2008 compiler, you must provide the Visual C++ run-time libraries. These files are required to run applications developed with Visual C++ on a computer that does not have Visual C++ 2008 installed. For information on locating the Microsoft Visual C++ 2008 Redistributable Package (x86), containing `vcredist_x86.exe` and `vcredist_x64.exe`, consult your Microsoft documentation.

## Environment Variables Required with Intel Visual Fortran 9.0

When you build a MEX-file, an engine application, or a MAT application using Intel Visual Fortran 9.0, MATLAB requires that you define an environment variable for the Windows platform you are using.

### Windows (32-bit) platform

Define the environment variable VS71COMNTOOLS. The value of this environment variable is the path to the Common7\Tools directory of the Microsoft Visual Studio .NET 2002 or 2003 installation directory. (Intel Visual Fortran requires Visual Studio .NET 2002 or 2003 on 32-bit Windows platforms.) The Visual Studio .NET 2003 installation program commonly defines this environment variable. For example, you might set the environment variable as follows:

```
C:\Program Files\Microsoft Visual Studio .NET 2003\Common7\Tools
```

### Windows x64 platform

Define the environment variable MSSdk. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server® 2003. (Intel Visual Fortran requires Microsoft Platform SDK for Windows Server 2003 on Windows x64 platforms.) The Microsoft Platform SDK installation program does not commonly define this environment variable. For example, the environment variable might have the value

```
C:\Program Files\Microsoft Platform SDK
```

## -largeArrayDims Option to MEX Will Become Default

In a future version of MATLAB, the default mex command will change to use the large-array-handling API. This means the -largeArrayDims option will be the default. For information about migrating your MEX-files to use the large-array-handling API, see the Technical Support solution 1-5C27B9.

## Compatibility Considerations

In the near future you will be required to update your code to utilize the new API. You should review your source MEX-files and mex build scripts.

## Changes to Dynamic Data Exchange (DDE) Documentation

In MATLAB Version 5.1, all development work for the Dynamic Data Exchange (DDE) server and client was stopped. MathWorks provides, instead, a MATLAB interface to COM technology that is documented in “Using COM Objects from MATLAB”.

### Obsolete Functionality No Longer Documented

Documentation for the following functions no longer included in External Interfaces.

Obsolete Functions
ddeadv
ddeexec
ddeinit
ddepoke
ddereq
ddeterm
ddeunadv

The following syntax for `enableservice` no longer included in External Interfaces.

```
enableservice('DDEServer',enable)
```

**Compatibility Considerations.** If you must support this obsolete functionality, we suggest you print and keep a copy of the relevant MATLAB function reference pages from V7.5 (R2007b) or earlier.

# Version 7.5 (R2007b)

## MATLAB Software

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This table summarizes what's new in Version 7.5 (R2007b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.5 (R2007b)” on page 301
- “Mathematics, MATLAB Version 7.5 (R2007b)” on page 321
- “Data Analysis, MATLAB Version 7.5 (R2007b)” on page 325
- “Programming, MATLAB Version 7.5 (R2007b)” on page 326
- “Graphics and 3-D Visualization, MATLAB Version 7.5 (R2007b)” on page 335
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.5 (R2007b)” on page 340

- “External Interfaces/API, MATLAB Version 7.5 (R2007b)” on page 344



# Desktop Tools and Development Environment, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 301
- “Desktop” on page 302
- “Running Functions — Command Window and History” on page 305
- “Help” on page 306
- “Editing and Debugging M-Files” on page 311
- “Publishing Results” on page 319

## Startup and Shutdown

### Windows Platforms Startup Changes

You can now change the MATLAB startup directory on Microsoft Windows platforms using the standard shortcut **Start in** field. The My Documents\MATLAB subfolder (or Documents\MATLAB on the Microsoft Windows Vista platform) is the default startup directory. Upon startup, MATLAB automatically creates a My Documents\MATLAB subfolder (or Documents\MATLAB on the Windows Vista platform) if it does not exist, and adds it to the top of the MATLAB search path. To change the startup directory:

- 1** Right-click the MATLAB shortcut icon and select **Properties** from the context menu. The MATLAB Properties dialog box opens to the **Shortcut** pane.
- 2** In the **Start in** field, specify the directory in which you want MATLAB to start, for example, C:\My MATLAB Place.

You can specify the directory via a UNC path (that is, the path can begin with \\).

The **Target** field specifies the full path to the file to start MATLAB, `matlab.exe`, located in the `bin` folder (for example, `C:\Program Files\MATLAB\R2007b\bin\matlab.exe`). Use the `bin\matlab.exe` to start MATLAB instead of `matlab.bat` or `matlab.exe` located in a platform directory such as `bin\win32`. The `bin\matlab.exe` detects the Windows platform and ensures required run-time files are installed.

**Compatibility Considerations.** The **Target** field no longer contains the `-sd $documents` startup option. In MATLAB Version 7.4 (R2007a), the startup directory was specified via the `-sd` startup option in the **Target** field. You had to specify the directory via a mapped drive. Any value in the **Start in** field was ignored.

The file to start MATLAB, as specified in the **Target** field, was `matlab.bat`.

Change any scripts you use to start MATLAB to specify the full path to `bin\matlab.exe`. If you use `matlab.bat` in R2007b, MATLAB issues a warning message instructing you to use `matlab.exe` instead.

If scripts include the `-sd` startup option to specify the startup directory, that will be the startup directory, even if a directory is specified in the **Start in** field.

## Desktop

New features and changes introduced in Version 7.5 (R2007b) are:

- “Minimizing Tools in the Desktop Now Supported on Macintosh Platforms” on page 303
- “Double-Click to Maximize or Restore Minimized Tools in Desktop” on page 303
- “New Desktop Layout — All but Command Window Minimized” on page 303
- “Start Button Now Includes New Category for Links and Targets” on page 304
- “Start Button — View Source Files Renamed” on page 305
- “Changes to Look of Buttons in Desktop and Other Tools” on page 305

- “Antialiasing Option No Longer Necessary on Windows and Macintosh Platforms” on page 305

## **Minimizing Tools in the Desktop Now Supported on Macintosh Platforms**

You can now minimize tools in the desktop on Apple Macintosh platforms. It was introduced for other platforms in a previous version.

## **Double-Click to Maximize or Restore Minimized Tools in Desktop**

After you minimize a tool within the desktop, you can now:

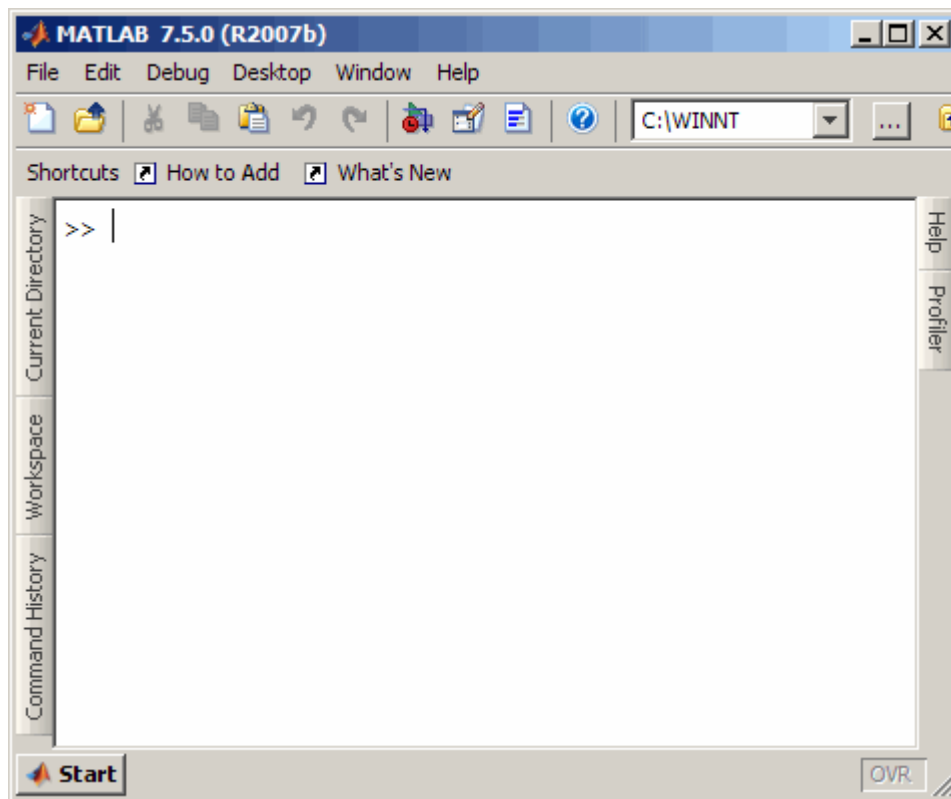
- Restore the tool to its former position by double-clicking the button.
- Drag a button to move its position—drag it to another edge of the desktop or to a new position within the edge where it’s currently located.
- Restore the tool by dragging the button to a location within the desktop, or outside the desktop to undock the tool.

Similarly, you can double-click a tool’s title bar to maximize the tool in the desktop; then double-click the title bar again to restore it to its former position. (The capability was introduced in R2007a, MATLAB Version 7.4).

For more information, see “Open and Rearrange Desktop Tools and Documents”.

## **New Desktop Layout – All but Command Window Minimized**

Select **Desktop > Desktop Layout > All but Command Window Minimized** to arrange the desktop as shown here. The Command Window is open in the desktop, and all other desktop tools are open, but minimized.



### Start Button Now Includes New Category for Links and Targets

In the Start button, there is a new category for Link and Target products. Select **Start > Links and Targets**, and then select one of the products. In previous versions, you accessed these products from the Toolboxes or Simulink software categories.

You also use this new category when running demos, or accessing **Demos** or **Contents** in the Help browser. For more information, see “Demos and Help Browser Contents Now Include New Category for Links and Targets” on page 306.

## Start Button – View Source Files Renamed

To add your own toolboxes to the **Start** button, select **Start > Desktop Tools > View Start Button Configuration Files**. In previous versions, this menu item was **View Source Files**. There has been no change in functionality or features.

## Changes to Look of Buttons in Desktop and Other Tools

Some icons on toolbar buttons have changed slightly. In addition, standard desktop icon image files are no longer provided in the `matlabroot/toolbox/matlab/icons` directory.

**Compatibility Considerations.** If your code relied on icon files in the `matlabroot/toolbox/matlab/icons` directory (for example, for adding your entries to the **Start** button or the Help browser), you might need to use other image files.

## Antialiasing Option No Longer Necessary on Windows and Macintosh Platforms

MATLAB now follows the operating system's font settings on Microsoft and Macintosh platforms. This provides smooth fonts without the need for antialiasing within MATLAB.

## Running Functions – Command Window and History

New features and changes introduced in Version 7.5 (R2007b) are:

- “Command History — Find Entry by Letter Now Looks in Collapsed Sessions” on page 305
- “Pop-Up Help for a Function in the Command Window” on page 306

## Command History – Find Entry by Letter Now Looks in Collapsed Sessions

When you type letters in the Command History, it finds and selects the next entry that begins with the letters you typed. Now, if the entry is in a session that was collapsed, MATLAB automatically expands the session and selects the matching entry in it. In previous versions, MATLAB did not find matching entries in collapsed sessions.

If you do *not* want to find entries in collapsed sessions (the previous behavior), you can instead select **Edit > Find**, which finds text in the Command History, but not in collapsed sessions. For more information, see “Quick Search for Entries Beginning with Specified Letters or Numbers”.

### **Pop-Up Help for a Function in the Command Window**

For more information, see “Help on Selection Enhanced in Command Window and Editor” on page 309.

## **Help**

New features and changes introduced in Version 7.5 (R2007b) are:

- “Minor Visual Changes to Help Browser” on page 306
- “Demos and Help Browser Contents Now Include New Category for Links and Targets” on page 306
- “Help on Selection Enhanced in Command Window and Editor” on page 309

### **Minor Visual Changes to Help Browser**

- To open the Help browser from a tool’s **Help** menu, select **Product Help**. In previous versions you selected **Full Product Family Help**.
- When the Help browser first opens, it displays help for MATLAB. In previous versions, it displayed a Begin Here page. The information previously available on the Begin Here page has been incorporated into the MATLAB roadmap page.
- When you close and reopen the Help browser, it maintains the list of pages you previously viewed, but does not open to the page you last viewed. In previous versions, upon reopening, the Help browser displayed the page you last viewed.


### **Demos and Help Browser Contents Now Include New Category for Links and Targets**


When you run the demo function or access **Demos** or **Contents** in the Help browser, there is a new category for Link and Target products.

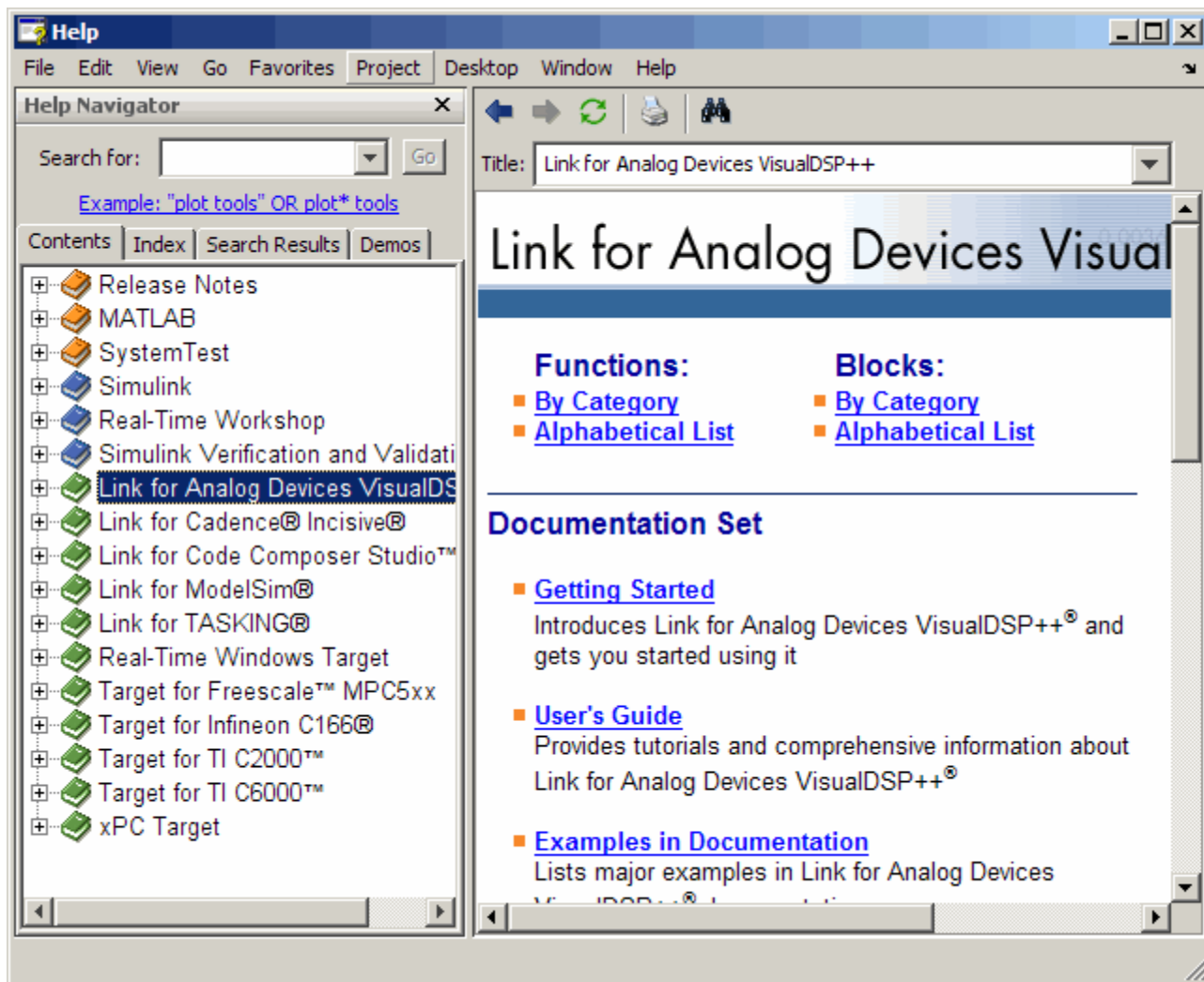
To use the `demo` function to access a demo that is now in the Links and Targets category, you specify the new subtopic 'links and targets', followed by the category. For example

```
demo('links and targets', 'link for modelsim')
```

displays the **Demos** pane, and expands the Link for ModelSim® demos listing.

In the Help **Demos**, Link and Target products appear together in their own category, and are identifiable by the new Links and Targets icon, .

In the Help **Contents**, Link and Target products appear together after any installed Simulink and blockset products, and are identifiable by the new Links and Targets green book icon, .



This new category is also used in the **Start** button in the MATLAB desktop—for more information, see “Start Button Now Includes New Category for Links and Targets” on page 304.

If you add help or demos to the Help browser for your own toolbox or list your own toolbox in the **Start** button and you want to take advantage of



the new Links and Targets category, use the new type, `links_targets`, in the `info.xml` file for your toolbox.

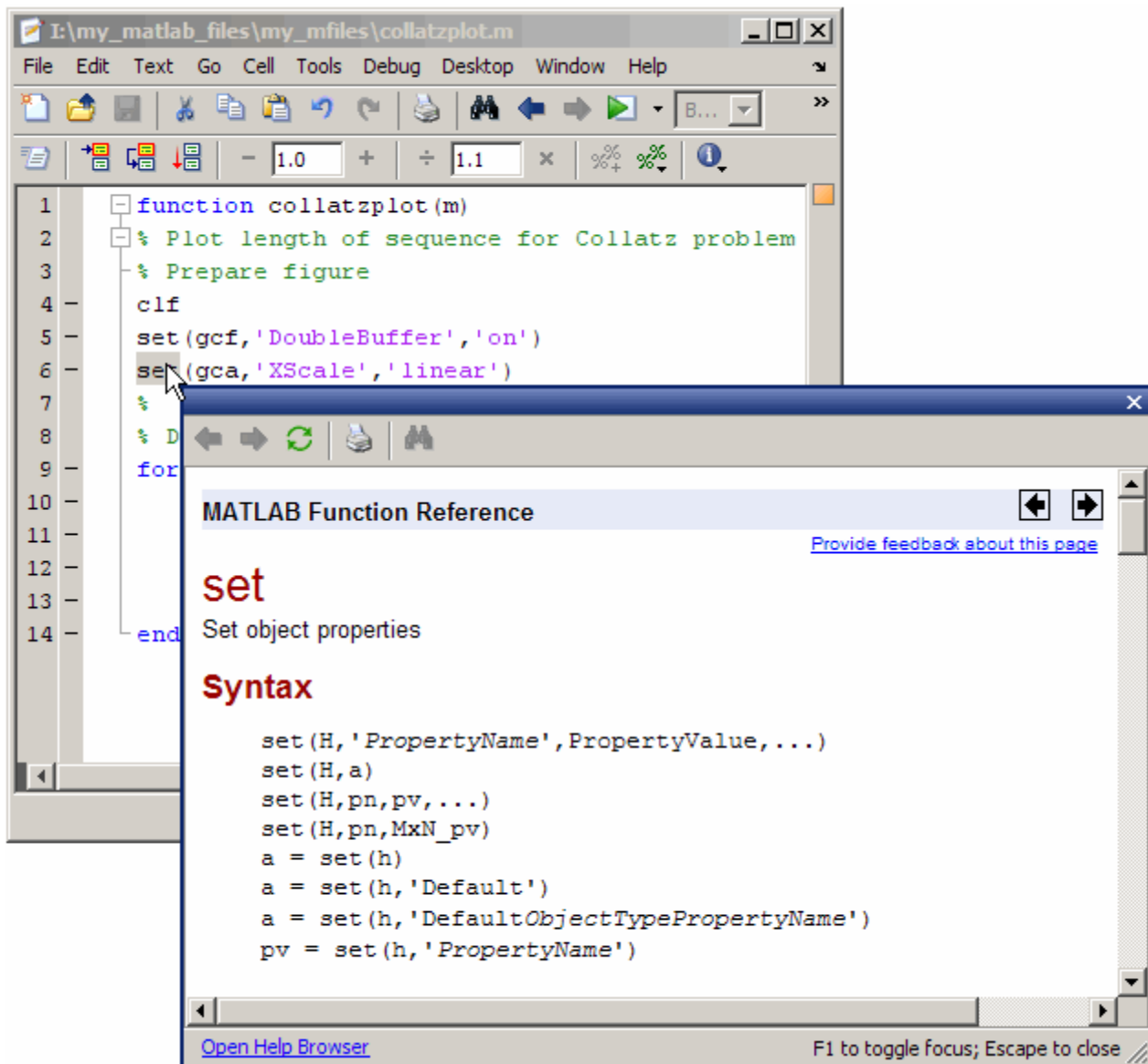
**Compatibility Considerations.** In previous versions, when you used the `demo` function to access a demo that is now in the Links and Targets category, you specified a different subtopic and category. If you have any code that relies on the `demo` function for accessing Links and Targets demos, you will need to replace the subtopic and category in the code.

In previous versions, you accessed the products in the Help browser **Demos** from the Toolbox or Simulink software categories.

In previous versions, you accessed the products in the Help browser **Contents** from within the list of toolbox products (orange book icon) or Simulink products (blue book icon).

### **Help on Selection Enhanced in Command Window and Editor**

To get help for a function in the Command Window or the Editor, click the pointer in the function name and press **F1**. The reference page for that function appears in a small help window. To close the window, press **Escape**. You can also access the feature by choosing **Help on Selection** from the context menu. To change the window in which this help appears, select **File > Preferences > Help**, and adjust the option for **Help on Selection and More Help**.



**Compatibility Considerations.** In the previous version, you could select the function name, right-click, and select **Help on Selection**. The documentation appeared in the Help browser. Now if you want to see the documentation for the function in the Help browser, first access the pop-up help, and then click the **Open Help Browser** link.


## Editing and Debugging M-Files

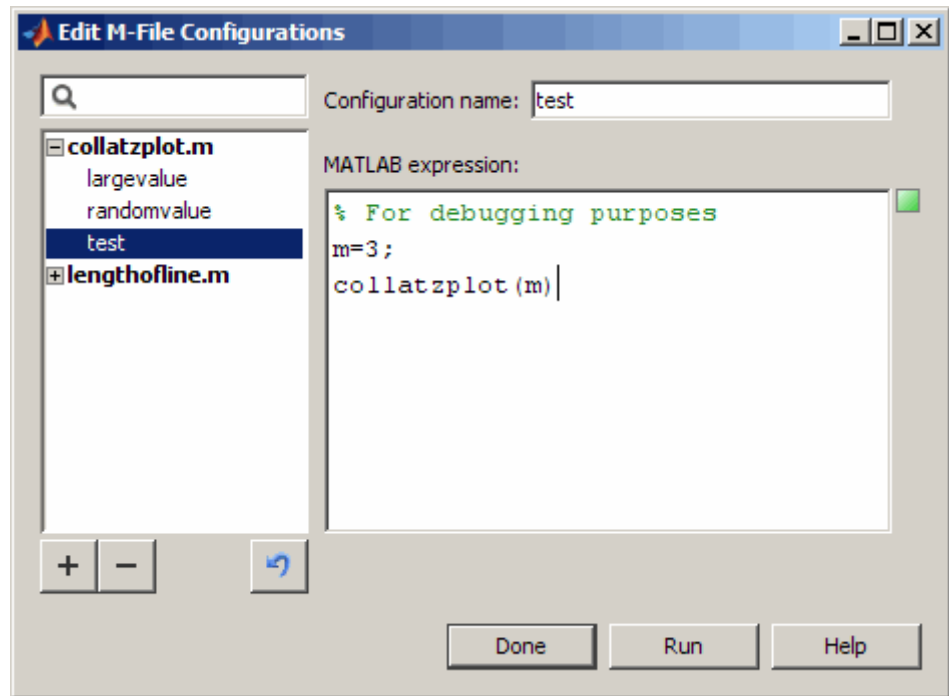
New features and changes introduced in Version 7.5 (R2007b) are:

- “Run Your Function M-Files in the Editor/Debugger Using Configurations” on page 311
- “Run/Continue Button Changes” on page 312
- “Code Folding Feature for Collapsing and Expanding Code” on page 313
- “Quick Help for a Function in the Editor” on page 315
- “Line Endings Removed in Files Provided with MATLAB Software for Windows Platforms; Impacts Viewing in Notepad Application” on page 315
- “Stand-Alone Editor Will Not Be Included in Next Version” on page 318
- “Determine the McCabe (Cyclomatic) Complexity of an M-File” on page 319

### Run Your Function M-Files in the Editor/Debugger Using Configurations

In the Editor/Debugger, you can provide values for a function’s input arguments using a configuration, and then run that configuration to use the assigned values. Use a configuration as an alternative to running the function in the Command Window. You can associate multiple configurations with an M-file, each for different input values. MATLAB saves the configurations between sessions.

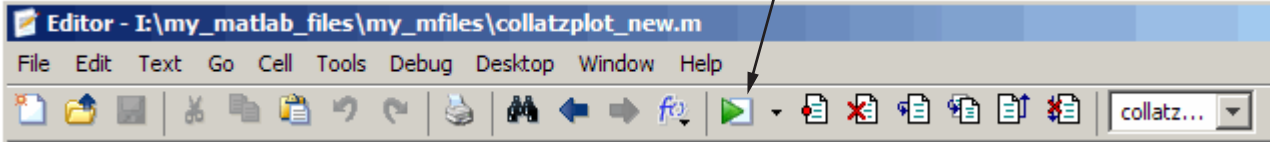
To create a configuration, first open an M-file in the Editor/Debugger. Then, from the down arrow on the Run button in the toolbar  select **Edit Configurations for *filename***. In the resulting Edit M-File Configurations dialog box, add statements and name the configuration. For more information, see “Run Files with Input Arguments in the Editor”.



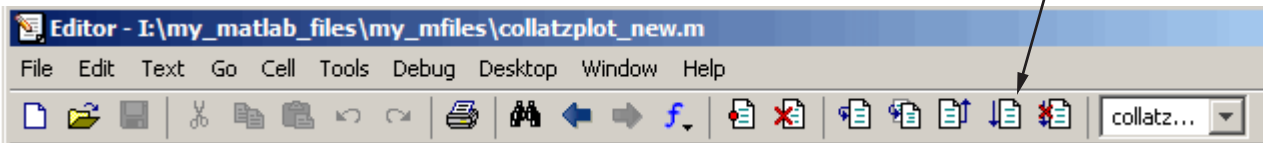
### Run/Continue Button Changes

The Run/Continue button has a new look and new location on the Editor/Debugger toolbar.

New look and position of Run/Continue button



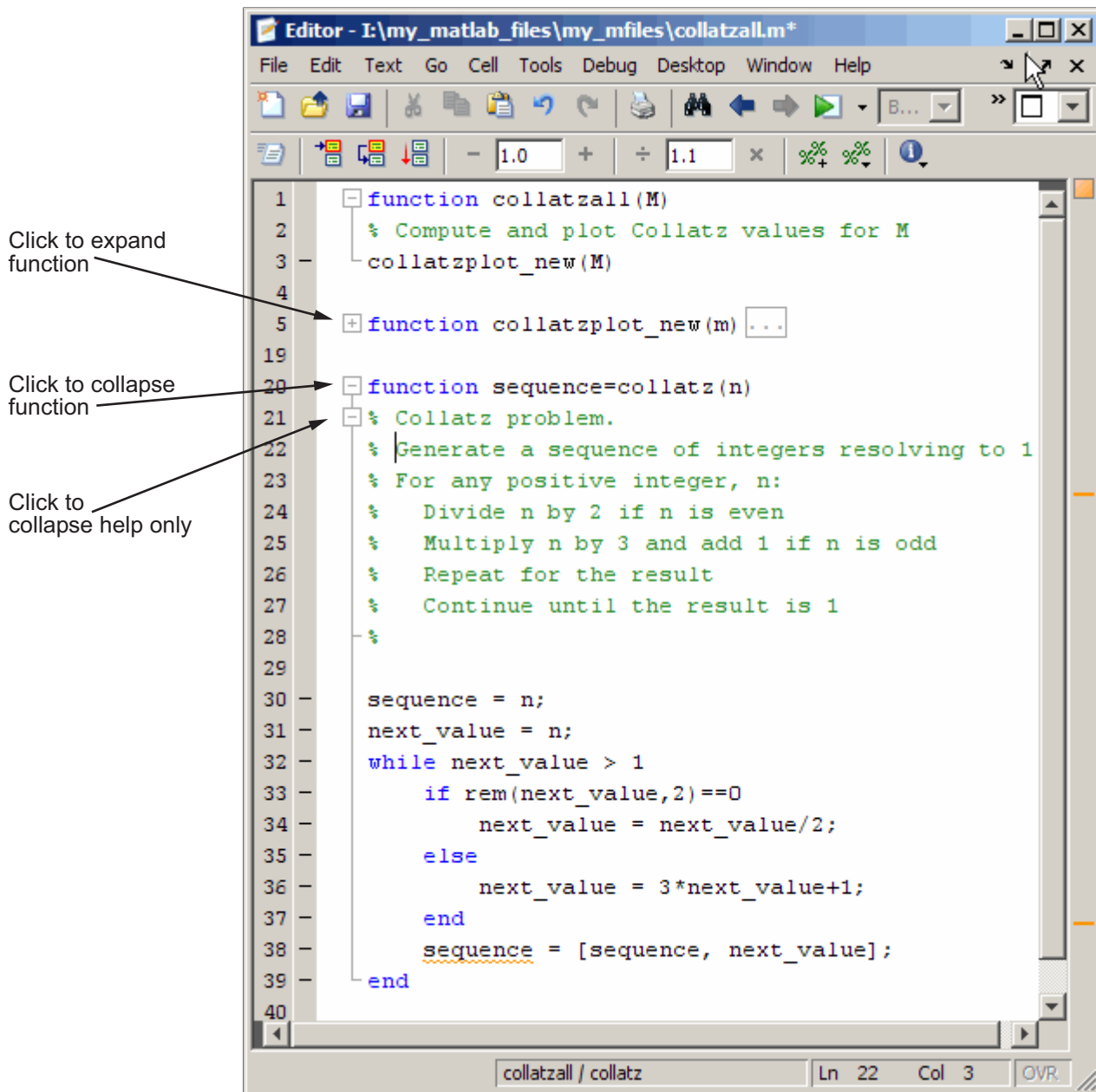
Run/Continue button in previous versions



**Compatibility Considerations.** The button performs the same as it did in previous versions, but you need to access it in the new position.

### Code Folding Feature for Collapsing and Expanding Code

To improve the readability of files containing several subfunctions, the Editor includes a code folding feature, which is enabled by default. Using this feature you can collapse and expand subfunctions and their associated help. The following figure shows the `collatzplot_new` function collapsed, such that only the function definition is displayed. The figure shows the `collatz` function expanded, revealing both the help code and the function code. If you collapse just the help code, only the H1 help line displays.



- To expand code that is collapsed, click the plus sign (+) to the left of the code you want to expand.
- To collapse code that is expanded, click the minus sign (-) to the left of the code you want to collapse.
- To expand or collapse all of the code in an M-file, place your cursor anywhere within the M-file, right-click, and then select **Code Folding > Expand All** or **Code Folding > Collapse All** from the context menu.

For more information, see [Code Folding—Expanding and Collapsing M-File Constructs](#)

### **Quick Help for a Function in the Editor**

For more information, see “[Help on Selection Enhanced in Command Window and Editor](#)” on page 309.

### **Line Endings Removed in Files Provided with MATLAB Software for Windows Platforms; Impacts Viewing in Notepad Application**

In previous versions, text files provided with MATLAB for Windows platforms included a carriage return and line feed at the end of each line. Starting in R2007b, the text files MATLAB provides do not include a carriage return and line feed at the end of each line.

File types affected are:

- .asc
- .bat
- .c
- .cc
- .cdr
- .cpp
- .def
- .for

- `gs.rights`
- `.h`
- `.ini`
- `.m`
- `.mdl`
- `.pl`
- `readme`
- `.tlc`
- `.tmf`
- `.txt`

There is no impact if you view the files in MATLAB and other common text editors, with the known exception of the Microsoft Notepad application.

**Compatibility Considerations.** If you use the Notepad application to view files provided with MATLAB, you see carriage return and line feed symbols `␣%` instead of line endings. This makes the files less readable in the Notepad application. Other text editors might display the symbols instead of line endings, but of the common text editors tested, none have been found that do so.

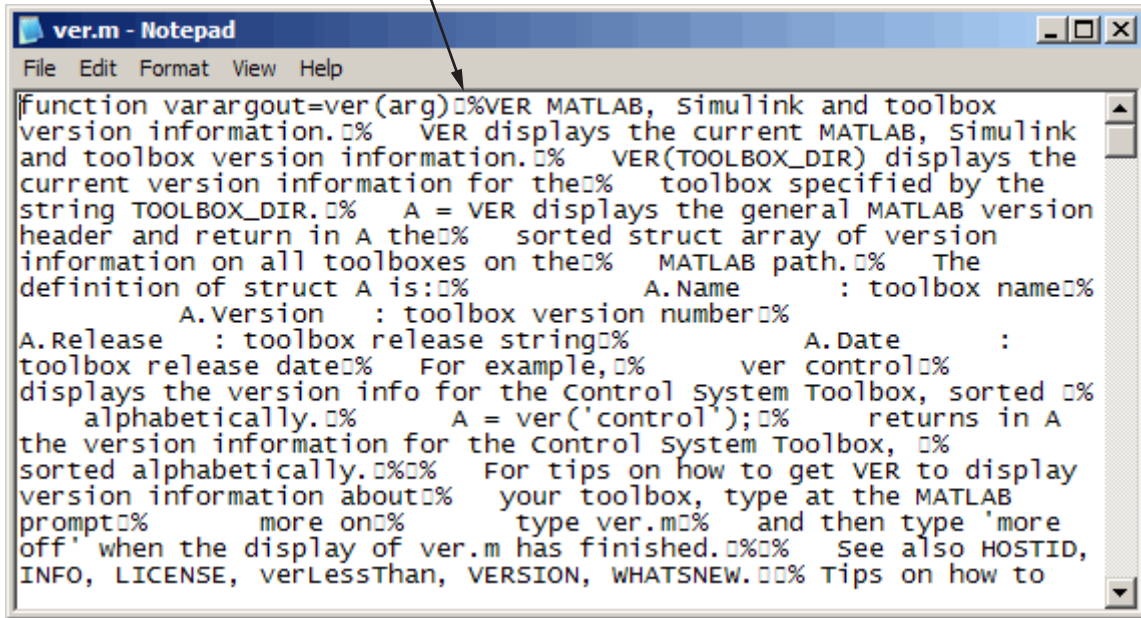
As an alternative to the Notepad application, use the Microsoft WordPad application, provided with Windows platforms, or another text editor to view the files.

If your Windows file associations are set to associate any of the listed file types with Notepad, change the associations to use WordPad or another text editor.

The following illustration shows how the `ver` M-file included with MATLAB Version 7.5 looks when opened in the Notepad application.



M-file from MATLAB Version 7.5 when opened in Notepad shows symbols instead of line endings.



The screenshot shows a Notepad window titled 'ver.m - Notepad'. The text inside is the source code for the 'ver' function, but the line endings are represented by symbols (like '[]' and '[]%') instead of standard carriage returns. An arrow points from the text above to the first line of code in the Notepad window.

```
function varargout=ver(arg)%VER MATLAB, Simulink and toolbox
version information.[]% VER displays the current MATLAB, Simulink
and toolbox version information.[]% VER(TOOLBOX_DIR) displays the
current version information for the[]% toolbox specified by the
string TOOLBOX_DIR.[]% A = VER displays the general MATLAB version
header and return in A the[]% sorted struct array of version
information on all toolboxes on the[]% MATLAB path.[]% The
definition of struct A is:[]%     A.Name      : toolbox name[]%
     A.Version  : toolbox version number[]%
A.Release  : toolbox release string[]%     A.Date      :
toolbox release date[]% For example,[]%     ver control[]%
displays the version info for the Control System Toolbox, sorted []%
alphabetically.[]%     A = ver('control');[]%     returns in A
the version information for the Control System Toolbox, []%
sorted alphabetically.[]%[]% For tips on how to get VER to display
version information about[]% your toolbox, type at the MATLAB
prompt[]%     more on[]%     type ver.m[]% and then type 'more
off' when the display of ver.m has finished.[]%[]% See also HOSTID,
INFO, LICENSE, verLessThan, VERSION, WHATSNEW.[]% Tips on how to
```

The following illustration shows how the ver M-file included with MATLAB Version 7.5 looks when opened in the WordPad application.

M-file from MATLAB Version 7.5 when opened in WordPad shows line endings.

The screenshot shows a WordPad window titled 'ver.m - WordPad'. The menu bar includes File, Edit, View, Insert, Format, and Help. The toolbar contains icons for file operations and editing. The text area displays the following code with visible line endings:

```
function varargout=ver(arg)
%VER MATLAB, Simulink and toolbox version information.
%   VER displays the current MATLAB, Simulink and toolbox version information.
%   VER(TOOLBOX_DIR) displays the current version information for the
%   toolbox specified by the string TOOLBOX_DIR.
%   A = VER displays the general MATLAB version header and returns a
%   sorted struct array of version information on all toolboxes on the
%   MATLAB path.
%   The definition of struct A is:
%       A.Name       : toolbox name
%       A.Version    : toolbox version number
%       A.Release    : toolbox release string
%       A.Date       : toolbox release date
```

At the bottom of the window, it says 'For Help, press F1' and there is a 'NUM' button.

There are no problems with files you create or edit in the Notepad application, and then view or edit in MATLAB. The files have line endings in the MATLAB Editor, and continue to have line endings when you open them in the Notepad application.

(Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.)

### **Stand-Alone Editor Will Not Be Included in Next Version**

The MATLAB stand-alone Editor (`meditor.exe`) will no longer be provided, starting in the next version of MATLAB. Instead of the stand-alone Editor, you can use the MATLAB Editor/Debugger. It provides all the features of the stand-alone Editor, plus the following:

- Tab completion

- Debugging M-files
- Evaluating selections
- Accessing source control features
- Docking the tool in the MATLAB desktop
- Using cell features for rapid code iteration or publishing

**Compatibility Considerations.** Some users have preferred the stand-alone Editor to the MATLAB Editor/Debugger because of slightly better startup performance and because it does not require a MATLAB license. For those situations, you can use any text editor you have, such as the UltraEdit® application from IDM Computer Solutions, or the GNU Emacs software.

### **Determine the McCabe (Cyclomatic) Complexity of an M-File**

The `cyc` option to the `mlint` function enables you to determine the McCabe complexity (also referred to as the cyclomatic complexity) of an M-file. Higher McCabe complexity values indicate higher complexity, and there is some evidence to suggest that programs with higher complexity values are more likely to contain errors. Frequently, you can lower the complexity of a function by dividing it into smaller, simpler functions. In general, smaller complexity values indicate programs that are easier to understand and modify. Some people advocate splitting up programs that have a complexity rating over 10. See `mlint` for syntax and an example.

## **Publishing Results**

New features and changes introduced in Version 7.5 (R2007b) are:

- “Notebook and Word for Office 2007” on page 319
- “Text Markup in Cells for Publishing” on page 320
- “Preference to Restrict Lines of Output” on page 320

### **Notebook and Word for Office 2007**

Notebook now supports Microsoft Word for Office 2007. For details, see “Creating a MATLAB Notebook to Publish to Microsoft Word”.

## Text Markup in Cells for Publishing

The following Editor/Debugger menu items are added to assist you in marking up cells in the Editor/Debugger for publishing. Access the menu items presented in the following list from **Cell > Insert Text Markup**. When you select the menu item, the Editor inserts code to assist you in adding the text markup for the specified item.

- **Document Title and Introduction**
- **Section Title with Cell Break**
- **Hyperlinked Text**
- **Image**
- **Numbered List**
- **HTML Markup**
- **LaTeX Markup**

The first two list items are provided instead of the **Cell Title** and **Descriptive Text** menu items that were offered in Version 7.4 (R2007a).

As an alternative to using the Cell menu items, you can manually insert code to mark up cells in your M-file for publishing. For details on the Cell menu items and the resulting code see *Marking Up Text in Cells for Publishing*

## Preference to Restrict Lines of Output

You can now specify options to restrict the number of lines included in the output of a published M-file. To access this option from the Editor/Debugger, follow these steps:

- 1** Select **File > Preferences > Editor/Debugger > Publishing**
- 2** In the Editor/Debugger Publishing Preferences pane, select the **Evaluate code** and **Restrict output to** options.
- 3** Specify the maximum number of lines that you want to include in the output.

## Mathematics, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are:

- “New Functions” on page 321
- “finite Function Deprecated” on page 321
- “dmperm Function Gives Coarse Decomposition” on page 322
- “ldl Function Supports Real Sparse Symmetric Matrices” on page 322
- “Upgrade to LAPACK Library” on page 322
- “Upgrade to BLAS Libraries” on page 322
- “Library for LAPACK and BLAS Symbols Separated” on page 322
- “Colon Operations on Characters Return Character Type Data” on page 323
- “Matrix Generating Functions No Longer Accept Complex Inputs” on page 323

### New Functions

Function	Description
quadgk	Numerically evaluates the integral, adaptive Gauss-Kronrod quadrature
bvp5c	Solves boundary value problems for ordinary differential equations, notably useful for small error tolerances
maxNumCompThreads	Gets and sets the maximum number of computational threads

### finite Function Deprecated

In this release, the `finite` function displays a warning message that the function is now deprecated. Support for `finite` will be removed in a future release of MATLAB software.

### **Compatibility Considerations**

It is recommended that you replace all calls to `finite` with the `isfinite` function.

### **dmperm Function Gives Coarse Decomposition**

The `dmperm` function now provides two additional output arguments for the indices of the Dulmage-Mendelsohn coarse decomposition.

### **ldl Function Supports Real Sparse Symmetric Matrices**

The `ldl` function now provides factorization and solving for an additional output argument, the scaling matrix, when the input matrix is real sparse and symmetric.

### **Upgrade to LAPACK Library**

MATLAB software now uses Version 3.1 of the Linear Algebra Package (LAPACK) library.

### **Upgrade to BLAS Libraries**

For AMD® processors, MATLAB software now uses Version 3.6 of the AMD Core Math Library (ACML™) for the Basic Linear Algebra Subroutine (BLAS) libraries.

### **Library for LAPACK and BLAS Symbols Separated**

The binder library, `libmwlapack.lib`, containing both LAPACK and BLAS symbols is now two separate library files: `libmwlapack.lib` for LAPACK symbols and `libmwblas.lib` for BLAS symbols.

### **Compatibility Considerations**

If you previously linked to the `libmwlapack.lib` library to use the BLAS symbols, you will need to update your code to link to the `libmwblas.lib` library.

## Colon Operations on Characters Return Character Type Data

Using a colon with characters to iterate a for-loop now returns data of type character. For example,

```
for x='a':'b',x,end
```

results in

```
x =
  a
x =
  b
```

## Compatibility Considerations

Previously, colon operations with characters iterating a for-loop returned data of type double. In previous releases the above example returned:

```
for x='a':'b',x,end

x =
  97
x =
  98
```

Existing program code that relies on the colon operations of character arrays returning a double, needs to be updated to expect a character data type.

## Matrix Generating Functions No Longer Accept Complex Inputs

Calling matrix generating functions, such as ones, zeros, rand, randn, true, and false, with a complex number as dimensions input now returns the error:

```
true([1 i])
??? Error using ==> true
Size vector must be a row vector with real elements.
```

## Compatibility Considerations

In previous releases, if you supplied a complex number as a dimension input, MATLAB software returned:

```
true([1 i])  
Warning: Size vector should be a row vector with integer elements.  
        Complex inputs will cause an error in a future release.  
  
ans =  
  
Empty matrix: 1-by-0
```

Existing program code that relies on entering complex numbers as dimension input to a matrix generating function should be modified.



## **Data Analysis, MATLAB Version 7.5 (R2007b)**

There were no new features or changes in this version.

## Programming, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are

- “Increased Size for Large Arrays” on page 326
- “Documentation for Multiprocessing in MATLAB” on page 326
- “Setting Number of Threads Programmatically” on page 327
- “New Internal Format for P-code” on page 327
- “New Split String Functionality in regexp” on page 327
- “Changes Related to Error Handling” on page 328
- “Results From tempname Are More Unique” on page 331
- “MATLAB Includes New Input Argument Validation Functions” on page 331
- “Windows Current Working Directory Corrected” on page 331
- “New Multimedia Functionality” on page 332
- “Compressed AVI Video Files in Windows Vista and Windows XP x64” on page 333
- “mmfileinfo Reads Files on MATLAB Path” on page 333
- “Changes to imread Support of TIFF Format” on page 333
- “Removal of freeserial Function” on page 334

### Increased Size for Large Arrays

On 64-bit platforms, MATLAB arrays are no longer limited to  $2^{31}$  elements. The limit in MATLAB 7.5 is  $2^{48}-1$ . For example, given sufficient memory, many numeric and low-level file I/O functions now support real double arrays greater than 16 GB.

### Documentation for Multiprocessing in MATLAB

Documentation for “Multiprocessing in MATLAB” has moved from Desktop Tools and Development Environment to the “Improving Performance and Memory Usage” section of MATLAB Programming.

## Setting Number of Threads Programmatically

In this release, MATLAB provides a way to set or retrieve the maximum number of computational threads from within an M-file program. With the `maxNumCompThreads` function, you can either set the maximum number of computational threads to a specific number, or indicate that you want the setting to be done automatically by MATLAB

## New Internal Format for P-code

P-code files have a new internal format in MATLAB Version 7.5. The new P-code files are smaller and more secure than those built with MATLAB 7.4 and earlier, and provide a more robust solution to protect your intellectual property.

Any P-code files that were built using MATLAB 7.4 or earlier also work in 7.5. However, support for these older files will at some point be removed from MATLAB.

P-code files built with MATLAB 7.5 only work on 7.5 or later. They cannot be used with MATLAB 7.4 or earlier versions.

## Compatibility Considerations

Rebuild any P-code files using MATLAB 7.5 that you expect to need in the future.

## New Split String Functionality in regexp

Using the regular expressions function `regexp`, you can now split an input string into sections by specifying the new `'split'` option when calling `regexp`:

```
s1 = ['Use REGEXP to split ^this string into ' ...
      'several ^individual pieces'];

s2 = regexp(s1, '\^', 'split');

s2(:)
ans =
      'Use REGEXP to split '
      'this string into several '
```

```
'individual pieces'
```

The `split` option returns those parts of the input string that are delimited by those substrings returned when using the `regexp` `'match'` option.

## Changes Related to Error Handling

### New Error Handling Mechanism

MATLAB extends its error-handling capabilities with the new `MException` class to provide you with a more secure and extensible system for throwing and responding to errors. Read about this new feature in the “Error Handling” section of the MATLAB Programming documentation and in related function reference pages such as `MException`.

This feature *extends* the error-handling capabilities available in earlier releases, but does not replace that functionality. Your M-file programs will continue to function the same when using Version 7.5.

### New Syntax for `catch` Function

As part of new error-handling mechanism, the `catch` function has a new, optional syntax as shown here in a try-catch statement:

```
try
    % Try to execute this block of code. Go to 'catch' on error
    - code that may error -
catch ME
    % Deal with the error captured in MException object, ME
    - code to handle the error -
end
```

`ME` is an object of the `MException` class. This command gives you access to the `MException` object that represents the error (i.e., exception) being caught.

### Warning and Error Messages Now Wrap

In previous versions of MATLAB, warning and error messages that were longer than the width of your terminal screen extended beyond the visible

portion of your screen. These messages now wrap onto succeeding lines so that the entire text of the warning or error is visible.

### Change to Error Message from Anonymous Function

The error message and M-file line number that MATLAB displays when encountering an error in an anonymous function defined within a script file or at the MATLAB Command Line has changed in this release. In MATLAB Version 7.4, the error message included the line number (set to 1 for anonymous functions), and the stack information returned by the `lasterror` function also showed the line number as 1. In MATLAB 7.5, the line number is not displayed in the error message and is set to 0 in the returned stack information.

For example, when you enter the following two lines at the command line, MATLAB generates an error from the anonymous function:

```
X = @() error('* Error *');
X()
```

This example shows the difference between MATLAB Versions 7.4 and 7.5:

```
e = lasterror;

e.message
ans =
Error using ==> @()error('Error') at 1      % V7.4 response
Error using ==> @()error('Error')          % V7.5 response
* Error *

e.stack
ans =
    file: ''
    name: '@()error('* Error *')'
    line: 1                                % V7.4 response
    line: 0                                % V7.5 response
```

**Compatibility Considerations.** If you have programs that rely on the line number returned in response to an error in an anonymous function, these programs may not work as expected. Remove dependencies on the returned error message and line number, or update your program code to use the new string and value.

### **New Message In Response to Ctrl+C**

MATLAB now displays a more user-friendly message when you press **Ctrl+C**. The previous response to **Ctrl+C** was

```
Error in ==> testctrlc>waitawhile at 5
pause(100);
```

```
Error in ==> testctrlc at 2
waitawhile
```

In this and future releases, pressing **Ctrl+C** still halts program execution, but now displays the response

```
??? Operation terminated by user during ==> testctrlc>
waitawhile at 5
```

```
In ==> testctrlc at 2
waitawhile
```

**Compatibility Considerations.** You only need to be aware that the change in the text of this message is intentional and does not signify any error on your part.

### **hdfread Errors Instead of Warns on I/O Failures**

In previous releases, `hdfread` issued a warning when a requested I/O operation failed. In addition, `hdfread` created an empty variable in the workspace. In this release, `hdfread` now errors when a requested I/O operation fails and does not create an empty variable in the workspace.

**Compatibility Considerations.** If you call `hdfread` in a script to perform an I/O operation and that operation fails, your script will now terminate. Previously, because `hdfread` only warned when an I/O operation failed, your script would continue processing.

## Results From tempname Are More Unique

The tempname function now produces a string such as

```
C:\Temp\tpe51f2ba3_9ad3_490f_8142_58359c98f4a5
```

when Java is present, or a string like

```
C:\Temp\tp346976948758473
```

when nojvm is selected. Underscores are included in the name so you can use the filename portion of it as a valid M-function name. If a string row vector is passed in as an argument, that string is used instead of tempdir as the root.

## Compatibility Considerations

Because the new string generated by tempname is generally longer than the string constructed in earlier versions, there is a possibility of exceeding length restrictions, especially if your program code passes a string to the tempname function. If you consider this to be a potential problem, verify that the strings you pass to tempname will not result in an overly long string being returned.

## MATLAB Includes New Input Argument Validation Functions

MATLAB now includes two new functions that validate the input arguments passed to functions. For example, you can use these functions to make sure that an input argument is numeric and nonempty. The following table lists these functions with a brief description.

Function	Description
validateattributes	Check validity of array
validatestring	Check validity of text string

## Windows Current Working Directory Corrected

On Windows, you can define a current working directory, cwd, for each drive letter. For example, entering the command cd D:\work at the DOS prompt defines your D current working directory as D:\work. All references to D: are then relative to this directory.

The term . . .	Represents the directory . . .
D:	D:\work
D:matlab	D:\work\matlab
D:\matlab	D:\matlab

(Note the difference between D:\ and D:, where the former is the drive D, and the latter is a user-defined working directory that may or may not be equal to D:\.)

Previous versions of MATLAB have been inconsistent in the way that volume-relative path specification is handled. For example, in MATLAB 7.4 and earlier, if D: were defined as the directory D:\work, the following commands on the left and right returned identical results:

```
dir D:                dir D:\
dir D:matlab         dir D:\work\matlab
fileparts('D:myfile.m') fileparts('D:\myfile.m')
```

This has been fixed in MATLAB 7.5 so that the following are now equivalent:

```
dir D:                dir D:\work
dir D:matlab         dir D:\work\matlab
fileparts('D:myfile.m') fileparts('D:\work\myfile.m')
```

## Compatibility Considerations

Some MATLAB commands may fail or return unexpected results if you use Windows current working directories on MATLAB. You might have to update hard-coded paths if you have been relying on the incorrect behavior exhibited in earlier versions.

## New Multimedia Functionality

A new `mmreader` video file reader object for Windows platforms supports formats such as AVI, MPEG, and WMV, and adds the ability to read additional video codecs that `aviread` does not support. For more information, see the `mmreader` and `read` reference pages.



## Compressed AVI Video Files in Windows Vista and Windows XP x64

Because Windows Vista, Windows Vista 64-bit, and Windows XP x64 operating systems do not ship with the Indeo® 5 codec, which is the default codec used by MATLAB Audio-Video functions for file compression, the functions `movie2avi` and `avifile` now generate uncompressed AVI files on these platforms. Also, `aviread` on these platforms cannot read files that were compressed using the Indeo 5 codec.

### Compatibility Considerations

If you have upgraded your Windows operating system to Windows Vista, Windows Vista 64-bit, or Windows XP x64, you need to install the Indeo 5 codec to read or create Indeo 5 compressed AVI files with `aviread`, `avifile`, or `movie2avi`. You can learn more about downloading the Indeo 5 codec from the Ligos Corporation Web site at <http://ligos.com/index.php/home/products/indeo/>

## mmfileinfo Reads Files on MATLAB Path

The `mmfileinfo` function now reads files on the MATLAB path, not only those in the current directory. The `mmfileinfo` output struct contains a field called `Path`, which indicates the directory where the file exists.

### Compatibility Considerations

The `Filename` field of the output struct from `mmfileinfo` now contains only the filename itself without any path information, while the path information is contained in the `Path` field. In previous releases, the `Filename` field contained both path and filename information.

## Changes to `imread` Support of TIFF Format

The `imread` function includes several updates to its TIFF support:

- `imread` reads TIFF files that use JPEG, LZW, and Deflate compression.
- `imread` reads image data from TIFF files in any arbitrary samples-per-pixel and bits-per-sample combination.

- `imread` provides increased performance when reading large images, when used with the 'PixelRegion' parameter.

## **Removal of freeserial Function**

The `freeserial` function is now obsolete. Use `fclose` to release the serial port.

## **Compatibility Considerations**

If your program code still makes use of the `freeserial` function, replace each instance with the `fclose` function instead.

## Graphics and 3-D Visualization, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are:

- “Datatips Are Now Saved to FIG-Files” on page 335
- “New Options for Displaying Groups of Lines in Legends” on page 335
- “Drawnow Update Option Now Updates Uicontrols Only” on page 336
- “Annotation Textboxes Can Automatically Resize to Fit their Contents” on page 336
- “Property Inspector Now Has Context-Sensitive Help” on page 338
- “The “v6” Option for Creating Plot Objects is Obsolete” on page 338

### Datatips Are Now Saved to FIG-Files

When you save a figure, all datatips existing in it are saved along with other annotations. When you open the FIG-file, the datatips are displayed and can be manipulated or deleted in the same ways they could in the original figure.

### Compatibility Considerations

If you open a FIG-file containing datatips while using a previous MATLAB version (V7.4 or earlier), no error results, but the datatips do not display.

### New Options for Displaying Groups of Lines in Legends

You can now customize how legends for figures display groups of lines, such as contours. Previously, legends displayed groups of lines such as contourgroups with a glyph that represented the entire group; now users have the flexibility to designate a single legend entry, a legend entry for each child of the group, or no legend entries for the group.

By default, a legend entry for an hggroup now consists of the `DisplayName` of its first child and a glyph representing it (previously, no glyph appeared, only the `DisplayName`). This is what you now see after clicking the legend tool icon in the figure’s toolbar. However, you can set the new `Annotation` property

of `hggroups` to control how the group is represented in a legend. For details and examples of its use in customizing legends, see “Controlling Legends” in the Graphics documentation.

## Drawnow Update Option Now Updates Uicontrols Only

The `drawnow` command can now selectively update the display of UI components. The update option enables you to update only uicontrol objects without allowing callbacks to execute or processing other events in the queue.

## Annotation Textboxes Can Automatically Resize to Fit their Contents

In previous releases, textboxes had fixed sizes that users needed to adjust to fit the size of their contents. Now, if you create a textbox annotation using a GUI or the `annotation` function, it can grow or shrink to just fit the text you type into it. This behavior is controlled by the Annotation Textbox object's `FitBoxToText` property, which can be 'on' or 'off'. When you create a textbox with the Annotation toolbar (using the **T** tool), this property is set to 'on' if you create a textbox without dragging; however, if you drag to make the new textbox have a certain size, the property is initially 'off'. When you create a textbox with the `annotation` function, for example,

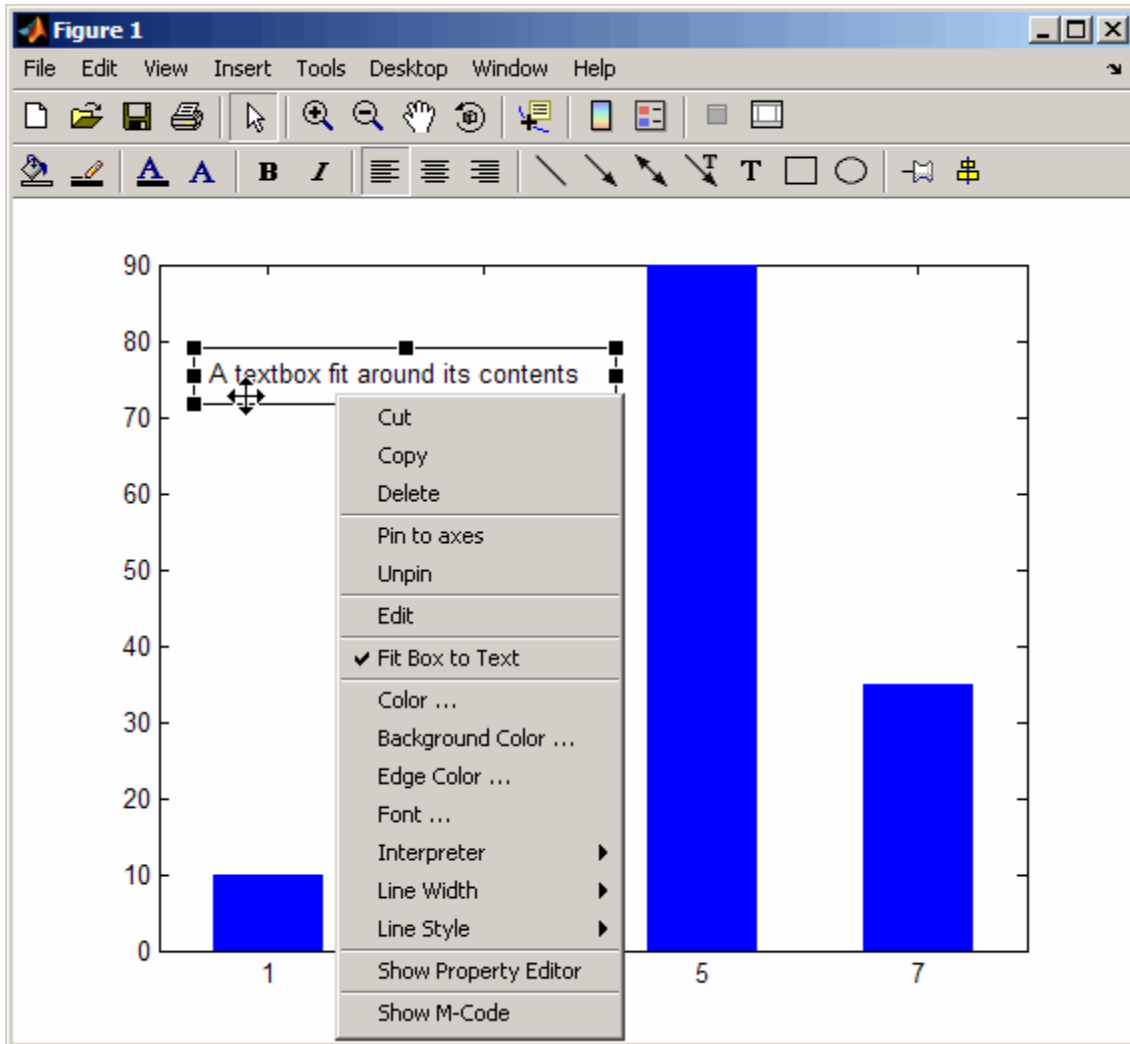
```
htb = annotation('textbox')
```

without specifying a position and size, the textbox is created with `FitBoxToText` set to 'on'. If you specify a position vector in the command, for example,

```
htb = annotation('textbox', [.1 .8 .4 .1])
```

the textbox is created with `FitBoxToText` set to 'off'.

Similarly, if you resize a textbox in plot edit mode or change the width or height of its `position` property directly, its `FitBoxToText` property is set to 'off'. You can toggle this property with `set`, with the Property Inspector, or more conveniently, via the object's context menu, as the illustration below shows.



If you edit a textbox that has `FitBoxToText` set to 'on', the textbox resizes to accommodate the number of characters and lines in the text as you type. You can reposition the textbox without changing the `FitBoxToText` property, but as soon as you resize it, the property becomes (or remains) 'off'.

## Property Inspector Now Has Context-Sensitive Help

When you use the Property Inspector (the `inspect` command), you can now ask for a description of any property it shows. The descriptions come from the property reference page for the type of object being inspected (e.g., axes, lineseries, annotations, uicontrols, etc.). To get a description of a property, right-click its name in the left-hand column of the Property Inspector and select **What's This?** from the context menu that appears. A mini-help window opens to show the property's description from the object's property reference page. If you need an overview of all properties pertaining to particular kinds of objects and how these objects relate, scroll through the entries in the mini-help window or open the Handle Graphics Property Browser from the Help Browser.

## The “v6” Option for Creating Plot Objects is Obsolete

Prior to MATLAB Version 7, handles returned by high-level plotting functions referenced graphic primitives, such as lines and patches. In Version 7, MATLAB began bundling the primitives into “series” objects, for example, lineseries, barseries, and contourgroups. At that time, the `v6` option was added to plotting functions to enable users of MATLAB Version 7.x to create FIG-files that previous versions can open. The `v6` option is now obsolete. It will be removed in a future MATLAB release. The following functions include the option in their syntax and now warn when it is used:

- `area`
- `bar`
- `barh`
- `colorbar`
- `contour`
- `contourf`
- `errorbar`
- `legend`
- `loglog`
- `mesh`
- `meshc`

- meshz
- plot
- quiver
- scatter
- scatter3
- semilogx
- semilogy
- stairs
- stem
- stem3
- subplot
- surf
- surfc

### **Compatibility Considerations**

Specifying the `v6` flag to any plotting function now results in a warning that the option is being removed, but the option still functions. To generate a FIG-file for a plot created with the `v6` option, you still need to use the `-v6` option to the `hgsave` command in order to save it in a form that a previous version of MATLAB can read. Figures containing annotations (such as textboxes, arrows, ovals, and rectangles) that are saved this way open in previous versions, but the annotations do not display because different objects are used to contain them in Version 7 than before. That is, the annotation objects have never been backward compatible.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are:

- “New Editors for Creating Custom Toolbars within GUIDE” on page 340
- “Coordinate Readouts in Layout Editor” on page 341
- “Documentation for Making GUIDE GUIs Interact” on page 341
- “Functions Being Removed” on page 342

### New Editors for Creating Custom Toolbars within GUIDE

In previous releases, adding toolbars to a GUI had to be done programmatically, by writing code for the `uitoolbar`, `uipushtool` and `uitoggletool` functions. GUIDE now has a Toolbar Editor and an associated Icon Editor that allow you to lay out a toolbar for a GUI and populate it with standard predefined tools for printing, saving, panning, zooming, annotating, etc. or with custom tools that you design yourself. You can draw or modify an icon for any tool on your toolbar with the Icon Editor or import one from an image file.

#### The Toolbar Editor

When you run GUIDE to create a new GUI or edit an existing one, click the Toolbar Editor icon in the Layout Editor Toolbar or choose **Toolbar Editor** from the **Tools** menu to open the Toolbar Editor. To add tools to the toolbar of your GUI, you drag standard or custom tool icons to the toolbar layout area at the top. You can modify a tool’s properties using the Toolbar Editor and Property Inspector. You can also create and customize icons for tools using the new Icon Editor, described next. You control the behavior of a tool in your toolbar with its `ClickedCallback` (and for toggle tools, their `OnCallback` and `OffCallback`) in the GUI’s associated M-file. If you use an existing tool, such as Print or Save, you do not need to modify its callback; it is predefined as `%default`.



## The Icon Editor

The Icon Editor lets you customize the icons for existing tools or create entirely new icons. Icons are stored as `CData` for each tool, and can also be read from and saved to `.icn` files. The Icon Editor also includes a Color Editor, a palette you can use for picking predefined colors and defining new ones.

## Coordinate Readouts in Layout Editor

The GUIDE Layout Editor now has two fields in its lower left corner that continuously provide numeric feedback for:

- **Current Point** — The cursor location within the layout window
- **Position** — The `Position` property of the currently selected object(s) in the layout window

Both measurements are given in pixels, regardless of the current `Units` settings for GUI objects. When multiple objects are selected, any elements of their `Position` properties that are not identical are read out as `MULTI`. The readouts help you to precisely size and align GUI components.

## Documentation for Making GUIDE GUIs Interact

A new documentation section, “Making Multiple GUIs Work Together”, has been added to illustrate how multiple GUIDE GUIs can work together by sharing data to create a more complicated GUI. It first summarizes the techniques that GUIDE GUIs can use to share data with one another. It then steps through two examples, accompanied by their `M`-files and `FIG`-files, to show how to use those techniques for specific tasks.

## Functions Being Removed

Function Name	What Happens When You Run the Function?	Use This Function Instead	Compatibility Considerations
axlimdgl	Errors	None	No replacement
cbedit	Errors	guide	Use the guide command instead
clruprop	Errors	rmappdata	Replace existing instances of clruprop with rmappdata
ctlpanel	Errors	guide	Use the guide command instead
edtext	Errors	Set the editing property on the text object	No replacement
extent	Errors	Get the extent property of the text object	No replacement
getuprop	Errors	getappdata	Replace existing instances of getuprop with getappdata
hthelp	Errors	web	Replace existing instances of hthelp with web
layout	Errors	None	No replacement
matq2ws	Errors	None	No replacement
matqdlg	Errors	None	No replacement
matqparse	Errors	None	No replacement

<b>Function Name</b>	<b>What Happens When You Run the Function?</b>	<b>Use This Function Instead</b>	<b>Compatibility Considerations</b>
matqueue	Errors	None	No replacement
menubar	Errors	Set the menubar property of the figure to none	No differences
menuedit	Errors	guide	Use the guide command instead
pagedlg	Errors	pagesetupdlg	Replace existing instances of pagedlg with pagesetupdlg
setupprop	Errors	setappdata	Replace existing instances of setupprop with setappdata
umtoggle	Errors	Set the Checked property of uimenu objects	No differences
wizard	Errors	guide	Use the guide command instead
ws2matq	Errors	None	No replacement

## External Interfaces/API, MATLAB Version 7.5 (R2007b)

- “Support for 64-bit mxArray” on page 344
- “Fortran MEX-Files Will Require mwSize and mxArray” on page 345
- “Changes to the MATLAB Locale Setting” on page 345
- “Changes to MEX Error-Handling Functions mexErrMsgTxt and mexErrMsgIdAndTxt” on page 346
- “Rebuild MEX-Files Created with MATLAB Versions Earlier Than V7 (R14)” on page 346
- “Changes to Compiler Support” on page 346
- “Changes to Applications Built with Borland 5.5 or 5.6 C Compilers” on page 348
- “Environment Variable Required for mex with Microsoft Platform SDK Compiler” on page 348
- “Environment Variables Required for mex with Intel Visual Fortran 9.0” on page 348
- “Changes to Handling ActiveX Methods” on page 349
- “Changes to Dynamic Data Exchange (DDE) Documentation” on page 349

### Support for 64-bit mxArray

MATLAB Version 7.5 (R2007b) supports 64-bit mxArray. This change allows C/C++ and Fortran files built on 64-bit platforms to handle large data arrays.

In earlier versions of MATLAB, mxArray are limited to  $2^{31}-1$  elements. In Version 7.5 (R2007b) your mxArray can have up to  $2^{48}-1$  elements.

The mex command option, `-largeArrayDims`, uses the large-array-handling mxArray API. Use `mwSize` to represents size values, such as array dimensions and number of elements. Use `mxIndex` to represent index values, such as indices into arrays.

## Compatibility Considerations

MEX-files that built properly in previous versions of MATLAB continue to build in Version 7.5 (R2007b).

The default option for `mex` is `-compatibleArrayDims`. If you use this option, `mex` builds the files using the 32-bit array-handling API.

To work with 64-bit `mxArrays`, your C, C++ and Fortran source code must comply with the 64-bit array-handling API. To use the API to create C/C++ MEX-files, see “Handling Large `mxArrays`” . To use the API to create Fortran MEX-files, see “Handling Large `mxArrays`” .

## Fortran MEX-Files Will Require `mwSize` and `mwIndex`

In a future version of MATLAB, the default `mex` command option will change to `-largeArrayDims`. Fortran MEX-files will be required to use the `mwSize` and `mwIndex` preprocessor macros

## Compatibility Considerations

To make your Fortran MEX-file compatible with the `-largeArrayDims` option, and to create platform-independent code, you need to include the `fintrf.h` header file in your Fortran source files, and you need to name your source files with an uppercase `.F` file extension. For information on creating MEX-files, see the “Gateway Routine” in the Fortran MEX-Files topic.

## Changes to the MATLAB Locale Setting

Retrieving and using the proper locale setting is a mandatory operation in creating and using applications for international audiences. In R2007b, MATLAB Version 7.5 standardizes the way it initializes the locale setting across platforms. As a result, on Microsoft Windows platforms, MEX-files that use C/C++ locale-dependent standard library functions should note that MATLAB now sets the locale using the `setlocale` function.

Because of changes to Microsoft Visual Studio, MEX-Files created on Windows with dMicrosoft Visual Studio 2003 will not have the same locale setting as MATLAB Version 7.5 (R2007b).

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**Note** C/C++ users must not change the locale setting using the `setlocale` function. This is true for all versions of MATLAB on all platforms.

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## Changes to MEX Error-Handling Functions `mexErrMsgTxt` and `mexErrMsgIdAndTxt`

In MATLAB Version 7.5 (R2007b), the `mexErrMsgTxt` and `mexErrMsgIdAndTxt` functions determine where the error occurred, and display the function name. In previous versions, these functions only display the error message.

For example, if an error occurs in the function `foo`, `mexErrMsgTxt` and `mexErrMsgIdAndTxt` display the following information before the error message:

```
??? Error using ==> foo
```

## Rebuild MEX-Files Created with MATLAB Versions Earlier Than V7 (R14)

To work with MATLAB V7.5 (R2007b), MEX-files compiled on any platform with MATLAB versions earlier than V7 (R14) no longer load correctly and must be rebuilt.

## Changes to Compiler Support

The set of compilers that MATLAB supports has changed in MATLAB Version 7.5 (R2007b). For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

- “New Compiler Support” on page 346
- “Discontinued Compiler Support” on page 347
- “Compiler Support to Be Phased Out” on page 347

## New Compiler Support

MATLAB V7.5 (R2007b) supports new compilers for building MEX-files.

**Windows platforms.**

- Microsoft Visual Studio 2005 SP1

**Sun Solaris SPARC (64-bit) platform.**

- gcc / g++ Version 4.1.2

**Discontinued Compiler Support**

The following compilers are no longer supported.

**Windows platforms.**

- Microsoft Visual Studio 2005 without SP1

**SolarisSPARC (64-bit) platform.**

- gcc / g++ Version 3.2.3

**Compatibility Considerations.** To ensure continued support for building your C/C++ programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

**Compiler Support to Be Phased Out**

The following compilers are supported in Version 7.5 (R2007b), but will not be supported in a future version of MATLAB.

**Windows (32-bit) platform.**

- Intel Visual Fortran Version 9.0
- Compaq Visual Fortran Version 6.6
- Intel C++ Version 7.1
- Borland C++Builder 6 Version 5.6
- Borland C++Builder 5 Version 5.5
- Borland C++ Compiler Version 5.5

- Compaq Visual Fortran Version 6.1

## **Changes to Applications Built with Borland 5.5 or 5.6 C Compilers**

MATLAB applications built with Borland Version 5.5 or 5.6 C compilers have changed in MATLAB Version 7.5 (R2007b). MATLAB applications that run under Windows are now implemented as console applications, not Windows applications.

### **Compatibility Considerations**

If you have customized the build process based on one of the `bcc*engmatopts.bat` options files, you must edit this file making changes to the appropriate `LINKFLAGS` statement, as described in the `.bat` file comments.

## **Environment Variable Required for mex with Microsoft Platform SDK Compiler**

When you build a MEX-file, an engine application, or a MAT application on a Windows 64-bit platform using the Microsoft Platform SDK compiler, MATLAB requires that you define the environment variable `MSSdk`. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK. The Microsoft Platform SDK installation program does not commonly define this environment variable. For example, you might set the environment variable as follows:

```
C:\Program Files\Microsoft Platform SDK
```

## **Environment Variables Required for mex with Intel Visual Fortran 9.0**

When you build a MEX-file, an engine application, or a MAT application using Intel Visual Fortran 9.0, MATLAB requires that you define an environment variable for the Windows platform you are using.

### **Windows (32-bit) platform**

Define the environment variable `VS71COMNTOOLS`. The value of this environment variable is the path to the `Common7\Tools` directory of the Visual Studio .NET 2002 or 2003 installation directory. (Intel Visual Fortran



requires Visual Studio .NET 2002 or 2003 on 32-bit Windows platforms.) The Visual Studio .NET 2003 installation program commonly defines this environment variable. For example, you might set the environment variable as follows:

```
C:\Program Files\Microsoft Visual Studio .NET 2003\Common7\Tools
```

### **Windows x64 platform**

Define the environment variable MSSdk. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server 2003. (Intel Visual Fortran requires Microsoft Platform SDK for Windows Server 2003 on Windows x64 platforms.) The Microsoft Platform SDK installation program does not commonly define this environment variable. For example, the environment variable might have the value

```
C:\Program Files\Microsoft Platform SDK
```

### **Changes to Handling ActiveX Methods**

In MATLAB Version 7.4 (R2007a), a change was made to Microsoft® ActiveX® methods which was not documented in the release notes. This change is described in “Changes to Handling Microsoft® ActiveX Methods” on page 400 in the MATLAB Release Notes, Version 7.4 (R2007a).

### **Changes to Dynamic Data Exchange (DDE) Documentation**

In MATLAB V5.1, all development work for the Dynamic Data Exchange (DDE) server and client was stopped. This functionality is no longer documented in V7.5 (R2007b). MathWorks provides, instead, a MATLAB interface to COM technology that is documented in “Using COM Objects from MATLAB”.

### **Obsolete Functionality No Longer Documented**

Documentation for Dynamic Data Exchange (DDE) is no longer included in External Interfaces.

**Compatibility Considerations.** If you must support this obsolete functionality, we suggest you print a copy of the External Interfaces chapter “COM and DDE Support (Windows Only)” from MATLAB V7.4 (R2007a) or earlier.

### Documentation for Obsolete Functions To Be Phased Out

Documentation for the following functions is included in the MATLAB Function Reference documentation for MATLAB V7.5 (R2007b), but will not be included in a future version of MATLAB.

Obsolete Functions
ddeadv
ddeexec
ddeinit
ddepoke
ddereq
ddeterm
ddeunadv

The following syntax for `enableservice`, included in the MATLAB Function Reference documentation for MATLAB V7.5 (R2007b), will be removed from the documentation.

```
enableservice('DDEServer',enable)
```

**Compatibility Considerations.** If you must support this obsolete functionality, we suggest you print and keep a copy of the relevant MATLAB function reference pages from V7.5 (R2007b) or earlier.

# Version 7.4 (R2007a)

## MATLAB Software

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This table summarizes what's new in Version 7.4 (R2007a):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.4 (R2007a)” on page 353
- “Mathematics, MATLAB Version 7.4 (R2007a)” on page 375
- “Data Analysis, MATLAB Version 7.4 (R2007a)” on page 378
- “Programming, MATLAB Version 7.4 (R2007a)” on page 379
- “Graphics and 3-D Visualization, MATLAB Version 7.4 (R2007a)” on page 387
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.4 (R2007a)” on page 391

- “External Interfaces/API, MATLAB Version 7.4 (R2007a)” on page 394

## Desktop Tools and Development Environment, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 353
- “Desktop” on page 358
- “Running Functions—Command Window and History” on page 366
- “Help” on page 367
- “Workspace, Search Path, and File Operations” on page 369
- “Editing and Debugging M-Files” on page 370
- “Tuning and Managing M-Files” on page 373
- “Publishing Results” on page 373

### Startup and Shutdown

New features and changes introduced in Version 7.4 (R2007a) are

- “Double-Clicking Associated File Type in Explorer Now Opens File in Existing Session of MATLAB Software” on page 353
- “Changes to Startup Directory (Folder) and Startup Options for MATLAB Application on Windows” on page 354
- “JVM for Windows Updated” on page 357
- “New Version of Java Access Bridge Software” on page 358
- “Confirm Exit Preference to be Enabled by Default in Future Version” on page 358

### Double-Clicking Associated File Type in Explorer Now Opens File in Existing Session of MATLAB Software

When you open a file from Microsoft Windows Explorer whose type is associated with the MATLAB application, the file opens in the appropriate tool in the existing session of MATLAB, if MATLAB is already running,

or if not, starts MATLAB. This assumes you associated the file types with MATLAB by accepting the defaults while installing MATLAB, or by changing the associations. For example, in Explorer, double-click an M-file to open the file in the MATLAB Editor/Debugger, or double-click a MAT-file to open the Import Wizard and load the data into the workspace in MATLAB. For details, including how to change file associations, see “Associating Files with MATLAB on Windows Platforms”.

**Compatibility Considerations.** In previous versions, when you double-clicked a file in Explorer whose type was associated with MATLAB, the file opened in a new session of MATLAB. The change made in MATLAB Version 7.4 (R2007a) to open the file in an existing session was based on many user requests.

In previous versions, double-clicking a MAT-file associated with MATLAB in Explorer opened a new session of MATLAB and loaded the data into the workspace. When clicked in the Apple Macintosh Finder, the data loaded into the existing session of MATLAB. Now on Microsoft Windows and Macintosh platforms, the Import Wizard opens in the existing session of MATLAB, and you use it to load the data into the workspace.

By default, in previous versions, double-clicking an M-file in Explorer opened it in the MATLAB stand-alone Editor. For more information about that change, see “Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version” on page 370.

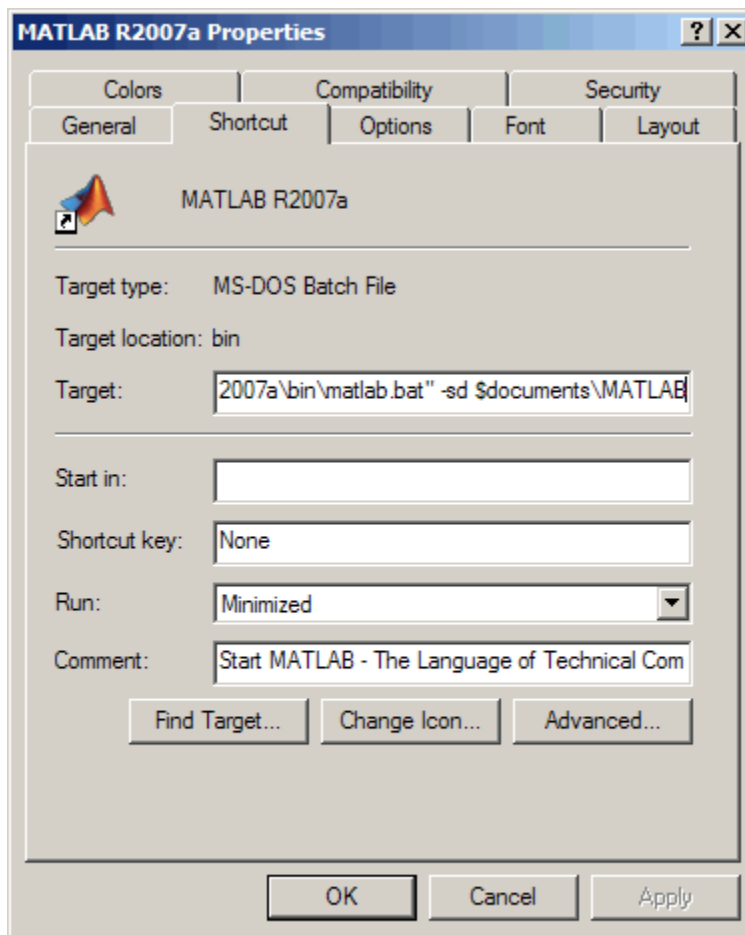
### **Changes to Startup Directory (Folder) and Startup Options for MATLAB Application on Windows**

The default startup directory for MATLAB on Microsoft Windows platforms is now My Documents\MATLAB, or Documents\MATLAB on the Microsoft Windows Vista platform. Upon startup, MATLAB automatically locates this MATLAB folder (creating it if it does not exist), and adds it to the top of the search path. This utilizes standard folders on Windows and Windows Vista platforms to provide a unique startup directory for each user. As such, the folder is part of the Windows (or Windows Vista) user’s profile, and will be accessible when the user runs MATLAB from other machines, when the profile is set up to roam.

In the Properties dialog box of the shortcut icon for MATLAB, the **Target** field includes a new startup option -sd (for startup directory), followed by

\$documents\MATLAB, where MATLAB interprets \$documents as the My Documents folder for the current user (or Documents for the Windows Vista platform). If the path for \$documents is specified in the configuration of the Windows environment via UNC pathname, MATLAB automatically assigns it a mapped drive, creating one if necessary. The -sd startup option overrides anything in the **Start in** field, which is now empty by default.

For more information, see .



**Compatibility Considerations.** In previous releases, the default startup directory was `\Work`, located in the directory in which MATLAB was installed. For example, in R2006b, if you installed MATLAB in `C:\Program Files`, the default startup directory was `C:\Program Files\MATLAB\R2006b\Work`.



Windows Vista User Account Control (UAC) security features restrict access to **Program Files**. To accommodate this enhanced security model, the default startup directory in MATLAB has been moved outside of **Program Files**.

These are the differences between the startup directory for R2007a and previous releases:

- In previous releases, upon installation, the default startup directory was specified in the **Start in** field of the Properties dialog box for the shortcut icon for MATLAB. You could change the startup directory by replacing the pathname in that field. In R2007a, if you want to specify the startup directory using the **Start in** field, you must also remove from the **Target** field the **-sd** startup option and the pathname that follows it.
- The default startup directory is no longer specific to a release. When you upgrade from R2007a to a future release, files you created and saved in **My Documents\MATLAB** (or **Documents\MATLAB** on Vista) will automatically be in the startup directory for the new release. Previously, you had to move files you created and saved in the **Work** folder for a release, for example, **R2006a\Work**, to the default startup directory for the new release, for example, **R2006b\Work**.
- In previous releases, the default startup directory, **Work**, was shared by all users running that installation of MATLAB. The default startup directory in R2007a, **My Documents\MATLAB** (or **Documents\MATLAB** on Vista), provides each user with a unique startup directory.
- In previous releases, MATLAB added the default startup directory, **Work**, to the bottom of the search path. In R2007a, MATLAB adds the default startup directory, **My Documents\MATLAB** (or **Documents\MATLAB** on the Windows Vista platform), to the top of the search path. In R2007a, for consistency with previous releases, MATLAB adds **... \MATLAB\R2007a\Work** to the bottom of the search path. However, we encourage you to stop using the **Work** folder because support for it might be removed in a future release.

## JVM for Windows Updated

MATLAB is now using Sun Microsystems Java (JVM) version 1.5.0\_07 on Windows platforms. Java is supplied with MATLAB for Windows platforms, so this change requires no action on your part.

**Compatibility Considerations.** If you use a specific version of Java with MATLAB on Windows platforms, this change might impact you.

### **New Version of Java Access Bridge Software**

MATLAB now installs Java Access Bridge 2.0, which is used by Freedom Scientific BLV Group JAWS® software for accessibility support.

### **Confirm Exit Preference to be Enabled by Default in Future Version**

When you exit from MATLAB, MATLAB terminates without displaying a confirmation dialog box that asks if you are sure you want to quit. This is the default behavior but you can set a preference to display a confirmation dialog box. In a future version, the confirmation dialog box will appear by default when you quit MATLAB.

**Compatibility Considerations.** When the confirmation dialog appears by default, you will be able to disable it using preferences. If you have files that include exit statements, you might need to ensure the preference for the confirmation dialog box is disabled.

## **Desktop**

New features and changes introduced in Version 7.4 (R2007a) are

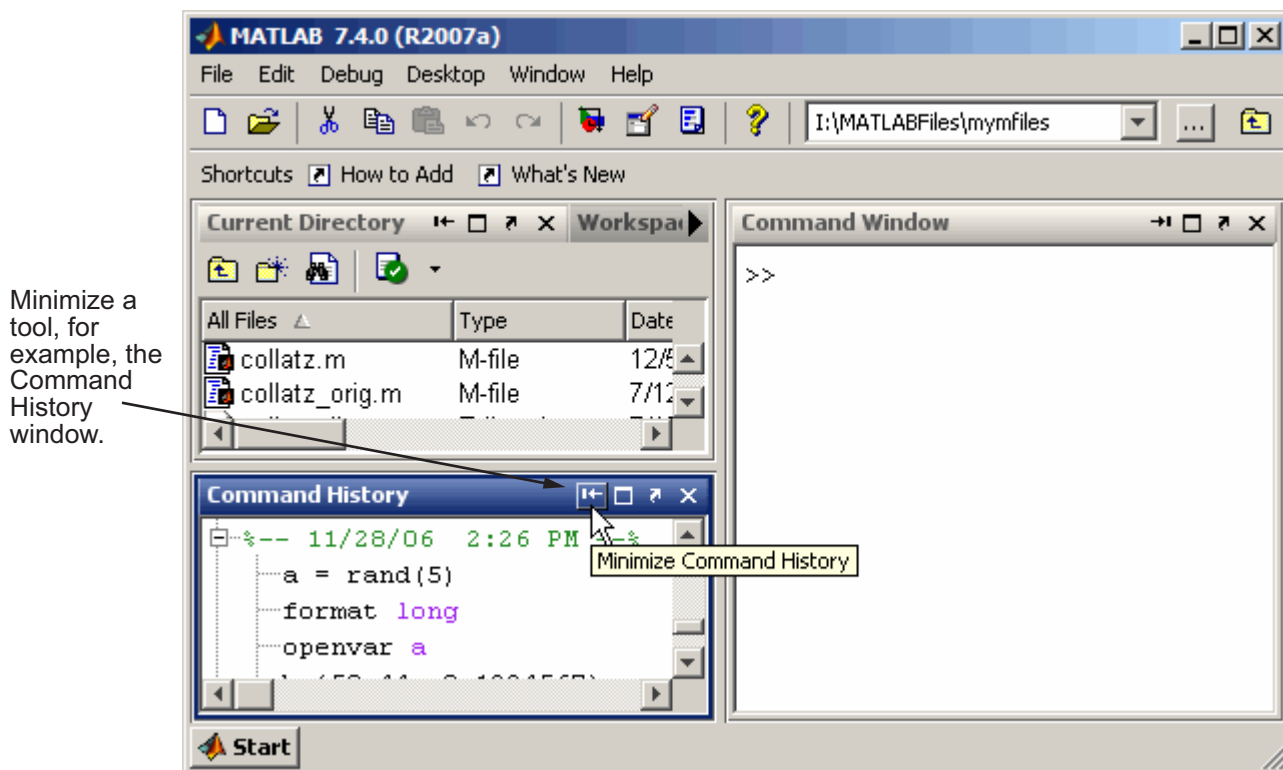
- “Minimize, Temporarily Display, and Restore Tools in the Desktop” on page 358
- “Maximize Tools in the Desktop” on page 362
- “Tabs for Tools Replaced by Title Bars” on page 364
- “Multithreaded Computation Support Added; Enable Via New Preference” on page 366

### **Minimize, Temporarily Display, and Restore Tools in the Desktop**

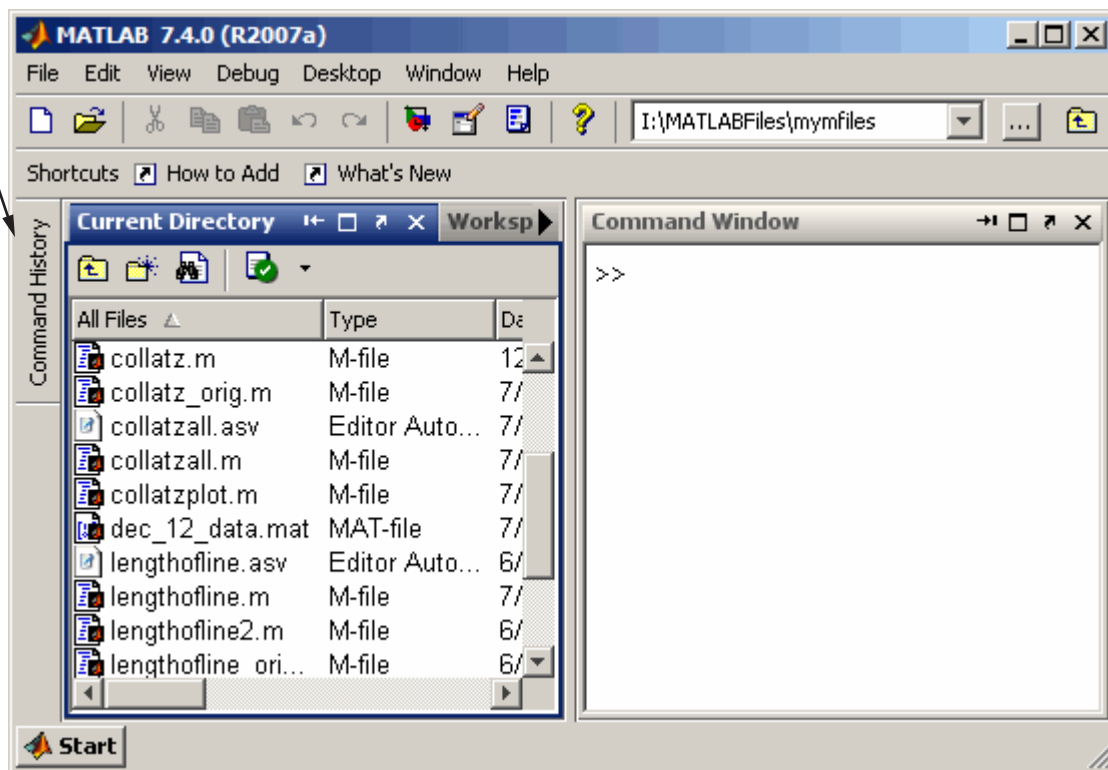
On Windows and The Open Group UNIX platforms, you can minimize any tool in the desktop. Minimizing a tool creates a button for it along the specified edge. When you want to view the tool, hover over or click the button

to temporarily show it in the desktop. Right-click the button and select **Restore toolname** to return the tool to the desktop. Perform these tasks for the selected tool using items in the **Desktop** menu, equivalent mnemonics (for example **Alt+D, N** to minimize), or buttons on the tool's titlebar.

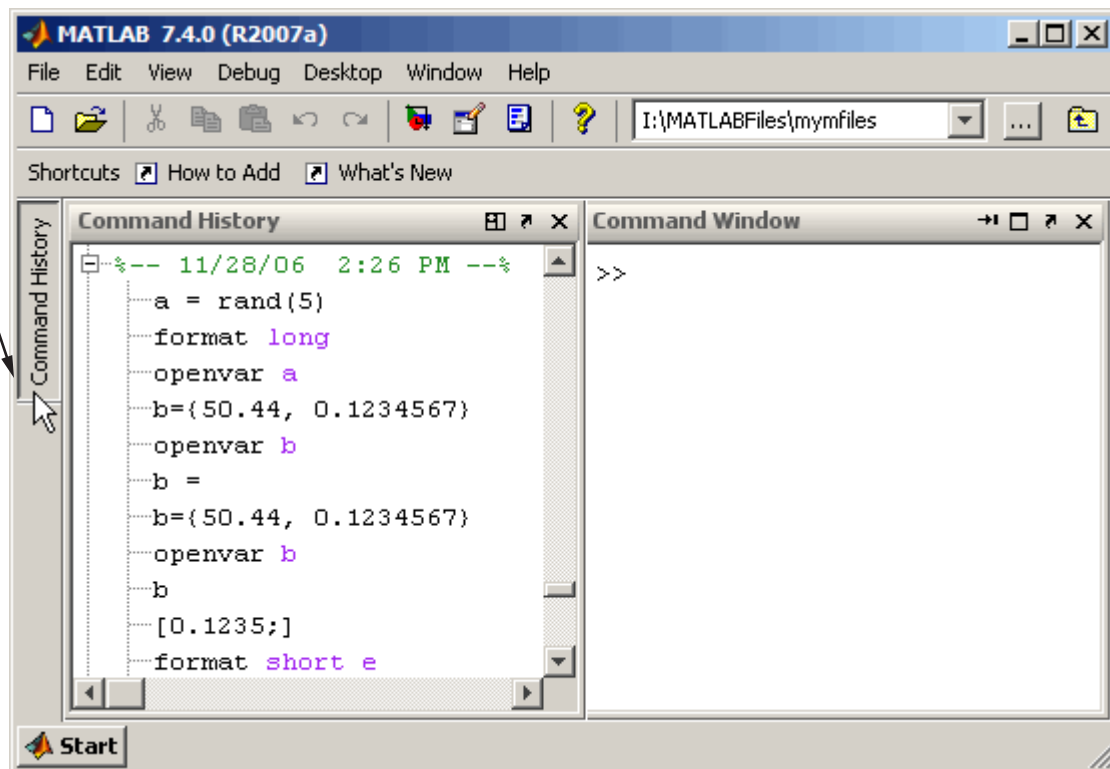
The following illustrations show how to use these features, using the example of the Command History window in the default desktop layout.



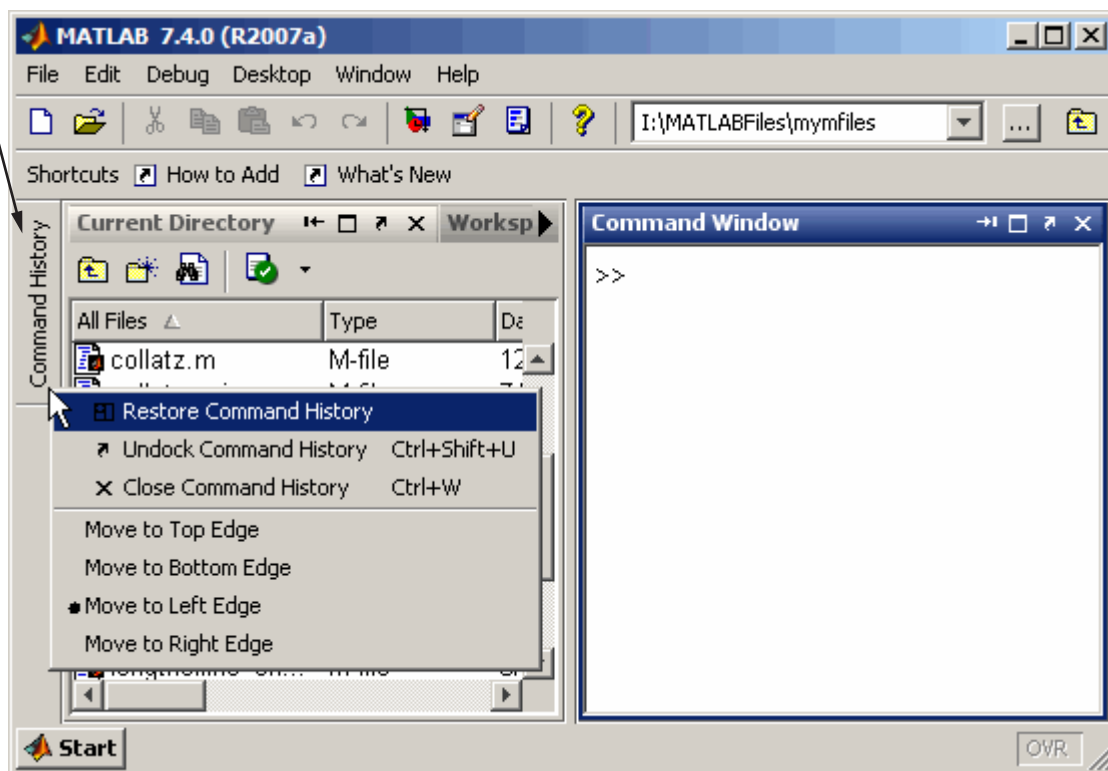
When minimized, a tool, such as the Command Window in this example, is represented by a button on the desktop border.



Hover over or click the button for a minimized tool to temporarily view the tool. The tool is temporarily displayed until you select another tool. Then the tool becomes minimized again.



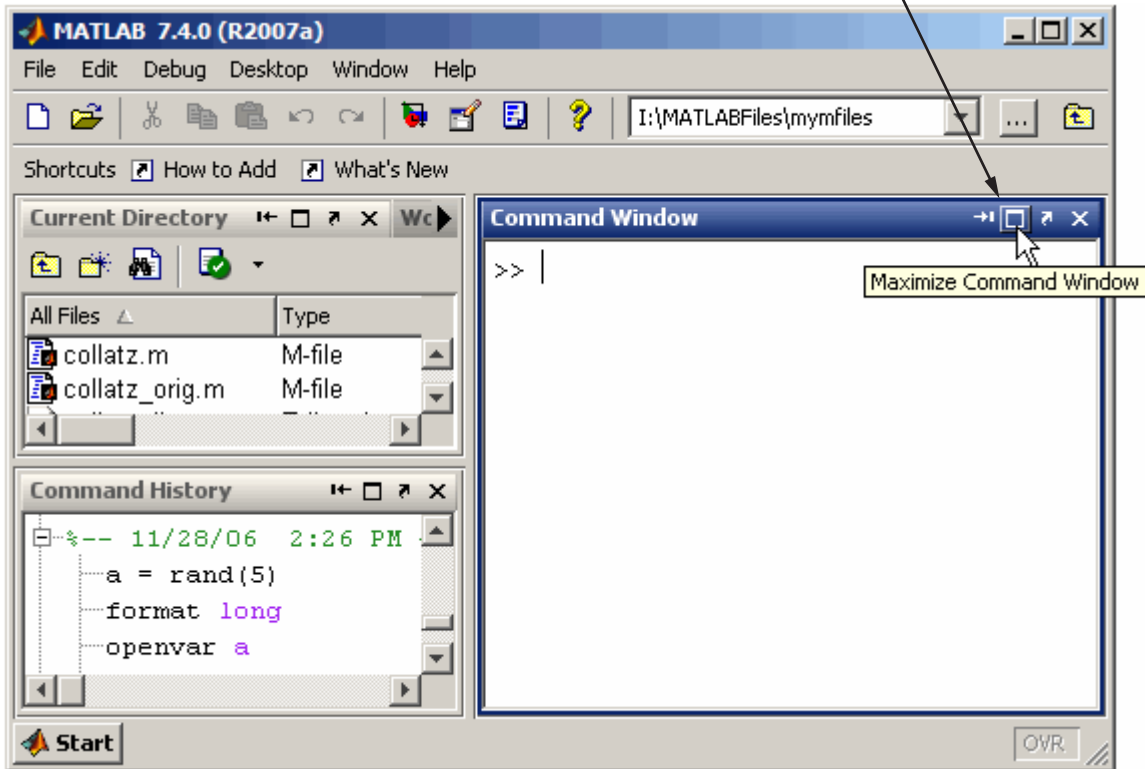
On the button for a minimized tool, right-click, and from the context menu, select **Restore**. The tool resumes the size and position it had in the desktop before it was minimized.



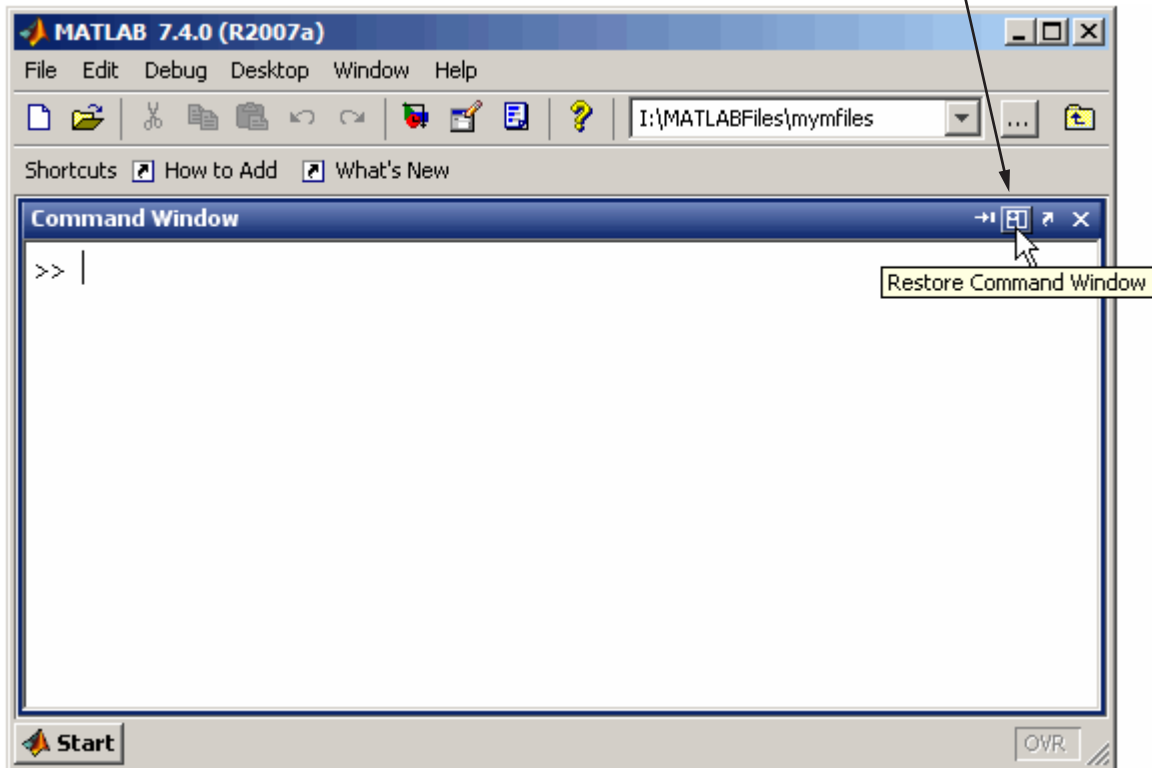
### Maximize Tools in the Desktop

On Windows and UNIX platforms, you can maximize a tool so it occupies the entire desktop tool area in MATLAB, then restore it to return it to its previous location. Perform these tasks for the selected tool using items in the **Desktop** menu, equivalent mnemonics (for example **Alt+D, X** to maximize), or buttons on the tool's titlebar.

Default desktop layout.  
Maximize a tool, for example, the Command Window  
so it occupies the full MATLAB desktop area.



Maximized, the Command Window now occupies the full desktop area. Restoring the Command Window returns it to its original size and location in the desktop.



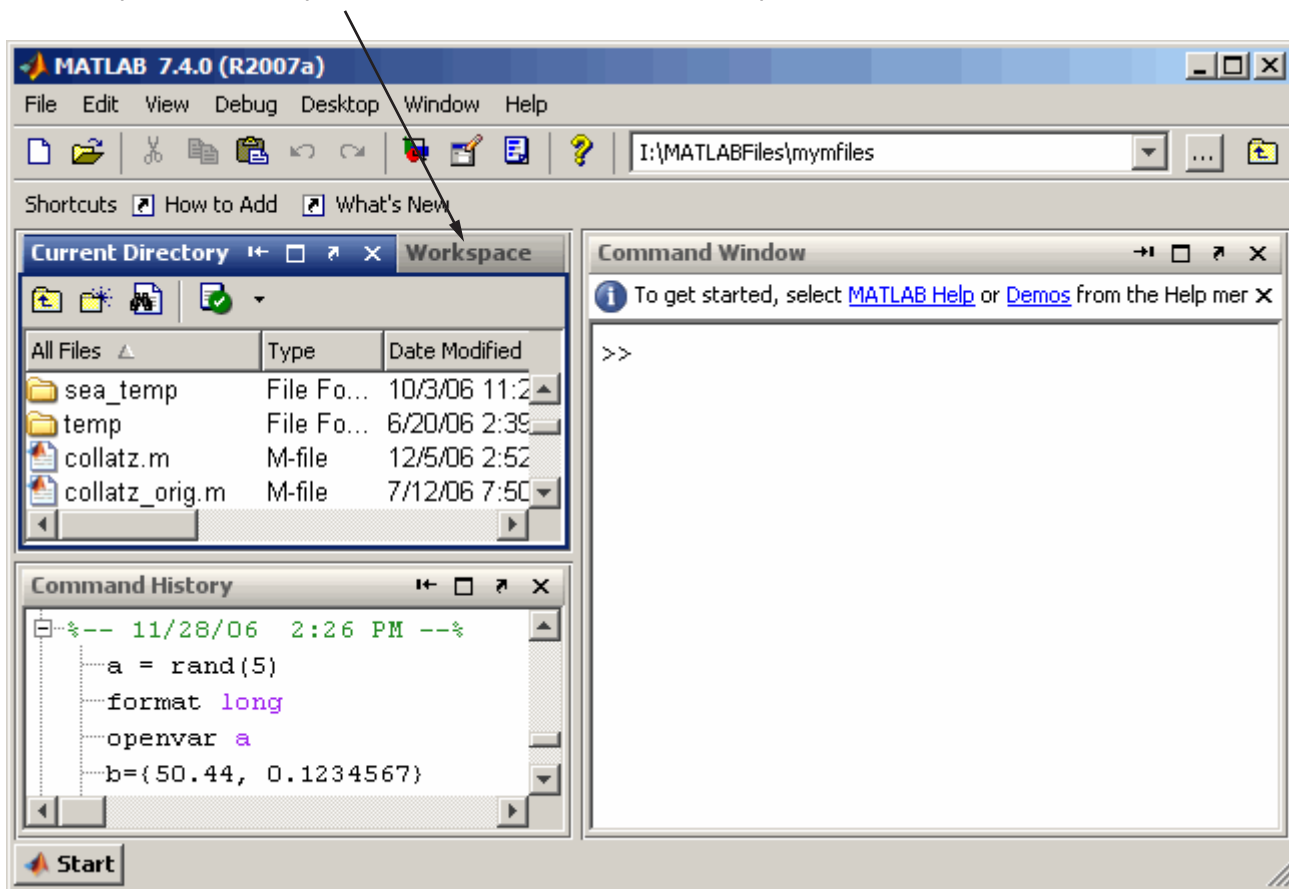
### Tabs for Tools Replaced by Title Bars

In the desktop, when you tab tools together, that is, arrange them so they occupy the same position, the tools' title bars share the title bar area. To make a tool active, select its name in the title bar.



The Current Directory browser and Workspace browser are "tabbed together".

The name of the tool in the title bar serves as the tab. To make a tool active, click its name in the title bar. For example, click Workspace in the title bar to make the Workspace browser active.



**Compatibility Considerations.** In previous versions, tools tabbed together each had a tab at the bottom of the area they occupied. The tabs have been removed in favor of tools sharing the titlebar area.

## **Multithreaded Computation Support Added; Enable Via New Preference**

If you run MATLAB on a multiple-CPU system (multiprocessor or multicore), use a new preference to enable multithreaded computation. This can increase performance in MATLAB for element-wise and BLAS library computations.

By default the preference is not set, so you must set it to enable multithreaded computation. With the preference enabled, MATLAB automatically specifies the recommended number of computational threads, although you can change that value. On AMD platforms running the Linux operating system, MATLAB supports multithreaded computation, but requires an extra step to change the default BLAS.

If you are using a multiple-CPU system, you can run the Multithreaded Computation demo to see the performance impact. For more information, see “Enabling Multithreaded Computation” in the MATLAB Desktop documentation.

## **Running Functions—Command Window and History**

New features and changes introduced in Version 7.4 (R2007a) are

- “Startup Message Bar Replaces Startup Message in Command Window” on page 366
- “Command History Searching Enhanced” on page 367
- “Macintosh Platforms—Some Key Bindings in Command Window Changed” on page 367

### **Startup Message Bar Replaces Startup Message in Command Window**

When you start MATLAB, a getting started message bar appears at the top of the Command Window, that provides links to information that is helpful for new users. You can dismiss the message bar by using the close box in it. Use Command Window preferences to specify whether or not the message bar should appear.

## Command History Searching Enhanced

You can now find entries in the Command History window by typing the first few letters of an entry; the previous entry that begins with those letters is selected. Then use up and down arrow keys to extend the find to the next and previous instances. Use the **Ctrl** key with an arrow key to select the current as well as next or previous instances. Use **Ctrl+A** to find and highlight all instances at once. The search does not look at entries in sessions that are collapsed. For more information about this search feature, see “Quick Search for Entries Beginning with Specified Letters or Numbers”.

## Macintosh Platforms—Some Key Bindings in Command Window Changed

On Macintosh platforms, some key bindings were changed to make them more consistent with Mac OS X/ Mac OS X standard behaviors.

**Compatibility Considerations.** Key bindings you have been used to in the Command Window might have changed.

## Help

New features and changes introduced in Version 7.4 (R2007a) are

- “Demos Now Included in Search Results and Product Filtering” on page 367
- “Get URL of Displayed Page for Viewing on Web” on page 368
- “Include Search Database for Your Own Help Files” on page 368
- “Video Tutorials Now Accessed Via Web Site” on page 368

## Demos Now Included in Search Results and Product Filtering

When you perform a search in the Help browser, the results now include code and text found in **Demos**. Also, the **Demos** listing in the Help Navigator pane now synchronizes with the demo currently open when you have the synchronization preference for the Help browser selected. For more information, see “Documentation Search Tips”.

When you select **File > Preferences > Help** and enable the Product Filter, only demos for selected products are shown in the **Demos** pane, and searched via the **Search for** field.

## Get URL of Displayed Page for Viewing on Web

When viewing a page in the Help browser, select **View > Page Locations**. A window appears providing the location of the current Help page you are viewing. The window provides the page location on both your local system and the MathWorks Web site. Use this feature to

- Send the URL to someone else who wants to view that information and might not have MATLAB or the same version of MATLAB, for example, a colleague or technical support.
- More easily see if this same documentation page has been updated for the latest product version.

## Include Search Database for Your Own Help Files

If you create your own HTML help files for use with the MATLAB Help browser, the Help browser can now search the content of your files. Create a search database for your help files using the new `builddocsearchdb` function. The function creates a `helpsearch` directory that contains the search database files. For information on this process, see “Making Your HTML Help Files Searchable”.

**Compatibility Considerations.** In previous versions of MATLAB, some users created help search databases for their own help files via assistance from MathWorks Technical Support. If you created a help search database for use with R2006b, it might work in R2007a, but it is recommended that you recreate it for R2007a, even if no content has changed. If you created a help search database prior to R2006b, you must recreate it for R2007a.

Help search databases in prior releases were built from a help jar file rather than html files. The `builddocsearchdb` function only supports html files. However, it is expected to support jar files in a future release. If you used a jar file for a prior version and want to use a jar file in R2007a, build your R2007a help search database using the same technique you used in R2006b.

## Video Tutorials Now Accessed Via Web Site

Previously video tutorials were installed when you installed MATLAB. Now the tutorials are on the MathWorks Web site.

**Compatibility Considerations.** You can still link to and play video tutorials from within the Help browser Demos listings or other links to them in the product and documentation, however this now requires an active Internet connection.

## **Workspace, Search Path, and File Operations**

New features and changes introduced in Version 7.4 (R2007a) are described here.

### **Current Directory Browser Enhancements**

- When you double-click a Windows shortcut in the Current Directory browser, it runs the shortcut.
- When you double-click a prj file in the Current Directory browser, it opens in the Deployment Tool.
- You can now find entries in the Current Directory browser by typing the first few letters of an entry; the entry that begins with those letters is selected.

### **Workspace Browser**

When you double-click an object, it opens in the Property Inspector.

### **Array Editor Enhancements**

You can now undo and redo the last operation you performed in the Array Editor. This applies to cut, paste, insert, delete, and clear contents features.

### **Search Path Changes**

On Windows platforms, MATLAB now adds the default startup directory, My Documents\MATLAB (or Documents\MATLAB on Windows Vista), to the top of the search path upon startup.

**Compatibility Considerations.** In previous releases, MATLAB added the default startup directory, `Work`, to the bottom of the search path on Windows platforms. For example, in R2006b, it added `... \MATLAB\R2006b\Work` to the bottom of the search path. In R2007a, for consistency with previous releases, MATLAB adds `... \MATLAB\R2007a\Work` to the bottom of the search path. However, we encourage you to stop using the `Work` folder because support for it might be removed in a future release. For more information, see “Changes to Startup Directory (Folder) and Startup Options for MATLAB Application on Windows” on page 354.

## Editing and Debugging M-Files

New features and changes introduced in Version 7.4 (R2007a) are

- “Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version” on page 370
- “Delimiter Matching Extended to Include Language Keyword Pairs” on page 371
- “M-Lint Automatic Correction Feature” on page 371
- “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 372
- “Macintosh Platforms—Some Key Bindings in Editor/Debugger Changed” on page 373
- “Other Changes in the Editor/Debugger” on page 373

### Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version

Starting in this release, by default, double-clicking an M-file in Windows Explorer opens the file in the MATLAB Editor/Debugger rather than in the MATLAB stand-alone Editor. In a future version, the stand-alone Editor will not be provided with MATLAB.

**Compatibility Considerations.** The change to open M-files in the MATLAB Editor/Debugger rather than the stand-alone Editor was made based on many user requests. You can still use the MATLAB stand-alone Editor in this release by starting the application located at: `matlabroot\bin\win##\meditor.exe`.

Starting MATLAB by double-clicking an M-file requires a MATLAB license, while starting the stand-alone Editor does not require a MATLAB license.

If you want to associate M-files so that when you double-click them they open in the MATLAB stand-alone Editor rather than in the MATLAB Editor/Debugger, follow the instructions in “Associating Files with MATLAB on Windows Platforms”; rather than specifying the executable for MATLAB, `matlab.exe`, specify `meditor.exe`, which is in the same folder.

Instead of the stand-alone Editor, you can use the MATLAB Editor/Debugger. It provides all the features of the stand-alone Editor plus some not found in the stand-alone Editor, such as debugging and tab completion; for a full list, see “Stand-Alone Editor Will Not Be Included in Next Version” on page 318.

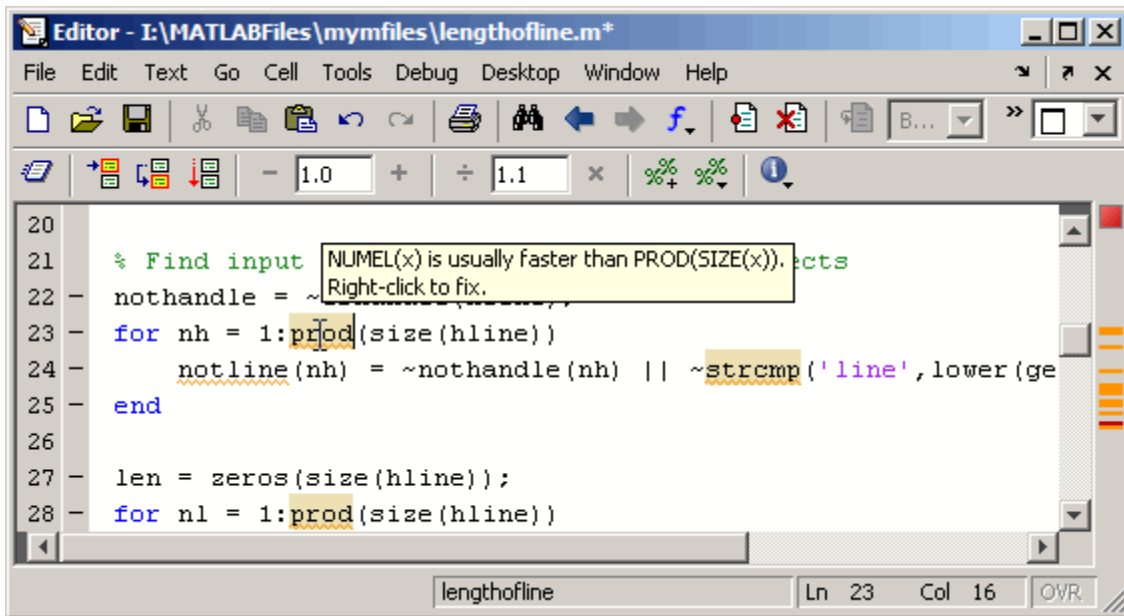
Some users have preferred the stand-alone Editor to the MATLAB Editor/Debugger because of slightly better startup performance and because it does not require a license for MATLAB. For those situations, you can use any text editor you have, such as UltraEdit or Emacs. If you have concerns about the pending removal of the stand-alone Editor, please contact us at [editor-feedback@mathworks.com](mailto:editor-feedback@mathworks.com), so we can plan to minimize transition issues.

## **Delimiter Matching Extended to Include Language Keyword Pairs**

You can now see the match to language keyword pairs using delimiter matching features that previously existed for parentheses and brackets. For example, when you type `end`, the Editor/Debugger highlights the matching `if`. To set delimiter matching preferences, select **File > Preferences > Keyboard > Delimiter Matching**; click **Help** for more information.

## **M-Lint Automatic Correction Feature**

For some types of warnings or errors, M-Lint can apply an automatic fix to the code. Code that can be automatically corrected appears with a different background color. To perform the fix, right-click the code that is highlighted (for a single single-button mouse, use **Ctrl**+click); from the resulting context menu, select the auto-fix action.



For more information, see step 8 in the example at “Automatically Check Code in the Editor — Code Analyzer”.

## M-Lint Detection of Missing End-of-Line Semicolons Enhanced

In previous versions, there was a single output message generated by a line with a missing terminating semicolon:

```
Terminate statement with semicolon to suppress output.
```

However, M-Lint suppressed displaying the message for files with three or more cells (a cell being indicated by a line with an initial %). This was done based on the assumption that such files were demo programs, and therefore display of the output was intentional.

In MATLAB Version 7.4 (R2007a), M-Lint no longer makes a distinction for files with three or more cells. Instead, M-Lint displays one message for scripts and a different message for functions:

```
Terminate statement with semicolon to suppress output (in functions).
Terminate statement with semicolon to suppress output (in scripts).
```



The corresponding M-Lint tags to suppress display of such messages within a line are  `%#ok<NOPRT>` for functions, and  `%#ok<NOPTS>` for scripts.

By default, both of the messages are initially selected in Preferences.

**Compatibility Considerations.** In MATLAB Version 7.3 (R2006b),  `%#ok<NOPRT>` was the only tag used to suppress the missing terminating semicolon. The tag will remain valid for function files, but will not be valid for script files. If you added any  `%#ok<NOPRT>` tags in script files in R2006b, change those tags to the new tag  `%#ok<NOPTS>`.

## Macintosh Platforms—Some Key Bindings in Editor/Debugger Changed

On Macintosh platforms, some key bindings were changed to make them more consistent with standard behaviors for Mac OS X.

**Compatibility Considerations.** Key bindings you have been used to in the Editor/Debugger might have changed.

## Other Changes in the Editor/Debugger

- There is a new confirmation preference for displaying a warning about exiting debug mode in order to save a file.

## Tuning and Managing M-Files

There was a minor change in M-Lint behavior—for details, see “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 372.

## Compatibility Considerations

See the compatibility considerations associated with “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 372.

## Publishing Results

New features and changes introduced in Version 7.4 (R2007a) are

- “Publishing Function M-Files Now Supported” on page 374

- “Specify Maximum Number of Output Lines in Published File” on page 374
- “New Publishing Options” on page 374

### **Publishing Function M-Files Now Supported**

You can now publish an M-file function. When publishing an M-file function, you cannot evaluate the code. This feature effectively allows you to save M-file functions to output formats such as HTML or Microsoft Word documents, with formatting. To publish an M-file function, first clear the **Evaluate code** preference in **Editor/Debugger Publishing Preferences**, or run the `publish` function with the `evalCode` option set to `false`.

### **Specify Maximum Number of Output Lines in Published File**

Using the `publish` function, you can specify the maximum number of lines in a published file. Set the new `maxOutputLines` field to a nonnegative value. The default value is `Inf`.

### **New Publishing Options**

New publishing options provide increased flexibility and control over the appearance of the published document. The added options are for adding inline links, inline links with link text, graphics, and HTML markup. See “Marking Up MATLAB Comments for Publishing” for more information.

## Mathematics, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “New Functions” on page 375
- “More Efficient Matrix Multiplication for Sparse Matrices” on page 375
- “rand Function Uses the Mersenne Twister Algorithm as Default” on page 375
- “Upgrade to BLAS Libraries” on page 377
- “mode of Empty Array Now Returns NaN” on page 377
- “Change to Syntax for Setting BLAS Library Version on Linux” on page 377

### New Functions

Function	Description
bsxfun	Applies an element-by-element binary operation to two full arrays with singleton expansion enabled
ilu	Performs the sparse incomplete LU factorization

### More Efficient Matrix Multiplication for Sparse Matrices

Matrix multiplication for  $A' * b$  now handles sparse matrices more efficiently.

### rand Function Uses the Mersenne Twister Algorithm as Default

The rand function now uses the Mersenne Twister algorithm as default generator algorithm. This method generates double precision values in the closed interval  $[2^{-53}, 1-2^{-53}]$ , with a period of  $(2^{19937}-1)/2$ . Prior to this release, MATLAB used an algorithm known as the Subtract-with-Borrow (SWB) algorithm.

The rand function now produces different results than in previous releases. However, the results returned are still pseudorandom values drawn from a

standard uniform distribution. Because the values returned by `rand` are intended to be random, this change should not affect your code.

## Compatibility Considerations

There are several things to keep in mind regarding this change:

- If your code requires the exact values returned by `rand` in previous releases, you should use the statement

```
rand('state',0);
```

to reset `rand` to use the SWB algorithm. The new default algorithm's internal state at startup is equivalent to using the statement

```
rand('twister',5489);
```

Note that the `'state'` keyword corresponds specifically to the SWB algorithm; it cannot be used generally to refer to the internal state of the currently active algorithm.

- Existing code that uses the `'state'` keyword to reinitialize `rand` in a statement such as

```
rand('state',sum(100*clock))
```

causes `rand` to switch to using the SWB algorithm. You may want to use the `'twister'` keyword, which resets `rand` but does not switch algorithms.

- Existing code that uses the `'state'` keyword to save and restore the internal state of `rand` in statements such as

```
savedState = rand('state');  
... % code that uses rand  
rand('state',savedState);
```

may no longer work as intended. Specifically, the first line of code saves the state of the SWB generator algorithm (see the `rand` documentation for details). If the default Mersenne Twister algorithm was the active one at that time, then using the saved state in the last line does not restore the `rand` internal state to its original conditions. Instead, it switches the `rand`

algorithm to SWB. To save and restore the internal state of the Mersenne Twister algorithm, use the 'twister' keyword.

## Upgrade to BLAS Libraries

MATLAB now uses new versions of the Basic Linear Algebra Subroutine (BLAS) libraries. For Windows, Intel Mac, and Intel processors on Linux platforms, MATLAB supports the Intel Math Kernel Library (MKL) version 9.0. For AMD processors on Linux platforms, MATLAB uses the AMD Core Math Library (ACML) version 3.5. For the Solaris platform, MATLAB uses the Sun Performance Library from Sun Studio 11.

## mode of Empty Array Now Returns NaN

The `mode` function, when operating on an empty array (`[]`), returns a 1-by-0 array in previous releases, while related functions `mean`, `median`, `std`, and `var` return NaN when given the same input. In this release, `mode` returns NaN for an empty array input.

## Compatibility Considerations

Existing program code that relies on `mode` of an empty array to return an empty array should be modified.

## Change to Syntax for Setting BLAS Library Version on Linux

If you change the BLAS library used by MATLAB on Linux platforms, MATLAB now loads libraries in the left-to-right order specified in the syntax. For example, to load the Intel MKL BLAS, from a system prompt, run

```
setenv BLAS_VERSION mk1.so:mk1compat.so
```

MATLAB loads `mk1.so` first, and then loads `mk1compat.so`.

This also applies if you edit `bin\$(ARCH)\blas.spec` directly.

## Compatibility Considerations

This syntax differs from that used for Linux platforms in prior versions.

## **Data Analysis, MATLAB Version 7.4 (R2007a)**

There were no new features or changes in this version.

## Programming, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “New Functions” on page 379
- “Parse Inputs with Consistently Implemented Mechanism” on page 380
- “textscan Returns Like Values in Same Cell Array” on page 380
- “Numbered Arguments for Formatted String Functions” on page 380
- “The dir Function Returns Additional datenum Field” on page 381
- “Using whos -file on Objects with Overloaded size or class Methods” on page 382
- “mat2str Returns Correct Output for Strings” on page 382
- “Warning Generated by try-catch” on page 383
- “save -regexp Saves to Correct Filename” on page 384
- “Functions Not Callable If in Directory Under Class Directory” on page 384
- “Improved Performance on Certain Platforms and Operations” on page 385
- “Technique to Conserve Memory on Windows Vista” on page 385
- “ispuma Function Deprecated” on page 386

### New Functions

New Functions in this release are

Function	Description
assert	Generates an error when a specified condition is violated. Displays either the default error message or one that you have written.
ismac	Returns true if you are currently running one of the Mac OS X versions of MATLAB.
verLessThan	Compares the specified version number and toolbox name with the version of that same toolbox that is currently running. Use verLessThan in your functions when you

Function	Description
	want to write code that can run across multiple versions of MATLAB.

## Parse Inputs with Consistently Implemented Mechanism

The new `inputParser` class provides a consistent mechanism for parsing and validating input arguments in the M-file functions you write. Using `inputParser` methods in the body of your function, you build a schema that represents each valid input argument to the function. In the schema, you can specify whether arguments are required or optional, and if they are to be passed as single values or as parameter-value pairs. The schema also provides a means of validating each incoming argument. The properties of the `inputParser` class give you additional information about arguments that are passed to the function.

For more information, see “Validating Inputs with Input Parser” in the MATLAB Programming documentation.

## textscan Returns Like Values in Same Cell Array

In previous versions of MATLAB, the `textscan` function always returned each output value in a separate cell array, even if those values were of the same data type. In this release, if you call `textscan` with the new `CollectOutput` switch, MATLAB returns all consecutive data that is of the same type in the same cell array. This can save you the extra task of sorting through the output and merging like data types together in your own code.

For more information, see the `textscan` function reference page.

## Numbered Arguments for Formatted String Functions

Using numbered argument specification with MATLAB functions that employ format specifiers such as `%d` or `%s` (e.g., `sprintf`, `error`), you can pass the numeric and character string values that correspond to these format specifiers in a varying order. This can be useful when translating format strings in a different sentence structure.



In addition to identifying the values, you can also use numbered arguments to specify the field width and precision of the format specifiers. In the following example, the first format specifier in the `sprintf` command is `%1$*4$f` (quite different from the usual `%f` specifier). The `1$` tells MATLAB that the value that is to replace this format specifier is in the first argument following the format string; that is, `123.45678`. The `*4$` indicates that the field width for this specifier is being passed in the fourth argument following the format string: `15`.

In the second and third arguments (`%2$.*5$f` and `%3$*6$.*7$f`), the symbols `2$` and `3$` represent the values, `*5$` and `*7$` represent precisions, and `*6$` represents field width:

```
sprintf('%1$*4$f   %2$.*5$f   %3$*6$.*7$f', ...
        123.45678, 16.42837, pi, 15, 3, 6, 4)

ans =
      123.456780    16.428    3.1416
```

For more information, see “Formatting Strings” in the MATLAB Programming documentation.

## The `dir` Function Returns Additional `datenum` Field

The `dir` function now returns the date the file or directory was last modified in two formats: string and numeric. The numeric date value is not specific to any particular locale, and thus is compatible for international use:

```
fileinfo = dir('myfile.txt')

fileinfo =
    name: 'myfile.txt'
    date: '16-Mar-2006 13:34:01'
    bytes: 251
    isdir: 0
    datenum: 7.3275e+005
```

This new output is also returned when running `dir` on an FTP server.

## Using whos -file on Objects with Overloaded size or class Methods

MATLAB is unable to determine the true size of an object stored in a MAT-file if the class of this object overloads the MATLAB `size` function. Likewise, MATLAB cannot determine the true class name of an object if it overloads the MATLAB `class` function. For these reasons, in previous versions of MATLAB, the command `whos -file` does not return or display object size and class accurately if the class of that object overloads these methods, but instead always returns `1x1` for the size and a default name for the class.

In this release, `whos -file` returns the empty matrix (`[]`) or displays a hyphen (`-`) for objects that overload `size`, and returns and displays `unknown` for objects that overload `class`.

## Compatibility Considerations

If you use `whos -file` on objects in any of your programs, and if any of these objects overloads the `size` function, then you need to be aware that MATLAB now returns `[]` instead of a 2–element vector of ones in the `size` field of the output structure.

## mat2str Returns Correct Output for Strings

The documentation for the `mat2str` function states that the `str` output of this function “is suitable for input to the `eval` function such that `eval(str)` produces the original matrix to within 15 digits of precision.” The behavior of `mat2str` when given a character array as input, however, did not abide by this rule. This inconsistency has been fixed in this release.

In MATLAB Version 7.3, the `eval` command below generated an error.

```
s = mat2str('MATLAB')
s =
    'MATLAB'

eval(s)
ans =
    MATLAB
```

## Compatibility Considerations

You might have to modify M-file programs that expect the previous behavior from `mat2str`.

## Warning Generated by try-catch

To accommodate future changes in the MATLAB error-handling capabilities, there is a new restriction to the syntax of the try-catch block. When the first MATLAB statement that follows the try keyword consists of just a single term (e.g., `A` as opposed to `A+B`) occurring on the same line as the try, then that statement and the try keyword should be separated by a comma. For example, the line

```
try A
```

should be written as either

```
try, A
```

or on two lines as

```
try
  A
```

This affects only single-term statements. For example, the following statement continues to be valid:

```
try A+B
```

The same holds true for the catch keyword and a single-term statement following the keyword on the same line. A valid try-catch statement of this type should be composed as follows:

```
try, A, catch, B, end
```

If you omit the commas following try and/or catch, your code will continue to operate correctly. However, MATLAB will issue a warning:

```
try statements, catch statements, end
```

Warning: This try-catch syntax will continue to work in R2007a, but may be illegal or may mean something different in future

releases of MATLAB.

As with previous releases, the recommended syntax for a try-catch block is as follows:

```
try
    try_statements
catch
    catch_statements
end
```

---

**Note** Due to a bug in the R2007a release, the warning for a catch followed immediately by a single term is thrown as an error, even though the text of the message says that it is a warning.

---

### Compatibility Considerations

Your M-file programs may generate the warning shown above if the correct syntax for try and catch is not used.

### save -regexp Saves to Correct Filename

In previous releases, the following command mistook the -regexp argument ([ab] in the case shown below) to be the name of the file to save to:

```
save -regexp [ab]
```

In this release, the filename is correctly understood to be the default save filename, matlab.mat, and any arguments that follow the -regexp flag and precede the next flag are interpreted as patterns to be matched.

### Functions Not Callable If in Directory Under Class Directory

M-files placed in a directory that is one or more levels beneath a MATLAB class directory are not callable from that same directory. A MATLAB class directory contains methods of a class and has a filename that begins with the @ character.

In the following example, function `myfun1` is not callable if the current working directory is set to `dir1`. The same holds true for `myfun2` if the current working directory is set to `dir2`.

```
\home\matlab\@myobj\dir1\myfun1.m  
\home\matlab\@myobj\dir1\dir2\myfun2.m
```

This behavior existed in the R2006b release, as well as in this release.

### **Compatibility Considerations**

You will no longer be able to call a file that is one or more levels beneath a MATLAB class directory if your current working directory is set to that same directory.

### **Improved Performance on Certain Platforms and Operations**

As of release R2006b, MATLAB offers improved performance in the following areas:

- Improved performance on 64-bit Windows XP and Linux platforms. This is independent of the size of data set in use.
- Faster scalar indexing into cell arrays.
- Faster assignment of cell array data to variables.

### **Technique to Conserve Memory on Windows Vista**

To conserve memory on machines running Windows Vista, you can reduce the amount of virtual memory space reserved by the operating system by using the command:

```
BCDEdit /set increaseuserva 3072
```

More documentation on this option can be found at the following URL:

<http://msdn2.microsoft.com/en-us/library/aa906211.aspx>

## **ispuma Function Deprecated**

Because MATLAB no longer supports OSX 10.1, the `ispuma` function always returns `false` in this release, and also displays a warning message that the function is now deprecated. Support for `ispuma` will be removed in a future release of MATLAB.

## **Compatibility Considerations**

It is recommended that you remove calls to `ispuma` from your M-file functions.

## Graphics and 3-D Visualization, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “Nudging Annotations with Arrow Keys” on page 387
- “Movies No Longer Play During Loading” on page 387
- “Ghostscript Printing Software Upgraded” on page 388
- “Property Inspector Now Categorizes Graphic Object Properties” on page 388
- “Figure WindowScrollWheelFcn Property Programs Scrollwheel Events” on page 390
- “Figure KeyReleaseFcn Property Programs Key Release Events” on page 390

### Nudging Annotations with Arrow Keys

In plot edit mode, annotations such as textboxes, lines, arrows, doublearrows, and text now respond to pressing directional arrow keys. Each keypress will move the selected annotation(s) one or more pixels in the indicated direction. If you select multiple objects, they all move together in response to arrow key strokes. Normally, selected objects move one pixel with each press of an arrow key. If you have selected **Snap to Layout Grid** from the **Tools** menu, each keypress makes objects move to the next grid position.

### Movies No Longer Play During Loading

The `movie` function no longer plays each frame one extra time. Previously, it would show frames as they were loaded into memory to speed up display. This behavior is no longer required and has been eliminated.

### Compatibility Considerations

If you have code that calls `movie` in a loop a certain number of times and want that number to remain the same, you need to add one iteration to the loop.

## **Ghostscript Printing Software Upgraded**

The Ghostscript software used by some print devices has been upgraded from an older version to Version 8.54. Starting in this release, MathWorks is no longer shipping a separate, standalone Ghostscript executable program.

### **Compatibility Considerations**

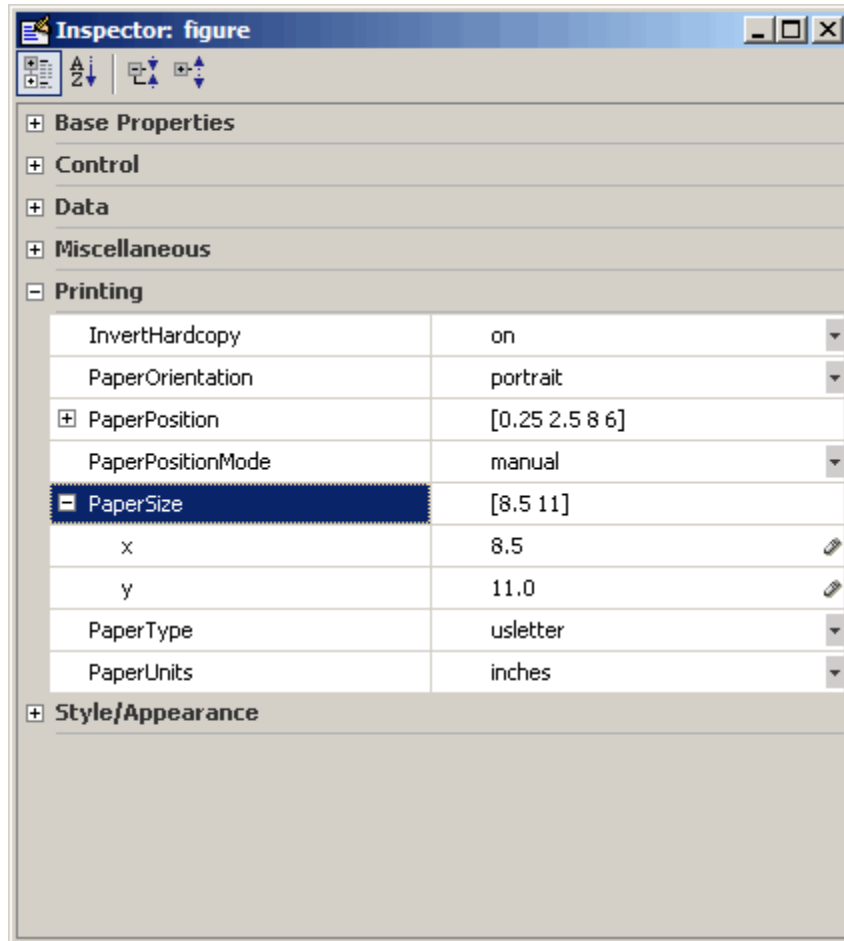
If you have written M-code based on undocumented functions that called the old version of Ghostscript, your code will no longer work.

As a consequence of this upgrade, support for printing on DEC LN03 printers (`print dlno3`) has been removed from MATLAB.

## **Property Inspector Now Categorizes Graphic Object Properties**

The Property Inspector (accessed via the Property Editor, GUIDE, and the `inspect` function) now provides tree views of groups of graphic object properties as well as an alphabetical list of all properties. You can switch between views via the two buttons at the top of the window, as shown in the following picture of the tree view of the Printing category:





In addition, the type of object currently being inspected is now shown in the title bar of the Property Inspector window. Formerly it was shown in the gray area below the title bar, which now contains the view manipulation buttons.

To change view, click a button without the blue background (the collapse and expand buttons at right are disabled in alphabetic list view). When you change views, the selected property stays the same. To inspect properties of graphic objects in the tree view, click the + icon next to a category of interest. Do the same to open properties within a category that have multiple elements.

Note that only Handle Graphics objects have categories; annotation and most other MATLAB objects can be displayed only in alphabetic list view.

The functionality of the Property Inspector has not changed; only its GUI has. As previously, if you select a set or array of objects and inspect them, the Property Inspector only displays those properties that all the objects share.

For details on using the Property Inspector, see “Accessing Object Properties with the Property Inspector” in the MATLAB Graphics documentation and the inspect reference page.

### **Compatibility Considerations**

Text that you type or delete after clicking a text field that has a text widget icon (for example, `XTickLabel`), will not persist unless you press **Return** before clicking elsewhere. This mimics the behavior of clicking the text widget icon to open a text entry dialog box, typing into it, and accepting the result by clicking **OK**. This behavior differs from that which existed prior to R2006b (MATLAB V. 7.3).

### **Figure WindowScrollWheelFcn Property Programs Scrollwheel Events**

The new figure property `WindowScrollWheelFcn` enables you to write a callback function that handles mouse wheel scrolling events while the figure has focus. See the documentation for the figure `WindowScrollWheelFcn` for more information.

### **Figure KeyReleaseFcn Property Programs Key Release Events**

The new figure property `KeyReleaseFcn` enables you to write a callback function that handles key release events (analogous to `KeyPressFcn`). See the documentation for the figure `KeyReleaseFcn` for more information.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “GUIDE No Longer Copies Callbacks When You Duplicate Components” on page 391
- “GUIDE M-File-Defined handles Structure Fields No Longer Become Permanent” on page 391
- “UNIX: File Dialog 'Location' Property Is Obsolete” on page 392
- “Functions Becoming Obsolete” on page 392

### **GUIDE No Longer Copies Callbacks When You Duplicate Components**

In GUIDE, when you copy a component for which one or more of its callback properties are defined, the callback properties of the newly created component are now set to their default values, the ones you get when adding a component directly from the Component Palette. Previously, their values were copied from the corresponding callback properties of the original component. New callback subfunctions can be generated in the GUI M-file for the new component in the same way as for any component in the GUIDE layout.

### **Compatibility Considerations**

If you have relied on the old behavior, in which the callbacks properties of the new component point to the callbacks of the original component, you will now have to explicitly change the callback properties, using the Property Inspector, to do that.

### **GUIDE M-File-Defined handles Structure Fields No Longer Become Permanent**

The `handles` structure that is provided to every GUIDE generated callback subfunction in the GUI M-file is constructed at runtime every time the GUI runs. When the GUI is fully initialized, the `handles` structure contains only handles to all the components in the GUI and custom data added in

any `CreatedFcn` callbacks and/or the `OpeningFcn`. Previously, fields that the M-file had added to the `handles` structure could sometimes become a permanent part of the structure.

### **Compatibility Considerations**

If your GUI runs well but displays error messages about missing fields in the `handles` structure when starting up, you may have to update the code in the GUI M-file where those fields are accessed. You may need to initialize those `handles` fields properly in a `CreateFcn` callback and/or in the `OpeningFcn`.

### **UNIX: File Dialog 'Location' Property Is Obsolete**

For UNIX platforms, the `Location` property of `uigetfile` and `uiputfile` is obsolete. Previously, for UNIX platforms only, you could use the `Location` property to specify the screen location at which the dialog box would originally be displayed.

### **Compatibility Considerations**

Since the UNIX `uigetfile` and `uiputfile` `Location` property is now obsolete, MATLAB ignores any occurrences in existing code of the `Location` property

```
uigetfile(...,'Location',[X Y])
```

or the older use of `X` and `Y` arguments to specify location

```
uigetfile(...,X,Y)
```

A warning is displayed for either syntax, on all platforms.

### **Functions Becoming Obsolete**

The following functions are either obsolete or grandfathered in MATLAB 7.4 (R2007a): `cshelp`, `figflag`, `getstatus`, `menulabel`, `popupstr`, `setstatus`, `hidegui`, `uigettoolbar`.

### **Compatibility Considerations**

The functions shown in the following table will continue to work but their use may generate a warning message. As soon as possible, replace any

occurrences you may have of these functions with the function(s) shown in the following table, if any, or with other suitable code.

<b>Function</b>	<b>Replacement</b>
<code>cshelp</code> , <code>figflag</code> , <code>getstatus</code> , <code>menulabel</code> , <code>popupstr</code> , <code>setstatus</code>	Grandfathered. There are no replacements. No enhancements will be made and only critical bugs will be fixed. No warnings will be displayed. These functions may become obsolete if replacements become available.
<code>hidegui</code>	Obsoleted. Now issues warnings. Set the figure <code>HandleVisibility</code> property instead.
<code>uigettoolbar</code>	Obsoleted. No warnings will be displayed until a replacement is available in a future release.

## External Interfaces/API, MATLAB Version 7.4 (R2007a)

- “New File Extensions for MEX-Files” on page 394
- “MEX-Files Built in MATLAB R11 or Earlier Must Be Rebuilt” on page 395
- “Changes to Compiler Support” on page 395
- “New COM Features” on page 399
- “Changes to Handling Microsoft® ActiveX Methods” on page 400

### New File Extensions for MEX-Files

#### MEX-Files in MATLAB for Apple Macintosh (Intel)

With the introduction of MATLAB for Macintosh (Intel), the MEX-files you build have the extension `.mexmaci`. The `mexext` command in MATLAB returns `mexmaci` for Macintosh (Intel).

**Compatibility Considerations.** MEX-files built using MATLAB for Macintosh PowerPC®, which have `.mexmac` extensions, cannot be used in MATLAB for Macintosh (Intel).

---

**Note** All MEX-files on Macintosh platforms need to be recompiled for R2007a.

---

#### MEX-Files in MATLAB for 64-bit Sun Solaris SPARC

With the introduction of MATLAB for 64-bit SolarisSPARC, you can now build 64-bit MEX-files for the Solaris platform. These MEX-files have the extension `.mexs64`. The `mexext` command in MATLAB returns `mexs64` for Solaris SPARC.

**Compatibility Considerations.** MEX-files built using MATLAB for Solaris 32, which have `.mexsol` extensions, cannot be used in MATLAB for Solaris SPARC.

---

**Note** All MEX-files on Solaris 64 platforms need to be recompiled for R2007a.

---

## **MEX-Files Built in MATLAB R11 or Earlier Must Be Rebuilt**

In order to work with MATLAB V7.4 (R2007a), MEX-files compiled on Microsoft Windows (32-bit) platforms with MATLAB R11 or earlier will no longer load correctly and must be recompiled. These files can be compiled with MATLAB R12 or later.

## **Changes to Compiler Support**

The set of compilers that MATLAB supports has changed in MATLAB Version 7.4 (R2007a). For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

- “New Compiler Support” on page 395
- “Fortran Compatibility Considerations” on page 397
- “Discontinued Compiler Support” on page 397
- “Compiler Support To Be Phased Out” on page 398
- “Additional Linker Support for Intel Fortran” on page 398

## **New Compiler Support**

MATLAB V7.4 (R2007a) supports new compilers for building MEX-files.

### **Windows (64-bit) platform.**

- Intel C++ version 9.1
- Intel Visual Fortran version 9.1

### **Windows (32-bit) platform.**

- Intel C++ version 9.1
- Intel Visual Fortran version 9.1

- Microsoft Visual C++ 2005 version 8.0 Express Edition

---

**Note** If you use the `mex -f matlabroot/bin/$ARCH/mexopts/msvc80freeopts.bat` switch to build a MEX-file using Microsoft Visual C++ 2005 Express Edition, the environment variable `MSSdk` must be defined. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server 2003. (Microsoft Visual C++ 2005 Express Edition requires Microsoft Platform SDK for Windows Server 2003.)

---

### **Macintosh PowerPC and Macintosh (Intel) platforms.**

- Apple Xcode 2.4.1 (gcc / g++ version 4.0.1)
- g95 version 0.90

---

**Note** All MEX-files on Macintosh platforms need to be recompiled for R2007a.

---

### **Linux (64-bit) platform.**

- gcc / g++ version 4.1.1
- g95 version 0.90

### **Linux (32-bit) platform.**

- gcc / g++ version 4.1.1
- g95 version 0.90

---

**Note** All Fortran MEX-files compiled on Linux platforms need to be recompiled for R2007a.

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**SolarisSPARC (64-bit) platform.**

- cc / CC version 5.8
- gcc / g++ version 3.2.3
- f90 version 8.2

**Fortran Compatibility Considerations**

In R2007a we have added support for a new Fortran compiler g95 on the Linux and Macintosh platforms. This compiler implements the Fortran 95 language standard. It replaces previously supported Fortran compilers which implemented a previous language standard.

This may cause incompatibilities in your Fortran source code for MEX-files. Refer to the IBM XL Fortran V10.1 for Linux Language standards Web site <http://publib.boulder.ibm.com/infocenter/lxpcmp/v8v101/index.jsp?topic=/com.ibm.xlf1011.doc/xlf1r/languagestandards.htm> for information about incompatibilities between language standards.

**Discontinued Compiler Support**

The following compilers are no longer supported.

**Linux (64-bit) platform.**

- gcc / g++ version 3.4.5
- g77 version 3.4.5

**Linux (32-bit) platform.**

- gcc / g++ version 3.4.5
- g77 version 3.4.5

**Macintosh PowerPC platform.**

- gcc / g++ version 3.3
- Absoft f77 / f90 version 8.2a

**Compatibility Considerations.** To ensure continued support for building your C/C++ programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

### **Compiler Support To Be Phased Out**

The following compilers are supported in Version 7.4 (R2007a) but will not be supported in a future version of MATLAB.

#### **Windows (32-bit) platform.**

- Intel C++ version 7.1
- Intel Visual Fortran 9.0
- Borland C++Builder 6 version 5.6
- Borland C++Builder 5 version 5.5
- Borland C++ Compiler version 5.5
- Compaq Visual Fortran version 6.6
- Compaq Visual Fortran version 6.1

### **Additional Linker Support for Intel Fortran**

MATLAB V7.4 (R2007a) supports new linkers for building MEX-files with Intel Visual Fortran 9.0.

#### **Windows (32-bit) platform.**

- Microsoft Visual Studio .NET 2003
- Microsoft Visual Studio 2005

#### **Windows (64-bit) platform.**

- Microsoft Visual Studio 2005
- Microsoft Platform SDK for Windows Server 2003 (Build 1289 or later)

## New COM Features

### Programmatically Connect to Instances of a COM Automation Server

MATLAB can now programmatically connect to an instance of a COM Automation server using the new `actxGetRunningServer` function.

### Improve the Custom Interface API

Changes to the `actxserver` function allow you to create a COM Automation server using a custom interface.

### New COM Data Type Support

Additional COM data type support has been added. See “Handling COM Data in MATLAB Software” for a description of supported data types.

### Enhanced Support for COM Interface Events

MATLAB users can take full advantage of event interfaces provided by COM Automation servers. This change is implemented in the `events`, `eventlisteners`, `isevent`, `registerevent`, `unregisterevent`, and `unregisterallevnts` functions.

For an example of this feature, see “Responding to Interface Events from an Automation Server”.

### Get the Status of a MATLAB Automation Server

Using the `enableservice` function you can learn the current state of a MATLAB Automation server. The function returns a logical value, where logical 1 (`true`) means MATLAB is an Automation server and logical 0 (`false`) means MATLAB is not an Automation server.

For example, if you type

```
enableservice('AutomationServer')
```

and MATLAB displays

```
ans =
```

```
1
```

then MATLAB is currently an Automation server.

## Changes to MATLAB Version-Specific ProgID

A programmatic identifier, or ProgID, is used to create a COM component. MATLAB's version-specific ProgID `Matlab.Application.N.M` now lets you specify both a major and minor version number.

For example, to specify MATLAB version 7.4, use the ProgID `Matlab.Application.7.4`.

## Changes to Handling Microsoft ActiveX Methods

Beginning in MATLAB Version 7.4 (R2007a), an ActiveX® method with the same name as a class is treated as a constructor and cannot be called in the same way as an ordinary method.

In the following example:

```
myApp = actxserver('Excel.Application');  
op = invoke(myApp.Workbooks, 'open', 'MyFile.xls');  
Sheets = myApp.ActiveWorkBook.Sheets;  
target_sheet = get(Sheets, 'item', 'Sheet1');  
invoke(target_sheet, 'Activate');  
Activesheet = myApp.Activesheet;  
cellname = 'B2';  
Range = Activesheet.cells.Range(cellname, cellname);
```

the term `Range` is both a function on the MATLAB path and a constructor of the class `Range`. MATLAB tries to execute the function `range`, which generates the error:

```
??? Error using ==> range  
Too many input arguments.
```

```
Error in ==> MyScript at 8  
Range = Activesheet.cells.Range(cellname, cellname);
```

To get the property value, use the `get` function.

For example:

```
Range = get(Activsheet.cells, 'Range', cellname, cellname);
```



# Version 7.3 (R2006b)

## MATLAB Software

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This table summarizes what's new in Version 7.3 (R2006b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.3 (R2006b)” on page 405
- “Mathematics, MATLAB Version 7.3 (R2006b)” on page 418
- “Data Analysis, MATLAB Version 7.3 (R2006b)” on page 424
- “Programming, MATLAB Version 7.3 (R2006b)” on page 425
- “Graphics and 3-D Visualization, MATLAB Version 7.3 (R2006b)” on page 434
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.3 (R2006b)” on page 438

- “External Interfaces/API, MATLAB Version 7.3 (R2006b)” on page 440



## Desktop Tools and Development Environment, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 405
- “Desktop” on page 406
- “Help” on page 409
- “Workspace, Search Path, and File Operations” on page 410
- “Editing and Debugging M-Files” on page 411
- “Tuning and Managing M-Files” on page 415
- “Publishing Results” on page 417

### Startup and Shutdown

New features and changes introduced in Version 7.3 (R2006b) are described here.

### Associate Files from MATLAB Program with Windows Operating System Using New Utility

You can run a utility from the Help browser to associate `.m`, `.mat`, `.fig`, `.p`, and `.mdl` files with the MATLAB program in the Microsoft Windows operating system. After running the utility, you will be able to start MATLAB by double-clicking any of those file types in Windows Explorer. You can still use Windows Explorer Folder Options to perform these file associations, but the utility makes the task more convenient. For details, see “Associating Files with MATLAB on Windows Platforms”.

### Redirect Output on UNIX Now Sends Errors to Shell

When you start MATLAB on platforms running The Open Group UNIX operating system using the `-nodesktop` startup option, and you redirect output, for example to a file, MATLAB now sends any errors to the shell, while normal output goes to the redirect target. This change was made so that

redirection with MATLAB follows standard behavior for the UNIX operating system.

For example:

```
matlab -nodesktop -"r magic(3), magi(5)" > test.txt
```

starts MATLAB in `nodesktop` mode, runs the statement `magic(3)` and writes the output to `test.txt`. When MATLAB runs `magi(5)`, execution fails and MATLAB displays the error message in the shell.

**Compatibility Considerations.** In previous versions, MATLAB redirected both output and error messages, so in the above example, MATLAB wrote the output of `magic(3)` as well as the error message from `magi(5)` to `test.txt`.

If you have shell scripts that use `>` to redirect output, and you rely on errors appearing in the output target, you need to modify the `matlab` startup statements in those scripts.

To achieve the former behavior, that is, to redirect both output and errors to the specified target, use that specific redirect syntax for your shell. For example, in `tcsh`, use `>&`, as in

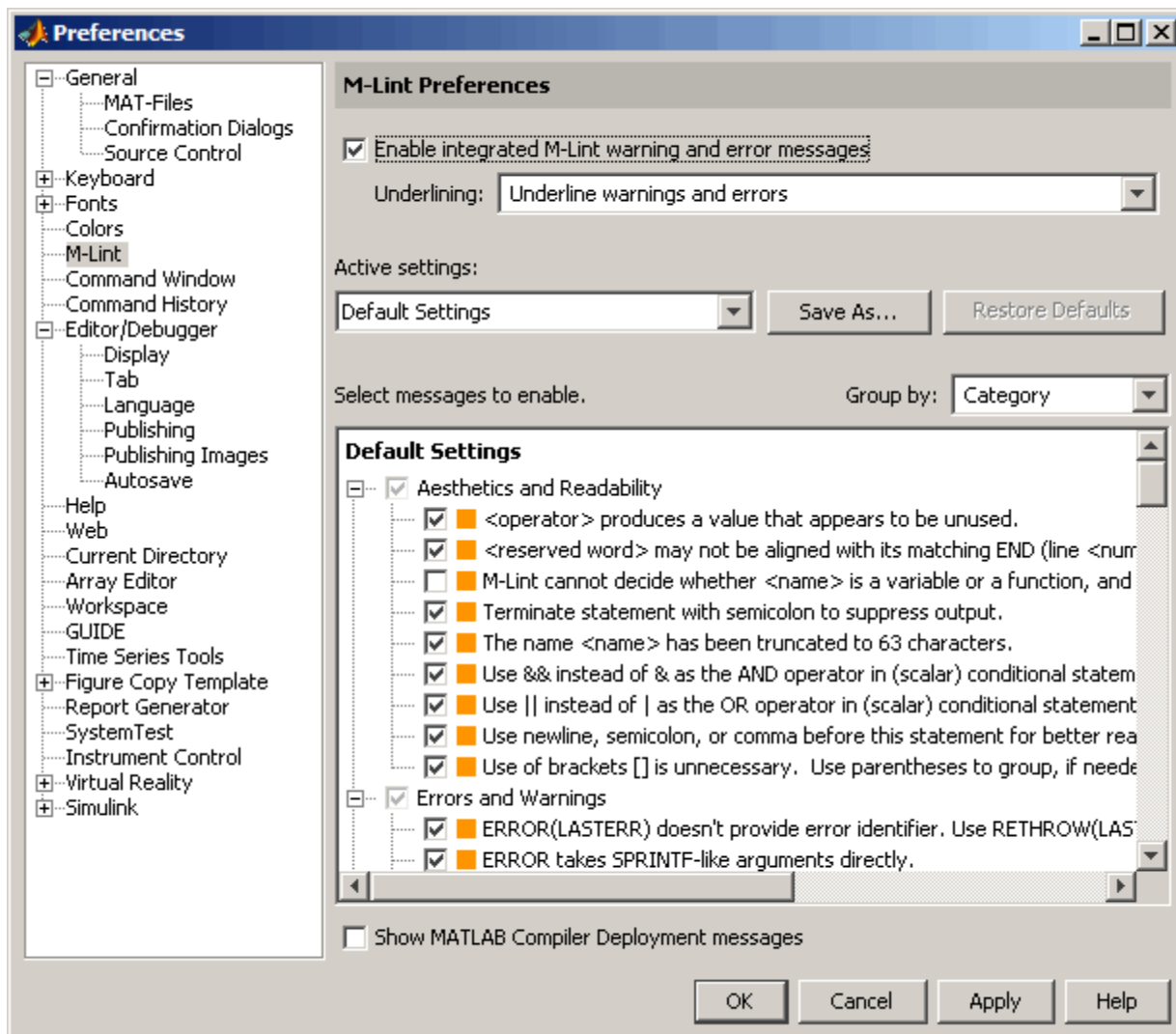
```
matlab -nodesktop -"r magic(3), magi(5)" >& test.txt
```

## Desktop

New features and changes introduced in Version 7.3 (R2006b) are described here.

### **M-Lint Preferences Added and Now Appear on M-Lint Panel**

M-Lint preferences now appear on a new M-Lint panel. There are new M-Lint preferences to disable specific messages or categories of messages, as well as to save the settings for use in a later session. In addition, you can choose to show or hide messages for the MATLAB Compiler product if the MATLAB Compiler product is installed. These new M-Lint preferences apply to the M-Lint code analyzer operating automatically in the Editor/Debugger as well as to the M-Lint Code Check Report you run via the Current Directory browser Directory Reports or **Tools > M-Lint > Show M-Lint Report**.



**Compatibility Considerations.** M-Lint preferences were previously accessed via the Editor/Debugger Language settings for M.

## Close All Documents and Close Selected Documents Feature Added

When you have multiple documents open within a tool, such as M-files in the Editor/Debugger, select **File > Close** to readily close selected files in that tool. Alternatively, right-click the document bar to close all open documents or all open documents except the selected document in that tool.

## Accessibility Documentation Included

Accessibility features and assistive technologies are now part of the Desktop documentation. In prior versions, they were documented in the general Release Notes.

## New Look and Feel on Linux and Solaris Platforms

MATLAB has a new look and feel on the Linux operating system from Linus Torvalds and the Sun Microsystems Solaris operating system that affects windows, decorations, color schemes, and responsiveness of the interface in MATLAB.

**Compatibility Considerations.** All of the changes are cosmetic, except for file dialog boxes, like Open file. The new file dialog boxes are more conventional and easier to use than in previous versions, and there is no loss in functionality.

## Invalid info.xml File on Path Now Generates an Error

When MATLAB finds an `info.xml` file on the search path or in the current directory, it assumes the file is intended to add information to the **Start** button or the Help browser, and automatically validates the file against the supported schema. If there is an invalid construct in the `info.xml` file, MATLAB displays an error in the Command Window. The error is typically of the form

```
XML-file failed validation against schema located in
...
XML-file name: full path to...\info.xml
```

and might appear when you start MATLAB, press the **Start** button, or in other situations. For more information about the error and how to eliminate it, see “Add Your Own Toolboxes to the Start Button”.

**Compatibility Considerations.** In previous versions, MATLAB displayed a warning when it encountered an invalid `info.xml` file.

## Help

New features and changes introduced in Version 7.3 (R2006b) are described here.

### Exact Phrase and Wildcard Searching Added; Change to Search Database

These improvements were made to the Help browser search feature. Note that they are not supported on Japanese systems.

- **Search Field Always Shown** — The **Search for** field is now always in view when the Help browser is open. The list of pages found appears in the **Search Results** tab.
- **Exact Phrase Searches for More Relevant Results** — Find an exact phrase by typing quotation marks around the search term. For example, "plot tools" finds only pages that include plot tools together, but does not find pages that include plot in one part of the page and tools in another part of the page. You can specify more than one exact phrase in a search term, such as "plot tools" "figure palette".
- **Wildcards (\*) in Search Terms for Variations of a Word (Partial Word Search)** — Use the wildcard character (\*) in place of letters or digits in your search terms. For example, plot\* finds various forms of the word plot, such as plot, plots, and plotting, while p\*t find those variations as well as variations of print and part, among others. You can use multiple wildcards in a word or search term.
- **Boolean Operator Evaluation Order Changed** — Boolean NOT operators in search terms are now evaluated first, followed by ORs, and then ANDs. In prior versions, Boolean operators were evaluated in left to right order.

**Compatibility Considerations.** The search enhancements were facilitated by changing to a new type of database. As a result, any existing Help search databases for non-Mathworks products will not work in R2006b and beyond. The documentation still displays in the Help browser, but it is not included in searches.

If you use Help browser documentation for non-MathWorks products with a pre-R2006b search database, a message will display in the Help browser to notify you that the documentation will not be included in searches. If you want search to work for that documentation, contact the product provider to request an R2006b-compatible search database.

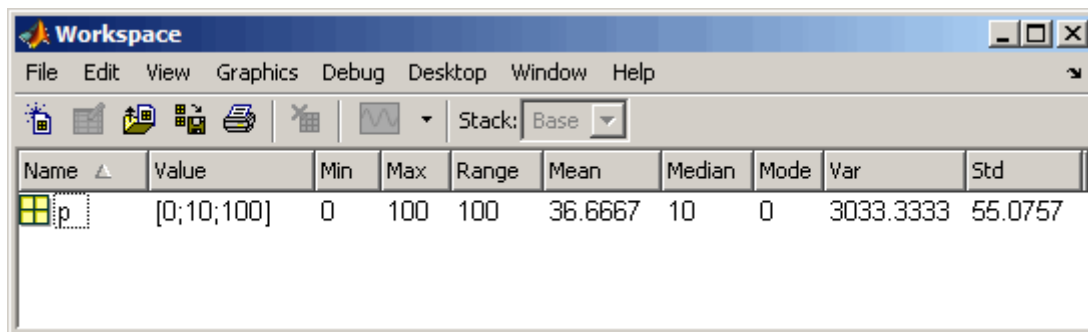
If you provide documentation for the Help browser and want the documentation to be included in the searches, you need to update the `helpsearch.db` entry in the `info.xml` file to the `helpsearch` directory, and prepare an R2006b-compatible help search database. This process is much easier than in the past. For instructions, contact Technical Support.

## Workspace, Search Path, and File Operations

New features and changes introduced in Version 7.3 (R2006b) are described here.

### Statistical Results in Workspace Browser

The Workspace browser includes new columns that automatically display results of common statistical calculations: Minimum, Maximum, Range, Mean, Median, Mode, Variance, and Standard Deviation. Use **View > Choose Columns** to specify the columns to show.



See also **File > Preferences > Workspace** for associated preferences.

### Open Larger Arrays in Array Editor

You can open larger arrays in the Array Editor. In previous versions, large arrays would fail to open in the Array Editor.

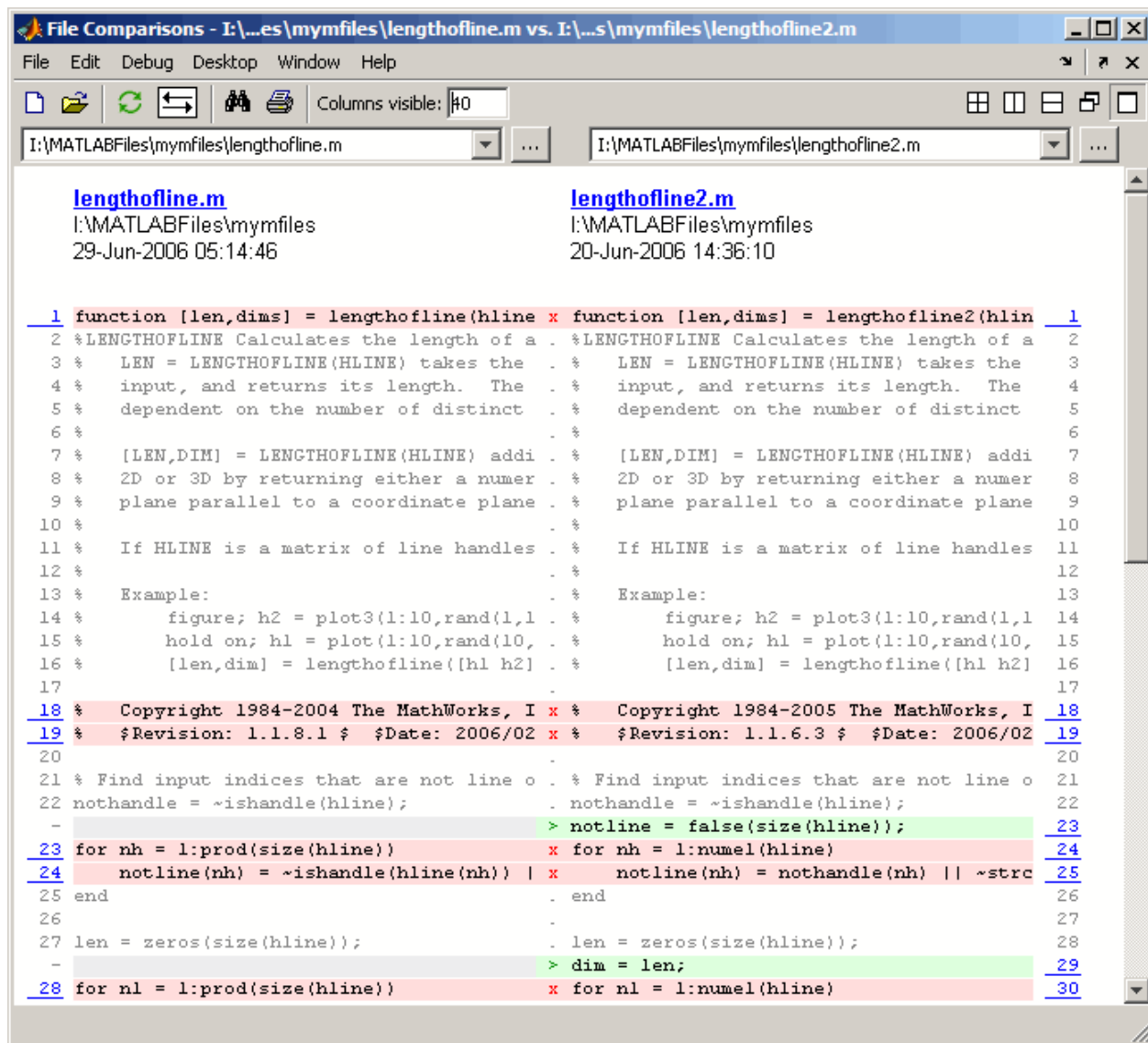
## Editing and Debugging M-Files

New features and changes introduced in Version 7.3 (R2006b) are

- “File Comparisons Tool Added” on page 411
- “M-Lint Enhancements for Suppressing Messages, and Showing Messages for the MATLAB® Compiler Product” on page 413
- “Restore Breakpoints Using New dbstop Feature” on page 414
- “End Debugging Completely Using New dbquit('all') Option” on page 414

### File Comparisons Tool Added

Use the new File Comparisons tool to highlight the differences between two files. Open a file, select **Tools > Compare Against**, and then browse to select the second file or drag it into the tool from the Current Directory browser or Windows Explorer. The two files appear aligned in a window with highlights and indicators for any lines that differ, as shown in this example. For more information, see “Comparing Files and Folders”.



Use elements in the toolbar to exchange the left-right positions of the two files and to specify the number of columns shown.



You can also run the File Comparisons tool from the desktop by selecting **Desktop > File Comparisons**. Drag a file from the Current Directory browser or Windows Explorer into the tool. Then drag the second file into the tool.

## **M-Lint Enhancements for Suppressing Messages, and Showing Messages for the MATLAB Compiler Product**

These are the new features and changes to M-Lint:

- “General Enhancements—Japanese Messages, and Line Number in Indicator Bar” on page 413
- “Suppressing M-Lint Messages” on page 413
- “Deployment Messages in M-Lint” on page 414
- “Compatibility Considerations” on page 414

### **General Enhancements—Japanese Messages, and Line Number in Indicator Bar.**

- On Japanese systems, messages now appear in Japanese.
- The messages that appear at the indicator bar now includes the line number.

**Suppressing M-Lint Messages.** The M-Lint automatic code analyzer in the Editor/Debugger now provides a few ways for you to suppress specific messages and categories of messages:

- Ignore Specific Instance — Right-click at the underline for an M-Lint message, and from the context menu, suppress just that instance. M-Lint adds `%#ok` and a new message ID tag to the end of the line, which is the syntax in MATLAB for suppressing an M-Lint message.
- Disable All Instances — Right-click at the underline for an M-Lint message, and from the context menu, disable all instances of that message in all files. This changes the preference setting for that message.
- Use Preferences to Disable All Instances — Select **File > Preferences > M-Lint**, and disable specific messages or categories of messages, which applies to all instances in all files. You can save the

settings to an M-Lint preference file. From the Editor/Debugger, you can select the M-Lint preference file from the **Tools > M-Lint** menu.

The M-Lint Code Check report also uses the preferences and suppresses the display of specific messages and categories of messages, per the preference settings.

**Deployment Messages in M-Lint.** M-Lint now displays deployment messages for the MATLAB Compiler product, such as MCC does not permit the CD function, which appear if the MATLAB Compiler product is installed and you select the M-Lint preference to **Show MATLAB Compiler deployment messages**. You can also disable or enable all deployment messages via the Editor/Debugger **Tools > M-Lint** menu. You can suppress specific messages using the same methods as for other M-Lint messages.

**Compatibility Considerations.** M-Lint preferences were previously accessed via the Editor/Debugger Language settings for M. See also “mlint Message IDs Changed and %#ok Syntax Enhanced” on page 415

### **Restore Breakpoints Using New dbstop Feature**

You can save the status of breakpoints to a MAT-file using `s=dbstatus` and restore the breakpoint status at a later time by loading the MAT-file using the new `dbstop(s)` option. For example, set breakpoints in `collatz`. Run `s=dbstatus` to assign the breakpoint status to `s`; use the '**completenames**' option to save absolute pathnames and breakpoint function nesting sequence. Save `s` to a MAT-file by running, for example, `save mydebugsession s`. At a later time, run `load mydebugsession` to restore `s`, and then run `dbstop(s)` to restore the breakpoints.

### **End Debugging Completely Using New dbquit('all') Option**

If you debug multiple files at once, you can exit debug mode for all files by running `dbquit('all')`. If you debug `file1` and step into `file2`, running `dbquit` terminates debugging for both files. However, if you debug `file3` and also debug `file4`, running `dbquit` terminates debugging for `file4`, but `file3` remains in debug mode until you run `dbquit` again. The new `dbquit('all')` option ends debugging for both `file3` and `file4`, and as `dbquit` does, ends debugging for `file1` and `file2`.

## Tuning and Managing M-Files

New features and changes introduced in Version 7.3 (R2006b) are described here.

### File Comparison Directory Report Removed; Replaced by File Comparison Tool

The File Comparison Report, one of the directory reports available in the Current Directory browser, was removed.

**Compatibility Considerations.** The new File Comparisons tool replaces the File Comparison Report. The tool provides the same functionality as the report did, and adds new features. For details, see “File Comparisons Tool Added” on page 411.

### M-Lint Code Check Report Enhancements and Changes

You can indicate specific messages or categories of messages you want M-Lint to report. For details, see “M-Lint Enhancements for Suppressing Messages, and Showing Messages for the MATLAB® Compiler Product” on page 413.

**Compatibility Considerations.** In previous versions, the M-Lint Code Check report showed all messages except those suppressed via a `%#ok` at the end of a line. Now, the M-Lint Code Check report will show only the messages that are enabled via M-Lint preferences.

### mlint Message IDs Changed and %#ok Syntax Enhanced

The `mlint` function with the `-id` option returns message IDs using a new form. For example, when you run

```
mlint('filename.m', '-id')
```

MATLAB Version 7.2 (R2006a) returns

```
L 22 (C 1-9) 2:AssignmentNotUsed : The value ...
```

whereas MATLAB Version 7.3 (R2006b) returns

```
L 22 (C 1-9): NASGU: The value ...
```

The `%#ok` syntax used in M-files to suppress the display of M-Lint messages for a line has been enhanced to support multiple messages per line. For example, given this line in an M-file,

```
data{nd} = getfield(flds,fdata{nd});
```

two M-Lint messages result:

```
34: 'data' might be growing inside a loop; ...  
    consider preallocating for speed.
```

```
34: Use dynamic fieldnames with structures instead of GETFIELD...  
    Type 'doc struct' for more information.
```

In MATLAB Version 7.2 (R2006a), M-Lint messages could only be suppressed for the entire line:

```
data{nd} = getfield(flds,fdata{nd}); %#ok
```

In MATLAB Version 7.3 (R2006b), you can still use `%#ok` to suppress all messages for the line, or you can add an ID tag to indicate the exact messages to suppress. For example, this suppresses only the first message about `data` growing inside a loop:

```
data{nd} = getfield(flds,fdata{nd}); %#ok<GFLD>
```

To suppress more than one message per line, separate the ID tags with a comma. For example, this suppresses both messages:

```
data{nd} = getfield(flds,fdata{nd}); %#ok<GFLD,AGROW>
```

**Compatibility Considerations.** In previous versions, the message IDs returned from `mlint` with the `-id` option, were of a form that included a numeric identifier, followed by the category. If you rely on the exact ID values, you will need to make modifications to use the new form.

If you use M-Lint in MATLAB Version 7.3 (R2006b) and then run those files a previous version, M-Lint in the previous version ignores the tag and IDs that follow the `%#ok`, and therefore suppresses all messages for that line, which is the expected behavior for the previous version.

## **mlintrpt Option Added to Use Preference Settings File**

The `mlintrpt` function now accepts a new option that applies the preferences saved to an M-Lint settings file. It works with the `file` or `dir` syntax:


```
mlintrpt('fullpath_to_file', 'file', 'fullpath_to_configfile.txt')
mlintrpt('fullpath_to_dir', 'dir', 'fullpath_to_configfile.txt')
```

For example, create the file `NoSemiSetting.txt` by saving settings in **File > Preferences > M-Lint**. Later, use the settings via preferences or M-Lint in the Editor/Debugger, or via `mlintrpt` as in this example:

```
mlintrpt('lengthofline.m', 'file', 'I:\MATLABFiles\NoSemiSettings.txt')
```

which displays an M-Lint report in the MATLAB Web browser for the `lengthofline` file in the current directory using the M-Lint settings in `I:\MATLABFiles\NoSemiSettings.txt`.

## **Toolbar Refresh Button Removed**

The Profiler included a refresh button  on the toolbar. This button has been removed. It performed an action similar to the **Refresh** button that appears in many of the Profiler reports, so use that button instead.

## **Publishing Results**

### **notebook Setup Arguments Removed**

In MATLAB 7.1 (R14SP3), the notebook function was enhanced to automatically detect the version of the Microsoft Word application and other required information. This feature changed the `notebook -setup` syntax—arguments to specify the version of the Microsoft Word application (`wordversion`, `wordlocation`, `templatelocation`) were no longer supported. If you used those arguments, MATLAB ignored them and issued a warning. Now in MATLAB 7.3 (R2006b), if you use those arguments, MATLAB errors.

**Compatibility Considerations.** If you use notebook with the `wordversion`, `wordlocation`, and `templatelocation` arguments in any of your files (for example, `startup.m`), remove them to prevent errors.

## Mathematics, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “New Functions” on page 418
- “max and min Now Use Magnitudes and Phase Angle for Complex Input” on page 419
- “Additional Output from lu” on page 419
- “Upper and Lower Factors for chol and ldl” on page 419
- “Permutation Vectors with lu, luinc, ldl” on page 419
- “Two-Element Threshold for lu, spparms” on page 419
- “Lower Triangular Factors from symbfact” on page 420
- “Support for New Versions of AMD, COLAMD, CHOLMOD, UMFPACK” on page 420
- “Sparse Arrays on 64-Bit Systems” on page 421
- “FFTW Upgraded to Version 3.1.1 in MATLAB” on page 421
- “Future Obsolete Functions” on page 422
- “Obsolete Functions” on page 422
- “max and min No Longer Return Warning Messages for Inputs with Different Data Types” on page 423

### New Functions

Function	Description
amd	Interface to the amd algorithm. This interface is similar to that used in symamd, but is typically faster than symamd.
bvpxtend	Forms a guess structure for extending the boundary value problem solution
ld1	Full ld1 factorization and solving for Hermitian matrices

## **max and min Now Use Magnitudes and Phase Angle for Complex Input**

For complex input, `min` and `max` are computed using the magnitude, `min(abs(x))` and `max(abs(x))` respectively. In the case of equal magnitude elements, the phase angle, `min(angle(x))` and `max(angle(x))`, is now used.

### **Compatibility Considerations**

In previous versions, `min` and `max` were computed using the magnitude, and in the case of equal magnitude elements, the first element was used. This behavior was indeterministic and not consistent with the `sort` function.

Code in previous releases that relied on the output of this functionality for the case described above should be updated.

## **Additional Output from lu**

The `lu` function returns an additional output that helps improve numerical stability of sparse `lu` factorization.

## **Upper and Lower Factors for chol and ldl**

Upper and lower triangular factors for `chol` and `ldl` improve performance for sparse `chol`. Referencing the lower triangle and returning the lower triangular factor is more memory efficient in the case of sparse `chol`.

## **Permutation Vectors with lu, luinc, ldl**

Permutation vectors for `lu`, `luinc`, and `ldl` provide memory savings and, for large data, a noticeable performance improvement. You can now store permutation information in a single 1-by-N vector instead of an n-by-n matrix,

## **Two-Element Threshold for lu, spparms**

A new two-element threshold for `lu` and `spparms` gives you more control over sparse `lu` and `sparse \` behavior.

## Lower Triangular Factors from `symbfact`

Extra arguments exported for `symbfact` allow the return of the lower triangular symbolic factor.

## Support for New Versions of `AMD`, `COLAMD`, `CHOLMOD`, `UMFPACK`

MATLAB 7.3 supports new versions of the following libraries:

Library Name	Version Supported in MATLAB 7.3
AMD	2.0
COLAMD	2.5
CHOLMOD	1.1
UMFPACK	5.0



## Sparse Arrays on 64-Bit Systems

The internal storage of sparse arrays on 64-bit systems has changed in the R2006b release. This change should be invisible to most MATLAB users. However, MEX-file programs that run on a 64-bit system and access sparse arrays must be modified and recompiled in order to run on MATLAB Version 7.3. This applies to existing MEX-files and to any new MEX-files that you write.

If you are affected by this change, you will need to take the following steps to make your code compatible with the new sparse array format:

- Modify all sparse array declaration statements in MEX-files that are to run on a 64-bit system so that they now use the `mwSize` and `mwIndex` types instead of more specific type declarations such as `int` or `INTEGER*4`.
- Change any MEX code that assigns a negative value to a variable used to hold a sparse array index or size. An example of this would be code that temporarily uses an array index as a flag, assigning a `-1` to it to mark the index as unset. Do not try to cast negative `int` values to `mwSize` or `mwIndex`. Instead, change your code to avoid using negative values.
- Recompile these MEX-files using the `-largeArrayDims` option

For a full description of what you will need to do, please read the section “Sparse Arrays on 64-bit Systems” on page 441 in the MATLAB External Interfaces release notes.

## Compatibility Considerations

Existing MEX-files that run on 64-bit systems and access sparse arrays in MATLAB will not operate correctly in MATLAB 7.3 unless the required changes outlined above are made and the files are recompiled with the `-largeArrayDims` option. New MEX-files that you create must also adhere to these guidelines.

## FFTW Upgraded to Version 3.1.1 in MATLAB

The version of FFTW used in MATLAB has been upgraded from 3.0.2 to 3.1.1. Please read the “Compatibility Considerations” on page 422 section, below.

Other changes in MATLAB FFTW support are:

- The default planner method is now `estimate`. Previously, `hybrid` was the default.
- There are new syntaxes for importing from and exporting to the library's internal single- and double-precision wisdom databases. These are as follows and are documented in the reference page for the MATLAB `fftw` function:
  - `str = fftw('dwisdom')`
  - `str = fftw('swisdom')`
  - `fftw('dwisdom', str)`
  - `fftw('swisdom', str)`

### Compatibility Considerations

FFTW version 3.1.1 does not support wisdom produced by previous versions of the FFTW library. For this reason, FFTW wisdom that has been exported from a previous version of MATLAB cannot be imported successfully in MATLAB R2006b. Trying to import “old” wisdom results in a warning.

### Future Obsolete Functions

The `betacore` function generates a warning message in R2006b but completes successfully. This function will be made obsolete in a future release.

### Compatibility Considerations

You should remove all instances of the `betacore` function from your M-file program code. This function will not be supported in a future release of MATLAB.

### Obsolete Functions

The following uses of MATLAB functions are obsolete as of this release. Attempts to use this functionality in the R2006a release generate a warning message but complete successfully. In R2006b, these operations fail and generate an error message.

- The following functions in their entirety: `bvpval`, `quad8`, `table1`, `table8`, `bessela`

- The `sort` function, when used with complex integer inputs
- The `gt`, `ge`, `lt`, and `le` functions, when used with complex integer inputs
- The `beta` function, when used with 3 inputs
- The `gamma` function, when used with 2 inputs
- The `opts.cheb` and `opts.stagtol` fields in the options structure of `eigs`

### **Compatibility Considerations**

You will need to remove all instances that reference these functions at this time. These functions are no longer supported in MATLAB.

## **max and min No Longer Return Warning Messages for Inputs with Different Data Types**

In MATLAB version 7.0 (Release 14), the functions `max` and `min` were changed to return results of a different data type than in previous releases. This behavior is described in “`max` and `min` Now Have Restrictions on Inputs of Different Data Types” on page 609. This change in behavior produced warning messages to assist you with diagnosing any resulting issues. In R2006b, these warning messages no longer exist.

### **Compatibility Considerations**

The warning messages for mixed-type inputs to the functions `max` and `min` are no longer produced. Turning warning messages on will no longer display messages for this behavior, and you will no longer be able to depend on the messages for the diagnosis of problems.

## Data Analysis, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Generate M-File Now Supports Basic Fitting and Data Statistics” on page 424
- “New Options for Working with Time Series Objects” on page 424

### Generate M-File Now Supports Basic Fitting and Data Statistics

The **Generate M-File** option on the **File** menu of MATLAB figure windows now generates code that reproduces plot objects created with the Basic Fitting Tool or the Data Statistics Tool. The generated M-file function accepts new data as input and creates plot objects with the same graphics properties as those in the generating figure. In addition, the M-file recomputes fits and statistics for the new data. The code shows you how to program what you do interactively with the Basic Fitting Tool or the Data Statistics Tool.

### New Options for Working with Time Series Objects

- Time Series Tools are now easier to find. From the MATLAB **Start** button, select **MATLAB > Time Series Tools**.
- Time series objects are now fully supported by the Array Editor. When you open a `timeseries` object (using `open` or the Workspace browser), the editor from Time Series Tools appears in the Array Editor.
- Time series objects can now be opened directly in Time Series Tools. Select a `timeseries` object in the Workspace browser, right click, and choose **Open in Time Series Tools** from the context menu.
- In Time Series Tools, you can now change subplot indices interactively. Click on a plotted line in a time series view and drag and drop it from one subplot to another. To create a new subplot, drag and drop the plotted line below the bottom axes.

## Programming, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Saving to MAT-Files Larger than 2 GB” on page 425
- “Import Wizard Generates Import M-Code” on page 427
- “New Dynamic Regular Expression Syntax” on page 427
- “New Reserved MATLAB Keywords” on page 427
- “Enhancements to Display Generated by whos” on page 428
- “unique Function Returns First and Last Indices” on page 429
- “save Compression and Unicode Options Removed” on page 429
- “Warning Generated by try-catch” on page 430
- “Case-Sensitivity Warning Removed” on page 431
- “fprintf(0,...) Now Throws an Error” on page 431
- “Assigning Nonscalar Structure Array Fields to a Single Variable” on page 432
- “Comma Separators Not Required in Function Declaration” on page 433
- “Improved Performance on Certain Platforms and Operations” on page 433

### Saving to MAT-Files Larger than 2 GB

With MATLAB R2006b, you can save data items that are over 2 gigabytes in size. This capability is implemented in MATLAB using a new HDF5-based format for MAT-files.

To save to a MAT-file in this format, specify the new `-v7.3` option with the `save` function:

```
save -v7.3 myfile v1 v2
```

---

**Note** MATLAB Version 7.3 does not write MAT-files in HDF5 format by default in this release; you must explicitly specify the `-v7.3` switch.

---

In this release,

- The default MAT-file format employed by `save` is the standard MAT-file format used in the R14, R14SP, and R2006a releases. You can explicitly specify this format with the command `save -v7`.
- To write an HDF5-based MAT-file, you must use `save -v7.3`.
- HDF5-based MAT-files are *not* compressed.

In a future release,

- The default MAT-file format will be the HDF5-based format. You can explicitly specify the HDF5-based format with the command `save -v7.3`.
- To write the standard MAT-file format, you must use `save -v7`.
- As of release R2008a, HDF5-based MAT files are compressed.

Here is a summary of the version options that you can use with `save`:

<b>save Option</b>	<b>Description</b>	<b>Available In</b>	<b>Is the Default In</b>
<code>save -v4</code>	Save to a MAT-file you can open in MATLAB version 4	V5 and later	V4, V5
<code>save -v6</code>	Save to a MAT-file you can open in MATLAB versions 5 or 6	V7 and later	V6
<code>save -v7</code>	Save to a MAT-file you can open in MATLAB version 7	V7.3 and later	V7.3
<code>save -v7.3</code>	Save to a MAT-file that supports data items $\geq 2$ GB	V7.3 and later	post V7.3

### Compatibility Considerations

If you are running MATLAB on a 64-bit computer system and you attempt to save a variable that is too large for a version 7 (or earlier) MAT-file, that is, you save without using the `-v7.3` option, MATLAB skips that variable during the `save` operation and issues a warning message to that effect.

If you are running MATLAB on a 32-bit computer system and attempt to load a variable from a -v7.3 MAT-file that is too large to fit in 32-bit address space, MATLAB skips that variable and issues a warning message to that effect.

## Import Wizard Generates Import M-Code

The Import Wizard now includes an automated M-code generation option. Click the Generate M-code button located in the lower right of the Import Wizard window and MATLAB generates an M-file that you can use to import additional files that are similar in type to the file you are currently importing. This simplifies the process of importing multiple files into MATLAB.

## New Dynamic Regular Expression Syntax

The new (`?@cmd`) operator specifies a MATLAB command that `regexp` or `regexpi` is to run while parsing the overall match expression. Unlike the other dynamic expressions in MATLAB, this operator does not alter the contents of the expression it is used in. Instead, you can use this functionality to get MATLAB to report just what steps it's taking as it parses the contents of one of your regular expressions. This can be helpful in debugging regular expressions, for example.

## New Reserved MATLAB Keywords

Two new reserved keywords have been added to the MATLAB language in this release:

- `parfor` – designates a for loop in the Distributing Computing Toolbox
- `classdef` – signals the beginning of a MATLAB class definition

The `iskeyword` function returns `true` for each of these functions, thus identifying them as reserved keywords in MATLAB:

## Compatibility Considerations

MATLAB keywords are reserved for use internal to MATLAB, and should not be used in your own program code as identifiers or function names. If your code uses either of these two new keywords in this manner, you should modify your code and use words that are not reserved.

## Enhancements to Display Generated by whos

The visual output of the information returned by `whos` looks slightly different in R2006b than in previous releases. Changes are as follows:

- There is a new column in the output called `Attributes` that identifies values that are `sparse`, `complex`, `global`, or `persistent`.
- The words “array” and “object” have been dropped from items under the `Class` heading. Items formerly listed as `double array` or `timer object`, for example, are now displayed as `double`, and `timer`.
- MATLAB no longer includes summary information showing the “Grand total” of elements and bytes at the bottom of the `whos` output display.
- There is an additional field in the structure returned by `whos`. This new field is `'persistent'` and is set to logical 1 for those variables that are persistent, or logical 0 otherwise.

Here is an example of the information displayed by `whos` in MATLAB 7.3:

```
whos
  Name          Size          Bytes  Class          Attributes
  -----
vCell          5x7             2380  cell
vComplex       6x2              192  double         complex
vDouble        6x5x9           2160  double
vFuncHdl       1x1               16  function_handle
vGlobal        0x0                0  double         global
vObject        1x1              248  timer
vPersist       0x0                0  double         persistent
vSparse        15x15            244  double         sparse
vStruct        1x3              804  struct
```

## Compatibility Considerations

If any of your programs depend on the displayed output of `whos`, specifically in relation to the changes listed above, you might have to modify your program code. Also, if your code relies on a specific number of fields for the output structure, you should be aware that this release adds a new field: `persistent`.



## unique Function Returns First and Last Indices

Using the new `first` option with the `unique` function returns a vector with elements that represent the *lowest* indices of unique elements in the input vector.

Given the following vector A

```
A = [16 7 5 41 2 16 8 2 6 3 16 6 2 5 2 5];
```

Get a sorted vector of the unique elements of A:

```
v = unique(A)
v =
     2     3     5     6     7     8    16    41
```

Use the `first` and `last` options to get indices of the first and last elements in A that make up the sorted vector v:

```
[v, m1] = unique(A, 'first');
m1
m1 =
     5    10     3     9     2     7     1     4

[v, m2] = unique(A, 'last');
m2
m2 =
    15    10    16    12     2     7    11     4
```

## save Compression and Unicode Options Removed

In MATLAB Versions 7.0 through 7.2, you could use the switches `compress`, `nocompress`, `unicode`, and `nounicode` with the `save` function to enable or disable compression and Unicode character encoding in the MAT-file being generated. In MATLAB Version 7.3, the `save` function no longer supports these switches. Instead, `save` now creates a MAT-file with compression and Unicode character encoding by default, or with the following command:

```
save -v7 filename
```

You can still save to a MAT-file without using compression or Unicode encoding. In fact, you will have to do this in order to create MAT-files that you

can load into a MATLAB Version 6 or earlier. To save to a MAT-file without compression or Unicode encoding, type

```
save -v6 filename
```

To disable compression and Unicode encoding for all save operations in a MATLAB session, open the MATLAB **Preferences** dialog, select **General** and then **MAT-Files**, and then click the button labelled **Ensure backward compatibility (-v6)**.

### Compatibility Considerations

If you have code that uses any of these option switches with the save function, you will need to modify that code to use the `-v6` option instead.

### Warning Generated by try-catch

To accommodate future changes in the MATLAB error handling capabilities, MathWorks has added a new restriction to the single-line syntax of the try-catch block. In this release, the following syntax operates as it did in previous releases, but now it also generates the following warning message:

```
try try_statements, catch catch_statements, end
```

Warning: This try-catch syntax will continue to work in R2006b, but may be illegal or may mean something different in future releases of MATLAB.

To make this single-line try-catch work without warning in R2006b, you must insert a separator character (comma, semicolon, or newline) immediately after the word `catch`

```
try try_statements, catch, catch_statements, end
```

As with previous releases, the recommended syntax for a try-catch block is as follows:

```
try
    try_statements
catch
    catch_statements
```

end

### **Compatibility Considerations**

Your M-file programs may generate this warning if correct syntax for `try` and `catch` is not used.

### **Case-Sensitivity Warning Removed**

The following warning has been removed from MATLAB in release R2006b:

```
"Function call foo invokes /somewhere/on/the/path/foo.m,  
however, function /somewhere/ahead/on/the/path/FOO.m that  
differs only in case precedes it on the path."
```

In previous versions of MATLAB, this warning message was triggered when you called a function such as `foo`, and all of the following were true:

- There was more than one MATLAB file of this name on the MATLAB path
- The names of these files differed only in letter case, and
- A MATLAB file of this name but with different case (e.g., `FOO.m`) preceded a file of matching case (e.g., `foo.m`) on the path

Earlier versions of MATLAB displayed this warning for the purpose of helping users cope with newly-introduced case sensitive dispatching changes. The warning is being removed at this time under the assumption that users are now sufficiently well-acquainted with the way MATLAB handles case sensitivity in function calls.

### **Compatibility Considerations**

The dispatching behavior regarding to the case sensitivity is NOT changed with the removal of this warning message. If both an exact match and inexact match are present on the path, the exact match is always the one to be invoked.

### **fprintf(0,...) Now Throws an Error**

Commands such as `fprintf(0, ...)` and `fwrite(0, ...)`, in which the file identifier is zero (the same as `stdin`) now result in an error being thrown.

In previous releases, MATLAB did not throw an error in response to these commands, even though printing or writing to `stdin` is clearly not a valid option.

### **Compatibility Considerations**

If any of your programs use lower-level MATLAB file I/O functions that send output to `stdin`, because these functions no longer ignore this type of operation, your code will now generate an error. You should modify your program code to use a file identifier other than zero.

## **Assigning Nonscalar Structure Array Fields to a Single Variable**

In the R14 and R14 service pack releases of MATLAB, assigning a nonscalar structure array field to a single variable incorrectly resulted in an error. For example, in the following code, you should be able to assign `S.A` to one, two, three, or four output variables. However, if you assign to just a single variable, MATLAB throws an error:

```
% Create a 1-by-4 structure array S with field A.
S(1).A = 1;   S(2).A = 2;   S(3).A = 3;   S(4).A = 4;

% Assigning S(1).A and S(2).A works as expected.
[x y] = S.A
x =
    1
y =
    2

% Assigning only S(1).A should work, but does not.
x = S.A;
??? Illegal right hand side in assignment. Too many elements.
```

This has been fixed in MATLAB 7.3.

### **Compatibility Considerations**

If any of your programs rely on this error being thrown, you will need to modify those programs.

## Comma Separators Not Required in Function Declaration

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. This now makes the function definition syntax the same as the syntax used when calling an M-file function:

```
function [A B C] = myfun(x, y)
```

## Compatibility Considerations

This new syntax is not valid in MATLAB versions earlier than Release 14. When writing an M-file that you expect to run on versions both earlier and later than R14, be sure to separate any output variables in the function definition line with commas:

```
function [A, B, C] = myfun(x, y)
```

## Improved Performance on Certain Platforms and Operations

In this release, MATLAB offers improved performance in the following areas:

- Improved performance on 64-bit Windows XP and Linux platforms. This is independent of the size of data set in use.
- Faster scalar indexing into cell arrays.
- Faster assignment of cell array data to variables.

## Graphics and 3-D Visualization, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Plotting Tools Are Now Modular Desktop Components” on page 434
- “Version 6 Property Editor Has Been Removed” on page 434
- “New Desktop Printing GUI” on page 435
- “Zoom Mode Now Supports Mouse Scroll Wheel” on page 435
- “Data Cursor Text Can Now Be Programmatically Modified” on page 436
- “Customizing Zoom, Pan, and Rotate3D Data Explore Modes” on page 436
- “Improvements to MATLAB Graphics Documentation” on page 437

### Plotting Tools Are Now Modular Desktop Components

The three MATLAB plotting tools (Figure Palette, Property Editor, and Plot Browser) now function as desktop components like the Workspace Browser and the Array Editor. They dock, however, not to the MATLAB desktop but to a Figures window. Figures windows contain one or more figures, each of which is accessible by a tab. Turning on any plotting tool changes your figure group into a mini-desktop. You can undock, rearrange, tab, and resize the plot tools within the mini-desktop, and their state will persist across MATLAB invocations. There are just one set of plot tools for all your figures, but they only operate on figures contained in the group; undocked figures are free of the plotting tools until you redock them.

For more information see Plotting Tools – Interactive Plotting in the MATLAB Graphics documentation.

### Version 6 Property Editor Has Been Removed

The MATLAB Version 6 Property Editor, one of the Plotting Tools, is no longer available. This means that the 'v6' switch for the `propedit` function now produces an error instead of starting the version 6 property editor. The error message is

```
??? Error using ==> propedit
```

The Version 6 property editor is no longer available. Sorry!

### Compatibility Considerations

If you have code that calls the version 6 property editor, you will need to modify it to use the modular plotting tools described above in “Plotting Tools Are Now Modular Desktop Components” on page 434. The `propedit` function remain otherwise the same.

### New Desktop Printing GUI

Printing MATLAB figures has become easier as a result of combining the **Page Setup**, **Print Setup**, and **Print Preview** dialogs into one tabbed **Print Preview** dialog. You can now specify paper size, plot size and layout, color and line weight, header text, rendering, and other printing characteristics in this new dialog. The **Page Setup** and **Print Setup** dialogs still exist, and the **Print** dialog that you call from **File** → **Print** remains the same. The **Page Setup** dialog is available on all platforms.

For more information, see Using Print Preview in the MATLAB Graphics documentation and `printpreview` in the MATLAB function reference documentation.

### Compatibility Considerations

The **Page Setup** dialog no longer is available from the figure window **File** menu. However, it does continue to exist; you can raise it using the `pagesetupdlg` command. The old **Print Preview** dialog has been removed, however. The old **Print Setup** dialog can be raised using the command

```
print -dsetup
```

When you dismiss the **Print Setup** dialog with **OK**, the settings you made with it are saved, but nothing is printed at that time.

### Zoom Mode Now Supports Mouse Scroll Wheel

If your mouse has a center scroll wheel, you can use it to zoom in and out of axes, as well as by clicking and/or dragging.

You can zoom in by positioning the mouse cursor where you want the center of the plot to be and either press the mouse button or rotate the mouse scroll wheel away from you (upward). Zoom out by positioning the mouse cursor where you want the center of the plot to be and either simultaneously press **Shift** and the mouse button, or rotate the mouse scroll wheel toward you (downward). Each mouse click or scroll wheel click zooms in or out by a factor of 2.

## Data Cursor Text Can Now Be Programmatically Modified

You can now easily customize the text of datatips. The `datacursormode` function lets you specify the contents and formatting of text displayed by the data cursor tool. When the data cursor tool is active, you can use its context (right-click) menu to edit or specify the text update function that MATLAB executes to display datatips. For more information, see [Data Cursor — Displaying Data Values Interactively in the MATLAB Graphics documentation](#) and `datacursormode` in the [MATLAB Function Reference documentation](#).

## Customizing Zoom, Pan, and Rotate3D Data Explore Modes

You can now customize the behavior of data explore modes by modifying the `zoom`, `pan` and `rotate3d` objects that are dereferenced as follows:

```
h = pan(figure_handle)
h = rotate3d(figure_handle)
h = zoom(figure_handle)
```

These syntaxes create *mode objects* that you can use to control the behaviors of the explore tools. Among the effects you can achieve using these explore mode objects are

- Allow, change, or inhibit a mode for a specified axes
- Create callbacks for pre- and post-buttonDown events
- Change callbacks dynamically



See `pan`, `rotate3d`, and `zoom` in the MATLAB Function Reference documentation for details and examples.

### Compatibility Consideration

Using mode objects can cause a forward incompatibility. In prior releases, `explore` modes did not return an argument. Therefore, code such as the above examples that you write to take advantage of the new API will not run in MATLAB versions prior to R2006b. `zoom`, `pan`, and `rotate3d` code written for previous MATLAB versions, however, will run as before (there is no backward incompatibility).

### Improvements to MATLAB Graphics Documentation

A new section in the Graphics User Guide, “Types of MATLAB Plots”, now includes a gallery of graphs that catalogs the kinds of plots that you can create using MATLAB graphics functions. There are two tables containing labeled icons, one for “Two-Dimensional Plotting Functions”, and one for “Three-Dimensional Plotting Functions”, classified by plot type. Clicking the function name above any thumbnail plot in the gallery opens the reference documentation for that function.

Reference pages for functions that create, edit, annotate, and save plots have been enhanced in several ways:

- Thumbnail figures at the top of plotting functions and related GUI reference pages illustrate what you see when you invoke these functions.
- *GUI Alternatives* sections above syntax descriptions describe how to invoke a function (or similar capability) from a GUI, and provide links to relevant topics in the Graphics and Desktop Tools User Guides.
- Revised printing documentation in user guides and reference pages (see “New Desktop Printing GUI” on page 435, above)
- Numerous corrections and clarifications of details in user guides and reference pages

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Functions Are Now Obsolete” on page 438
- “Colored Buttons on Windows XP” on page 438
- “Documentation Enhancement” on page 439

### Functions Are Now Obsolete

The following functions are obsolete in MATLAB 7.3 (R2006b): `axlimdlg`, `edtext`, `menubar`, `pagedlg`, `umtoggle`.

### Compatibility Considerations

The functions shown in the following table will continue to work but their use will generate a warning message. As soon as possible, replace any occurrences you may have of these functions with the function(s) shown in the following table, if any, or with other suitable code.

Function	Replacement
<code>axlimdlg</code>	None
<code>edtext</code>	Set the <code>Editing</code> property of the <code>text</code> object.
<code>menubar</code>	Set the <code>MenuBar</code> property of the figure to <code>none</code> .
<code>pagedlg</code>	<code>pagesetupdlg</code>
<code>umtoggle</code>	Set the <code>Checked</code> property of the <code>uimenu</code> object.

### Colored Buttons on Windows XP

Setting the background color of user interface control (`uicontrol`) push buttons and toggle buttons on Windows XP now results in flat, colored buttons.

### Compatibility Considerations

Prior to this release, if you set the background color of a push button or toggle button to any color other than the factory color on Windows XP, the color

displayed only as a border around the button. With this release, any such buttons will display as flat, colored buttons with a simple border.

## **Documentation Enhancement**

The Creating GUIs Programmatically section of the documentation now contains information commensurate with information in the Creating GUIs with GUIDE section. It adds, in workflow order, information and many basic examples about:

- Adding components, menus, and toolbars to your GUI. Placing and aligning components.
- Designing for cross-platform compatibility.
- Initializing the GUI and creating callbacks.
- Callback examples for the different components.

## External Interfaces/API, MATLAB Version 7.3 (R2006b)

- “New Types for Declaring Size and Index Values” on page 440
- “Sparse Arrays on 64-bit Systems” on page 441
- “New MAT-File Format Based on HDF5” on page 442
- “-V5 Option to MEX to Be Removed” on page 443
- “Location of mex.bat File Changed” on page 443
- “Changes to Compiler Support” on page 443
- “Actxcontrol Command Now Validates ProgID” on page 443

### New Types for Declaring Size and Index Values

Version 7.3 (R2006b) defines two new types for API arguments and return values. These are

- `mwSize` — represents size values, such as array dimensions and number of elements.
- `mwIndex` — represents index values, such as indices into arrays.

Using these types in array declarations replaces more specific type declarations such as `int` or `INTEGER*4`. In general, using these types consistently in your C or Fortran source files can insulate your code from changes in the API implementation that might take place between different versions of MATLAB.

The `mwSize` and `mwIndex` types are required when working with functions that access sparse arrays on a 64-bit system. This is described in the release note on “Sparse Arrays on 64-bit Systems” on page 441, below.

---

**Note** In Fortran, `mwSize` and `mwIndex` are implemented as preprocessor macros. To use these types in Fortran code, add the declaration `#include "fintfrf.h"` in your source file and build your MEX-files using the Fortran preprocessor.

---

## Sparse Arrays on 64-bit Systems

The internal storage of sparse arrays on 64-bit systems has changed in the R2006b release. Due to this change, you will need to

- Change declaration statements in your source code so that you use the new types `mwSize` and `mwIndex` in place of specific type declarations such as `int` or `INTEGER*4`. This is described in the section “New Types for Declaring Size and Index Values” on page 440, above.
- Recompile all MEX-files that interact with sparse arrays using the new `-largeArrayDims` switch. For more information about the `-largeArrayDims` switch, see the section “New MEX Switch” on page 441, below.

See the section on “Compatibility Considerations” on page 442 to find out if you will need to make any modifications to your existing MEX code to accommodate these changes.

### Sparse API Functions Affected By This Change

You will need to recompile any MEX-files that use the following sparse functions on a 64-bit system:

- `mxGetIr`
- `mxGetJc`
- `mxSetIr`
- `mxSetJc`

### New MEX Switch

In order to build MEX-files that use any of the sparse array functions listed above, you need to compile these files with the `-largeArrayDims` switch, as shown here:

```
mex -largeArrayDims filename
```

Also, any existing MEX-files that interact with sparse arrays in MATLAB Version 7.3 must be recompiled using the `-largeArrayDims` switch.

---

**Note** The `-largeArrayDims` option is likely to become the default in a future version of MATLAB.

---

### **Compatibility Considerations**

If you are using any of the functions listed above, then you should be aware of the following potential compatibility issues if your MEX code uses sparse arrays on a 64-bit system:

- In release R2006b, you must rebuild all MEX-files that use sparse arrays using the new `-largeArrayDims` switch.
- Before building your MEX-files, change your C or Fortran sources to use the `mwSize` or `mwIndex` types introduced in this release. See the `mxArray` reference pages for the types to use for each function.
- MEX-files that compiled properly in Version 7.2 (R2006a) and do not use sparse arrays should build and execute correctly in Version 7.3 (R2006b) without changes.
- For more information on how the sparse API is affected, see the **Sparse Arrays on 64-Bit Systems** section in the MATLAB Mathematics release notes.

### **New MAT-File Format Based on HDF5**

In Version 7.3 (R2006b), you can save MAT-files in a format based on HDF5. Unlike earlier MAT-file formats, the HDF5-based format is capable of saving variables that occupy more than 2 GB of storage, including large arrays created on 64-bit systems.

To save a MAT-file in the HDF5-based format, use the `-v7.3` option to the MATLAB `save` function or the `"w7.3"` mode argument to the C or Fortran `matOpen` function. The default MAT-file format is the same as that in Version 7.2 (R2006a).

### **Compatibility Considerations**

Earlier versions of MATLAB cannot read MAT-files written in the HDF5-based format.

MAT-files written with MATLAB Version 7.3 (R2006b) on a 64-bit system can be read back into MATLAB 7.3 on a 32-bit system, provided that none of the values stored in the MAT-file require more than 32 bits to store.

## **-V5 Option to MEX to Be Removed**

The -V5 option to mex is not supported in this and future versions of MATLAB.

## **Compatibility Considerations**

You will no longer be able to build a MEX-file that is compatible with MATLAB Version 5.

## **Location of mex.bat File Changed**

In MATLAB Version 7.3, the Microsoft Windows script mex.bat is located in the directory \$MATLAB\bin.

## **Compatibility Considerations**

You may need to change any scripts or environment variables that relied on the previous location of mex.bat.

## **Changes to Compiler Support**

Compaq Visual Fortran version 6.1 is supported in Version 7.3 (R2006b) but will not be supported in a future version of MATLAB.

## **Compatibility Considerations**

To ensure continued support for building your Fortran programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

## **Actxcontrol Command Now Validates ProgID**

Attempting to insert a COM server into a MATLAB figure can result in unpredictable behaviors. To prevent this condition, the actxcontrol command now checks the ProgID by looking at the registry's HKR/CLSID/Control keyword and throws an error if the ProgID does not belong to a Microsoft ActiveX control.

## Compatibility Considerations

Before the validation check was added, some server ProgIDs worked with `actxcontrol`, probably because there are cases where Microsoft software points the server GUID to a control GUID underneath. An example of a ProgID that might not work with `actxcontrol` is the Windows Media® Player server ProgID `Mediaplayer.mediaplayer.1`. Therefore, depending on how Microsoft software registers the control, the following command might now return an error:

```
h = actxcontrol('Mediaplayer.mediaplayer.1'); % Returns an error
```

The correct ProgID to use for Mediaplayer is the ActiveX control ProgID:

```
h = actxcontrol('WMPlayer.OCX.7'); % Use control ProgID
```

Note that methods and properties to open and play files are different when using the control ProgID.

You can disable the validation check with the following command:

```
feature('COM_ActxProgIdCheck',0)
```

Or reenable it with:

```
feature('COM_ActxProgIdCheck',1)
```

By default, ProgID checking is on.



# Version 7.2 (R2006a)

## MATLAB Software

---

This table summarizes what's new in Version 7.2 (R2006a):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports at Web site

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.2 (R2006a)” on page 447
- “Mathematics, MATLAB Version 7.2 (R2006a)” on page 461
- “Data Analysis, MATLAB Version 7.2 (R2006a)” on page 463
- “Programming, MATLAB Version 7.2 (R2006a)” on page 464
- “Graphics and 3-D Visualization, MATLAB Version 7.2 (R2006a)” on page 471
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.2 (R2006a)” on page 473

- “External Interfaces/API, MATLAB Version 7.2 (R2006a)” on page 475

## Desktop Tools and Development Environment, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 447
- “Desktop” on page 448
- “Running Functions — Command Window and Command History” on page 449
- “Help” on page 450
- “Workspace, Search Path, and File Operations” on page 450
- “Editing and Debugging M-Files” on page 451
- “Tuning and Managing M-Files” on page 458
- “Publishing Results” on page 460
- “Source Control Interface” on page 460

### Startup and Shutdown

New features and changes introduced in Version 7.2 (R2006a) are described here.

### Installation Directory Structure on Windows Platforms

The installation directory structure on Microsoft Windows platforms is slightly different than in previous versions. By default, the structure now includes a general MATLAB top level directory, with a subdirectory for R2006a. The root directory for the MATLAB software returned by the `matlabroot` function, is now of the form in this example:

```
D:\Applications\MATLAB\R2006a
```

In previous versions, the top-level directory included the version number, so the root directory for MATLAB, as returned by the `matlabroot` function, was of the form in this example:

```
D:\Applications\MATLAB 7.1
```

**Compatibility Considerations.** If you relied on the explicit root directory structure for MATLAB in your code, change it to reflect the new structure including the top-level MATLAB directory. The `matlabroot` function might be useful.

## **Error Log Reporting**

If MATLAB experiences a segmentation violation, it generates an error log. Upon the next startup, MATLAB prompts you to e-mail the error log to The MathWorks. The MathWorks uses the log to work on resolving the problem. When you send a log, you receive a confirmation e-mail and will only receive further e-mails if The MathWorks develops a fix or workaround for the problem.

There are some situations where the Error Log Reporter does not open, for example, when you start MATLAB with a `-r` option or run in deployed mode. If you experience segmentation violations but do not see the Error Log Reporter on subsequent startups, you can instead e-mail logs by following the instructions at the end of the segmentation violation message in the Command Window.

## **JVM Software Updated for 64-Bit Linux Platforms**

The Sun Microsystems JVM software version that MATLAB uses is now version 1.5.0\_04 for 64-bit platforms running the Linux operating system from Linus Torvalds.

## **Desktop**

New features and changes introduced in Version 7.2 (R2006a) are described here.

## **Preferences Reorganized and New Keyboard Pane Added to Support Command Window and Editor/Debugger**

Preferences includes a new pane, **Keyboard**, for setting key bindings, tab completion, and delimiter-matching preferences for the Command Window and Editor/Debugger. Most of these preferences were previously located in the preference panes for the Command Window or Editor/Debugger.

**Compatibility Considerations.** You no longer access keyboard and indenting preferences for the Command Window and Editor/Debugger from the component preferences, but rather from the new **Keyboard** preferences. In addition, some preferences that were set separately for these components are now shared. For details about the changes, see “Keyboard and Indenting Command Window Preferences Reorganized” on page 449, and “Keyboard and Indenting Editor/Debugger Preferences Reorganized” on page 453.

### **Open All Desktop Tools from Desktop Menu**

You can now open (and close) all desktop tools from the **Desktop** menu. In previous versions, you could not access document-based tools from the **Desktop** menu. The document-based desktop tools are: Editor/Debugger, Figures, Array Editor, and Web Browser.

### **Access Login Renamed to MathWorks Account**

Use **Help > Web Resources > MathWorks Account** menu items to go to your MathWorks Account if you are registered, or to register online. MathWorks Account was previously called Access Login.

## **Running Functions — Command Window and Command History**

New features and changes introduced in Version 7.2 (R2006a) are described here.

### **Keyboard and Indenting Command Window Preferences Reorganized**

The Command Window Keyboard and Indenting preferences pane was removed. The tab size preference is now on the Command Window preferences pane. The tab completion, keybinding, and parentheses matching preferences were moved to the new Keyboard preferences pane. The parentheses-matching preferences are now called delimiter-matching preferences and are shared with the Editor/Debugger.

## Help

New features and changes introduced in Version 7.2 (R2006a) are described here.

### help for Model Files

You can now use the `help` function to get the complete description for MDL-files. For example, run

```
help f14_dap.mdl
```

MATLAB displays the description of the F-14 Digital Autopilot High Angle of Attack Mode model in the Simulink software, as defined in its **Model Properties > Description**:

```
Multirate digital pitch loop control for F-14 control design demonstration.
```

## Workspace, Search Path, and File Operations

New features and changes introduced in Version 7.2 (R2006a) are described here.

### toolboxdir function added

The `toolboxdir` function returns the absolute pathname to the specified toolbox. It is particularly useful with the MATLAB Compiler product because the toolbox root directory is different than in MATLAB.

### Visual Directory View Removed

The Visual Directory view was removed from the Current Directory browser. Most of the features it provided are accessible from the Current Directory browser standard view.

## Editing and Debugging M-Files

New features and changes introduced in Version 7.2 (R2006a) are

- “Tab Completion — Tab Now Completes Function and Variable Names” on page 451
- “Go Menu Added; Bookmark and Go To Items Moved from Edit Menu to Go Menu” on page 452
- “Navigate Back and Forward in Files” on page 453
- “Keyboard and Indenting Editor/Debugger Preferences Reorganized” on page 453
- “M-Lint Automatic Code Analyzer Checks for Problems and Suggests Improvements” on page 453
- “Debugging Changes” on page 454
- “Cell Mode On by Default — Shows Cell Toolbar and Possibly Horizontal Lines and Yellow Highlighting; Cell Information Bar and Button Added” on page 455
- “Lines Between Cells” on page 457
- “Cell Titles in Bold Preference Removed” on page 457

### Tab Completion — Tab Now Completes Function and Variable Names

You can now use tab completion in the Editor/Debugger to complete function names and variable names that are in the current workspace. When you type the first few characters of a function or variable name and press the **Tab** key, the Editor/Debugger displays a list of all function and variable names that begin with those letters, from which you choose one.

It operates essentially the same way as the existing tab completion feature in the Command Window, with the exception that Editor/Debugger tab completion does not support completion of file and path names.

To enable tab completion in the Editor/Debugger, select **File > Preferences > Keyboard**, and then under **Tab completion**, select **Tab key narrows completions**. By default, the preference is selected.

With tab completion enabled in the Editor/Debugger, you can still include tab spacing, for example, to include a comment at the end of a line. To add tab spacing, include a space after the last character you type and then press **Tab**. Instead of showing possible completions, the Editor/Debugger moves the cursor to the right where you can continue typing.

**Compatibility Considerations.** If you press the **Tab** key to add spacing within your statements, you might instead get a completion for a function or see a list of possible completions. For example, if the preference for tab completion is on and you want to create this statement

```
if a=mate    %test input value
```

where you press **Tab** after `mate` to achieve the spacing, the following happens instead

```
if a=material
```

This is because the tab completion preference completes `mate`, automatically supplying the `material` function.

To achieve the spacing with **Tab** (as in previous versions), either add a space after `mate` and then press **Tab**, or turn off the preference **Tab key narrows completions** in **Keyboard Preferences**.

## **Go Menu Added; Bookmark and Go To Items Moved from Edit Menu to Go Menu**

- To set, clear, and navigate to bookmarks, use the menu items in the new **Go** menu, which were previously located in the **Edit** menu.
- The **Go To** feature for navigating to line numbers, functions in M-files, and cells has moved to the new **Go** menu. It was previously located in the **Edit** menu.

**Compatibility Considerations.** Use the new **Go** menu items instead of **Edit > Bookmark** features and **Edit > Go To**.



## Navigate Back and Forward in Files

Use **Go > Back** (and **Go > Forward**) to go to lines you previously edited or navigated to in a file, in the sequence you accessed them. The main benefit of this feature is going directly to lines of interest. As an alternative to the menu items, use the Back and Forward buttons on the toolbar.

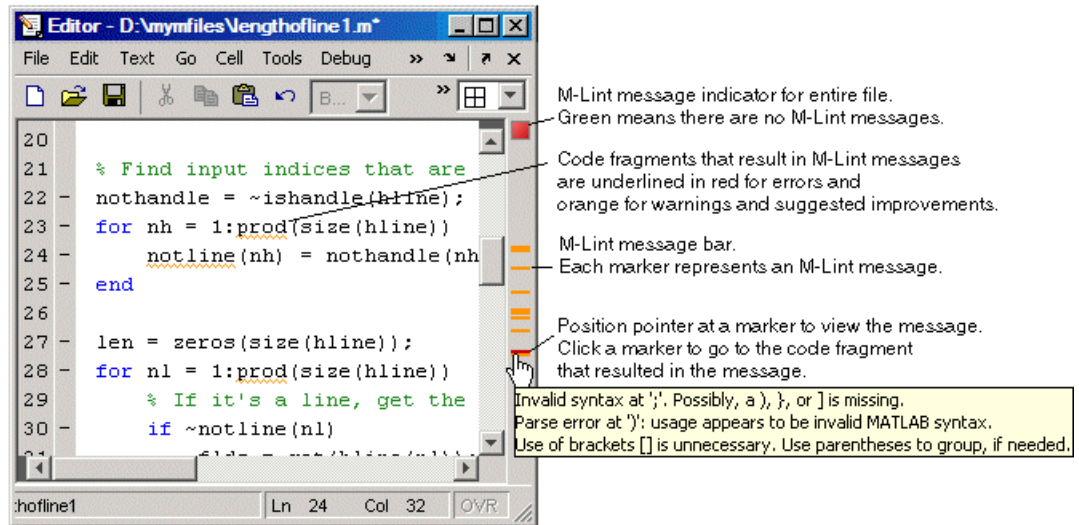
## Keyboard and Indenting Editor/Debugger Preferences Reorganized

The Editor/Debugger **Keyboard and Indenting** preferences pane was renamed to **Tab** preferences, and keybinding and parentheses-matching preferences were moved to the new **Keyboard** preferences pane. The parentheses-matching preferences are now called delimiter-matching preferences and are shared with the Command Window.

## M-Lint Automatic Code Analyzer Checks for Problems and Suggests Improvements

The M-Lint code analyzer, now built into the Editor/Debugger, continuously checks your code for problems and recommends modifications to maximize performance and maintainability. It performs the same analysis as the existing M-Lint Code Check report, but also provides these features:

- Indicates the problem lines and associated M-Lint messages directly in the M-file rather than in a separate report.
- Identifies (underlines) code fragments within a line that result in M-Lint messages.
- Distinguishes messages that report errors (red) from warnings and suggestions (orange).
- Continually analyzes and updates messages as your work so you can see the effect of your changes without having to save the M-file or rerun an M-Lint report.




To use or turn off M-Lint in the Editor/Debugger, select **File > Preferences > Editor/Debugger > Language**, and for **Language**, select **M**. Under **Syntax**, select **Enable M-Lint messages**, or clear the check box to turn it off. Use the associated drop-down list to specify the types of code fragments that you want M-Lint to underline, for example, **Underline warnings and errors**.

## Debugging Changes

- The `dbstop` function now allows you to stop at, (not in), a non M-file, allowing you to view code and variables near it in your M-file. For example, if you want to stop at the point in your M-file `myfile.m` where the built-in `clear` function is called, run `dbstop in clear; myfile`. Use this feature with caution because the debugger stops in M-files it uses for running and debugging if they contain the non M-file, and then some debugging features do not operate as expected, such as typing `help functionname` at the `K>>` prompt.

## **Cell Mode On by Default – Shows Cell Toolbar and Possibly Horizontal Lines and Yellow Highlighting; Cell Information Bar and Button Added**

Cell mode, a useful feature in the Editor/Debugger for publishing results and rapid code iteration, is now enabled by default. An M-file cell is denoted by a %% at the start of a line. Any M-file that contains %% at the start of a line is interpreted as including cells. The Editor/Debugger reflects the cell toolbar state and the cell display preferences, such as yellow highlighting of the current cell and gray horizontal lines between cells.

For quick access to information about using cells in M-files, use the new information  button on the cell toolbar.

%% at the start of a line denotes a cell, used for publishing or rapid code iteration. The current cell is highlighted in yellow.

The screenshot shows the MATLAB Editor window titled "Editor - H:\Documents\MATLABFiles\myfiles\sine\_w...". The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, and Desktop. The toolbar contains icons for file operations and zooming. The code is as follows:

```

1  %% Simple Sine Wave Plot
2
3  %% Part One: Calculate Sine Wave
4  % Define the range |x|.
5  % Calculate the sine |y| over that range.
6  x = 0:.01:6*pi;
7  y = sin(x);
8
9  %% Part Two: Plot Sine Wave
10 % Graph the result.

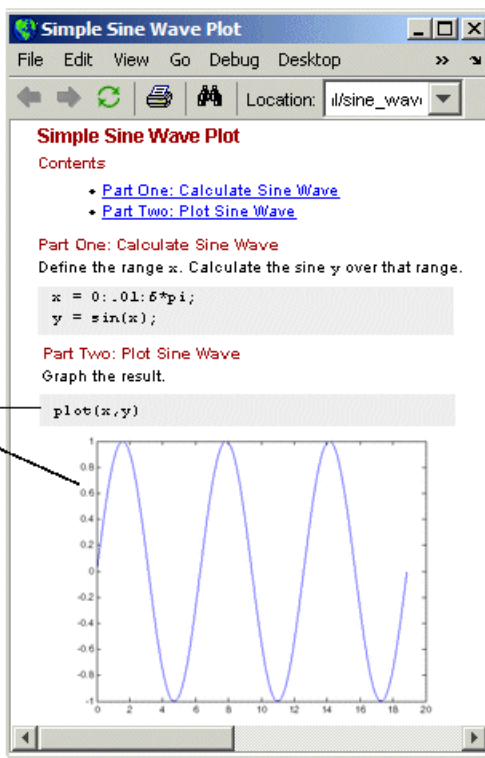
```

The current cell (lines 3-8) is highlighted in yellow. The status bar at the bottom shows "script", "Ln 5", "Col 23", and "OVR".

Example of M-file with cells published to HTML.

Includes source code and output.

Supported formats are: HTML, Word, PowerPoint, LaTeX, and XML.



If you do not want cell mode enabled, select **Cell > Disable Cell Mode**.

MATLAB remembers the cell mode between sessions. If cell mode is disabled when you quit MATLAB, it will be disabled the next time you start MATLAB, and the converse is true.

In MATLAB Version 7.2, the first time you open an M-file in the Editor/Debugger, the cell toolbar appears. If the M-file contains a line beginning with `%`, an information bar appears below the cell toolbar, providing links for details about cell mode. To dismiss the information bar, click the close box on the right side of the bar. To hide the cell toolbar, right-click the toolbar and select **Cell Toolbar** from the context menu.

**Compatibility Considerations.** In previous versions, cell mode was off by default. The cell toolbar and yellow highlighting or horizontal rules in M-files that contain `%` at the start of a line might be unexpected. If you used the `%` symbols at the start of a line in M-files for a purpose other than denoting M-file cells, consider replacing the `%` symbols with a different indicator, or keep cell mode disabled.

### Lines Between Cells

You can set an Editor/Debugger display preference, **Show lines between cells**, to add a faint gray rule above each cell in an M-file. The line does not print or appear in the published M-file.

### Cell Titles in Bold Preference Removed

Previous versions included an Editor/Debugger display preference to **Show bold cell titles**. When cleared, cell titles appeared in plain text, rather than bold text. This is no longer a preference you can set — all cell titles now appear in bold text.

## Tuning and Managing M-Files

New features and changes introduced in Version 7.2 (R2006a) are

- “M-Lint and mlint Enhancements and Changes” on page 458
- “Profiling Enhancements” on page 459
- “Visual Directory View Removed from Current Directory Browser” on page 459

### M-Lint and mlint Enhancements and Changes

The M-Lint code analyzer is now built into the Editor/Debugger where it continuously checks your code for problems and recommends modifications to maximize performance and maintainability. For details, see “M-Lint Automatic Code Analyzer Checks for Problems and Suggests Improvements” on page 453.

**Compatibility Considerations.** The `mlint` function has changed slightly to support its use in the Editor/Debugger. Specifically, the results returned from `mlint` with the `-id` option are of a different form than for previous versions. If you rely on the exact values, you need to make modifications.

For example, this is the form of a message returned in R2006a: `L 22 (C 1-9) 2:AssignmentNotUsed : The value assigned here to variable 'nothandle' might never be used.`

This is the form of the message from R14SP3: `22 (C 1-9) InefficientUsage:AssignmentNotUsed : The value assigned here to variable 'nothandle' might never be used.`

There is now a numeric identifier, followed by the category, for example: `2:AssignmentNotUsed`

If you do rely on the exact values, note that there have been very few changes to the message text itself. For example, both R14SP3 and R2006a use the same text: `The value assigned here to variable 'nothandle' might never be used.`

Because of improvements being made to `mlint`, the values returned using the `-id` option are expected to change in the next version as well, particularly

the numeric identifier and category form. Do not rely on the exact values returned using `mlint` with the `-id` option or you will probably need to make modifications.

## Profiling Enhancements

**nohistory Option Added to profile Function.** Use the new `profile -nohistory` option after having previously set the `-history` option to disable further recording of history (exact sequence of function calls). All other profiling statistics continue to accumulate.

**Accuracy Improved.** The Profiler provides more accurate accounting. The total time you see with the Profiler GUI now matches total wall clock time from when you started profiling until you stopped profiling. Overhead associated with the Profiler itself is now applied evenly.

**Statistics for Recursive Functions.** The `profile` function now gathers and reports time for recursive functions in the `FunctionTable`'s `TotalTime` for the function. In previous versions, `profile` attempted to break out `TotalRecursiveTime`, which was not always accounted for accurately. The value for `TotalRecursiveTime` in `FunctionTable` is no longer used.

This change is also reflected in the Profiler GUI reports.

**PartialData Reported in Results, AcceleratorMessages Removed.** The `FunctionTable` now includes the `PartialData` value. A value of 1 indicates the function was modified during profiling, for example, by being edited or cleared, so data was only collected up until the point it was modified.

In previous versions, `FunctionTable` included `AcceleratorMessages` although it was not used. `AcceleratorMessages` is no longer included.

## Visual Directory View Removed from Current Directory Browser

The Visual Directory view was removed from the Current Directory browser.

**Compatibility Considerations.** Most of the features it provided are accessible from the Current Directory browser standard view.

## Publishing Results

New features and changes introduced in Version 7.2 (R2006a) are described here.

### Insert Italic Text Markup

You can now make designated text comments in cells appear italicized in the published output. Use **Cell > Insert Text Markup > Italic Text**, or use the equivalent markup symbols, underscores, as in `_SAMPLE ITALIC TEXT_`.

### publish Function has New catchError Option

The `publish` function has a new `catchError` option that allows you to continue or stop publishing if the M-file contains an error.

## Source Control Interface

New features and changes introduced in Version 7.2 (R2006a) are described here.

### PVCS Source Control System Name Change

The PVCS® source control system (from Merant) now has a new name, ChangeMan® (from Serena®), and the source control interface in MATLAB on UNIX platforms reflects this change.

If you use the ChangeMan software on UNIX platforms, the `cmopts` value returned for it is `pvcs`. If you use PVCS software, select ChangeMan in the Source Control Preferences pane.

**Compatibility Considerations.** PVCS software users on UNIX platforms formerly selected PVCS in the Source Control Preferences pane. Now, PVCS software users select ChangeMan instead.



## Mathematics, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are

- “New Library CHOLMOD for Sparse Cholesky Factorization” on page 461
- “New Solver for State-Dependent DDEs” on page 461
- “Upgrade to BLAS Libraries” on page 461
- “New Function for Integer Division” on page 462
- “New Input to gallery Function” on page 462
- “Improved Algorithm for expm” on page 462
- “More Efficient condst for Sparse Matrices” on page 462
- “accumarray Accepts Cell Vector Input” on page 462

### **New Library CHOLMOD for Sparse Cholesky Factorization**

For sparse matrices, MATLAB now uses CHOLMOD version 1.0 to compute the Cholesky factor. CHOLMOD is a set of routines offering improved performance in factorizing sparse symmetric positive definite matrices. See the function reference pages for `chol`, `spparms`, and `mldivide` for more information on how CHOLMOD is used by MATLAB.

### **New Solver for State-Dependent DDEs**

In this release, MATLAB provides a second solver function, `ddesd`, in addition to the existing `dde23` function, for delay differential equations (DDEs). This new solver is for use on equations that have *general* delays. You supply a function in the input argument list that returns the vector of delays to be used by the solver. See the function reference page for `ddesd`, and “Delay Differential Equations” in the MATLAB Mathematics documentation for more information.

### **Upgrade to BLAS Libraries**

MATLAB now uses new versions of the Basic Linear Algebra Subroutine (BLAS) libraries. For Intel processors on Windows and Linux platforms,

MATLAB supports the Math Kernel Library (MKL) version 8.0.1. For AMD processors on Linux platforms, MATLAB uses the AMD Core Math Library (ACML) version 2.7.

## **New Function for Integer Division**

The new `idivide` function provides division similar to `A./B` on integers except that fractional quotients are rounded to integers according to a specified rounding mode.

## **New Input to `gallery` Function**

The `gallery` function has a new, optional input argument called `classname`. The `classname` input is a quoted string that must be either `'single'` or `'double'`. When you specify a `classname` argument in the call to `gallery`, MATLAB produces a matrix of that class.

## **Improved Algorithm for `expm`**

The `expm` function now uses an improved algorithm to compute a matrix exponential. This algorithm often requires fewer matrix multiplications.

## **More Efficient `condest` for Sparse Matrices**

The `condest` function handles sparse matrices more efficiently when estimating a 1-norm condition number.

## **`accumarray` Accepts Cell Vector Input**

The `accumarray` function now accepts a cell vector as the `subs` input. This vector can have one or more elements, each element a vector of positive integers. All the vectors must have the same length. In this case, `subs` is treated as if the vectors formed columns of an index matrix.

## Data Analysis, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are

- “Data Analysis Collection Revised and Expanded” on page 463
- “Reference Pages for timeseries and tscollection Objects” on page 463
- “Text Files Can Be Imported In Time Series Tools” on page 463
- “Linux 64 Platform Fully Enabled for Time Series Tools” on page 463

### Data Analysis Collection Revised and Expanded

In this release, the *MATLAB Data Analysis* collection has been thoroughly revised to improve content organization and flow. In addition, most examples have been updated and streamlined.

### Reference Pages for timeseries and tscollection Objects

Detailed reference pages are now available for `timeseries` and `tscollection` objects, properties, and methods. You can access these reference pages in the Help contents, under “Data Analysis” in the MATLAB Function Reference.

### Text Files Can Be Imported In Time Series Tools

In Time Series Tools, you can now use the Import Wizard to import data from text files, such as `.csv`, `.dat`, and `.txt`.

### Linux 64 Platform Fully Enabled for Time Series Tools

Time Series Tools is now fully enabled on the Linux 64 platform.

### Compatibility Considerations

On the Linux 64 platform, you no longer need to manually enable the Time Series Tools feature before starting Time Series Tools (as in MATLAB 7.1).

## Programming, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are

- “Larger Data Sets with 64-Bit Windows XP” on page 464
- “Using avifile and movie2avi on Windows XP 64” on page 464
- “Regular Expressions” on page 465
- “Setting Environment Variables” on page 466
- “issorted Support for Cell Arrays” on page 466
- “XLS Functions Support More Formats” on page 466
- “Archiving Functions Accept Files on Path and ~/” on page 467
- “sendmail No Longer Requires ASCII Messages” on page 467
- “MATLAB Warns on Invalid Input to str2func” on page 467
- “Changes to Character Encoding in File I/O” on page 467

### Larger Data Sets with 64-Bit Windows XP

MATLAB support for Windows XP 64-bit edition enables you to handle much larger data sets. To learn more about how this affects the amount of workspace available, maximum matrix size, and maximum number of elements you can have in an array, see Technical Note 1110: “Maximum Matrix Size by Platform” at the following URL:

<http://www.mathworks.com/support/tech-notes/1100/1110.html>

### Using avifile and movie2avi on Windows XP 64

---

**Note** You must change the compression setting if you use the `avifile` or `movie2avi` function on Windows XP 64.

---

MATLAB currently defaults to using Indeo codecs to compress video frames when using `avifile/addframe` or `movie2avi`. If you attempt to use `avifile` and `addframe`, or `movie2avi` on a Windows XP 64-bit platform without

specifying the compression type, an error message appears indicating the codec was not found. Nondefault settings must be explicitly passed in when using these functions on Windows XP 64 because Microsoft does not provide Indeo codecs on this platform.

This issue does not affect 32-bit Windows XP installations.

## Compatibility Considerations

To work around this issue, do the following:

- 1 Explicitly specify no compression when creating the `avifile` object or when calling `movie2avi`. Two examples of this are

```
aviobj = avifile('myvideo.avi', 'compression', 'none');
movie2avi(mov, 'myvideo.avi', 'compression', 'none');
```

- 2 Specify a codec for a compression that is installed. The ones that are included with Windows XP 64 are

- IYUV — Intel YUV codec (c:\winnt\system32\iyuv\_32.dll)
- MRLE — Microsoft RLE codec (c:\winnt\system32\msrle32.dll)
- MSVC — Microsoft Video 1 codec (c:\winnt\system32\msvidc32.dll)

For example, to use the Intel YUV codec, use the four-CC code:

```
aviobj = avifile('myvideo.avi', 'compression', 'IYUV');
```

Other codecs can be found at <http://fourcc.org>.

Note there are restrictions with some codecs. For example, some codecs can only be used with grayscale images.

## Regular Expressions

MATLAB 7.2 introduces the following new features for regular expressions in MATLAB. For more information on these features, see “Regular Expressions” in the MATLAB Programming documentation.

## New Features

- Dynamic regular expressions — You can now insert MATLAB expressions or commands into regular expressions or replacement strings. The dynamic part of the expression is then evaluated at runtime.
- Generating literals in expressions — Use the new `regexpttranslate` function when you want any of the MATLAB regular expression functions to interpret a string containing metacharacters or wildcard characters literally.
- New parsing modes — Four matching modes (case-sensitive, single-line, multiline, and freespacing) extend the parsing capabilities of the MATLAB regular expression functions.
- Warnings display — Use the new 'warnings' option with the regular expression functions to enable the display of warnings that are otherwise hidden.

## Compatibility Considerations

Calling `regex` or `regextest` with the 'tokenExtents' and 'once' options specified now returns a double array instead of a cell array. You may need to change your code to accommodate the new return type.

## Setting Environment Variables

Use the new `setenv` function to set the value of an environment variable belonging to the underlying operating system.

## issorted Support for Cell Arrays

You can now use the `issorted` function on a cell array of strings.

## XLS Functions Support More Formats

`xlsread` now supports Excel files having formats other than XLS (e.g., HTML) as long as the COM server is available. Also, `xlsfinfo` now returns this file format information.

## Archiving Functions Accept Files on Path and ~/

Files specified as arguments to `gzip`, `gunzip`, `tar`, and `zip` can now be specified as partial path names. On UNIX machines, directories can start with `~/` or `~username/`, which expands to the current user's home directory or the specified user's home directory, respectively. The wildcard character `*` can be used when specifying files or directories, except when relying on the MATLAB path to resolve a filename or partial pathname.

## sendmail No Longer Requires ASCII Messages

E-mail messages that you send using `sendmail` are no longer restricted to ASCII character encoding schemes.

## MATLAB Warns on Invalid Input to str2func

Due to a bug introduced in MATLAB R14, the `str2func` function failed to issue a warning or error when called with an invalid function name or a function name that includes a path specification. In the R2006a release, `str2func` now generates a warning under these conditions. In a future version of MATLAB, `str2func` will generate an error under these conditions.

## Compatibility Considerations

Any existing code that calls `str2func` with an invalid function name or a function name that includes the path now generates a warning message from MATLAB. In a future version, this will cause an error. You should note any such warnings when using R2006a, and fix the input strings to `str2func` so that they specify a valid function name.

## Changes to Character Encoding in File I/O

The `fopen` function has a new optional argument, a string that specifies a name or alias for the character encoding scheme associated with the file. If this argument is omitted or is the empty string (`''`), the MATLAB default encoding scheme is used. Given a file identifier as the only argument, `fopen` now returns an additional output value, a string that identifies the character encoding scheme associated with the file.

Low-level file I/O functions that read data from files, including `fread`, `fscanf`, `fgetl`, and `fgets`, read characters using the encoding scheme associated with

the file during the call to `fopen`. Low-level file I/O functions that write data, including `fwrite` and `fprintf`, write characters using the encoding scheme associated with the file during the call to `fopen`.

Support for character encoding schemes has these limitations:

- Surrogate pairs are not supported. Each surrogate pair is read as a replacement character, the equivalent of `char(26)`.
- Stateful character encoding schemes are not supported.
- Byte order marks are not interpreted in any special way. Your code must skip them if necessary.
- Scanning numbers, using `fscanf`, is supported only for character encoding schemes that are supersets of ASCII. (Most popular character encoding schemes, with the exception of UTF-16, are such supersets.)

## Compatibility Considerations

In V7.1 (R14SP3), low-level file I/O functions that read and write data treated characters as unsigned bytes. Programs using such functions as `fread` may have called `native2unicode` to convert input to MATLAB characters using a particular encoding scheme. Programs using such functions as `fwrite` may have called `unicode2native` to convert output from MATLAB characters using a particular encoding scheme.

For example, on a Japanese Windows platform, where the default character encoding scheme is Shift-JIS, a program may have used `native2unicode` and `unicode2native` to read and write Japanese text in this way:

```
fid = fopen(file);
data = fread(fid, '*char');
fclose(fid);
dataU = native2unicode(data);
% operate on data
outData = unicode2native(dataU);
fid = fopen(file, 'w');
fwrite(fid, outData, 'char');
fclose(fid);
```



Such a program would produce different and possibly incorrect results in V7.2 (R2006a). The calls to `native2unicode` and `unicode2native` are no longer necessary, because the `fread` and `fwrite` functions now convert data to and from MATLAB characters using the character encoding scheme specified in the calls to `fopen`. In V7.2 (R2006a), the example code can be simplified to produce correct results:

```
fid = fopen(file);
dataU = fread(fid, '*char')';
fclose(fid);
% operate on data
fid = fopen(file, 'w');
fwrite(fid, dataU, 'char');
fclose(fid);
```

**Changes to code using `fread`, `fgets`, `fgetl`, and `fscanf`.** If your code calls `native2unicode` to convert input to MATLAB characters using a specified (or default) encoding scheme, you can, but do not have to, remove the calls to `native2unicode`.

This applies to reading from an encoded file using any of the following:

- `fread` with precision set to `'*char'` or `'char=>char'`
- `fgets` or `fgetl`
- `fscanf` with the format specifier set to either `'%s'` or `'%c'`

When you remove a call to `native2unicode`, be sure that the call to `fopen` supplies the same encoding argument (if any) as the call to `native2unicode`.

You may have used code like these examples in V7.1 (R14SP3):

```
indata = native2unicode(fread(fid, '*char')');
indata = native2unicode(fread(fid, 'char=>char')');
indata = native2unicode(fgets(fid));
indata = native2unicode(fgetl(fid));
indata = native2unicode(fscanf(fid, '%s'));
indata = native2unicode(fscanf(fid, '%c'));
```

You can, but do not have to, remove the calls to `native2unicode` in V7.2 (R2006a):

```
indata = fread(fid, '*char')';
indata = fread(fid, 'char=>char')';
indata = fgets(fid);
indata = fgetl(fid);
indata = fscanf(fid, '%s');
indata = fscanf(fid, '%c');
```

**Changes to code using fwrite.** If your code calls `unicode2native` to convert output from MATLAB characters using a specified (or default) encoding scheme, in most cases you must remove the calls to `unicode2native`. This is especially important if the encoding represents multibyte characters.

This applies to writing an encoded file using `fwrite` with precision set to either `'char'` or `'char*1'`.

When you remove a call to `unicode2native`, be sure that the call to `fopen` supplies the same encoding argument (if any) as the call to `unicode2native`.

You may have used code like these examples in V7.1 (R14SP3):

```
fwrite(fid, unicode2native(outbuff), 'char');
fwrite(fid, unicode2native(outbuff), 'char*1');
```

You must remove the calls to `unicode2native` in V7.2 (R2006a):

```
fwrite(fid, outbuff, 'char');
fwrite(fid, outbuff, 'char*1');
```

## Graphics and 3-D Visualization, MATLAB Version 7.2 (R2006a)

Two changes have been introduced in this version:

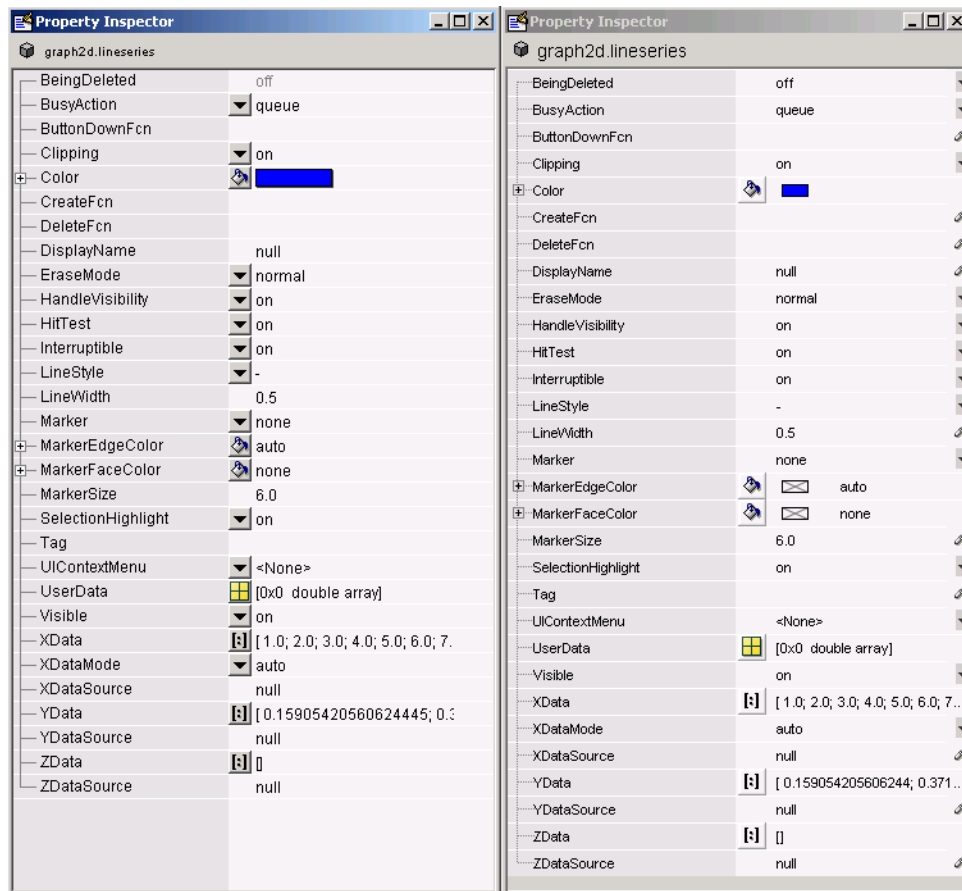
### Pasting Cut or Copied Graphic Objects Can Create an Axes

The way in which MATLAB handles copying (or cutting) and pasting children of axes such as lineseries, barseries, or contourgroup objects has changed slightly. In previous releases, if no destination axes was selected prior to pasting one or more such objects, they would be pasted into the current axes (returned by the `gca` function). MATLAB no longer makes this assumption; if no axes is currently selected when you paste graphic objects, a new axes is created in the destination figure to contain them.

To avoid creating a new axes where you do not want to do so, you should be in plot edit mode and have selected a destination axes before using **Edit** -> **Paste** or typing **CTRL-V**. You can use the Plot Browser to conveniently select objects to copy and to paste into.

### Inspector Has New Look

The Property Inspector (the GUI summoned by the MATLAB `inspect` command) has a new look, but no changed functionality. The inspector enables you to view and change the most commonly used object properties. The figure below compares the previous version (7.1, left) of the Property Inspector with the new version (7.2, right):



Note that in addition to having a smaller font and wider line spacing, the new inspector locates pop-up menus at the right margin instead of between the two columns. Also, some icons have been redesigned.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are:

- “Treatment of & in Menu Label Is Changed” on page 473
- “Major Documentation Revision” on page 473

### Treatment of & in Menu Label Is Changed

The use of '&' (ampersand) in the `uimenu` 'Label' property string is changed for cases that use the constructs 'A& B' and 'A&&B'. The changes bring these constructs in line with the way '&' is used in other 'Label' constructs. See “Compatibility Considerations” below for specific information.

### Compatibility Considerations

Interpretation of 'Label' property strings that use the following constructs is changed:

- The string 'A& B' now produces the menu label **A& B** with no underlined mnemonic. Previously, 'A& B' produced the label **A\_B**, in which the space is a mnemonic.
- The string 'A&&B' now produces the menu label **A & B** with no underlined mnemonic. Previously, 'A&&B' produced the label **A&B** with no mnemonic.

If you use either construct, 'A& B' or 'A&&B', in your menu labels, verify that the new resulting label is acceptable or change the 'Label' property to a new string.

### Major Documentation Revision

The MATLAB document *Creating Graphical User Interfaces* is reorganized and rewritten. It now consists of three sections:

- Getting Started—Leads you through the steps needed to create a simple GUI, both programmatically and using GUIDE.

- **Creating GUIs with GUIDE**—Contains the information, previously included in *Creating Graphical User Interfaces*, that you need to create a GUI using GUIDE. This section is organized in workflow order with many small examples of the various steps. A final chapter provides advanced examples.
- **Creating GUIs Programmatically**—For now, this section contains a summary of the available functions and complete code examples for three GUIs.

One GUI uses a variety of user interface controls to enable a user to calculate the mass of an object after specifying the object's density and volume.

Two other GUIs work together as an icon editor. One GUI, a color palette, is embedded in the other GUI, an icon editor. The color palette passes data to the icon editor whenever the GUI user selects a new color.

---

**Note** Following the release of MATLAB version 7.2, *Creating Graphical User Interfaces* will be further updated and expanded. The PDF and HTML versions of this document will be updated on The MathWorks Web site some time after the release. Check the top page of the HTML document and the title page of the PDF to determine if they have been updated.

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## External Interfaces/API, MATLAB Version 7.2 (R2006a)

- “MEX-Files Built with gcc on Linux Must Be Rebuilt” on page 475
- “MEX-Files in MATLAB for Microsoft Windows x64” on page 476
- “New Microsoft and Intel Compilers Supported” on page 476
- “MWPOINTER Macro for Platform-Independent Fortran Code” on page 477
- “Compaq Visual Fortran Engine and MAT Options File Renamed” on page 477
- “Options Files Removed for Unsupported Compilers” on page 477
- “Obsolete Functions No Longer Documented” on page 478
- “Support for Licensed ActiveX Controls” on page 482
- “Support for VT\_Date Type” on page 483
- “Dynamic Linking of External Libraries” on page 483

### **MEX-Files Built with gcc on Linux Must Be Rebuilt**

In MATLAB V7.2 (R2006a) on Linux and Linux x86-64 platforms, MEX-files built with gcc must be recompiled and relinked using gcc version 3.4 or later. Rebuilding is required because MATLAB V7.2 (R2006a) on Linux and Linux x86-64 platforms is built with gcc version 3.4.

### **Compatibility Considerations**

Changes in gcc version 3.4 have caused incompatibilities between MATLAB V7.2 (R2006a) and MEX-files built with gcc versions earlier than 3.4.

On Linux and Linux x86-64 platforms, MEX-files built with gcc versions earlier than 3.4 cannot be used in MATLAB V7.2 (R2006a).

On Linux and Linux x86-64 platforms, MEX-files built with gcc version 3.4 or later cannot be used in versions of MATLAB earlier than V7.2 (R2006a).

## **MEX-Files in MATLAB for Microsoft Windows x64**

With the introduction of MATLAB for Windows x64, you can now build 64-bit MEX-files. These MEX-files have the extension `.mexw64`. The `mexext` command returns `mexw64` in MATLAB for Windows x64.

### **Compatibility Considerations**

MEX-files built using MATLAB for Windows (32-bit), which have `.mexw32` extensions by default, cannot be used in MATLAB for Windows x64.

By default, when MATLAB for Windows x64 is installed, the `mex.pl` and `mex.bat` scripts build MEX-files for a Windows x64 platform (with `.mexw64` extensions).

## **New Microsoft and Intel Compilers Supported**

MATLAB V7.2 (R2006a) supports new compilers for building MEX-files on Windows and Windows x64 platforms:

- Microsoft Visual C++ 2005, also informally called Visual C++ 8.0, part of Microsoft Visual Studio 2005
- Intel Visual Fortran 9.0

### **Environment Variables Needed for Intel Visual Fortran**

When you build a MEX-file or an Engine or MAT application using Intel Visual Fortran 9.0, MATLAB requires an environment variable to be defined, depending on whether you are building in MATLAB for Windows (32-bit) or MATLAB for Windows x64:

- MATLAB for Windows (32-bit): The environment variable `VS71COMNTOOLS` must be defined. The value of this environment variable is the path to the `Common7\Tools` directory of the Visual Studio .NET 2002 or 2003 installation directory. (Intel Visual Fortran requires Visual Studio .NET 2002 or 2003 on 32-bit Windows platforms.) This environment variable is commonly defined by the Visual Studio .NET 2003 installation program.
- MATLAB for Windows x64: The environment variable `MSSdk` must be defined. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server



2003. (Intel Visual Fortran requires Microsoft Platform SDK for Windows Server 2003 on Windows x64 platforms.) This environment variable is *not* commonly defined by the Microsoft Platform SDK installation program.

## **MWPOINTER Macro for Platform-Independent Fortran Code**

MATLAB provides a preprocessor macro, `mwPointer`, that declares the appropriate Fortran type representing a pointer to an `mxArray` or to other data that is not of a native Fortran type, such as memory allocated by `mxMalloc`. On 32-bit platforms, the Fortran type that represents a pointer is `INTEGER*4`; on 64-bit platforms, it is `INTEGER*8`. The Fortran preprocessor translates `MWPOINTER` to the Fortran declaration that is appropriate for the platform on which you compile your file.

## **Compaq Visual Fortran Engine and MAT Options File Renamed**

MATLAB V7.1 (R14SP3) included a Windows Engine and MAT options file named `df66engmatopts.bat`. This file contained options for Compaq Visual Fortran version 6.6 for use in building Fortran engine or MAT stand-alone programs. The file name `df66engmatopts.bat` originated with an earlier version of the Fortran compiler, named Digital Fortran.

In V7.2 (R2006a), this file has been renamed `cvf66engmatopts.bat` to match the Compaq Visual Fortran product name.

## **Compatibility Considerations**

You may need to change any scripts that depend on the earlier name for the options file.

## **Options Files Removed for Unsupported Compilers**

MATLAB V7.1 (R14SP3) included MEX, Engine, and MAT options files for a number of Windows C and Fortran compilers that were untested. These options files are not included in V7.2 (R2006a). The unsupported compilers, and the supported compilers that replace them, are:

<b>Unsupported Compiler</b>	<b>Supported Replacement</b>
Borland 5.0, 5.2, 5.3, 5.4	Borland 5.5, Borland 5.5 Free, Borland 5.6
Digital Visual Fortran 5.0, 6.0	Compaq Visual Fortran 6.1, Compaq Visual Fortran 6.6, Intel Visual Fortran 9.0
Microsoft Visual C++ 5.0, Visual C++ .NET 2002 (7.0)	Microsoft Visual C++ 6.0, Visual C++ .NET 2003 (7.1), Visual C++ 2005 (8.0)
Watcom 10.6, 11	Open Watcom 1.3

### **Compatibility Considerations**

If you were using an untested compiler with a previous version of MATLAB, replace it with a supported compiler. You may need to recompile your MEX-files or applications.

### **Obsolete Functions No Longer Documented**

In V7.1 (R14SP3), many MAT-file access, MX array manipulation, MEX-files, and MATLAB engine functions were declared obsolete in the External Interfaces Reference documentation. These functions are no longer documented in V7.2 (R2006a).

This section lists the obsolete functions removed from the documentation, along with replacement functions, if any.

#### **Obsolete Functions: MAT-File Access**

<b>Obsolete Function</b>	<b>Replacement</b>
<code>matDeleteArray</code> (C and Fortran)	<code>matDeleteVariable</code>
<code>matDeleteMatrix</code> (C and Fortran)	<code>matDeleteVariable</code>

<b>Obsolete Function</b>	<b>Replacement</b>
matGetArray (C and Fortran)	matGetVariable
matGetArrayHeader (C and Fortran)	matGetVariableInfo
matGetFull (C and Fortran)	matGetVariable followed by mxGetM, mxGetN, mxGetPr, mxGetPi
matGetMatrix (C and Fortran)	matGetVariable
matGetNextArray (C and Fortran)	matGetNextVariable
matGetNextArrayHeader (C and Fortran)	matGetNextVariableInfo
matGetNextMatrix (C and Fortran)	matGetNextVariable
matGetString (C and Fortran)	matGetVariable followed by mxGetString
matPutArray (C and Fortran)	matPutVariable
matPutArrayAsGlobal (C and Fortran)	matPutVariableAsGlobal
matPutFull (C and Fortran)	mxCreateDoubleMatrix followed by mxSetPr, mxSetPi, matPutVariable
matPutMatrix (C and Fortran)	matPutVariable
matPutString (C and Fortran)	mxCreateString followed by matPutVariable

**Obsolete Functions: MX Array Manipulation**

<b>Obsolete Function</b>	<b>Replacement</b>
mxClearLogical (C and Fortran)	None
mxCreateFull (C and Fortran)	mxCreateDoubleMatrix
mxCreateScalarDouble (C and Fortran)	mxCreateDoubleScalar
mxFreeMatrix (C and Fortran)	mxDestroyArray
mxGetName (C and Fortran)	None
mxIsFull (C and Fortran)	mxIsSparse
mxIsString (C and Fortran)	mxIsChar
mxSetLogical (C and Fortran)	None
mxSetName (C and Fortran)	None

**Obsolete Functions: MEX-Files**

<b>Obsolete Function</b>	<b>Replacement</b>
mexAddFlops (C)	None
mexGetArray (C and Fortran)	mexGetVariable
mexGetArrayPtr (C and Fortran)	mexGetVariablePtr
mexGetEps (C and Fortran)	mxGetEps

<b>Obsolete Function</b>	<b>Replacement</b>
mexGetFull (C and Fortran)	mexGetVariable followed by mxGetM, mxGetN, mxGetPr, mxGetPi
mexGetGlobal (C and Fortran)	mexGetVariablePtr
mexGetInf (C and Fortran)	mxGetInf
mexGetMatrix (C and Fortran)	mexGetVariable
mexGetMatrixPtr (C and Fortran)	mexGetVariablePtr
mexGetNaN (C and Fortran)	mxGetNaN
mexIsFinite (C and Fortran)	mxIsFinite
mexIsInf (C and Fortran)	mxIsInf
mexIsNaN (C and Fortran)	mxIsNaN
mexPutArray (C and Fortran)	mexPutVariable
mexPutFull (C and Fortran)	mxCreateDoubleMatrix followed by mxSetPr, mxSetPi, mexPutVariable
mexPutMatrix (C and Fortran)	mexPutVariable

### **Obsolete Functions: MATLAB Engine**

<b>Obsolete Function</b>	<b>Replacement</b>
engGetArray (C and Fortran)	engGetVariable
engGetFull (C and Fortran)	engGetVariable followed by mxGetM, mxGetN, mxGetPr, mxGetPi

<b>Obsolete Function</b>	<b>Replacement</b>
engGetMatrix (C and Fortran)	engGetVariable
engPutArray (C and Fortran)	engPutVariable
engPutFull (C and Fortran)	mxCreateDoubleMatrix followed by mxSetPr, mxSetPi, engPutVariable
engPutMatrix (C and Fortran)	engPutVariable
engSetEvalCallback (C)	None
engSetEvalTimeout (C)	None
engWinInit (C)	None

### **Compatibility Considerations**

Most of the functions listed as obsolete in this section are unsupported in V6.5 (R13) and later versions. Some obsolete functions are unsupported in earlier versions.

If this section lists a replacement for an obsolete function, change any code that refers to the obsolete function to use the replacement instead.

If you must use an obsolete function in a MEX-file or application, use the `-V5` option to `mex` when you build the file.

### **Support for Licensed ActiveX Controls**

MATLAB supports the use of Microsoft ActiveX controls that require licensing at both design time and runtime.

See the `actxcontrol` function for information on how to specify a design-time license key.

See “Deploying ActiveX Controls Requiring Run-Time Licenses” for information on how to use ActiveX Controls that require runtime licenses in your MATLAB application.

## **Support for VT\_Date Type**

MATLAB defines a data type to be used with controls requiring input defined as type VT\_DATE. See “Using Date Data Type” for more information.

## **Dynamic Linking of External Libraries**

MATLAB supports dynamic linking of external libraries only on 32-bit Windows systems and 32-bit Linux systems. See “Calling C Shared Library Functions from MATLAB” for more information.





# Version 7.1 (R14SP3) MATLAB Software

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This table summarizes what's new in Version 7.1 (R14SP3):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports at Web site

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.1 (R14SP3)” on page 487
- “Mathematics, MATLAB Version 7.1 (R14SP3)” on page 501
- “Data Analysis, MATLAB Version 7.1 (R14SP3)” on page 505
- “Programming, MATLAB Version 7.1 (R14SP3)” on page 507
- “Graphics and 3-D Visualization, MATLAB Version 7.1 (R14SP3)” on page 514
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.1 (R14SP3)” on page 515

- “External Interfaces/API, MATLAB Version 7.1 (R14SP3)” on page 517

# Desktop Tools and Development Environment, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 487
- “Desktop” on page 488
- “Running Functions — Command Window and Command History” on page 491
- “Help” on page 492
- “Workspace, Search Path, and File Operations” on page 494
- “Editing and Debugging M-Files” on page 495
- “Tuning and Managing M-Files” on page 498
- “Publishing Results” on page 499

## Startup and Shutdown

New features and changes introduced in this version are described here.

### **Startup Option, `-nodesktop`, on Windows Platforms No Longer has Menu Bar and Toolbar; Use Function Equivalents Instead**

The behavior of MATLAB software when started on Microsoft Windows platforms with the `-nodesktop` option has changed. The MATLAB Command Window no longer displays a menu bar or toolbar. This change resolves a number of problems that occurred in previous versions when running MATLAB in `-nodesktop` mode on Windows platforms.

**Compatibility Considerations.** Use equivalent functions instead of the menu and toolbar.

Instead of using the **File > Preferences** menu to modify the font or colors used in the Command Window, run `preferences -nodesktop`. For more information, see “preferences Function Now Supports `-nodesktop` Option” on page 490.

## Desktop

New features and changes introduced in this version are organized by these topics:

- “Arranging Windows and Documents” on page 488
- “Preferences Directory Added for R14SP3; Supplements R14 Directory” on page 489
- “Preferences Changes for Fonts, Hyperlinks, and -nodesktop” on page 490
- “info.xml File Automatic Validation; Shows Warnings for Invalid Constructs” on page 491
- “Other Desktop Changes” on page 491

## Arranging Windows and Documents

**Figure Windows Now Dockable on Macintosh Platforms.** On Apple Macintosh platforms, figure windows are now dockable.

**Resize Multiple Tools at Once.** You can now position the pointer at the intersection of three or four tools or documents to resize all of them at once.

**Resize and Move Desktop Tools Using the Keyboard.** There are now menu items you can select to move and resize the active tool in the desktop. Use the menu item mnemonics to perform those action with the keyboard. For example, if the Command Window is in the desktop along with other tools, press **Ctrl+0** (or click in it) to make the Command Window the active tool. Then press **Alt+D, V**, which is the mnemonic equivalent for selecting **Desktop > Move Command Window**. The pointer becomes an arrow. Use the arrow keys to move an outline of the Command Window to a new dockable location. Press **Enter** to dock it there, or press **Esc** to return the Command Window to its original position.

**Resize Names in the Document Bar.** You can now adjust the width of a name in the document bar when the bar is at the top or bottom of the window.

**Positioning Document Bar Menu Item Name Changed.** In previous versions, selecting **Desktop > Document Bar** displayed only menu items for positioning the document bar. Now, there are additional menu items. The same change was made to the context menu for the document bar. To access the menu items for positioning the document bar, select **Desktop > Document Bar > Bar Position**.

**Keyboard Access Added for Document Bar Options.** The **Desktop > Document Bar** now includes these items: **Alphabetize**, **Width**, and **Move documentname On Bar**. With their inclusion in the menu, you can use the keyboard to access these features via mnemonics. For example, on Windows platforms, press **Alt+D, M, A** as a shortcut to for **Desktop > Document Bar > Alphabetize**.

**Left/Right and Top/Bottom Split for Document Arrangements Name Changed.** When arranging documents in desktop tools, you can choose **Window > Left/Right Split** or **Window > Top/Bottom Split** to show two documents at once in the tool. Those menu items are now called **Left/Right Tile** and **Top/Bottom Tile**. This change was made to avoid any confusion with the Editor/Debugger's new split screen feature.

### **Preferences Directory Added for R14SP3; Supplements R14 Directory**

There is a new preferences directory, R14SP3. This is the directory name returned when you run the `prefdir` function. When you install R14SP3, MATLAB migrates files from your existing preference directory, R14, to the new directory, R14SP3. Changes made to files in the directory when you run R14SP3 are not used when you run previous R14 releases.

This represents a change in the preference directory MATLAB uses for a minor release, and was done to prevent serious backwards compatibility problems. It is primarily relevant if you use R14SP3 and previous R14 releases. If you only run R14SP3, or run R14SP3 with R13 or R12 releases, you will not be affected by this change.

In the past, minor releases and the associated major release used the same preferences directory. For example, R13 and R13SP1 shared the R13 preferences directory. That continues to be true for all previous releases, but is not true for R14SP3 and beyond. The R14 preferences directory will be

shared by the R14 through R14SP2 releases, but the new R14SP3 preferences directory is only used by R14SP3. This means that changes made to files in the directory while running R14SP3 are not used when you run a previous R14 release, and the reverse is true. For example, statements added to the Command History when you run R14SP3 are not in the Command History when you run R14SP2.

For more information, see the reference page for `prefdir`.

**Compatibility Considerations.** This change was made to prevent major backwards compatibility problems. Use the R14SP3 preferences directory instead of the R14 directory. If you use the `prefdir` function and have code that relies on the result being R14, you will need to modify that code.

## Preferences Changes for Fonts, Hyperlinks, and -nodesktop

**Font Antialiasing Preference Added.** In **Preferences > Fonts**, select the new antialiasing preference to provide a smoother appearance to desktop fonts.

**Hyperlink Color Preference Changed.** There is a new **Colors** preference for specifying the color of hyperlinks in the Command Window and the Help browser **Index** pane. In previous releases, this preference only applied to the Command Window hyperlinks and was accessed via Command Window preferences.

**preferences Function Now Supports -nodesktop Option.** Run `preferences -nodesktop` after starting MATLAB on Windows platforms with the `-nodesktop` option to change Command Window font and colors via a special **Preferences** dialog box.

To set other available preferences for the Command Window after starting MATLAB with the `-nodesktop` option, run `preferences` and use the resulting **Preferences** dialog box for all tools and products. Note that changes you make to font and color preferences in this dialog box do not apply to the Command Window.

## info.xml File Automatic Validation; Shows Warnings for Invalid Constructs

If you add your own toolbox to the **Start** button, you can use the schema file for its `info.xml` file, `matlabroot/sys/namespace/info/v1/info.xsd`. MATLAB now automatically validates your `info.xml` file against this schema when you click the **Start** button after updating and refreshing your `info.xml` file.

**Compatibility Considerations.** If your `info.xml` contains invalid constructs, you will see warnings in the Command Window until you correct the problems.

## Other Desktop Changes

**Paste Special Menu Item Renamed.** In the **Edit** menu, the name of the **Paste Special** item has been replaced by **Paste to Workspace**, but the functionality remains the same. It opens the Import Wizard so you can paste the clipboard contents to the workspace in MATLAB.

**Rename Shortcut Categories.** You can now rename shortcut categories.

## Running Functions – Command Window and Command History

New features and changes introduced in this version are

- “Tab Completion Preference Added” on page 491
- “Tab Completion No Longer Shows Entries Twice” on page 492
- “Incremental Search Now Supports Removing Characters” on page 492
- “Hyperlink Color Preference Moved” on page 492

### Tab Completion Preference Added

There is a new Command Window preference, **Tab key narrows completion**. When selected, with a list of possible completions in view, type another character and press **Tab** to further narrow the list shown. Repeat to continue narrowing the list. This behavior is similar to tab completion behavior in releases prior to R14.

## Tab Completion No Longer Shows Entries Twice

In previous versions, when completing filenames or function names, a name sometimes appeared twice in the completion list, once with the file extension and once without. Now the entry appears only once.

## Incremental Search Now Supports Removing Characters

In incremental search, use **Ctrl+G** to remove characters back to the previous successful string of characters found. For example, when searching for the term `plode`, the text is not found and `Failing` appears in the incremental search field. **Ctrl+G** automatically removes the `de` from the search term because `plo` does exist in the file.

## Hyperlink Color Preference Moved

The preference for specifying the hyperlink color has moved from the Command Window preferences pane to the **Colors** preferences pane. The hyperlink color now also applies to links in the Help browser **Index** pane.

**Compatibility Considerations.** Use the **Colors** preference pane to specify the hyperlink color, and be aware that it also impacts the Help browser Index pane color.

## Help

New features and changes introduced in this version are

- “Hyperlink Color in the Index Pane Preference Added” on page 493
- “New Look for Demos, Including Thumbnails and Categories” on page 493
- “Demos Run in Command Window as Scripts and Their Variables Now Created in Base Workspace” on page 493
- “echodemo Function Added to Replace playshow function” on page 494
- “Add Demos to Favorites” on page 494
- “Adding Your Own Demos Type Tag Now Supported” on page 494
- “Bug Reporting System Introduced” on page 494



## Hyperlink Color in the Index Pane Preference Added

You can now specify the color for links in the Help browser **Index** pane using the **Colors** preferences pane. The hyperlink color also applies to links in the Command Window, so changes you make to the preference apply to both tools.

## New Look for Demos, Including Thumbnails and Categories

Stylistic changes were made to the Demos interface in the Help browser. On the summary page for a product, each demo appears with a thumbnail image that provides an indication of the type of output it creates, as well as an icon representing the type of demo (M-file, M-GUI, model, or video).

## Demos Run in Command Window as Scripts and Their Variables Now Created in Base Workspace

In this release, all M-file demos include the **Run in the Command Window** link, which executes the demo via `echodemo`.

In previous releases, some M-file demos provided a **Run** hyperlink in the display pane. When you clicked **Run**, the M-file demo executed in a GUI via the `playshow` function. An example of this type of demo is the MATLAB Mathematics Basic Matrix Operations demo, `intro.m`. In this release, the **Run** hyperlink for these M-file demos has been replaced by **Run in the Command Window**. It executes the demo step by step in the Command Window via the `echodemo` function. Double-clicking this type of M-file demo in the Navigator pane no longer runs the M-file demo, but opens the M-file in the Editor/Debugger where you can run it step by step using **Cell > Evaluate Current Cell and Advance**.

**Compatibility Considerations.** The new **Run in Command Window** hyperlink represent a change in the way demos run.

The `echodemo` function MATLAB uses to run M-file demos in the Command Window runs the demos as scripts. The `playshow` function MATLAB used to run M-file demos in previous releases ran the demos as a function. This means that now the demo's variables are created in the base workspace. If you have variables in the base workspace when you run an M-file demo, and the demo uses an identical variable name, there could be problems with variable name conflicts. For example, your variable could be overwritten. The demo's variables remain in the base workspace after the demo finishes running until

you clear them or quit MATLAB. Another change is that figures are not automatically closed when you end the demo.

### **echodemo Function Added to Replace playshow function**

There is a new echodemo function that replaces playshow. The Demos browser uses echodemo to execute M-file demos when you click the **Run in the Command Window** link.

**Compatibility Considerations.** The playshow function is deprecated in favor of the echodemo function. In a future release, the playshow function will be removed. In practice, both echodemo and playshow are helper functions for running demos. It is unlikely you would ever call either playshow or echodemo directly, and especially not in M-files.

### **Add Demos to Favorites**

You now can add published M-file demos to favorites.

### **Adding Your Own Demos Type Tag Now Supported**

If you add demos for your own toolbox, you can use the new <type> tag for a <demoitem> to identify the type of demo in your toolbox's demos.xml file.

### **Bug Reporting System Introduced**

You now can view bugs fixed with this release, as well as any known bugs using the Bug Reports database in the Support section of the MathWorks Web site. The MathWorks continuously updates the database to add any newly found bugs and compatibility issues, as well as any new workarounds and solutions. The system includes bugs found and fixed in R14SP2 and later releases.

### **Workspace, Search Path, and File Operations**


New features and changes introduced in this version are described here.

### **Find Files Offers Additional Filtering**

The Find Files tool has been enhanced. It now allows you to search all file types except those specified. It also lets you ignore files larger than a specified

size. Along with enhancements to the Find Files tool, some minor feature changes were made, including the removal of the **Restore Defaults** button.

### **Visual Directory View to be Removed**

In the next release, the Current Directory browser will no longer support the Visual Directory view (accessed using the  toolbar button).

**Compatibility Considerations.** Some features currently available using the Visual Directory view will not be available in the next release when the feature is removed.

### **Editing and Debugging M-Files**

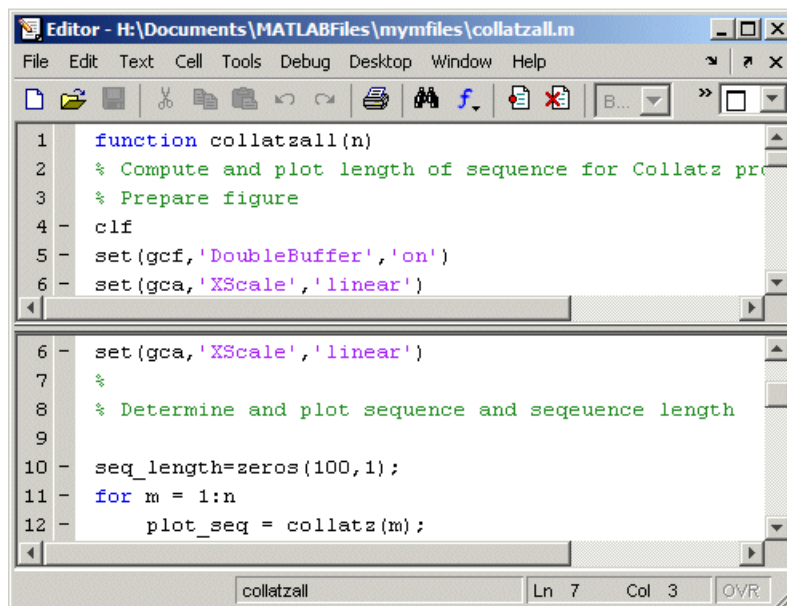
New features and changes introduced in this version are

- “Split Screen Display Added” on page 495
- “Highlight Current Line Added” on page 496
- “Comment Lines in Java, C, or C++ Program Files Now Supported” on page 497
- “HTML File Indenting Feature Added as the Default” on page 497
- “Incremental Search Now Supports Removing Characters” on page 498
- “Emacs Key Binding for Select All” on page 498
- “Change Case Added to Menu” on page 498
- “Nested Function Name No Longer in Status Bar” on page 498

### **Split Screen Display Added**

The Editor/Debugger now supports a horizontal or vertical split screen for displaying two different parts of the same document at once. To split the screen, select **Window > Split Screen** and the splitting action you want, for example, **Top/Bottom**. Alternatively, drag the splitter bar that appears above the vertical scroll bar or to the left of the horizontal scroll bar. To remove the splitter, drag it to an edge of the window.

Document with top/bottom split.

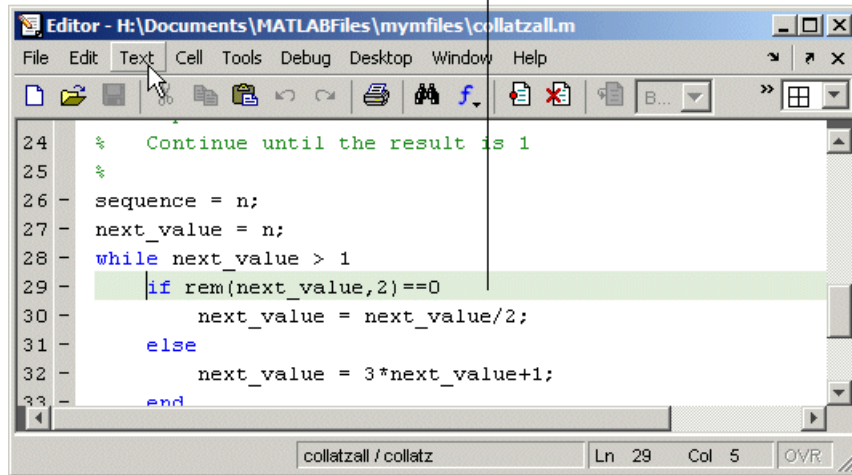


```
1 function collatzall(n)
2 % Compute and plot length of sequence for Collatz pro
3 % Prepare figure
4 clf
5 set(gcf,'DoubleBuffer','on')
6 set(gca,'XScale','linear')
6 set(gca,'XScale','linear')
7 %
8 % Determine and plot sequence and sequence length
9
10 seq_length=zeros(100,1);
11 for m = 1:n
12     plot_seq = collatz(m);
```

### Highlight Current Line Added

You can set a preference to highlight the current line, that is, the line with the caret (also called the blinking cursor). This is useful, for example, to help you see where copied text will be inserted when you paste. To highlight the current line, select **Preferences > Editor/Debugger > Display** and under **General Display Options**, select the check box for **Show caret row highlighting**. You can also specify the color used to highlight the line.

Current line (line with the caret/blinking cursor) is highlighted.



## Comment Lines in Java, C, or C++ Program Files Now Supported

You can now use the **Text > Comment** feature to comment selected lines in Sun Microsystems Java, ANSI® C, and C++ program files. This adds the // symbols at the start of the selected lines. Similarly, **Text > Uncomment** removes the // symbols from the front of selected lines in Java, C, and C++ program files.

## HTML File Indenting Feature Added as the Default

There is a new Editor/Debugger language preference for HTML files to specify block indenting. By default, the preference is selected so block indenting applies when typing text in HTML files.

In addition, you now can select **Text > Smart Indent** to apply smart indenting to selected text in HTML files.

**Compatibility Considerations.** When typing text in HTML files, you will automatically see block indenting because the preference is selected by default.

## Incremental Search Now Supports Removing Characters

In incremental search, use **Ctrl+G** to remove characters back to the previous successful string of characters found. For example, when searching for the term `plode`, the text is not found and **Failing** appears in the incremental search field. **Ctrl+G** automatically removes the `de` from the search term because `pl0` does exist in the file.

## Emacs Key Binding for Select All

With the Emacs key bindings preference selected, use **Ctrl+X, H** to select all.

## Change Case Added to Menu

Use new items in the **Text** menu to change the case of selected text. You can also use the keyboard equivalents for changing case that existed in previous versions—these are shown in the menu next to each item.

## Nested Function Name No Longer in Status Bar

The Editor/Debugger no longer displays the current nested function name in the status bar. Look in the M-file to view the current nested function name.

## Tuning and Managing M-Files

New features and changes introduced in this version are described here.

## Directory Reports Uses New Run Buttons

With Directory Reports displayed in the Web browser, you can use these two new buttons:

- **Rerun This Report** — This updates the currently displayed report after you have made changes to the report options or to any files in the current directory.
- **Run Report on Current Directory** — Use this after changing the current directory to run the same type of report for the new current directory.

These new buttons replace the **Refresh** button.

## Override %#ok with the New mlint -notok Option

There is a new option for the `mlint` function, `'-notok'` you can use to override any statements that include `%#ok` (the symbol you add to the end of a line instructing `mlint` to ignore the line). That is, `mlint` will run for all lines in the file and will not ignore any statements.

## Hyperlink Now Part of Messages Displayed by mlint

When you run the `mlint` function, the line number in the messages displayed is a hyperlink that when clicked, opens the file in the Editor/Debugger scrolled to that line number.

## Profiler Button Added to Toolbar

There is now a button  on the MATLAB desktop toolbar to open the Profiler.

## Publishing Results

New features and changes introduced in this version are described here.

## Notebook Setup Changes; Some Arguments Removed

The notebook function setup behavior and syntax have changed.

When you run `notebook(' -setup')`, MATLAB automatically obtains all the information about your Microsoft Word application from the system registry for your Windows environment and you are no longer prompted to supply the information.

In previous versions, when you configured Notebook, you ran

```
notebook (' -setup')
```

Notebook then prompted you to specify the version of Word you were using, and if needed, the location of Word and its template directory. You could supply the information using optional arguments to the `notebook` function:

```
notebook(' -setup', wordversion, wordlocation, templatelocation)
```

Now, when you run `notebook(' -setup')`, MATLAB automatically obtains all the Word information from the registry for your Windows environment.

**Compatibility Considerations.** If you use notebook with the `wordversion`, `wordlocation`, and `templatelocation` arguments in any of your files (for example, `startup.m`), remove those arguments in your files. If you specify the optional arguments, the `notebook` function runs and issues a warning, but ignores the values. In a future release, MATLAB will issue an error when it encounters notebook with these arguments.

### **Versions of Microsoft Word Application Supported by Notebook; Microsoft Word 97 No Longer Supported**

MATLAB Notebook supports the Microsoft Word version 2000 application. Notebook also supports the Microsoft Word 2002 application and Microsoft Word 2003 application, both for the Microsoft Windows XP platform.

**Compatibility Considerations.** As of MATLAB 7.1 (R14SP3), Notebook no longer supports the Microsoft Word 97 application.



## Mathematics, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are organized by these topics:

- “New Functions” on page 501
- “Modified Functions” on page 502
- “Changes to accumarray” on page 502
- “Imposing Nonnegativity Constraints on Computed ODE Solution” on page 503
- “Mersenne Twister Support in rand” on page 503
- “svd Returns Economy Decomposition” on page 503
- “New Location for LAPACK Libraries” on page 504
- “Documentation on Data Analysis” on page 504

### New Functions

The following functions are new in R14SP3:

Function	Description
hypot	Square root of sum of squares
mode	Finds most frequent values in sample

### Compatibility Considerations

A new function name can potentially introduce a backward incompatibility since it can, under certain circumstances, override a variable with the same name as the new function. This is especially true for names that are commonly used as variable names in program code.

An example of such a function name is the `mode` function, introduced in this release. If you have M-file programs that use `mode` as a variable name, it is possible under certain conditions for MATLAB to interpret these variable names as function names by mistake. Read the section “Potential Conflict with Function Names” in the MATLAB Programming documentation to find out how to avoid having these variables misinterpreted.

If your program code uses a user-written function named `mode`, you may find that MATLAB calls the new MATLAB `mode` function instead of your own `mode` function. To correct this, modify your MATLAB path by placing the location of your own `mode` function closer to the beginning of the path string than the location of the MATLAB `mode.m` file. The help for the `addpath` and `rmpath` functions explains how to modify your MATLAB path.

## Modified Functions

The following functions have been modified in MATLAB 7.1:

Function	Modified Behavior
<code>accumarray</code>	Allows more flexibility for input/output classes and functions to be called
<code>odeset</code>	New <code>NonNegative</code> integration property to impose nonnegativity constraints on an ODE solution
<code>rand</code>	Supports the Mersenne Twister algorithm in generating random numbers
<code>svd</code>	Returns economy decomposition

## Changes to `accumarray`

MATLAB Version 7.1 adds the following new features to the `accumarray` function:

- The data type for the `val` input can be any numeric type, or logical, or character.
- The data type for the `subs` input can be any numeric type.
- You can use a cell array of separate index vectors for the `subs` input.
- When you specify a function input argument, the value returned by `accumarray` is given the same class as the values returned by that function.
- You can control the sparsity of the value returned by `accumarray` by specifying the new input argument `issparse`.

## Imposing Nonnegativity Constraints on Computed ODE Solution

There is a new integration property called `NonNegative` that you can use when applying ODE initial value problem solvers. If you need to solve a problem in which certain components of the solution must be nonnegative, use the `NonNegative` property to impose nonnegativity constraints on the computed solutions.

See “Nonnegative Solutions” under “Calculus” in the MATLAB Mathematics documentation for more information on this feature.

## Mersenne Twister Support in `rand`

The `rand` function now supports a method of random number generation called the Mersenne Twister. The algorithm used by this method, developed by Nishimura and Matsumoto, generates double precision values in the closed interval  $[2^{(-53)}, 1-2^{(-53)}]$ , with a period of  $(2^{19937}-1)/2$ .

For a full description of the Mersenne twister algorithm, see <http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/emt.html>.

## `svd` Returns Economy Decomposition

The following feature was released in MATLAB 7.0, but was undocumented until this release.

The command `svd(A, 'econ')` returns economy decomposition on matrices having few rows and many columns as well as those with many rows and few columns. `svd(A,0)` continues to behave as it always has, namely to only return economy-sized decomposition on matrices having many rows and few columns.

Note that this does not carry over to the `qr` function as there is no valid way of cutting out any of the information returned by `qr` to make an economy-sized decomposition of matrices having few rows and many columns.

## **New Location for LAPACK Libraries**

The location of the LAPACK libraries has been changed. These libraries are now located in

```
extern/lib/win32/microsoft/libdflapack.lib  
extern/lib/win32/microsoft/libmwlpack.lib
```

This change impacts you only if you build MEX-files that call LAPACK and BLAS functions.

## **Documentation on Data Analysis**

The section of the MATLAB Mathematics documentation on “Data Analysis and Statistics” has been moved to a new *MATLAB Data Analysis* book.

This book documents MATLAB functions and tools that support basic data analysis, including plotting, descriptive statistics, correlation, interpolation, filtering, and Fourier analysis. It also documents the new object-oriented command-line API for analyzing time-series data.

## Data Analysis, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are described in this section:

### Data Analysis Documentation

The MATLAB 7.1 documentation includes a new Data Analysis book that describes how to use MATLAB functions and tools for common data-analysis tasks:

- Plotting
- Filtering
- Interpolation
- Descriptive statistics
- Correlation
- Data fitting using linear regression
- Fourier analysis
- Time-series analysis

Some of the content in Data Analysis is incorporated from the Mathematics and Graphics books, such as data plotting, descriptive statistics, data fitting, and Fourier analysis. All information about time-series analysis is new.

### Time-Series Analysis

You can analyze time-series data using the new `timeseries` and `tscollection` objects and methods, as well as the Time Series Tools graphical user interface. This new functionality supports the following:

- Representation for univariate or multivariate MATLAB time series and Simulink logged-signals data
- Built-in management of time units
- Removal or interpolation of missing data
- Resampling of data

- Arithmetic operations for `timeseries` objects
- Synchronization of time series

---

**Note** Due to reported instabilities on the Linux 64 platform, you must manually enable the Time Series Tools feature before starting Time Series Tools.

---

To manually enable Time Series Tools on the LinuxLinux 64 platform, type the following at the MATLAB prompt:

```
rehash toolboxcache  
feature('TimeSeriesTools',1)
```

## Programming, MATLAB Version 7.1 (R14SP3)

New features and changes are organized by these topics:

- “New Functions” on page 507
- “Modified Functions” on page 508
- “Evaluation Functions for Arrays, Structures, Cells” on page 509
- “Using who and whos with Nested Functions” on page 509
- “Date and Time Functions Support Milliseconds” on page 509
- “Stack Trace Provided for lasterror” on page 509
- “isfield Function Supports Cell Arrays; Results Might Differ from Previous Version” on page 509
- “Support for Reading EXIF Data from Image Files” on page 510
- “Performance Improvements to the MATLAB JIT/Accelerator on Macintosh” on page 511
- “Specifying fread Precision as Number of Bits” on page 511
- “Seconds Field Now Truncated; Results Might Differ” on page 512
- “Built-in Functions No Longer Use .bi; Impacts Output of which Function” on page 512
- “New Warning About Potential Naming Conflict” on page 513

### New Functions

This version introduces the following new functions:

Function	Description
arrayfun	Applies a given function to each element of an array. This is especially useful for arrays of structures.
exifread	Reads EXIF information from JPEG and TIFF image files
structfun	Applies a given function to each field of a structure

Function	Description
swapbytes	Swaps byte ordering
typecast	Converts data types without changing underlying data

### Compatibility Considerations

A new function name can potentially introduce a backward incompatibility since it can, under certain circumstances, override a variable with the same name as the new function. This is especially true for names that are commonly used as variable names in program code. Read the section “Potential Conflict with Function Names” in the MATLAB Programming documentation to find out how to avoid having these variables misinterpreted.

### Modified Functions

The following functions were modified in this version:

Function	Modified Behavior
cellfun	Applies a given function to each cell of a cell array
datestr	Seconds field truncates instead of rounding
error	Saves stack information that you can retrieve using <code>lasterror</code>
isfield	Supports cell array input
lasterror	Returns stack information on last error
rethrow	Accepts stack information as input
who, whos	Displays information separately for nested functions

### Compatibility Considerations

The following functions might, under certain circumstances, return a different value than what was returned in MATLAB 7.0.4 (R14SP2):

- `datestr`: Output might differ by 1 second from what was returned in a previous version.



- `isfield`: Output might differ if you used this feature in a release in which it was not officially supported.

## Evaluation Functions for Arrays, Structures, Cells

MATLAB offers the capability to apply a given function to each element of an array, each field of a structure, or each cell of a cell array. See the help on `arrayfun`, `structfun`, and `cellfun` for more information.

## Using `who` and `whos` with Nested Functions

When you use `who` or `whos` inside of a nested function, MATLAB returns or displays all variables in the workspace of that function, and in the workspaces of all functions in which that function is nested. This applies whether you include calls to `who` or `whos` in your M-file code or if you call `who` or `whos` from the MATLAB debugger. See the `thewho` reference page for more information.

## Date and Time Functions Support Milliseconds

The `datestr`, `datenum`, and `datevec` functions now support time specification in milliseconds. Use the symbol `.FFF` to represent milliseconds in any of these three functions. See the table labeled Free-Form Date Format Specifiers on the `datestr` reference page for more information.

## Stack Trace Provided for `lasterror`

The `lasterror` function now returns an additional field in the structure that it returns. The new `stack` field contains information from the stack on the M-file, function, and line in which the error occurred.

You can use this stack information to track down the source of an error, or as an input to the `rethrow` function. When used with `rethrow`, MATLAB sets the stack of the rethrown error to the value contained in the `stack` input.

## `isfield` Function Supports Cell Arrays; Results Might Differ from Previous Version

The `isfield` function now supports cell array input as shown in this example. Check structure `S` for any of four possible field names. In this case, only the first is found, so the first element of the return value is set to true:

```
S = struct('one', 1, 'two', 2);

fields = isfield(S, {'two', 'pi', 'One', 3.14})
fields =
     1     0     0     0
```

## Compatibility Considerations

There might be backward compatibility issues associated with this change if you used `isfield` with cell array input in a previous release. In previous releases, although `isfield` might have worked with this type of input in certain cases, it was not officially a supported feature. If you used this previously unsupported syntax in previous releases, you may see a change in the content and/or size of the return values in this release.

For example, create a structure `s` with three fields `a`, `b`, and `c` created in that order. In MATLAB 7.0.4, `isfield` called with a cell array input returns `true` if any of the elements of the cell array matches a field name, and if that element is in the same position in the cell array as the field is in the structure. This is true for `'c'`:

```
isfield(s, {'b'; 'a'; 'c'})
ans =
     1
```

In MATLAB 7.1, `isfield` returns `true` for each element in the cell array that matches a field name, regardless of where the string is positioned in the cell array. This is true for `'a'`, `'b'`, and `'c'`:

```
isfield(s, {'b'; 'a'; 'c'})
ans =
     1
     1
     1
```

## Support for Reading EXIF Data from Image Files

You can now read EXIF (Exchangeable Image File Format) data from JPEG and TIFF graphics files using the new `exifread` function. EXIF is a standard used by digital camera manufacturers to store information in the image file,

such as the make and model of a camera, the time the picture was taken and digitized, the resolution of the image, exposure time, and focal length.

## Performance Improvements to the MATLAB JIT/Accelerator on Macintosh

The JIT/Accelerator for MATLAB, introduced in MATLAB Version 6.5 for Windows and UNIX, is now also supported on Macintosh systems. The JIT/Accelerator affects the performance of MATLAB and can give you a substantial performance increase over earlier MATLAB versions for many MATLAB applications.

## Specifying fread Precision as Number of Bits

The following information on the `fread` function applies to MATLAB 7.1 and also to earlier versions.

MATLAB provides the following method of specifying a precision argument in a call to `fread`:

```
input_format=>output_format
```

For example, to read 50 8-bit unsigned integers from a file and convert them to characters, you can use

```
c = fread(fid, 50, 'uint8=>char')
```

If the input format and output format are the same, you can abbreviate the precision specifier by using

```
*input_format
```

For example, you can replace

```
c = fread(fid, 50, 'uint8=>uint8')
```

with

```
c = fread(fid, 50, '*uint8')
```

You can also use this notation with an input stream that is specified as a number of bits (e.g., `bit4` or `ubit18`). MATLAB translates this into an

output type that is a signed or unsigned integer (depending on the input type), and which is large enough to hold all of the bits in the source format. For example, `*ubit18` does not translate to `ubit18=>ubit18`, but instead to `ubit18=>uint32`.

## Seconds Field Now Truncated; Results Might Differ

When handling time data, MATLAB now truncates the seconds field instead of rounding it. This is consistent with the way that MATLAB handles hours and minutes.

For example, using MATLAB 7.0.4 (R14SP2), `datestr` returns

```
t = datestr('11:30:01.666')
t =
    01-Jan-2005 11:30:02
```

while MATLAB 7.1 (R14SP3) returns

```
t = datestr('11:30:01.666')
t =
    01-Jan-2005 11:30:01
```

## Compatibility Considerations

If your M-files relied on the previous behavior, you might get different results.

## Built-in Functions No Longer Use `.bi`; Impacts Output of which Function

In previous releases, MATLAB function dispatching located built-in functions by means of special files having a `.bi` file extension. MATLAB no longer uses this mechanism to locate built-in functions. All `.bi` files have been removed in MATLAB 7.1.

## Compatibility Considerations

If you have M-files that relied on built-in files having a `.bi` extension, your files need to accommodate this change.

There are changes in how MATLAB displays built-in functions using `which`:

In MATLAB 7.0.4 (R14SP2),

```
which -all int32
  \\matlab\toolbox\symbolic\@sym\int32.m           % sym method
  \\matlab\toolbox\matlab\datatypes\int32.bi      % Shadowed
  \\matlab\toolbox\matlab\datatypes\int32.m      % Shadowed
```

In MATLAB 7.1 (R14SP3),

```
which -all int32
  built-in (\\matlab\toolbox\matlab\datatypes\int32)
  \\matlab\toolbox\symbolic\@sym\int32.m           % sym method
```

## New Warning About Potential Naming Conflict

If you change directories (`cd`) or add a new directory to your current MATLAB path, and the new directory contains an M-file having the same name as a MATLAB built-in function, MATLAB now displays a warning alerting you to the potential naming conflict. For example,

```
Warning: Function D:\test\matlab\disp.m has the same name as a
MATLAB builtin. We suggest you rename the function to avoid a
potential name conflict.
```

In general, any file system event that leads to path refreshing in MATLAB can trigger this warning if the directory involved in this event has such a user function under it.

## Compatibility Considerations

MATLAB might generate warnings about naming conflicts that did not appear in previous versions. To avoid this warning, renaming your M-files that have name conflicts with built-in functions.

## **Graphics and 3-D Visualization, MATLAB Version 7.1 (R14SP3)**

This version introduces the new features and changes described below.

### **Plot Tools Now Available on Mac Platform**

As a consequence of enabling Java figures on Macintosh, the Plot Tools user interface is now available to Mac users, enabling them to interactively add data to plots, change plot symbology, and otherwise customize their data plots.

### **Documentation for Data Analysis Reorganized**

Documentation explaining techniques for analyzing graphical data has been shifted from the Graphics book of the MATLAB documentation to a new book called Data Analysis.

# Creating Graphical User Interfaces (GUIs), MATLAB Version 7.1 (R14SP3)

## Plans for Obsolete Functions

The table below indicates functions that were designated as obsolete prior to R14SP3 and that will be removed in a future version.

## Compatibility Considerations

If you use these functions, you should use replacement functions instead.

Obsolete Function	Removed from Version	Replacement
<code>clruprop</code>	Future version	<code>rmappdata</code>
<code>ctlpanel</code>	Future version	<code>guide</code>
<code>extent</code>	Future version	<code>get(txtobj, 'extent')</code>
<code>figflag</code>	Future version	<code>findobj</code> to determine if figure exists.  <code>figure(figurehandle)</code> to bring figure to front and give it focus.
<code>getuprop</code>	Future version	<code>getappdata</code>
<code>hthelp</code>	Future version	<code>web</code>
<code>layout</code>	Future version	None provided
<code>matq2ws</code>	Future version	None provided
<code>matqdlg</code>	Future version	None provided
<code>matqparse</code>	Future version	None provided
<code>matqueue</code>	Future version	None provided
<code>menuedit</code>	Future version	<code>guide</code>
<code>menulabel</code>	Future version	Use <code>'&amp;'</code> to specify mnemonics and <code>'Accelerator'</code> property to define accelerator keys.

<b>Obsolete Function</b>	<b>Removed from Version</b>	<b>Replacement</b>
setupprop	Future version	setappdata
wizard	Future version	None provided
ws2matq	Future version	None provided



## External Interfaces/API, MATLAB Version 7.1 (R14SP3)

- “mex Switches Now Supported on Microsoft Windows” on page 517
- “New COM Programmatic Identifier” on page 518
- “New File Extension for MEX-Files on Windows Systems” on page 518
- “New Preferences Directory and MEX Options” on page 520
- “Compiler Support” on page 521
- “Import Libraries Moved” on page 521
- “MEX Perl Script Moved” on page 522
- “Linking to System Libraries” on page 522
- “COM Automation Server Now Displays Figure” on page 522

### mex Switches Now Supported on Microsoft Windows

MATLAB now supports the `-l` and `-L` options to the `mex` command on Windows operating systems. In previous releases of MATLAB, these options were supported only on UNIX systems.

Switch	Description
-l	<p>Specifies additional libraries to link against.</p> <hr/> <p><b>Note</b> On Windows operating systems, the <code>-l</code> option can specify libraries of two forms. For example, specifying <code>-l</code> name matches either <code>name.lib</code> or <code>libname.lib</code>, whereas on UNIX it matches only <code>libname.lib</code>.</p> <hr/>
-L	<p>Specifies a path to use when MATLAB searches for library files specified with the <code>-l</code> option. The <code>-L</code> option must precede the <code>-l</code> option.</p>

For the switches you can use with the `mex` command, see the “MEX Script Switches” table in the “Custom Building MEX-Files” section of “Creating C/C++ and Fortran Programs to be Callable from MATLAB (MEX-Files)” in the MATLAB External Interfaces documentation.

## New COM Programmatic Identifier

There is now a ProgID that enables you to use the full desktop version of MATLAB as an automation server.

`Matlab.Desktop.Application` starts an automation server using the most recent version of MATLAB that is installed on your system.

## New File Extension for MEX-Files on Windows Systems

MATLAB now uses the extension `.mexw32` for MEX-files on 32-bit versions of Windows systems. In previous versions, MATLAB used the extension `.dll`.

MathWorks recommends that you recompile all MEX-files after installing MATLAB 7.1. MEX-files compiled in MATLAB 7.0.4 with `.dll` extensions should still work in MATLAB 7.1.

There may be two MEX-files with the same name, except that one has a `.mexw32` extension and the other has a `.dll` extension. When these files are both on the MATLAB search path:

- If the two files are in the same directory, MATLAB uses the `.mexw32` file.
- If the two files are in different directories, MATLAB uses the file in the directory that is higher on the search path.

If you want one of these two files to take precedence over the other, ensure that the directory that contains the file you want MATLAB to use is higher on the search path than the directory that contains the file you do not want MATLAB to use.

## Compatibility Considerations

Previous versions of MATLAB do not recognize MEX-files compiled in MATLAB 7.1 with `.mexw32` extensions. However, you can use the `mex` -output option in MATLAB 7.1 to build a MEX-file with a `.dll` extension that earlier versions of MATLAB can recognize.

You may need to update any MATLAB scripts or makefiles that explicitly expect `.dll` extensions for compiled MEX-files. You can use the `mexext`

function in MATLAB to obtain the extension for the platform and version you are working on. A new `mexext` script obtains the appropriate extension when executed from outside MATLAB, as in a makefile.

On Windows systems, MATLAB issues warnings at MEX setup time, compile time, and run-time to notify you of possible incompatibilities resulting from the change in MEX-file extension from `.dll` to `.mexw32`.

### **New mex-output Behavior for Compatibility**

The `-output` option to `mex` specifies the filename of the compiled MEX-file. In general, `mex` ignores any filename extension supplied in the `-output` argument and uses the extension for the compiled file that is appropriate for the architecture. However, on Windows systems, if the `-output` argument specifies a `.dll` extension, the compiled file has this extension instead of `.mexw32`. Previous versions of MATLAB can recognize the resulting compiled file.

### **Conflicting MEX-Files Renamed Automatically**

If two files with the same name but with `.mexw32` and `.dll` extensions exist in the same directory, MATLAB uses the `.mexw32` file. To avoid unintended shadowing, MATLAB automatically renames compiled MEX-files under the following circumstances:

- When you build a MEX-file with a `.mexw32` extension and the directory contains an existing file with the same name, but with a `.dll` extension, the extension of the `.dll` file is changed to `.dll.old`.
- When you build a MEX-file with a `.dll` extension (using the `mex -output` option) and the directory contains an existing file with the same name, but with a `.mexw32` extension, the extension of the `.mexw32` file is changed to `.mexw32.old`.

### **New Return Value for mexext on Windows Systems**

On 32-bit Windows platforms, the `mexext` function now returns `mexw32`. In MATLAB 7.0.4 it returned `dll`.

## **New mexext Script to Obtain MEX-File Extension in Makefiles**

A new script displays the MEX-file extension in the current version of MATLAB that corresponds to the platform on which the script is executed. It is intended to be used outside MATLAB, in makefiles or scripts, to obtain the appropriate filename extension for compiled MEX-files. Use this script instead of explicitly specifying the MEX-file extension in a makefile.

The script is named `mexext.bat` on Windows platforms and `mexext.sh` on UNIX platforms. It is located in the directory `$matlab/bin`, where `$matlab` represents the string returned from the `matlabroot` command.

The script displays the MEX-file extension without a leading period. For example, on 32-bit Windows platforms, it returns `mexw32`.

Following is a fragment of a GNU makefile that uses the `mexext` script to obtain the MEX-file extension:

```
ext = $(shell mexext)

yprime.$(ext) : yprime.c
    mex yprime.c
```

## **New Preferences Directory and MEX Options**

The MATLAB preferences directory has changed. In MATLAB 7.1, the preferences directory is named `R14SP3`. In previous R14 releases, the preferences directory was named `R14`. For more information, see the documentation for `prefdir`, which returns the preferences directory.

## **Compatibility Considerations**

When you install MATLAB 7.1, MATLAB migrates some files from any existing `R14` preferences directory to the new `R14SP3` directory. However, MATLAB does not migrate the MEX options file, `mexopts.bat`. If you want to preserve any MEX options that you have customized in an earlier R14 release, you need to migrate your options to the new `R14SP3` preferences directory.

You can migrate your MEX options in either of two ways:

- If you have customized only a few options: Invoke `mex` with the `-setup` option to create a new `mexopts.bat` file in the R14SP3 preferences directory. Edit the new `mexopts.bat` file to customize the MEX options there.
- If you have customized many options: Copy your customized `mexopts.bat` file from the old R14 preferences directory to the new R14SP3 directory. Edit at least the settings of the `LIBLOC` and `NAME_OUTPUT` linker parameters in the `mexopts.bat` file. These lines should look as follows on Windows systems when using a Microsoft compiler:

```
set LIBLOC=%MATLAB%\extern\lib\win32\microsoft
set NAME_OUTPUT=/out:"%OUTDIR%%MEX_NAME%%MEX_EXT%"
```

The `LIBLOC` parameter has changed because import libraries have moved; see “Import Libraries Moved” on page 521. The value of this parameter depends on the platform you are running MATLAB on and the vendor of the compiler you are using.

The `NAME_OUTPUT` parameter has changed because the extension for compiled MEX-Files has changed on Windows systems; see “New File Extension for MEX-Files on Windows Systems” on page 518.

## Compiler Support

The set of compilers that MATLAB supports has changed in MATLAB 7.1. For an up-to-date list of supported compilers, see the Supported and Compatible Compilers Web page.

## Compatibility Considerations

You may need to recompile code compiled with an earlier compiler that is no longer supported.

## Import Libraries Moved

The import libraries (`.lib` files) for the MATLAB `dll` files have been moved up a directory level and are no longer specific to the compiler version. The new location for these files is

```
$matlab/extern/lib/$arch/$vendor
```

where the terms `$matlab`, `$arch`, and `$vendor` respectively represent the string returned from the `matlabroot` command, the platform you are running MATLAB on, and the vendor of the compiler you are using.

### **Compatibility Considerations**

You may need to change any code that depends on the previous library locations.

### **MEX Perl Script Moved**

The MEX Perl script used in building MEX-files is now located in `$matlab/bin`, rather than `$matlab/bin/win32`. (The term `$matlab` represents the string returned by the `matlabroot` function.) You should not notice any difference, however, as a batch file located in `$matlab/bin/win32` provides backward compatibility.

### **Linking to System Libraries**

MATLAB now links with the system libraries by default. You no longer need to specify them explicitly.

### **COM Automation Server Now Displays Figure**

When using MATLAB as an Automation server, executing MATLAB commands that create figures now displays the figure window.

Previous releases of MATLAB created the figure in the background. To duplicate the old behavior, create a figure with its `Visible` property set to `off`, then set the property to `on` when you want the figure to be visible:

```
h = actxserver('matlab.application');  
h.Execute('figure visible off');  
h.Execute('plot(1:10)');  
h.Execute('set(gcf, 'visible', 'on')');
```

# Version 7.0.4 (R14SP2)

## MATLAB Software

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This table summarizes what's new in Version 7.0.4 (R14SP2):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Bug Reports at Web site

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.0.4 (R14SP2)” on page 524
- “Mathematics, MATLAB Version 7.0.4 (R14SP2)” on page 531
- “Programming, MATLAB Version 7.0.4 (R14SP2)” on page 532
- “Graphics and 3-D Visualization, MATLAB Version 7.0.4 (R14SP2)” on page 538
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.4 (R14SP2)” on page 539
- “External Interfaces/API, MATLAB Version 7.0.4 (R14SP2)” on page 540

## Desktop Tools and Development Environment, MATLAB Version 7.0.4 (R14SP2)

New features and changes are organized by these topics:

- “Installation Folder with Spaces” on page 524
- “Startup and Shutdown” on page 525
- “Desktop” on page 525
- “Running Functions — Command Window and History” on page 526
- “Help” on page 526
- “Workspace, Search Path, and File Operations” on page 527
- “Editing and Debugging M-Files” on page 528
- “Source Control Interface” on page 529
- “Publishing Results” on page 529

### Installation Folder with Spaces

In MATLAB 7.0.4 (R14SP2) software, the following two changes have been made to the MathWorks Installer on Microsoft Windows platforms:

- The Installer now allows a folder name with spaces in the installation path.
- The Installer honors the default installation folder for Windows software, which on most machines is Program Files.

These changes were made in response to many customer requests and the desire to conform to a widely established industry practice for the PC platform.

---

**Note** MathWorks products are used and integrated into many software environments. If you use MathWorks products in conjunction with other third party applications (compilers, other numerical analysis packages, etc.) you might want to continue installing into a folder that does not have spaces in the path until you have tested that those applications work with MathWorks products.

---



## Startup and Shutdown

### Confirmation Dialog Box for Quitting Added

When quitting MATLAB, a confirmation dialog box appears if you set a new preference for that purpose. By default, the confirm quitting preference is not set, so the dialog box will not appear. To change the preference, see the instructions for “Confirmation Dialogs Preferences” in the desktop documentation.

### JVM Software Updated

MATLAB is now using version 1.5 of Sun Microsystems Java JVM software on Windows, Linux Torvalds Linux (32-bit), and Sun Microsystems Solaris platforms. Java software is supplied with MATLAB, so this change requires no action on your part.

### Compatibility Considerations

If you use a specific version of Java with MATLAB on Windows, Linux 32-bit, or Solaris platforms, this change might affect you.

## Desktop

### Confirmation Dialog Boxes Preference Introduced

There are new preferences for displaying or not displaying confirmation dialog boxes for desktop tools. In previous versions, some of these preferences existed but were located with other preferences for the associated desktop tool. They are now organized in one preference panel for all desktop tools. Access them by selecting **File > Preferences > General > Confirmation Dialogs**. These preferences work in conjunction with the **Do not show this prompt again** check boxes that appears on various desktop confirmation dialog boxes. For more information, see “Confirmation Dialogs Preferences” in the desktop documentation.

## Running Functions – Command Window and History

### Overwrite Mode Now Supported

The Command Window now supports overwrite mode. Press the **Insert** key to enter text in overwrite mode. Press the **Insert** key again to return to entering text in insert mode. View the current state at the far right end of the status bar of the Command Window when it is undocked, or in the desktop when the Command Window is docked and has focus. In insert mode, **OVR** in the status bar is gray and the cursor has a wide block shape.

### Hyperlink Color Preference Added

Set the color of hyperlinks that display in the Command Window. Select **File > Preferences > Command Window**, and under **Display**, select **Hyperlink color**.

## Help

### Subfunction Help Syntax Changed

To get help for a subfunction, use

```
help functionname>subfunctionname
```

### Compatibility Considerations

In previous versions, the syntax was `help functionname/subfunctionname`. This change was introduced in R14 (MATLAB 7.0) but was not documented.

### Bug Fixes and Known Problems Now on Web; No Longer Found Via Help Search

The Release Notes sections “Major Bug Fixes” and “Known Software and Documentation Problems” no longer include the content in the installed help files. Instead, the sections provide links to these lists on the MathWorks Web site. The lists on the Web site can be updated after the release date to reflect the latest information.

## Compatibility Considerations

As a result of this change, the Help browser **Search** feature will not find search terms that are in the content of those reports. Use the MathWorks Web site search features to look for search terms in those reports.

## Workspace, Search Path, and File Operations

### Formatting Decimal Separator when Copying From the Array Editor

You can now specify how you want decimal numbers to be formatted when you cut or copy cells from the Array Editor and paste them into text files or other applications. You can specify a separator for this purpose in the Array Editor panel of the **Preferences** dialog. The **Decimal separator to use when copying** edit field is by default "." (period). If you are working in or providing data to a locale that uses a different character to delimit decimals, type that character in this edit field and click **OK** or **Apply**.

### Workspace Browser Preference Panel Removed

The Workspace browser preferences panel was removed. The entry on that panel was for confirming deletion of variables. That preference is now part of **General > Confirmation Dialogs** preferences.

Compatibility Considerations

Use **File > Preferences > General > Confirmation Dialogs** instead of **File > Preferences > Workspace Browser**.

### Current Directory Browser Preferences Added

There are new Current Directory browser preferences you can access by selecting **File > Preferences > Current Directory Browser, Browser display options**:

- View the file size by selecting the **Show file sizes** check box. (This is selected by default.)

- For models created with Simulink software, view brief descriptions in the **Description** column when **Show M and MDL file descriptions** is selected.
- For models created with Simulink, view the complete descriptions in the lower pane when the preference for **Show M, MDL and MAT file contents** is selected. This allows you to view information about a model without running Simulink.

## Editing and Debugging M-Files

### Go To Subfunction or Nested Function

Go directly to a subfunction or nested function within an M-file using the enhanced **Go To** dialog box. Access the dialog box by selected **Edit > Go To**. Click the **Name** column header to arrange the list of functions alphabetically, or click the **Line** column header to arrange the list by the position of the functions in the file.

### Help Browser Now Accessible from MATLAB Stand-Alone Editor

You can now access the MATLAB Help browser from the MATLAB stand-alone Editor. This provides you with documentation for MATLAB, including using Editor features and MATLAB functions.

### Preference for Editor/Debugger Dialog Moved

The **Show dialog prompt** preference has been moved to **Preferences > General > Confirmation Dialogs**. For more information, see “Confirmation Dialogs Preferences” in the desktop documentation.

### Compatibility Considerations

Use **File > Preferences > General > Confirmation Dialogs** instead of **File > Preferences > Editor/Debugger** to set this preference.

### Dragging Text Maintains Font and Highlighting

Now, when you drag text from the Editor/Debugger to another application, it maintains the syntax highlighting and font characteristics.

## Source Control Interface

### Register Project Feature Added; Add to Source Control Behavior Changed

There is a new source control interface feature for Windows platforms, **Register Project with MATLAB**. Use this to associate all files in a directory with a source control project. You perform this for any file in a directory, which registers the directory and all files in that directory. You only perform this once in a directory, and must perform it before you perform any other source control actions for files in that directory.

Access the feature in the Current Directory browser by right-clicking a file and selecting **Source Control > Register Your Source Control System Project with MATLAB** from the context menu. You can also access it from the Editor/Debugger **File** menu. To access the feature for files created with Simulink or Stateflow® software, use the Current Directory browser.

For a summary of the process, see the topic “Source Control Interface on Microsoft Windows” in the desktop documentation.

### Compatibility Considerations

In previous releases, this feature was part of the **Add to Source Control** feature. You still need to add each file to source control, but you do this after first registering the directory that contains the file.

### Project Name Exact Match No Longer Required

The name of the project in the source control system is no longer required to exactly match the name of the directory on disk containing the files.

## Publishing Results

### Cell Publishing: File Extension Changes

The files created when publishing using cells now have more natural extensions. JPEG files now have a `.jpg` instead of a `.jpeg` extension, and EPSC2 files now have an `.eps` instead of an `.epsc2` extension.

### **Compatibility Consideration**

If you relied on the formerly used file extensions, you need to accommodate the changes.

### **Cell Publishing: LaTeX Image File Type Changes**

Publishing to LaTeX now respects the image file type you specify in preferences rather than always using EPSC2 files.

### **Cell Publishing: Image Options More Restrictive**

The **Publish image options** in Editor/Debugger preferences for **Publishing Images** have changed slightly. The changes prevent you from choosing invalid formats.

### **Notebook Support for Microsoft Word 97 Application to be Discontinued**

Notebook will no longer support the Microsoft Word 97 application starting in the next release of MATLAB.

### **Compatibility Considerations**

If you use Word 97 with Notebook, you will need to migrate to a more recent version.

## Mathematics, MATLAB Version 7.0.4 (R14SP2)

This version introduces the following new features and changes:

- “New Vendor BLAS Used for Linear Algebra in MATLAB” on page 531
- “max and min on Complex Integers Not Supported” on page 531

### **New Vendor BLAS Used for Linear Algebra in MATLAB**

MATLAB uses Basic Linear Algebra Subprograms (BLAS) for its vector inner product, matrix-vector product, matrix-matrix product, and triangular solvers in `\`. MATLAB also uses BLAS behind its core numerical linear algebra routines from Linear Algebra Package (LAPACK), which are used in functions like `chol`, `lu`, `qr`, and within the linear system solver `\`.

Starting in this release

- On Macintosh, MATLAB now uses the Accelerate framework.
- On 64-bit Linux, MATLAB uses Intel® Math Kernel Library (MKL) 7.0.1 on Intel chips, and AMD Core Math Library (ACML) 2.0 on AMD chips.

### **max and min on Complex Integers Not Supported**

Using the `max` and `min` functions on complex integer inputs (as shown in the example below) is no longer supported. This operation had been supported from release R11 through R14SP1, but now returns an error.

```
max(int8([3-4i 3+4i]))
```

### **Compatibility Considerations**

Any code that calls `max` or `min` on complex integers should be removed from your program files.

## Programming, MATLAB Version 7.0.4 (R14SP2)

This version introduces the following new features and changes:

- “Memory-Mapping” on page 532
- “textscan Enhancements” on page 533
- “xlsread Enhancements” on page 533
- “xlsread Imported Date Format Changes” on page 533
- “format Options Added” on page 533
- “Nonscalar Arrays of Function Handles to Become Invalid” on page 534
- “Assigning Nonstructure Variables As Structures Displays Warning” on page 534
- “Function Declaration Compatibility with Pre-R14 M-Files” on page 536

### Memory-Mapping

Memory-mapping is a mechanism that maps a portion of a file, or an entire file, on disk to a range of addresses within an application’s address space. The application can then access files on disk in the same way it accesses dynamic memory. This makes file reads and writes faster in comparison with using functions such as `fread` and `fwrite`.

Another advantage of using memory-mapping in MATLAB is that it enables you to access file data using standard MATLAB indexing operations. Once you have mapped a file to memory, you can read the contents of that file using the same type of MATLAB statements used to read variables from the MATLAB workspace. The contents of the mapped file appear as if they were an array in the currently active workspace. You simply index into this array to read or write the desired data from the file.

Memory-mapped files also provide a mechanism for sharing data between applications. This is achieved by having each application map sections of the same file. This feature can be used to transfer large data sets between MATLAB and other applications.



## **textscan Enhancements**

The `textscan` function originally read data only from files. As of this release, you can use `textscan` to read from strings as well.

## **xlsread Enhancements**

In this release, you can write a function and pass a handle to this function to `xlsread`. When `xlsread` executes, it reads from the spreadsheet, executes your function on the data read from the spreadsheet, and returns the final results to you.

You can use either of the following syntaxes:

```
num = xlsread('filename', ..., functionhandle)
[num, txt, raw, X] = xlsread('filename', ..., functionhandle)
```

For an example, see the `xlsread` reference page.

## **xlsread Imported Date Format Changes**

In MATLAB versions prior to R14, date values read into MATLAB from an Excel spreadsheet using `xlsread` were always imported as numeric date values. The R14 and later releases of MATLAB import dates in the format in which they were stored in the Excel file. Dates stored in string or date format are now imported as strings by `xlsread`. Dates stored in numeric format are imported as numeric date values.

## **Compatibility Considerations**

Because of a difference in the way Excel and MATLAB compute numeric date values, any numeric dates imported from Excel into MATLAB must be converted to the MATLAB format before being used in the MATLAB application. For more information, see “When to Convert Dates from Excel Files”.

## **format Options Added**

You can display MATLAB output using two new formats: `short eng` and `long eng`. See the `format` reference page for more information.

- `short eng` — Displays output in an engineering format that has at least 5 digits and a power that is a multiple of three.
- `long eng` — Displays output in an engineering format that has exactly 16 significant digits and a power that is a multiple of three.

```
format short eng
pi
ans =
    3.1416e+000
```

```
format long eng
pi
ans =
    3.14159265358979e+000
```

## **Nonscalar Arrays of Function Handles to Become Invalid**

Creation of nonscalar arrays of function handles by `str2func` may be invalid or may return different results in future versions of MATLAB, but will continue to work in R14.

### **Compatibility Considerations**

To avoid this warning and prepare for this change, convert the cell array of strings to a cell array of function handles.

For more information, type `help function_handle` and see the section entitled Note on Backward Compatibility.

## **Assigning Nonstructure Variables As Structures Displays Warning**

Assigning to a nonstructure variable as if it were a structure is not recommended in MATLAB. For example, if variable `x` holds a double (as shown below), then attempting to add a fieldname to it, thus converting `x` to a structure, is not good programming practice and should generate an error.

```
x = 10;
x.name = magic(3);
```

Note that if `x` were empty (i.e., `x == []`), then assigning a field to it as if it were already a structure is acceptable.

### Behavior Prior to Release R14

Because of a bug in releases of MATLAB prior to R14, you can assign a field to a nonempty, nonstructure variable in those releases without MATLAB generating a warning message or error. The result is that MATLAB quietly converts the variable to a structure:

```
x = 10;
class(x)
ans =
    double

x.name = magic(3);      % Invalid expression completes
                        %   without warning or error.

class(x)
ans =
    struct
```

### Behavior In R14 and Later

In the MATLAB R14 and R14 service pack releases, you can still perform this type of operation, but MATLAB now displays a warning message:

```
x = 10;
x.name = magic(3);

Warning: Struct field assignment overwrites a value with class
"double".
```

In a future release of MATLAB, attempting this type of operation will throw an error instead of just displaying a warning message.

### Compatibility Considerations

You are encouraged to modify any code that generates this warning. The section “Making a Valid Assignment” on page 536 gives instructions on how to do this.

### Another Case – Extending the Depth of a Structure

The same rules apply when extending the depth of a structure by adding additional, lower-level fields. The first line of the example shown below creates a structure named `handle` and assigns to it a field of type `double` named `output`. The line after that treats this `double` as if it were a structure by attempting to assign a field named `time` to it. The second line is an invalid expression:

```
handle.output = 5;  
handle.output.time = 13;
```

As in the case discussed earlier, this assignment does not generate a warning or error in MATLAB releases prior to R14. In the R14 and R14 service pack releases of MATLAB, you get the warning shown in the previous example. Beginning in a future release of MATLAB, this assignment will throw an error.

### Making a Valid Assignment

To avoid this warning and future errors, first make `x` an empty structure or empty array as shown here. Once a variable is established as a structure or empty array, you can assign fields to it without getting an error:

```
x = struct;      or      x = [];  
x.name = magic(3);
```

In the case of extending the depth of an existing structure, you can perform this type of assignment without generating a warning or error using the `struct` function as shown here:

```
handle.output = struct('time', 13);
```

### Function Declaration Compatibility with Pre-R14 M-Files

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. However, because this syntax is not compatible with earlier releases, you should always include the comma separators when writing an M-file function that you intend to run on releases both earlier and later than Release 14.

### **Compatibility Considerations**

See “Comma Separators Not Required in Function Declaration” on page 640 in the Release 14 release notes.

## Graphics and 3-D Visualization, MATLAB Version 7.0.4 (R14SP2)

This version introduces the following new feature:

### **imwrite Now Supports GIF Export**

The `imwrite` function now supports exporting image data in Graphics Interchange Format (GIF).

### **Compatibility Considerations**

The MATLAB 7.0.4 graphics features have the following platform limitations:

#### **Cannot Dock Figures on Macintosh**

You cannot dock figures in the Desktop, because MATLAB uses native figure windows on the Macintosh platform.

#### **Plotting Tools Not Working on Macintosh**

The plotting tools are not supported on the Macintosh platform. This means the Figure Palette, Plot Browser, and Property Editor do not work these platforms. To use the MATLAB 6 Property Editor, see the `propedit` command.

#### **Not All Macintosh System Fonts Are Available**

MATLAB figures do not support the same fonts as native Macintosh applications. Use the `uisetfont` functions to see which fonts are available in the MATLAB environment.

#### **XDisplay Property Setable on Motif-Based Systems**

You can specify the value of the figure `XDisplay` property only on systems using Motif-Based figure windows.

# Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.4 (R14SP2)

## **New Callbacks Chapter**

The Creating Graphical User Interfaces documentation offers a new chapter, in draft form, that attempts to bring information regarding callbacks into one place. It introduces the concepts and mechanisms with which you work, and explains some basic techniques for programming your GUI's behavior. This chapter is not yet complete, but you may find it useful, even in its current state, particularly if you are new to creating GUIs.

Temporarily, this new chapter appears as Appendix A, "Working with Callbacks (Draft)." It contains some new information, but also duplicates information that can be found in various places throughout the rest of the book. In cases where information has not yet been included in the new chapter, links take you to the main part of the book.

## External Interfaces/API, MATLAB Version 7.0.4 (R14SP2)

New features and changes introduced in this version are described here.

### **New File Archiving Functions and Functionality**

In addition to being able to `zip` and `unzip` compressed file archives, MATLAB software now supports the following archiving functions:

- `gzip/gunzip` — Compress/uncompress files in gzip format.  
`gunzip` reads archives from both file systems and URLs.
- `tar/untar` — Compress/extract files in a tar-file.  
`untar` reads archives from both file systems and URLs.
- The `unzip` function can now also open a zip archive from a URL.



# Version 7.0.1 (R14SP1)

## MATLAB Software

---

This table summarizes what's new in Version 7.0.1 (R14SP1):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Fixed bugs

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.0.1 (R14SP1)” on page 542
- “Mathematics, MATLAB Version 7.0.1 (R14SP1)” on page 548
- “Programming, MATLAB Version 7.0.1 (R14SP1)” on page 552
- “Graphics, MATLAB Version 7.0.1 (R14SP1)” on page 558
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.1 (R14SP1)” on page 559
- “External Interfaces/API, MATLAB Version 7.0.1 (R14SP1)” on page 562

## Desktop Tools and Development Environment, MATLAB Version 7.0.1 (R14SP1)

New features and changes are organized by these topics:

- “Startup and Shutdown” on page 542
- “Desktop” on page 542
- “Running Functions — Command Window and Command History” on page 543
- “Help” on page 544
- “Workspace, Search Path, and File Operations” on page 544
- “Editing and Debugging M-Files” on page 545
- “Source Control Interface” on page 546
- “Publishing Results” on page 546

### Startup and Shutdown

#### Construction of Classpath for Java Software Now Uses librarypath

When the MATLAB software starts, it now uses `librarypath.txt` as well as `classpath.txt` to construct the classpath for Sun Microsystems Java software.

**Compatibility Considerations.** If you call Java software from MATLAB, refer to “Locating Native Method Libraries” in the MATLAB External Interfaces documentation for details. This change was part of MATLAB 7.0.

### Desktop

#### System Web Browser Used for Large Files

The MATLAB Web browser displays files up to 1.5 MB. When the Web browser tries to open a file greater than 1.5 MB, MATLAB instead automatically displays the file in the system default browser.

## Keyboard Access Added for More Desktop Tools

Additional desktop tools provide keyboard access to toolbar buttons and fields via mnemonics. For example, **Alt+K** moves the cursor to the **Stack** field in the Editor/Debugger toolbar. In the Profiler, the **R** in the **Run this code** toolbar field is underlined, indicating that **Alt+R** moves the cursor to this field. You might need to hold down the **Alt** key while the tool is selected in order to see the mnemonics on the menus and buttons.

## Macintosh Menus

On the Apple Macintosh platform, the location of menus in MATLAB has changed. In this version, menus in MATLAB are not located at the top of the screen with other screen menus for the Macintosh environment. Instead, MATLAB menus appear within the MATLAB desktop and MATLAB tools. This change was made because of a problem with screen menus that caused MATLAB on the Macintosh platform to crash.

## Running Functions – Command Window and Command History

### Preferences for Parentheses Matching Added

There are now Command Window preferences you can set to perform parenthesis matching. Select **File > Preferences > Command Window > Keyboard and Indenting** to set them. With the preference **Match parentheses while typing** selected, when you type a parenthesis or another delimiter, MATLAB highlights the matched parenthesis or other delimiter in the pair. With the preference **Match parentheses on arrow key or mouse movement** selected, when you move over a parenthesis or another delimiter, MATLAB highlights the matched parenthesis or other delimiter in the pair. MATLAB also alerts you to mismatches. These preferences also allow you to specify how MATLAB notifies you of matches and mismatches.

### Clear Command Window Now Available from Context Menu

You can now select **Clear Command Window** from the context menu in the Command Window. A confirmation dialog box does not appear and the Command Window clears immediately. If you want a confirmation dialog box

to appear before the Command Window clears, use **Edit > Clear Command Window** instead.

### **End Key Behavior Changes**

With the **Display** preference for **Wrap lines** selected, pressing **End** moves the cursor to the end of the current statement. When the **Command line key bindings** preference is set to **Emacs (MATLAB standard)**, you can also do this using **Ctrl+E**. In the previous version, **End** (and **Ctrl+E**) moved the cursor to the end of the current line.

## **Help**

### **Own Help Files Now Allow Special Icons**

When you supply your own help files, you can now specify the type of icon that appears in the Help browser **Contents** pane via the `<help_contents_icon>` tag in the `info.xml` file. For details, see “Summary of Workflow for Providing HTML Help Files”.

## **Workspace, Search Path, and File Operations**

### **Array Editor: F2 Keyboard Shortcut Added to Edit Current Element**

A keyboard shortcut to use instead of double-clicking a cell is **F2** (or **Ctrl+U** on the Macintosh platform), which allows you to edit the current element, positioning the cursor at the end of the element.

### **Array Editor: Single Quotation Marks Now Supplied for Strings During Paste from Excel**

When you copy data from the Microsoft® Excel® application and paste it into a cell array in the Array Editor using the menu item **Edit > Paste Excel Data**, MATLAB assumes the values are strings and automatically supplies the single quotation marks if they cannot be interpreted as numeric values.

### **Current Directory Browser Comments Now Include First Line**

When you select the Current Directory preference **Show M-file comments and MAT-file contents**, the help shown now includes the first comment line (also called the H1 line).

### **Current Directory Browser Auto-Refresh Rate Now Specifiable**

The Current Directory browser preference for auto-refresh now allows you to specify the update time. By default, every 2 seconds the Current Directory browser checks for and reflects any changes you made to files and directories in the current directory using other applications.

In some cases when the current directory is on a network and the Current Directory browser is open, MATLAB becomes slow because of the auto-refresh feature. If you experience general slowness in MATLAB and have the Current Directory browser open, increase the default update time to improve responsiveness. If increases do not alleviate the slowness enough, clear the check box in preferences to turn auto-refresh off. Then you can manually refresh the display selecting **Refresh** from the context menu in the Current Directory browser.

### **Find Files Field Now Uses Selected Text**

You can now select text in the Command Window or Editor and the **Find Files** dialog box enters that text in its **Find files containing text** field.

## **Editing and Debugging M-Files**

### **Breakpoints Supported in Anonymous Functions**

The Editor/Debugger supports breakpoints in anonymous functions. Lines containing anonymous functions can have more than one breakpoint in a line: one for the start of the line and one for each anonymous function in the line. A line that contains multiple breakpoints has a blue breakpoint icon.

### **dbstatus Supports Anonymous and Nested Functions**

The `dbstatus` function now supports anonymous and nested functions, including a new `'-completenames'` argument. Running `dbstatus(' -completenames')` displays, for each breakpoint, the absolute

filename and the sequence of functions that nest the function containing the breakpoint.

### **Colors Now Maintained when Copying From Editor**

When you paste a selection from the Editor into another application, such as Word, the Editor now maintains the syntax highlighting colors in the file in the other application. MATLAB pastes the selection to the clipboard in RTF format, which many applications for Windows and Macintosh platforms support.

### **Open Selection Now Works for Current Cursor Position**

In an M-file, position the cursor within a subfunction, function, file, variable, or Simulink model, and press **Ctrl+D** (or right-click and select **Open Selection**). The item opens in the appropriate tool. In the previous version of MATLAB, you had to select the complete name in the M-file to use this feature. See “Open a File or Variable from Within a File” for more information.

## **Source Control Interface**

### **verctrl Function Does Not Support Handle**

The `verctrl` function, available for Windows platforms only, was documented incorrectly. The documentation stated that you could create a handle, and showed the handle argument in the function syntax. You cannot create a handle, but must instead use a value of 0 for that field.

## **Publishing Results**

### **Notebook Causes MATLAB to Become Automation Server**

If you run Notebook from MATLAB and MATLAB is not an automation server, MATLAB will become an automation server. This is a change from Release 14, where MATLAB spawned a second instance that was an automation server.

### **Notebook Now Supports Office 2003**

Notebook now supports Office 2003 (for XP); it is one of the notebook `-setup` options.

### **Notebook Support for Word 97 to Be Discontinued**

The Microsoft Word 97 application is supported in this release, but will not be supported in future releases.

**Compatibility Considerations.** If you use Word 97 with Notebook, move to a newer version of Word before moving to the next version of MATLAB.

## Mathematics, MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new features and changes:

- “New Function — `ordeig`” on page 548
- “More Functions Accept Single-Precision Data Inputs” on page 548
- “New Vendor BLAS Used for Linear Algebra in MATLAB” on page 549
- “Overriding the Default BLAS Library on Sun/Solaris Systems” on page 549
- “FDLIBM Version Upgraded” on page 550
- “Different Results When Solving Singular Linear Systems on Intel Systems; Inconsistent NaN Propagation” on page 550
- “`funm` Returns Status Information; New Output Might Result In Error” on page 551

### New Function — `ordeig`

The new function `ordeig` takes a quasitriangular matrix `T` or matrix pair `(A,B)` and returns the vector of eigenvalues in the same order that they appear down the diagonal of `T` or `(A,B)`. You can use `ordeig` with the functions `ordschur` and `ordqz`, which reorder the eigenvalues of a Schur factorization or a `QZ` factorization, respectively.

### More Functions Accept Single-Precision Data Inputs

More MATLAB functions now accept single-precision data inputs in addition to the usual double-precision inputs. To determine whether a function works on single precision inputs, look for the `Class support` line in the M-file help for the function. For example, to determine whether the function `mean` accepts single-precision inputs, type

```
help mean
```

The `Class support` line is

```
float: double, single
```

which tells you that `mean` does accept single-precision inputs.



## New Vendor BLAS Used for Linear Algebra in MATLAB

MATLAB uses Basic Linear Algebra Subprograms (BLAS) for its vector inner product, matrix-vector product, matrix-matrix product, and triangular solvers in `\`. MATLAB also uses BLAS behind its core numerical linear algebra routines from Linear Algebra Package (LAPACK), which are used in functions like `chol`, `lu`, `qr`, and within the linear system solver `\`.

On some platforms, MATLAB continues to use ATLAS BLAS.

Starting in Release 14, MATLAB 7.0 uses vendor BLAS from the `vecLib` library on the Mac.

Starting in Release 14 with Service Pack 1, MATLAB 7.0.1 uses vendor BLAS from

- The Intel Math Kernel Library (MKL) Version 7.0 on Intel chips running both Windows and Linux. See the MATLAB 7.0 Release Notes for how to use the multi-threaded capabilities of MKL.
- The AMD Core Math Library (ACML) Version 2.0 library on AMD chips, native 64 bit application

## Overriding the Default BLAS Library on Sun/Solaris Systems

MATLAB uses the Basic Linear Algebra Subroutines (BLAS) libraries to speed up matrix multiplication and LAPACK-based functions like `eig`, `svd`, and `\(mldivide)`. At start-up, MATLAB selects the BLAS library to use.

For Release 14 with Service Pack 1, MATLAB still uses the ATLAS BLAS libraries on the Sun Microsystems Solaris Operating System. However, you can switch the BLAS library that MATLAB uses to the Sun Performance Library (Sunperf) BLAS, provided by Sun Microsystems.

If you want to take advantage of the potential performance enhancements provided by the Sun BLAS, you can set the value of the environment variable `BLAS_VERSION` to the name of the Sun Performance Library, `libsunperf.so.4`. MATLAB uses the BLAS specified by this environment variable, if it exists.

To set the `BLAS_VERSION` environment variable, enter the following command at the at the UNIX prompt.

```
% setenv BLAS_VERSION libsunperf.so.4
```

Then start MATLAB as usual.

To get visual feedback that the BLAS version has changed, also type at the UNIX prompt

```
% setenv LAPACK_VERBOSITY 1
```

before starting MATLAB. This will display diagnostic information while MATLAB is starting up, for example:

```
cpu_id: sun4u
libmwlpack: loading libsunperf.so.4
libmwlpack: loading lapack.so
```

## **FDLIBM Version Upgraded**

In Release 14, MATLAB used FDLIBM Version 5.2. In R14SP1, MATLAB has been upgraded to use FDLIBM Version 5.3.

## **Different Results When Solving Singular Linear Systems on Intel Systems; Inconsistent NaN Propagation**

In previous releases, when you solved  $n$ -by- $n$  linear systems  $Ax=b$  using `x = A\b`, where  $A$  is singular or contains NaN, the computed result  $x$  often contained NaN. In Version 7.0.1, the same command might return 0 in  $x$ , due to the way the Intel Math Kernel Library (MKL) implementation of the BLAS handles this operation.

### **Compatibility Considerations**

Code that relies on the result containing NaN should check for the following warnings instead:

- For singular  $A$ , an existing warning is issued.

```
x = [1 2; 0 0]\[1; 0]
```

```
Warning: Matrix is singular to working precision.
```

```
x =
    1
    0
```

- For A that contains NaN, a new warning message is issued.

```
x = [1 2; 0 NaN]\[1; 0]
```

```
Warning: Matrix is singular, close to singular or badly scaled.
```

```
Results may be inaccurate. RCOND = NaN.
```

```
x =
    1
    0
```

## **funm Returns Status Information; New Output Might Result In Error**

Prior to Release 14, the second output of the function `funm` was an error estimate that was sometimes inaccurate. In Release 14, Version 7.0, the second output was replaced by an exit flag that indicates whether the computation was successful.

### **Compatibility Considerations**

Code that was created prior to Release 14 and that uses the second output of `funm`, might not work correctly in Version 7.0 or later.

## Programming, MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new features and changes:

- “Character Set Conversion Functions Added” on page 552
- “datevec Support of Empty String Argument” on page 553
- “depfun Function Supports New Options” on page 553
- “ftell Returning Invalid Position in Rare Cases” on page 553
- “fwrite Saves uint64 and int64 Types” on page 554
- “mat2str Enhanced to Work with Non-double Types” on page 554
- “nargin, nargout Operate on Function Handles” on page 554
- “regexprep Now Supports Character Representations in Replacement String” on page 555
- “Logical OR Operator | in regexp Expressions Might Yield Different Results from Previous Version” on page 555
- “Multiple Declarations of Persistent Variables No Longer Supported” on page 556
- “Function Declaration Compatibility with Pre-R14 M-Files” on page 557

### Character Set Conversion Functions Added

Unicode is becoming the preferred internal presentation of characters in MATLAB. For example, MATLAB functions such as `disp` require an input string in Unicode to display properly. To facilitate the use of different character sets, MATLAB provides two new functions to convert characters from a native character set to Unicode and back.

The `native2unicode` function converts from either a default, or user specified, native character set to Unicode. The `unicode2native` function does the opposite, converting from Unicode to either a default, or user specified, native character set. Note that any MATLAB string containing only US-ASCII characters does not require any conversion.

Type `doc native2unicode` or `doc unicode2native` for more information on these functions.

## datevec Support of Empty String Argument

For the purpose of backwards compatibility, invoking the command `datevec('')` now returns an empty vector.

## Compatibility Considerations

This behavior was not intentional in previous versions of MATLAB, and it is subject to change in future releases.

## depfun Function Supports New Options

The `depfun` function now supports these options:

Option	Description
'-all'	Computes all possible left-side arguments and displays the results in the report(s). Only the specified arguments are returned.
'-calltree'	Returns a call list in place of a called_from list. This is derived from the called_from list as an extra step.
'-expand'	Includes both indices and full paths in the call or called_from list.
'-print', 'file'	Prints a full report to file.
'-quiet'	Displays only error and warning messages, and not a summary report.
'-toponly'	Examines <i>only</i> the files listed explicitly as input arguments. It does not examine the files on which they depend.
'-verbose'	Outputs additional internal messages.

## ftell Returning Invalid Position in Rare Cases

The `ftell` function is likely to return an invalid position when *all* of the following are true. This is due to the way in which the Microsoft Windows C library currently handles its `ftell` and `fgeptos` commands:

- The file you are currently operating on is an ASCII text file.
- The file was written on a UNIX-based system, or uses the UNIX-style line terminator: a line feed (with no carriage return) at the end of each line of text. (This is the default output format for MATLAB functions `dlmwrite` and `csvwrite`.)
- You are reading the file on a Windows system.
- You opened the file with the `fopen` function with mode set to `'rt'`.
- The `ftell` command is directly preceded by an `fgets` command.

Note that this does not affect the ability to accurately read from and write to this type of file from MATLAB.

### **Compatibility Considerations**

This represents a change in behavior.

### **fwrite Saves uint64 and int64 Types**

The `fwrite` function can now save `uint64` and `int64` values. Previously `fwrite` supported these data types only on DEC Alpha systems. Now, it works on all supported MATLAB platforms.

### **mat2str Enhanced to Work with Non-double Types**

In MATLAB 7.0.1, you can use the `mat2str` function to convert nondouble data types to a string that represents the input value. Type `doc mat2str` for more information.

### **nargin, nargout Operate on Function Handles**

The `nargin` and `nargout` functions now accept either a function name or function handle as an input argument. When called with a function handle, `nargin` and `nargout` return the number of input or output arguments you can pass to or receive from the function that the handle maps to.

## regexprep Now Supports Character Representations in Replacement String

The `regexprep` function now supports the use of character representations (e.g., `'\t'` for tab, `'\n'` for newline) in replacement strings. For example, the following `regexprep` command replaces the `|` character with two horizontal tabs:

```
str = 'Field 1 | Field 2 | Field 3';
regexprep(str, '\|', '\t\t')
ans =
    Field 1     Field 2     Field 3
```

In Version 6, the same command yielded the string

```
Field 1 \t\t Field 2 \t\t Field 3
```

## Logical OR Operator | in regexp Expressions Might Yield Different Results from Previous Version

Be careful about using the logical OR (`|`) operator within square brackets (e.g., `[A|B]`) in regular expressions in MATLAB. The recommended way to match “the letter A or the letter B” in a MATLAB `regexp` expression is to use `'[AB]'`.

### Compatibility Considerations

If you have used `'[A|B]'` for this purpose in earlier versions of MATLAB, you may get unexpected results when you run your code in version 7.0.

MATLAB versions 6.0 and 6.5 treat `|` as an ordinary character when it is used between square brackets. For example, these versions interpret the expression `'[A|B]'` as “match 'A', or match '|', or match 'B'.” MATLAB 7.0 correctly gives precedence to the logical OR functionality of the `|` operator. Because of this change, MATLAB now interprets `'[A|B]'` as “match '[A', or match 'B]'.”

You can avoid the effects of this bug fix altogether by using the recommended syntax `'[AB]'` for this type of operation. This syntax returns the correct results in all MATLAB versions.

The following example attempts to find the word Jill or Bill in the string 'My name is Bill'. The syntax used in the expression is incorrect, but `regexp` in

MATLAB 6.5 finds a match anyway because of the software bug. This syntax does not work in version 7.0 or 7.0.1 because MATLAB now interprets the expression as the logical OR of the two statements, '[J' and 'B]ill':

MATLAB 6.5	MATLAB 7.0.1
<pre>str = 'My name is Bill'; expr = '[J B]ill'; [s e] = regexp(str, expr); str(s:e) ans =     Bill</pre>	<pre>str = 'My name is Bill'; expr = '[J B]ill'; [s e] = regexp(str, expr); str(s:e) ans =     Empty string: 1-by-0</pre>

Using the recommended syntax returns the correct results in all MATLAB versions:

```
str = 'My name is Bill';  
expr = '[JB]ill';  
[s e] = regexp(str, expr);  
str(s:e)  
ans =  
    Bill
```

If you want to use | in an expression as an ordinary character, precede it with a backslash:

```
str = 'The | operator performs a logical OR';  
expr = 'The [\$ \\ | \#] operator';  
[s e] = regexp(str, expr);  
str(s:e)  
ans =  
    The | operator
```

## Multiple Declarations of Persistent Variables No Longer Supported

You can no longer declare a variable as persistent more than once within a function.

## Compatibility Considerations

If you do this, you will need to modify your code.



## **Function Declaration Compatibility with Pre-R14 M-Files**

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. However, because this syntax is not compatible with earlier releases, you should always include the comma separators when writing an M-file function that you intend to run on releases both earlier and later than Release 14.

### **Compatibility Considerations**

See “Comma Separators Not Required in Function Declaration” on page 640 in the Release 14 release notes.

## Graphics, MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new feature:

### **OpenGL Trouble Shooting**

The `opengl` command now enables you to switch from hardware to software-based OpenGL® rendering. It also enables you to select various known bug workarounds. See the `opengl` reference page for more information.

### **Compatibility Considerations**

#### **Cannot Dock Figures on Macintosh Systems**

You cannot dock figures in the Desktop, because MATLAB uses native figure windows on the Macintosh platform.

#### **Plotting Tools Not Working on Macintosh Systems**

The plotting tools are not supported on the Macintosh platform. This means the Figure Palette, Plot Browser, and Property Editor do not work these platforms. To use the MATLAB 6 Property Editor, see the `propedit` command.

#### **Not All Macintosh System Fonts Are Available**

MATLAB figures do not support the same fonts as native Macintosh applications. Use the `uifont` functions to see which fonts are available in MATLAB.

#### **Preview Java Figures on the Macintosh Platform**

You can preview the use of Java Figure on the Mac by starting MATLAB with the `-useJavaFigures` option.

## Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new features and changes:

- “FIG-File Format Change” on page 559
- “Panels, Button Groups, and ActiveX Components” on page 559
- “Comments Now Optional for Newly Generated Callback Functions” on page 560
- “Windows XP Display of Push and Toggle Buttons” on page 560

### FIG-File Format Change

GUI FIG-files that are created or modified with MATLAB 7.0 or a later MATLAB version are not automatically compatible with Version 6.5 and earlier versions.

- GUIs Saved from GUIDE or from the Command Line: You can check the **Ensure backward compatibility (-v6)** preference in the **Preferences** dialog box under **General > MAT-Files**. When this preference is checked, all MAT-files are saved so as to be backward compatible with Version 6.5 and earlier versions.
- Alternative for GUIs Saved from the Command Line: If you do not want to check the **MAT-Files** preference described above, but want to make individual GUI FIG-files backward compatible, use the 'v6' argument when you save the GUI with the `hgsave` function.

### Compatibility Considerations

To make FIG-files, which are a kind of MAT-file, backward compatible, you must explicitly specify that you want the backwards compatibility.

### Panels, Button Groups, and ActiveX Components

Panels, button groups, and ActiveX components were introduced in MATLAB 7.0. These components are not compatible with versions earlier than 7.0.

## Compatibility Considerations

You should not use these components in GUIs that you expect to run in earlier MATLAB versions.

You can export a GUI that contains a panel, button group, or ActiveX component from GUIDE to a single M-file that does not require a FIG-file. However, you will not be able to run that M-file in MATLAB versions earlier than 7.0.

## Comments Now Optional for Newly Generated Callback Functions

In prior releases, GUIDE automatically generated comment lines for each callback that you added to an existing GUI M-file. For example:

```
% --- Executes during object deletion, before destroying properties.  
function figure1_DeleteFcn(hObject, eventdata, handles)  
% hObject    handle to figure1 (see GCBO)  
% eventdata  reserved - to be defined in a future version of MATLAB  
% handles    structure with handles and user data (see GUIDATA)
```

Comment lines are now optional for most callbacks. If you want the comments to be generated automatically when you add a callback, check the new preference **Add comments for newly generated callback functions** on the **GUIDE** panel of the **Preferences** dialog box. The factory default is checked.

If this preference is unchecked, GUIDE includes the comment lines only for callbacks that are automatically included for the GUIDE template you chose. No comments are included for any other callbacks that are added to the M-file.

## Windows XP Display of Push and Toggle Buttons

Push buttons and toggle buttons with background colors other than the default display differently in Windows XP.

## Compatibility Considerations

For Windows XP, GUI push buttons are displayed with a white background. If you have specified a background color other than the default, that color

appears as a border around the push button. Unselected toggle buttons are displayed with the specified background color, but selected toggle buttons are displayed with a white background bordered by the background color.

## External Interfaces/API, MATLAB Version 7.0.1 (R14SP1)

New features and changes introduced in this version are described here.

### Function Handles in COM Event Callbacks

MATLAB software now supports function handles as callbacks for Microsoft ActiveX objects. This example passes a function handle that maps to `samev` to `registerevent`:

```
cd $matlabroot\toolbox\matlab\winfun
h = actxcontrol('mwsamp.mwsampctrl1.2', [0 0 200 200]);
registerevent(h, @samev); % Click the control.
```

### Registering Events for COM Servers and Controls

With MATLAB 7.0.1, you can register events for COM servers as well as for COM controls.

### Expanded Support for Web Services (SOAP and WSDL)

This version expands MATLAB support for Web services, that is, Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL). These are some of the key enhancements:

- MATLAB now supports document style messages, in addition to the Remote Procedure Call (RPC) style supported in version 7.0.
- MATLAB preserves the case in method, class, and object names.
- Web services functions now decode results that use Base64 encoding.
- The `createClassFromWsd1` function now supports WSDL files that define multiple services.

### Specifying the Search Path for Sun Java Native Method DLLs

The mechanism that MATLAB uses to locate native method libraries that are required by Java has changed. MATLAB no longer uses system environment variables to define the paths to these libraries.

## Compatibility Considerations

If you presently rely on the PATH (for Windows) or LD\_LIBRARY\_PATH (for UNIX) environment variables for this purpose, you will need to use the file `librarypath.txt`, as described below, in its place.

## Specifying the Java Library Path

Java classes can dynamically load native methods using the Java method `java.lang.System.loadLibrary("LibFile")`. In order for the JVM software to locate the specified library file, the directory containing it must be on the Java Library Path. This path is established when MATLAB launches the JVM software at startup, and is based on the contents of the file

```
$matlab/toolbox/local/librarypath.txt
```

(where `$matlab` is the MATLAB root directory represented by the MATLAB keyword `matlabroot`).

You can augment the search path for native method libraries by editing the `librarypath.txt` file. Follow these guidelines when editing this file:

- Specify each new directory on a line by itself.
- Specify only the directory names, not the names of the DLL files. The `LoadLibrary` call does this for you.
- To simplify the specification of directories in cross-platform environments, you can use any of these macros: `$matlabroot`, `$arch`, and `$jre_home`.

## MATLAB DDE Server Is Now Disabled By Default

To enable the DDE server start MATLAB with the `/Automation` option.

The outgoing MATLAB DDE commands (`ddeinit`, `ddeterm`, `ddeexec`, `ddereq`, `ddeadv`, `ddeunadv`, `ddepoke`) function normally without the MATLAB DDE server. See <http://www.mathworks.com/support/solutions/data/1-Q4728.html?solution=1-Q4728> for more information.

## **Clearing MEX-Functions**

The command `clear mex` now clears MEX-functions, but not MATLAB scripts. Entering `clear mex` does not clear locked functions or functions that are currently in use. It does however clear breakpoints and persistent variables.



# Version 7 (R14) MATLAB Software

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This table summarizes what's new in Version 7 (R14):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
Yes Details below	Yes — Details labeled as <b>Compatibility Considerations</b> in descriptions of new features and changes. See also Summary.	Fixed bugs

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7 (R14)” on page 566
- “Mathematics, MATLAB Version 7 (R14)” on page 595
- “Programming, MATLAB Version 7 (R14)” on page 620
- “Graphics and 3-D Visualization, MATLAB Version 7 (R14)” on page 660
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7 (R14)” on page 669
- “External Interfaces/API, MATLAB Version 7 (R14)” on page 675

## **Desktop Tools and Development Environment, MATLAB Version 7 (R14)**

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 566
- “Desktop” on page 567
- “Running Functions — Command Window and Command History” on page 571
- “Help” on page 575
- “Workspace, Search Path, and File Operations” on page 578
- “Editing and Debugging M-Files” on page 583
- “Tuning and Managing M-Files” on page 589
- “Source Control Changes” on page 593
- “Publishing Results” on page 593

### **Startup and Shutdown**

#### **Version of JVM Software Updated**

MATLAB software is now using version 1.4.2 of Sun Microsystems Java JVM software.

## Desktop

New features and changes introduced in this version are


- “Arranging Documents Supports New Options” on page 567
- “Finding Files and Content in Files with New Tools” on page 568
- “MATLAB Shortcuts—Use to Easily Run Group of Statements” on page 568
- “MATLAB Web Browser Added” on page 569
- “Menu Changes” on page 569
- “Keyboard Shortcuts Added to Go to Tools and Documents” on page 569
- “Drag and Drop Supported Between Desktop Tools” on page 569
- “Arranging Columns in Tools” on page 570
- “Font and Color Preferences for Tools” on page 570
- “terminal Function Removed” on page 570
- “license Function Results Modified Slightly” on page 571

### Arranging Documents Supports New Options

The MATLAB desktop now provides you with new options for arranging the following types of documents:

- M-files and other files in the Editor/Debugger
- Arrays in the Array Editor
- Figure windows
- HTML documents in the MATLAB Web browser

You can dock these types of documents in the desktop, undock them from the desktop so each is in its own separate window, or group undocked documents together in their tool. You can now position the documents using these features: tile, left/right split, top/bottom split, floating, or maximized. Use the **Window** menu or toolbar icons to position documents.

**Docking Tools and Documents.** There are now dock buttons  in the menu bars of undocked tools and documents. Click a dock button to move the tool into the desktop, or to move the document into its tool.

**Document Bar.** There is now a Document Bar in tools that support documents that you use to go to open documents. It appears when there is more than one maximized document open in a tool. You can hide or move the Document Bar by selecting **Desktop > Document Bar** menu options.

**Saving Layouts.** You can save desktop layouts. Select **Desktop > Save Layout** and provide a name. To restore a saved layout, select **Desktop > Desktop Layout > name**.

**Launch Pad Removed.** The Launch Pad tool was removed. Use the **Start** button instead.

**Adding Your Own Toolbox to Start Button.** Add your own toolbox to the **Start** button. Select **Start > Desktop Tools > View Source Files**. Click **Help** in the resulting dialog box for details.

### **Finding Files and Content in Files with New Tools**

Search for files and directories, as well as for content within files by selecting **Edit > Find Files** from any desktop tool. For details, see “Advanced Search for Files — Find Files Tool” in the online documentation.

### **MATLAB Shortcuts—Use to Easily Run Group of Statements**

You can create and run MATLAB shortcuts, where a shortcut is an easy way to run a group of MATLAB statements. A shortcut is like an M-file script, but unlike an M-file, a shortcut does not have to be on the search path or in the current directory for MATLAB when you run it.

Create a shortcut by selecting **Start > Shortcuts > New Shortcut** and completing the dialog box. Run the shortcut from the **Start** button.

You can also create a shortcut by dragging selected statements to the shortcut toolbar. This adds the shortcut to the toolbar, from where you can then run it. For details, see “Create MATLAB Shortcuts to Rerun MATLAB Commands” in the online documentation.

## MATLAB Web Browser Added

MATLAB now displays HTML documents it produces in a new desktop tool, the MATLAB Web browser. You can display HTML documents in this Web browser using the `web` function.

The `web` function now opens the MATLAB Web browser by default, instead of opening the MATLAB Help browser. Use the `web` function's `-helpbrowser` option to display files in the Help browser.

## Menu Changes

**Debug Menu Added.** You can now access debugging features from the **Debug** menu of most desktop tools.

**View, Window, and Desktop Menus.** There is no longer a desktop **View** menu, although some tools still have a **View** menu. The **Window** menu in the desktop has changed. Use the new **Desktop** menu to select a layout, and to open and close tools. Use the **Window** menu to access open tools and documents, as well as to position documents. The menus and the menu items in the desktop change, depending on the current tool selected.

**Web Menu Items Moved.** The **Web** menu was removed. Access the items it contained from **Help > Web Resources**.

## Keyboard Shortcuts Added to Go to Tools and Documents

There is now a keyboard shortcut you can use to go to each tool and to each open document. For example, use **Ctrl+0** to go to the Command Window, and **Ctrl+Shift+0** to go to the most recently used Editor document. See the **Window** menu for the shortcuts to go to currently open tools and documents.

There have been some changes to the keyboard shortcuts you use with desktop tools. For example, **Ctrl+Tab** now moves you to the next open tool or group of tools tabbed together. In previous releases, **Ctrl+Tab** moved you to the next open document or tool. In MATLAB version 7, use **Ctrl+Page Down** to move to the next open document or tool in a tabbed group.

## Drag and Drop Supported Between Desktop Tools

You can drag selected text or files between desktop tools. For example, you can

- Select text in the Editor and drag it to the Command Window, which cuts and pastes it into the Command Window. You can use **Ctrl** while dragging to copy selected text instead of just moving it.
- Select a file in the Current Directory browser and drag it to the Editor, which opens the file in the Editor.

You can also drag selected text or files between desktop tools and external tools and applications. For example, you can

- Select a MAT-file from the Microsoft Windows Explorer and drag it to the Command Window, which loads the data into the workspace for MATLAB.
- Select text from a page displayed in a Netscape Navigator browser and drag it to a file in the Editor, which pastes the text into the file in the Editor.

### **Arranging Columns in Tools**

In desktop tools that contain columns, you can drag a column to a new position. For example, this includes the Current Directory browser, and the Help browser **Index** and **Search** panes. Click a column head to sort by that column. For some tools, you can click again to reverse the sort order.

When a column is too narrow to show all the information in it, position the cursor over a long item in that column, and a tooltip displays showing the complete content of the item.

### **Font and Color Preferences for Tools**

Access font and color preferences for all desktop tools in the **Fonts** and **Colors** preference panes. Select **File > Preferences > Fonts** or **File > Preferences > Colors**. For more information, click the **Help** button in the preferences dialog box.

### **terminal Function Removed**

The terminal function was removed.

**Compatibility Considerations.** If your code refers to the terminal function, you need to change it.

## license Function Results Modified Slightly

The data returned by the `license` command is now sorted in alphabetical order and uses only lowercase characters.

**Compatibility Considerations.** If you rely on the data returned by `license`, be sure your code works properly with these changes.

## Running Functions – Command Window and Command History

New features and changes introduced in this version are

- “Tab Completion Graphical Interface Added; Removed Preference to Limit Completions” on page 571
- “Navigate in Command Window Using Arrow Keys Via New Preference” on page 572
- “Incremental Search Indicates Search Direction and is Now Case Sensitive” on page 572
- “commandwindow Function Added to Open or Select the Command Window” on page 572
- “Macintosh Platforms: Command +. Now Stops Execution” on page 572
- “Comment After Ellipsis Now Properly Highlighted” on page 572
- “Evaluate Selection from Context Menus No Longer Appends” on page 573
- “Syntax Highlighting Default Colors Modified” on page 573
- “Ctrl+C to Stop Execution is Now More Consistent” on page 573
- “Parentheses Matching Support Removed” on page 573
- “Command History Features” on page 574

### Tab Completion Graphical Interface Added; Removed Preference to Limit Completions

Tab completion now has a graphical interface. For example, type `cos` and press the **Tab** key. A list of functions that begin with `cos` appears. Double-click the function you want and MATLAB completes the name in the Command Window. Alternatively, when the list of names appears, you can

type the next unique letter in the name, and the first name in the list that matches it is selected. Continue typing unique letters to select the name you want, and press **Enter**. Press **Esc** to clear the list without selecting a name.

With the new interface, there is no longer a preference allowing you to limit the number of tab completions that display. MATLAB always displays all possible completions.

**Compatibility Considerations.** If you relied on the preference to limit the number of tab completions MATLAB displays, type more characters before pressing **Tab** so fewer possible completions display.

### **Navigate in Command Window Using Arrow Keys Via New Preference**

There is a new preference that allows you to use arrow keys to navigate in the Command Window instead of recalling history.

### **Incremental Search Indicates Search Direction and is Now Case Sensitive**

The incremental search interface now indicates the search direction. It is also case sensitive when you enter uppercase letters in the search field.

### **commandwindow Function Added to Open or Select the Command Window**

Use the new `commandwindow` function to open the Command Window when it is closed. For example, use this function in an M-file. Or if the Command Window is already open, use the function to select the Command Window, making it the active window.

### **Macintosh Platforms: Command +. Now Stops Execution**

On Apple Macintosh platforms, you can now use **Command+.** (**Command** key and period key) to stop execution of a running program.

### **Comment After Ellipsis Now Properly Highlighted**

When you include an ellipsis in a statement so that you can continue the statement on the next line, any text you type after the `...` on the same line is



considered to be a comment in MATLAB and now is syntax highlighted as a comment. In previous releases, the syntax highlighting did not indicate the text after the `...` as a comment.

### **Evaluate Selection from Context Menus No Longer Appends**

Evaluate selection, available from context menus for various tools, no longer appends the selection to the statement at the prompt, but instead runs the selection. Make a selection and press **Enter** or **Return** to append the selection to the statement at the prompt and execute it.

### **Syntax Highlighting Default Colors Modified**

The default colors for syntax highlighting have been modified. Unterminated strings are now maroon, while terminated strings are now purple. This is the opposite of previous versions. Maroon is considered to be more of an “alerting” color, resembling the default of red for errors, which is the reason for the change. If you prefer the colors used in previous versions, change them using preferences — select **File > Preferences > Colors** to open the Colors Preferences dialog box.

In addition, arguments in statements entered using command syntax rather than function syntax are highlighted as strings, emphasizing that variables in command syntax are passed as literal strings rather than as their values.

### **Ctrl+C to Stop Execution is Now More Consistent**

Stopping execution using **Ctrl+C** (^C) has changed. Windows and The Open Group UNIX platforms now respond similarly to **Ctrl+C**, and in general, stop execution without the need for `pause` or `drawnow` statements in your M-files. For M-files that run for a long time, or that call built-ins or MEX-files that take a long time, **Ctrl+C** does not always effectively stop execution. In that event, include a `drawnow` command in your M-file, for example, within a large loop. **Ctrl+C** might be less responsive if you started MATLAB with the `-nodesktop` option.

### **Parentheses Matching Support Removed**

Matching parentheses in the Command Window is not supported in this version.

**Compatibility Considerations.** This feature was available in the Command Window in previous versions but you cannot use it in this version.

## Command History Features

**Syntax Highlighting in Command History.** Entries in the Command History tool now appear with syntax highlighting.

**Tree View in Command History.** Entries in the Command History now appear in a tree view so you can minimize the length of the visible history. The top-level nodes of the tree are the dates/times for each session, and beneath that is the history for that session. Click the - to the left of a date/time to hide the history entries for that session. Click the + to the left of a date/time entry to show history entries for that session.

**commandhistory Function Added to Go to Tool.** Use the new commandhistory function to open the Command History when it is closed, and to select it when it is open.

**Save Frequency Higher by Default.** The default for saving the history has changed. Now, by default, MATLAB saves the history file after five statements have been added to the history. You can modify the frequency using Command History preferences.

## Help

New features and changes introduced in this version are

- “Documentation Now Automatically Installed; Not Accessible from CD-ROMs and docroot Not Supported” on page 575
- “Index Pane Adds Alphabetical Links” on page 575
- “Search Type Removed” on page 576
- “Favorites in Help Browser” on page 576
- “Display Pane Find in Page Icon” on page 576
- “Title Field No Longer Supports Web Browsing” on page 576
- “docsearch Function Added to Execute Help Browser Search” on page 576
- “help Function Provides Help for Methods and Classes” on page 577
- “web Function Now Opens MATLAB Web Browser By Default” on page 577
- “HTML Documentation Not Viewable with -nojvm Startup Option” on page 577

### **Documentation Now Automatically Installed; Not Accessible from CD-ROMs and docroot Not Supported**

Documentation is automatically installed for all the products you install. Documentation is no longer accessible from CD-ROMs. To access the documentation for products not installed on your system, use The MathWorks Web site, <http://www.mathworks.com/access/helpdesk/help/helpdesk.shtml>.

**Compatibility Considerations.** Because of this change, the docroot function is no longer needed and will not be supported.

### **Index Pane Adds Alphabetical Links**

The **Index** pane now has an alphabetical quick index, so you can choose a letter to see entries starting with that letter. You can still type any index term in the text box to go directly to that term. Index entries are now shown as links. Entries that are merely headings do not go to a specific page and do not

appear as links. As is true for all desktop tools, you can now drag columns in the **Index** pane to reorder them, or click a column head to sort by that column.

### **Search Type Removed**

In the **Search** pane, you no longer select the type of search. Results are ordered so reference pages appear first, followed by headings that include the search terms. After performing a search, click the link at the bottom of the **Search** pane to look for the same term in the technical support database on The MathWorks Web site. As is true for all desktop tools, you can now drag columns in the **Search** pane to reorder them, or click a column head to sort by that column.

### **Favorites in Help Browser**

Add pages in the Help browser to favorites (also known as bookmarking pages) by selecting **Favorites > Add to Favorites**. The **Favorites Editor** dialog box opens. Accept the default entries or modify the **Label** and click **Save**. Access favorites from the **Favorites** menu or from the **Start** menu **Shortcuts** item.

### **Display Pane Find in Page Icon**

Click the binoculars icon on the display pane toolbar to search within the page.

### **Title Field No Longer Supports Web Browsing**

The Help browser is now used only for MathWorks documentation installed with your products.

You can no longer enter a URL in the **Title** field of the display pane. Instead run the web function to enter a URL in the **Location** field. Links from the documentation to Web pages display the Web pages in the MATLAB Web browser, not in the Help browser.

### **docsearch Function Added to Execute Help Browser Search**

The new docsearch function allows you to execute a full text search of the Help browser documentation from the Command Window.

**help Function Provides Help for Methods and Classes**

The `help` function now allows you to get help for methods and classes. For details, see specific instructions in the release notes about using `help` and `doc` for each product, or type `help help`.

**web Function Now Opens MATLAB Web Browser By Default**

The `web` function no longer opens the specified URL in the Help browser by default, but instead opens the page in the MATLAB Web browser.

**Compatibility Considerations.** If you want `web` to open pages in the Help browser, use the `-helpbrowser` option.

**HTML Documentation Not Viewable with -nojvm Startup Option**

If you start MATLAB using the `-nojvm` option, you cannot view the HTML documentation files from within MATLAB. The `docopt` function no longer supports that option.

**Compatibility Considerations.** This represents a change from previous versions. You can view the HTML documentation files at the MathWorks Web site.

## Workspace, Search Path, and File Operations


New features and changes introduced in this version are organized by these topics:

- “Workspace Browser Enhancements and Changes” on page 578
- “Array Editor Enhancements and Changes” on page 579
- “Built-In Functions Now Treated Like Other M-Files on Search Path” on page 579
- “savepath Function Added to Replace path2rc” on page 580
- “Search Path Functions — Other Enhancements and Changes” on page 580
- “File Operations” on page 581
- “Current Directory Browser Changes and Enhancements” on page 582
- “Visual Directory and Directory Reports in Current Directory Browser” on page 582

### Workspace Browser Enhancements and Changes

**Value Column Added to Workspace Browser.** The Workspace browser now includes a **Value** column where you can see the content of the variable, or a description of the content. Click the value in the **Value** column to edit the content.

**Rename or Duplicate Variable in Workspace Browser.** Click a variable name (in the **Name** column) to rename the variable. To create a copy of a variable, right-click and select **Duplicate** from the context menu.

**Plotting Selected Variables from Workspace Browser.** Click the plot icon  in the Workspace browser toolbar to plot the selected variable. Choose from other applicable plots by clicking the arrow next to the plot button. The function used to create the plot appears in the Command Window so you can use it again later.

**Print from Workspace Browser.** Click the Print button in the Workspace browser toolbar to print a view of the current workspace.


**MAT-Files Compressed by Default.** MAT-files are now compressed by default. For details on compressing MAT-files, see the “Compressed Data Support in MAT-Files” on page 626 in the Programming release notes.

**genvarname Function Added to Construct Variable Name in MATLAB Software.** Use the new function `genvarname` to construct a valid variable name in MATLAB from a given candidate, where the candidate can be a string or a cell array of strings. For details, type `help genvarname`.

**datatipinfo Function Added to Display Information About Variable.** The new function `datatipinfo(x)` displays information about the variable, `x`.

## Array Editor Enhancements and Changes

**Cell Arrays and Structures Now Supported.** You can now view and edit the content of cell arrays and structures in the Array Editor. For example, double-click a structure in the Workspace browser to open it in the Array Editor. In the Array Editor, double-click an element of the structure to open it as its own Array Editor document. You can then view and edit the contents.

**Plotting Multiple Elements.** You can select contiguous elements in an array, and then click the **plot** button  on the Array Editor toolbar to plot only the selected elements. Click the arrow next to the plot button in the toolbar to select from other applicable plots.

**Print from Array Editor.** You can print an array from the Array Editor. Select **File > Print** to create a print of the current variable.

**Larger Arrays Supported.** You can open arrays having up to  $2^{19}$  (524288) elements, which is eight times more than the previous limit,  $2^{16}$  (65536).

**Save to MAT-File.** You can save a variable to a MAT-file from the Array Editor. Select **File > Save** and complete the resulting **Save** dialog box.

## Built-In Functions Now Treated Like Other M-Files on Search Path

MATLAB now considers built-in files to be the same as other M-files on the search path.

**Compatibility Considerations.** MATLAB no longer considers built-in functions differently from any other M-files on the search path. MATLAB now looks for a given name first as a variable, then as an M-file in the current directory, and finally as an M-file on the search path. Previously MATLAB looked for a given name as a built-in function after looking for it as a variable.

If you have a function name that is the same as a MATLAB built-in function, your function might run instead of the built-in function, whereas in previous releases the built-in function would have run. For the built-in function to run, remove or rename your function, or change the directory order in the search path.

### **savepath Function Added to Replace path2rc**

There is a new function, `savepath`, that saves the current search path to a file, `pathdef.m`, so that you can use the same search path in future sessions. Note that this function replaces `path2rc`.

**Compatibility Considerations.** The `path2rc` function has been replaced by a new function, `savepath`. If you use `path2rc`, it will run `savepath` instead. The new function, `savepath`, performs the same actions as `path2rc` did, but uses a more intuitive name. In addition, `savepath` is case sensitive on PC platforms, whereas `path2rc` was not. Use `savepath` instead of `path2rc`, and replace existing instances of `path2rc` with `savepath`.

## **Search Path Functions – Other Enhancements and Changes**

**restoredefaultpath Function Added for Recover from Problems.** There is a new function, `restoredefaultpath`, that helps redefine the search path file, `pathdef.m`, to include only files installed with MathWorks products. Use this function to recover from problems with the path. If that fails, run

```
restoredefaultpath; matlabrc
```

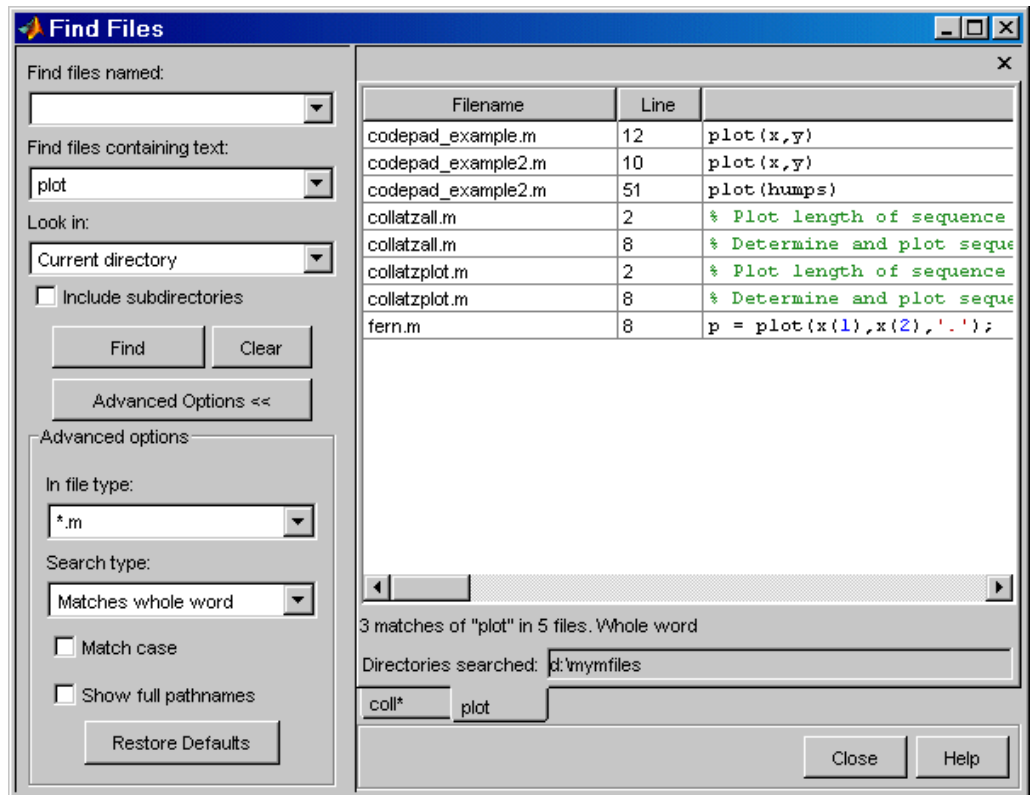
**genpath Function Now Includes Empty Directories.** The `genpath` function now includes empty directories in the generated path string.

**which Function Now Shows Built-In Functions.** The `which` function now displays the pathname for built-in functions, as well as for overloaded functions when only the overloaded functions are available



## File Operations

**Finding Files and Content Within Files.** From any desktop tool, select **Edit > Find Files**. Complete the resulting dialog box to find specified files or files containing specified text in the directories you choose. Double-click a file in the results listing to open it. For details, see “Advanced Search for Files — Find Files Tool” in the online documentation.



**Preventing Accidental File Deletion.** Use the new recycle function or the **General** preference for the delete function to send files you remove using the delete function to the Recycle Bin on Windows platforms, to the Trash Can on Macintosh platforms, or to a /tmp/MATLAB\_Files\_timestamp directory on UNIX platforms. You can then recover any accidentally deleted files from these locations.

## Current Directory Browser Changes and Enhancements

**Source Control Interface Features Accessible from Current Directory Browser.** You can access source control system features from the Current Directory browser. Right-click a file or directory, and from the context menu, select **Source Control** and then select the source control function you want to use.

**Open File Using External Application.** To open a file using an external application, select **Open Outside MATLAB** from the context menu. For example, if you select `myfile.doc`, **Open Outside MATLAB** opens `myfile.doc` in the Microsoft Word application, assuming you have the `.doc` file association configured to launch Word.

**Copy and Paste Directories.** Using the Current Directory browser, you can now copy and paste directories, including the entries' contents.

**Drag to Reorder Columns.** As is true for all desktop tools, you can drag columns in the Current Directory browser to reorder them, or click a column head to sort by that column. For an item that does not fit in its column, you can hover over it to see the full name of the item.

**Current Directory Text Field Does Not Display When Current Directory Browser is Docked.** The current directory field appears in the Current Directory browser only when the Current Directory browser is undocked from the MATLAB desktop. When the Current Directory browser is docked in the MATLAB desktop, use the current directory text field in the desktop toolbar.

### Visual Directory and Directory Reports in Current Directory Browser

There are new tools accessible from the Current Directory browser for tuning and managing M-files. For details, see “Visual Directory Tool in the Current Directory Browser” on page 589 and “Directory Reports in the Current Directory Browser” on page 590.

## Editing and Debugging M-Files

New features and changes introduced in this version are

- “Opening, Arranging, and Closing Documents” on page 583
- “Visual Changes” on page 584
- “Entering Statements” on page 585
- “Create Block Comments Using %{ and %}” on page 585
- “Finding and Replacing Text” on page 586
- “Printing M-Files” on page 586
- “Breakpoints and Debugging” on page 586
- “Debugging Functions Enhanced” on page 587
- “dbstack Function Supports Nested Functions” on page 587
- “dbstatus Function Supports Conditional Breakpoints” on page 588
- “Access Tools from Editor/Debugger” on page 588
- “Rapid Code Iteration Using Cells” on page 588
- “Preferences for the Editor/Debugger” on page 589

## Opening, Arranging, and Closing Documents

**Drag File into Editor.** You can drag a file onto the Editor to open it. For example, drag a text file from Windows Explorer onto the Editor.

### **Automatically Remove Autosave Files – Preference Added.**

There is now an Editor/Debugger preference you can set to automatically remove autosave files when you close the source file. Select **Preferences > Editor/Debugger > Autosave**, and under **Close options**, select the **Automatically delete autosave files** check box.

**Toggle Between Command Window and Editor/Debugger.** To move from an Editor document to the Command Window, press **Ctrl+0**. To move back to the Editor document, press **Ctrl+Shift+0**.

**Editor Remains Open with No Files Open.** When you close the last open document in the Editor, the Editor remains open.

**Automatic Reloading of Files When Changes Made Outside of MATLAB Software.** When a file is open in the Editor and you open that same file outside of MATLAB and make changes to it, the Editor automatically updates the file to include the changes you made outside the Editor. This only applies if you did not make any changes to the file in the Editor. If you want to be prompted before the Editor updates the file, clear the Editor/Debugger preference for automatically reloading files.

**Open Files While Debugging Preference Moved to Debug Menu.** In the previous version, you used a preference to automatically open files when debugging. Now, instead of using a preference, you select **Open M-Files When Debugging** from the **Debug** menu in any desktop tool.

With this item selected, when you run an M-file containing breakpoints, the file opens in the Editor/Debugger when MATLAB encounters a breakpoint.

## Visual Changes

**Syntax Highlighting for Other Languages.** The Editor now supports syntax highlighting for other languages, specifically ANSI C, C++, Java, and HTML. Use Editor language preferences to change the colors for the syntax highlighting.

**Datatypes Now Off By Default in Edit Mode.** In edit mode, datatypes are now off by default. Select the preference to display them in edit mode. Datatypes display until you move the cursor. Datatypes are always on in debug mode.

**Vertical Line in Files.** There is now a faint line at column 75, which serves as a useful reminder of where text would be cut off when printing the document. Remove the line or change the column at which the line appears using Editor/Debugger Display preferences.

**Balance Delimiters Removed.** The feature **Text > Balance Delimiters** has been removed.

**Syntax Highlighting Default Colors Modified.** The default colors for syntax highlighting M-files have been modified. Unterminated strings are now maroon, while terminated strings are now purple. This is the opposite of previous versions. Maroon is considered to be more of an "alerting" color, resembling the default of red for errors, which is the reason for the change. If you prefer the colors used in previous versions, change them by selecting **File > Preferences > Colors**, and then adjust **MATLAB syntax highlighting colors**.

In addition, arguments in statements entered using command syntax rather than function syntax are highlighted as strings, emphasizing that variables in command syntax are passed as literal strings rather than as their values.

## Entering Statements

**Change Case of Selected Text.** To change the case of selected text, select the text and then press

- **Alt+U, U** to change all text to upper case
- Press **Alt+U, L** to change all text to lower case
- Press **Alt+U, R** to change the case of each letter

**Nested Function Indenting Supported.** MATLAB now supports nested functions and the Editor provides preferences regarding how to indent them.

**Overwrite Mode Supported.** When you press the **Insert** key, text entry is done in overwrite mode and the cursor assumes a block shape. Press the **Insert** key again to return to insert mode.

## Create Block Comments Using %{ and %}

You can create a block comment in an M-file using any text editor, that is, you can comment out contiguous lines of code. Type **%{** on the line before the first line of the comment and **%}** following the last line of the comment. The lines in between are considered to be comments. Do not include any code on the lines with the block comment symbols. You can also nest block comments. See "Commenting in MATLAB Code Using Any Text Editor" for details.

**Compatibility Considerations.** Because of the new block comment symbols, if you have any files with lines that consist only of %{ and %}, they might be misinterpreted as block comment start and end symbols, and might cause errors in your file.

## Finding and Replacing Text

**Find Files and Content Within Files.** You can find directories, files, and content within multiple files. Select **Edit > Find Files**. For details, see “Advanced Search for Files — Find Files Tool” in the online documentation.

**Incremental Search Now Indicates Direction and is Case Sensitive.** The incremental search interface has been updated. It now indicates the search direction. It is also case sensitive when you enter uppercase letters in the search field.

## Printing M-Files

Page setup options differ slightly from previous versions.

## Breakpoints and Debugging

**Conditional Breakpoints Supported.** You can specify conditional breakpoints in an M-file. MATLAB only stops at the line with the breakpoint if the condition is met. Conditional breakpoints have a yellow breakpoint icon, which you can copy and paste to other lines.

**Disable (Ignore) Breakpoints.** You can disable standard and conditional breakpoints. MATLAB ignores a disabled breakpoint until you enable it again. A disabled breakpoint icon has an X through it.

**Error Breakpoints Supported.** Set error breakpoints for all files by selecting **Debug > Stop If Errors/Warnings**, and then completing the resulting dialog box. You can specify a message identifier for an error or warning breakpoint so that MATLAB stops only if it encounters the specified error or warning message.

## Debugging Functions Enhanced

**Error Support Added to `dbstop` and `dbclear`.** Enhancements to debugging functions include `dbstop` if caught error, `dbclear` if caught error, and `dbclear` if all error. The `dbstop` if all error option has been grandfathered and will not be supported in future versions. To specify a message identifier, use `dbstop` if error ID, `dbstop` if caught error ID, `dbstop` if warning ID, and the corresponding `dbclear` options. The `dbstatus` function has been updated to reflect the changes to `dbstop` and `dbclear`.

**`dbstop` Function Supports Nested and Anonymous Functions.** The `dbstop` function has been updated to support nested and anonymous functions. See the `dbstop` reference page for details. You cannot use the Editor/Debugger GUI to set breakpoints in anonymous functions, but must use the `dbstop` function instead. Note that when you save a file in the Editor/Debugger that contains breakpoints in anonymous functions, those breakpoints are cleared. They are also cleared when you run an unsaved file from the Editor/Debugger GUI, because running first saves the file.

**Notation for Reporting Path Modified.** MATLAB now uses a new notation for reporting the path of functions, subfunctions, and nested functions. As an example, `A/B>C/D` means directory A, file B, (sub)function C within the file B, and nested function D within C.

### **`dbstack` Function Supports Nested Functions**

The `dbstack` function has been updated to supported nested functions. See the `dbstack` function reference page for more information.

**Compatibility Considerations.** If you use `dbstack` in M-files, you might need to update your files because of this change. When you run `dbstack` and return results to a structure, there are now three fields, whereas in previous versions, there were only two fields. The fields are

- `file`, the file in which the function appears
- `name`, the function name within the file
- `line`, the line number in the function

The `file` field does not contain a complete pathname, as the `name` field did in previous versions. To get the complete pathname, use `dbstack('-completenames')`.

### **dbstatus Function Supports Conditional Breakpoints**

The `dbstatus` function has been updated to support conditional breakpoints. See the `dbstatus` function reference page for more information.

**Compatibility Considerations.** As a result there have been changes to some of the fields in the structure returned with `s = dbstatus(...)`. If you use `dbstatus` in M-files, you might need to update your files because of this change. For details on the new format, see the `dbstatus` reference page.

### **Access Tools from Editor/Debugger**

You can access useful tools for M-files from the Editor/Debugger. From the **Tools** menu, select **Check Code with M-Lint**, **Show Dependency Report**, or **Open Profiler**. For details about these tools, see “Tuning and Managing M-Files” on page 589.

### **Rapid Code Iteration Using Cells**

In the Editor, cell features allow you to easily make changes to values in a section of an M-file to readily see the impact of the changes. First, you define cells in a file, then evaluate a cell or cells, iterate values in the cell, and then reevaluate the cell(s). Cells also allow you to publish M-file code and results to popular formats, such as HTML and for the Microsoft Word application. For details, see “Evaluate Subsections of Files Using Code Cells” in the online documentation.

**Demo of New Rapid Code Iteration Features.** If you are using the Help browser, watch the new Rapid Code Iteration Using Cells video demo for an overview of the major functionality.

**Compatibility Considerations.** Because of the new symbols for cell publishing, if you have any files with lines that consist only of `%%`, those lines might be misinterpreted as the start of a cell. Your files will still run without problems, but if you publish the M-files, you might need to modify those lines.



## Preferences for the Editor/Debugger

**Add New Line to End of File Upon Save.** There is now a preference that allows you to add a new line to the end of a file upon saving.

**Open M-Files When Debugging Preference Moved.** The feature that instructs M-files to open automatically when debugging is no longer in preferences but is now accessible from the **Debug** menu in all desktop tools.



## Tuning and Managing M-Files

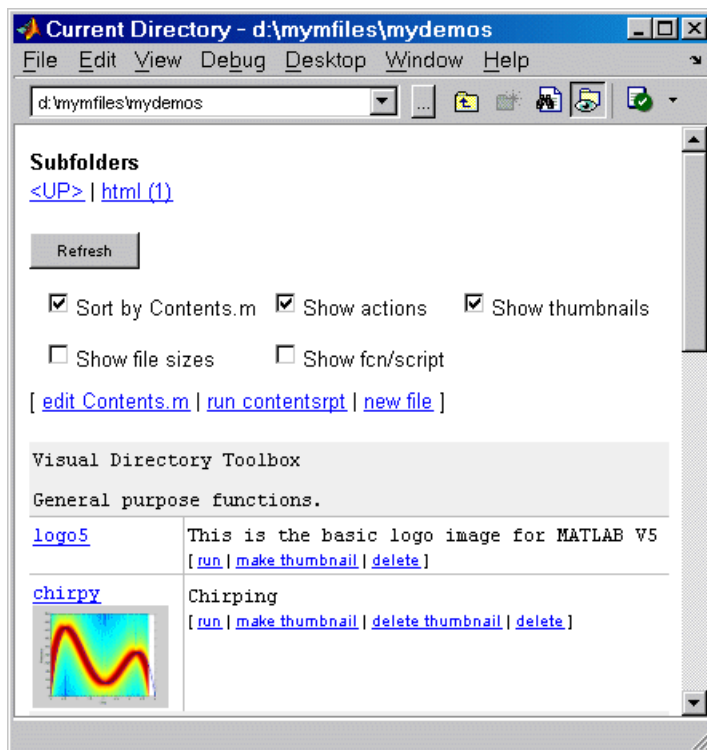
Use these tools to fine-tune and manage your M-files, and to prepare them for distribution to other users. New features introduced in this version are organized by these topics:

- “Visual Directory Tool in the Current Directory Browser” on page 589
- “Directory Reports in the Current Directory Browser” on page 590
- “Profiler for Measuring Performance” on page 592

### Visual Directory Tool in the Current Directory Browser

The Visual Directory view of the Current Directory provides useful information about the M-files in a directory. It can help you polish M-files before providing them to others to use.

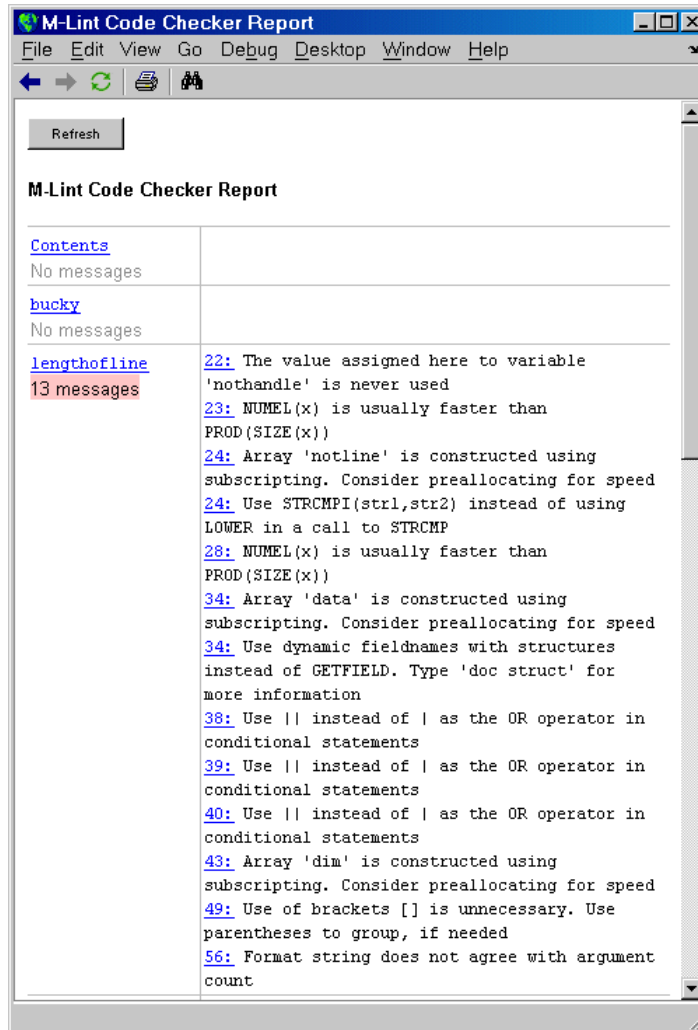
Click the **Show Visual Directory** button  on the Current Directory browser toolbar. To view changes — see the following figure for an example. To return to the Classic view of the Current Directory browser, click the button  again.



## Directory Reports in the Current Directory Browser

In the Current Directory browser, select **View > Directory Reports** and select the type of report to run. The report appears as an HTML document in the MATLAB Web browser. A summary of the reports follows. For more information, see “Using MATLAB Reports” in the online documentation.

**M-Lint Code Check Report.** The M-Lint report displays potential errors and problems, as well as opportunities for improvement in your code. For example, one common message is that a variable is defined but never used. You can also produce an M-Lint report for specified files using the `mlint` function, or run the M-Lint report from the Editor/Debugger or Profiler.



**TODO/FIXME Report.** The TODO/FIXME report shows M-files that contain text strings you included as notes to yourself, such as TODO.

**Help Report.** The Help report presents a summary view of the help component of your M-files. Use this information to help you identify files of interest or to help you identify files that lack help information.

**Contents Report.** The Contents report displays information about the integrity of the `Contents.m` file for the directory. A `Contents.m` file is a file you create that provides a brief description for relevant M-files in the directory. When you type `help` followed by the directory name, such as `help mydemos`, MATLAB displays the information in the `Contents.m` file. Use the Contents report to help you clean up and maintain your `Contents.m` file. If there is no `Contents.m` file, use the Contents report to create one.

**Dependency Report.** The Dependency report shows all M-files called by each M-file, or in other words, shows all children of each M-file. Use this report to determine all files you need to provide to someone who wants to run an M-file.

**File Comparison Report.** The File Comparison report identifies the differences between two files in the current directory. For example, you can easily compare an autosaved version of a file to the latest version of the file.

**Coverage Report.** Run the Coverage report after you run the Profile report to identify what percentage of the file was executed when it was profiled.

## Profiler for Measuring Performance

**Access Profiler from Desktop or Editor/Debugger.** Access the Profiler from the **Desktop** menu or the Editor/Debugger **Tools** menu.

**Profiler Summary Report.** In the Profiler summary report, click a column name to sort the report by that column.

**Profiler Detail Report.** In the Profiler detail report, specify options to show busy lines (lines where the most time was spent) and to show the file listing (the M-file code). Other options allow you to run the M-Lint Code Check report, which provides messages for improving the file, and the Coverage report, which indicates how much of the file was exercised during profiling. For more information about these reports, see “Using MATLAB Reports” in the online documentation. After selecting an option in the detail report, click **Refresh** to update the report. The performance acceleration information in the detail report has been removed.

**profile Function.** The profile function no longer supports the `-detail` flag's builtin option.

**Compatibility Considerations.** The profile report previously supported in MATLAB is no longer available. This was the report you generated by running `profile report` or `profreport`. There is a new function, `profsave` that replaces `profreport`. The `profsave` function saves a static version of the HTML profile report.

Because the `profile` function no longer supports the `-detail` flag's builtin option, the only remaining option is `mmex`, which is also the default. If you continue to specify the builtin option on the `-detail` flag, the `profile` function will behave as though you specified the `mmex` option, and no built-in functions are profiled.

## Source Control Changes

In MATLAB version 6.5 (R13) and MATLAB version 7.0 (R14), only source control systems that comply with the Microsoft Common Source Control standard are supported. If there is a compliant source control system installed on your machine, it will be listed in the Source Control options in the MATLAB Preferences dialog box.

There are several vendors who provide and interface into Revision Control Systems (RCS), Concurrent Versions System (CVS), and other such tools using Microsoft Source Code Control API. ComponentSoftware provides one such interface layer.

## Compatibility Considerations

This represents a change to how MATLAB interfaced with source control systems in prior versions.

## Publishing Results

### Publishing to HTML, XML, LaTeX, and Formats for Word and PowerPoint Applications

You can publish M-files to HTML, XML, LaTeX, and to formats for Microsoft Word and Microsoft® PowerPoint® applications. The published documents can

include code, formatted comments, and results, such as graphs in Figure windows. Use cells and cell publishing features in the Editor/Debugger. For details, see “Overview of Publishing MATLAB Code” in the online documentation.

**Demo of New Publishing Features.** If you are using the Help browser, watch the new Publishing M Code from the Editor video demo for an overview of the major functionality.

### **Notebook**

If you currently use Notebook, consider using cell publishing from the Editor instead, which provides more features and flexibility for most applications.

Notebook has been improved with regards to speed and stability, with a few minor changes in operation. The improvements were available via a Web-downloadable update to MATLAB version 6.5, and are now part of MATLAB version 7.

## Mathematics, MATLAB Version 7 (R14)

This version introduces the following new features and changes:

### New and Obsolete Functions

- “New Functions” on page 597
- “Obsolete Functions” on page 598

### Nondouble Math

- “New Nondouble Mathematics Features” on page 598
- “Nondouble Arithmetic” on page 599
- “New Integer Functions — intmax and intmin” on page 600
- “New Warnings for Integer Arithmetic” on page 600
- “Warning on Concatenating Different Integer Classes” on page 601
- “Integer Data Type Functions Now Round Instead of Truncate” on page 602
- “Changes to Behavior of Concatenation” on page 603
- “Class Input for realmax and realmin” on page 603
- “Class Input for ones, zeros, and eye” on page 604
- “Class and Size Inputs for Inf and NaN” on page 605
- “New Class and Data Inputs for eps” on page 605
- “New Class Inputs for sum” on page 606
- “complex Now Accepts Inputs of Different Data Types” on page 607
- “Bit Functions Now Work on Unsigned Integers” on page 607

### Matrices and Elementary Math

- “New Function accumarray for Constructing Arrays with Accumulation” on page 607
- “Enhanced sort Capabilities and Performance” on page 608

- “New Functions for Numerical Data Types” on page 609
- “max and min Now Have Restrictions on Inputs of Different Data Types” on page 609
- “Mathematic Operations on Logical Values” on page 610

## **Linear Algebra**

- “New Function linsolve for Solving Systems of Linear Equations” on page 610
- “New Output for polyeig” on page 610
- “Enhancements to lscov” on page 611
- “New Form for Generalized Hessian” on page 611

## **Nonlinear Methods**

- “New Function quadv Integrates Complex, Array-Valued Functions” on page 612

## **Trigonometry, Geometry**

- “New Trigonometric Functions For Angles in Degrees” on page 612
- “Matrix, Trigonometric, and Other Math Functions No Longer Accept Inputs of Type char” on page 613
- “New Warnings for Complex Inputs to atan2, log2, and pow2” on page 613
- “Enhanced Functions for Computational Geometry” on page 614
- “New Support for Interpolation Functions” on page 614

## **Differential Equations**

- “New and Enhanced Functions for Ordinary Differential Equations (ODEs)” on page 615



## FFT

- “Enhancements to Discrete Fourier Transform Functions” on page 616
- “FFT Functions Applied to Integer Data Types are Becoming Obsolete” on page 616

## Optimization

- “New Output Function for Optimization Functions” on page 617

## Special Functions

- “New Input Argument for Incomplete Gamma Function” on page 617

## Other

- “Overriding the Default BLAS Library on Intel/Windows Systems” on page 618
- “New Names for Demos expm1, expm2, and expm3” on page 619

## New Functions

This release introduces the following new functions:

Function	Description
accumarray	Construct array with accumulation
cast	Cast variable to different type
expm1	Compute $\exp(x) - 1$ accurately for small values of $x$
intmax	Largest value of specified integer type
intmin	Smallest value of specified integer type
intwarning	Control state of integer warnings
isfloat	Determine whether input is floating-point array
isinteger	Determine whether input is integer array
linsolve	Solve linear system of equations

Function	Description
log1p	Compute $\log(1+x)$ accurately for small values of $x$
nthroot	Real $n$ th root of real numbers
ode15i	Solve fully implicit differential equations, variable order method
odextend	Extend solution of initial value problem for ordinary differential equation
quadv	Vectorized quadrature

## Obsolete Functions

The functions listed in the left column of the following table are obsolete and will be removed from a future version of MATLAB.

## Compatibility Considerations

Use the replacement functions listed in the right column instead.

Obsolete Function	Replacement Function
colmmd	colamd
quad8	quadl
symmmd	symamd

The following obsolete functions are no longer included in MATLAB:

fmin, fmins, icubic, interp4, interp5, interp6, meshdom, nnls, saxis

## New Nondouble Mathematics Features

MATLAB Version 7.0 supports many arithmetic operations and mathematical functions on the following nondouble MATLAB data types:

- single
- int8 and uint8

- `int16` and `uint16`
- `int32` and `uint32`

Most of the built-in MATLAB functions that perform mathematical operations now support inputs of type `single`. In addition, the arithmetic operators and the functions `sum`, `diff`, `colon`, and some elementary functions now support integer data types.

---

**Note** In Version 7.0, MATLAB only supports mathematical operations on nondouble data types for built-in functions; it does *not* support these operations for M-file functions unless otherwise stated in the M-file help.

---

## Nondouble Arithmetic

This section describes how MATLAB performs arithmetic on nondouble data types.

### Single Arithmetic

You can now combine numbers of type `single` with numbers of type `double` or `single`. MATLAB performs arithmetic as if both inputs had type `single` and returns a result of type `single`. For more information, see “Single-Precision Floating Point” in the online MATLAB Programming documentation.

### Integer Arithmetic

You can now combine numbers of an integer data type with numbers of the same integer data type or type `scalar double`. MATLAB performs arithmetic as if both inputs had type `double` and then converts the result to the same integer data type.

MATLAB computes operations on arrays of integer data type using *saturating* integer arithmetic. Saturating means that if the result is greater than the upper bound of the integer data type, MATLAB returns the upper bound. Similarly, if the result is less than the lower bound of the data type, MATLAB returns the lower bound. For more information, see “Integers” in the online MATLAB Programming documentation.

## New Integer Functions – `intmax` and `intmin`

Two new functions, `intmax` and `intmin`, return the largest and smallest numbers, respectively, for integer data types. For example,

```
intmax('int8')
ans =
    127
```

returns the largest number of type `int8`. See “Largest and Smallest Values for Integer Classes” in the online MATLAB documentation for more information.

## New Warnings for Integer Arithmetic

This section describes four new warning messages for integer arithmetic in Version 7.0. While these warnings are turned off by default, you can turn them on as a diagnostic tool or to warn of behavior in integer arithmetic that might not be expected.

To turn all four warning messages on at once, enter

```
intwarning on
```

## Integer Conversion of Noninteger Values

MATLAB can now return a warning when it rounds up a number in converting to an integer data type. For example,

```
int8(2.7)
Warning: Conversion rounded non-integer floating point value to
nearest int8 value.

ans =
     3
```

## Integer Conversion of NaN

When MATLAB converts NaN (Not-a-Number) to an integer data type, the result is 0. MATLAB can now return a warning when this occurs. For example,

```
int16(NaN)
```

```
Warning: NaN converted to int16(0).
```

```
ans =
    0
```

### Integer Conversion Overflow

MATLAB can now return a warning when you convert a number to an integer data type and the number is outside the range of the data type. For example,

```
int8(300)
Warning: Out of range value converted to intmin('int8') or
intmax('int8').

ans =
    127
```

### Integer Arithmetic Overflow

MATLAB can now return a warning when the result of an operation on integer data types is either NaN or outside the range of that data type. For example,

```
int8(100) + int8(100)
Warning: Out of range value or NaN computed in integer arithmetic.

ans =
    127
```

To turn all of these warnings off at once, enter

```
intwarning off
```

### Warning on Concatenating Different Integer Classes

If you concatenate integer arrays of different integer classes, MATLAB displays the warning

```
Concatenation with dominant (left-most) integer class may
overflow other operands on conversion to return class.
```

The class of the resulting array is the same as the dominant (or left-most) value in the concatenation:

```
a = int8([52 37 89; 23 16 47]);
b = int16([74 61 32; 98 73 25]);

% Combine int8 and int16 (int8 is dominant)
c = [a b];
class(c)
ans =
    int8

% Combine int16 and int8 (int16 is dominant)
c = [b a];
class(c)
ans =
    int16
```

## Integer Data Type Functions Now Round Instead of Truncate

The following integer data functions now round noninteger inputs instead of truncating:

```
int8, uint8, int16, uint16, int32, uint32, int64, uint64
```

For example, in MATLAB 7.0,

```
int8(3.7)
```

returns

```
ans =
    4
```

## Compatibility Considerations

In previous releases, the same command returned 3. If you have code that contains these functions, it might return different results in Version 7.0 than in previous releases, in particular, results that differ by 1 after converting floating-point inputs to an integer data type.

You can turn the following warning on to help diagnose these differences:

warning on MATLAB:intCovertNonIntVal

See “New Warnings for Integer Arithmetic” on page 600 for more information about this and other new warning messages.

## Changes to Behavior of Concatenation

When you perform concatenation (`[a, b]`, `[a;b]`, and `cat(a,b,dim)`) on mixed integer and other numeric or logical inputs, the left-most integer type among the inputs is the type of the result. As a result, the other inputs might lose values when they are converted to the integer data type. In Version 7.0, MATLAB now returns a warning when you concatenate these mixed data types.

For example,

```
[int8(100) uint8(200)]
Warning: Concatenation with dominant (left-most) integer class
may overflow other operands on conversion to return class.
(Type "warning off MATLAB:concatenation:integerInteraction" to
suppress this warning.)

ans =
    100    127

class(ans)
ans =
    int8
```

## Compatibility Considerations

Concatenating an input of any nondouble numeric data type (single and integer data type) with type `char` now returns a result of type `char`. In previous releases, the same operation returned a result of the same type as the numeric data type.

## Class Input for `realmax` and `realmin`

You can now call the function `realmax` with the syntax

```
realmax('single')
```

```
ans =
```

```
3.4028e+038
```

which returns the largest single-precision number. Similarly,

```
realmin('single')
```

returns the smallest single-precision number.

The commands `realmax('double')` and `realmin('double')` return the same results as `realmax` and `realmin`, respectively. See “Largest and Smallest Values for Floating-Point Classes” in the online MATLAB Programming documentation for more information.

## **Class Input for ones, zeros, and eye**

You can now call `ones` or `zeros` with an input argument specifying the data type of the output. For example,

```
ones(m, n, p, ..., 'single')
```

or

```
ones([m, n, p, ...], 'single')
```

returns an `m`-by-`n`-by-`p`-by ... array of type `single` containing all ones. `zeros` uses the same syntax.

You can now call `eye` with this input argument for two-dimensional arrays. For example,

```
eye(m, 'single')
```

returns an `m`-by-`m` identity matrix of type `single`. The command

```
eye(m, n, 'int8')
```

returns an `m`-by-`n` array of type `int8`.



## Class and Size Inputs for Inf and NaN

The functions `Inf` and `NaN` now accept inputs that enable you to create `Infs` or `NaNs` of specified sizes and floating-point data types. As examples,

- `Inf('single')` or `NaN('single')` create the single-precision representations of `Inf` and `NaN`, respectively.
- `Inf(m,n,p, ...)` or `NaN(m,n,p, ...)` create `m`-by-`n`-by-`p`-by-... arrays of `Infs` or `NaNs`, respectively.

See the reference pages for `Inf` and `NaN` for more information.

## New Class and Data Inputs for `eps`

You can now call the function `eps` with the syntax

```
eps(x)
```

If `x` has type `double`, `eps(x)` returns the distance from `x` to the next largest double-precision floating point number. This is a measure of the accuracy of `x` as a double-precision number. `eps(1)` returns the same value as `eps` with no input argument.

You can now replace expressions of the form

```
if Y < eps * abs(X)
```

with

```
if Y < eps(X)
```

If `x` has type `single`, `eps(x)` returns the distance from `x` to the next largest single-precision floating point number. This is a measure of the accuracy of `x` as a single-precision number.

The command

```
eps('single')
ans =
    1.1921e-007
```

returns the same value as `eps(single(1))`. The value of `eps('single')` is the same as `single(2^-23)`. The command `eps('double')` returns the same result as `eps`.

See “Accuracy of Floating-Point Data” in the online MATLAB documentation for more information.

## New Class Inputs for `sum`

The following new input arguments for `sum` control how the summation is performed on numeric inputs:

- `s = sum(x, 'native')` and `s = sum(x, dim, 'native')` accumulate in the native type of its input and the output `s` has the same data type as `x`. This is the default for `single` and `double`.
- `s = sum(x, 'double')` and `s = sum(x, dim, 'double')` accumulate in double-precision. This is the default for integer data types.

In Version 7.0, `sum` applied to a vector of type `single` performs `single` accumulation and returns a result of type `single`. In other words, `sum(x)` is the same as `sum(x, 'native')` if `x` has type `single`. This is a change in the behavior of `sum` from previous releases. To make `sum` accumulate in `double`, as in previous releases, use the input argument `'double'`.

## Compatibility Considerations

In Version 7.0, `sum` applied to a vector of type `single` performs `single` accumulation and returns a result of type `single`. In previous releases, `sum` performed this operation in `double` accumulation.

To restore the previous behavior, call `sum` with the syntax

```
sum(X, 'double')
```

or

```
sum(X, dim, 'double')
```

## complex Now Accepts Inputs of Different Data Types

The function `complex` now accepts inputs of different data types when you use the syntax

```
complex(a,b)
```

according to the following rules:

- If either of `a` or `b` has type `single`, `c` has type `single`.
- If either of `a` or `b` has an integer data type, the other must have the same integer data type or type `scalar double`, and `c` has the same integer data type.

## Bit Functions Now Work on Unsigned Integers

The following functions now work on unsigned integer inputs:

```
bitand, bitcmp, bitget, bitor, bitset, bitshift, bitxor
```

Instead of using `flints` (integer values stored in floating point) to do your bit manipulations, consider using unsigned integers, as a more natural representation of bit strings. Instead of using `bitmax`, use the `intmax` function with the appropriate class name. For example, use `intmax('uint32')` if you are working with unsigned 32 bit integers.

In addition, the function `bitcmp` now accepts the following new syntax for inputs of type `uint8`, `uint16`, and `uint32`:

```
bitcmp(A)
```

`bitcmp` now uses the data type of `A` to determine how to take the bitwise complement.

## New Function `accumarray` for Constructing Arrays with Accumulation

The new `accumarray` function enables you to construct an array with accumulation. The following example uses `accumarray` to construct a 5-by-5 matrix `A` from a vector `val`. The function `accumarray` adds the entries of `val` to `A` at the indices specified by the matrix `ind`, which has the same number of

rows as `val`. If an index in `ind` is repeated, the entries of `val` accumulate at the corresponding entry of `A`.

```
ind = [1 2 5 5;1 2 5 5]';
val = [10.1 10.2 10.3 10.4]';
A = accumarray(ind, val)
```

A =

```
10.1000         0         0         0         0
         0 10.2000         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0 20.7000
```

To get the (5,5) entry of `A`, `accumarray` adds the entries of `val` corresponding to repeated pair of indices (5,5).

$$A(5, 5) = 10.3 + 10.4$$

In general, if `ind` has `ndim` columns, `A` will be an `N`-dimensional array with `ndim` dimensions, whose size is `max(ind)`.

## Enhanced sort Capabilities and Performance

### Improved Performance

`sort` performance has been improved for numeric arrays of randomly ordered data. Although there is some performance improvement for all such numeric arrays, you should see the greatest improvement for integer arrays and multidimensional arrays.

### Sort Direction

A new argument, `mode`, lets you specify whether `sort` returns the sorted array in ascending or descending order.

## New Functions for Numerical Data Types

MATLAB 7.0 contains three new functions for detecting and converting data types:

- `cast` enables you to cast a variable to a different data type or class
- `isfloat` enables you to detect floating-point arrays. `isfloat(A)` returns 1 if `A` has type `double` or `single` and 0 otherwise. `isfloat(A)` is the same as `isa(A, 'float')`.
- `isinteger` enables you to detect integer arrays. `isinteger(A)` returns 1 if `A` has integer data type and 0 otherwise. `isinteger(A)` is the same as `isa(A, 'integer')`

## max and min Now Have Restrictions on Inputs of Different Data Types

In MATLAB 7.0, the functions `max` and `min` now have the following restrictions on inputs of different data types:

- If any input has an integer data type, all other inputs must have the same integer data type or type `scalar double`.
- If any input is of type `single`, all other inputs must have type `double` or `single`.

Other combinations of inputs now return an error message. In previous releases, inputs to `max` or `min` could have any combination of data types.

For the allowed mixed-type combinations listed above, `max` and `min` now return results of a different data type than in previous releases:

- If one input has an integer data type, while another has type `double`, the result now has the same integer data type. In previous releases, the result had type `double`.
- If one input has type `single`, while another has type `double`, the result now has type `single`. In previous releases, the result had type `double`.

You can turn on the following warning messages to diagnose any issues that might result from this change in behavior:

- warning on MATLAB:max:mixedIntegersScalarDoubleInputs
- warning on MATLAB:max:mixedSingleDoubleInputs
- warning on MATLAB:min:mixedIntegersScalarDoubleInputs
- warning on MATLAB:min:mixedSingleDoubleInputs

### **Compatibility Considerations**

Combinations of inputs other than those listed above now return an error message. Also, for these allowed mixed-type combinations, `max` and `min` now return results of a different data type than in previous releases:

### **Mathematic Operations on Logical Values**

Most mathematic operations are not supported on logical values.

### **New Function `linsolve` for Solving Systems of Linear Equations**

The new `linsolve` function enables you to solve systems of linear equations of the form  $Ax = b$  more quickly when the matrix of coefficients  $A$  has a special form, such as upper triangular. When you specify one of these special types of systems, `linsolve` is faster than `mldivide` or `\` (backslash) because it does not check whether the matrix actually has the form you specify.

---

**Note** If the matrix  $A$  does not have the form you specify in `opts`, `linsolve` returns incorrect results because it does not perform error checking. If you are unsure of the form of  $A$ , use `mldivide`, or `\` instead.

---

### **New Output for `polyeig`**

The function `polyeig` can now return a vector of condition numbers for the eigenvalues, when you call it with the syntax

```
[X,E,S] = polyeig(A0,A1,...,Ap)
```

At least one of  $A_0$  and  $A_p$  must be nonsingular. Large condition numbers imply that the problem is close to one with multiple eigenvalues.

## Enhancements to `lscov`

The command

$$\text{lscov}(A, b, V)$$

now accepts either a weight vector or a covariance matrix for  $V$ . If you enter `lscov(A, b)` without a third argument, `lscov` uses the identity matrix for  $V$ .

The command `lscov(A, b, V, alg)` now enables you to specify the algorithm used to compute the result when  $V$  is a matrix. You can specify `alg` to be one of the following:

- 'chol' uses the Cholesky decomposition of  $V$
- 'orth' uses the orthogonal decomposition of  $V$

The command

$$[x \text{ stdx } \text{mse}] = \text{lscov}(\dots)$$

now returns `mse`, the mean squared estimate (MSE).

The command

$$[x \text{ stdx } \text{mse } S] = \text{lscov}(\dots)$$

now returns `S`, the estimated covariance matrix of  $x$ .

In addition, `lscov` can now accept a design matrix  $A$  that is rank deficient and a covariance matrix,  $V$ , that is positive semidefinite.

## New Form for Generalized Hessian

The function `hess` has a new syntax of the form

$$[AA, BB, Q, Z] = \text{hess}(A, B)$$

where  $A$  and  $B$  are square matrices, and returns an upper Hessenberg matrix  $AA$ , an upper triangular matrix  $BB$ , and unitary matrices  $Q$  and  $Z$  such that

$$Q^*A^*Z = AA$$

and

$$Q*B*Z = BB$$

## New Function `quadv` Integrates Complex, Array-Valued Functions

The new function `quadv` integrates complex, array-valued functions.

## New Trigonometric Functions For Angles in Degrees

The following new functions compute trigonometric functions of arguments in degrees.

Function	Purpose
<code>sind</code>	Compute the sine of an argument in degrees
<code>cosd</code>	Compute the cosine of an argument in degrees
<code>tand</code>	Compute the tangent of an argument in degrees
<code>cotd</code>	Compute the cotangent of an argument in degrees
<code>secd</code>	Compute the secant of an argument in degrees
<code>cscd</code>	Compute the cosecant of an argument in degrees

The following new functions compute the inverse trigonometric functions and return the answer in degrees:

Function	Purpose
<code>asind</code>	Compute the inverse sine of an argument and return answer in degrees
<code>acosd</code>	Compute the inverse cosine of an argument and return answer in degrees
<code>atand</code>	Compute the inverse tangent of an argument and return answer in degrees
<code>acotd</code>	Compute the inverse cotangent of an argument and return answer in degrees



Function	Purpose
asecd	Compute the inverse secant of an argument and return answer in degrees
acscd	Compute the inverse cosecant of an argument and return answer in degrees

## Matrix, Trigonometric, and Other Math Functions No Longer Accept Inputs of Type char

Matrix functions, such as `chol`, `lu`, and `svd`, and trigonometric functions, such as `sin` and `cos`, no longer accept inputs of type `char`. In previous releases, these functions simply converted `char` inputs to `double` before performing operations on them.

### Compatibility Considerations

To restore the previous behavior of these functions, create an M-file that converts its input to `double` before applying the function. For example, to restore the behavior of `sin`,

- 1 Create a directory called `@char` in a directory on the MATLAB path, for example, your work directory.
- 2 Create an M-file with the following commands:

```
function s = sin(x)
    s = sin(double(x));
```

- 3 Save the file as `sin.m` in the directory `@char`.

## New Warnings for Complex Inputs to `atan2`, `log2`, and `pow2`

The following functions now return a warning for inputs that are not real numbers:

- `atan2(y,x)`
- `[f,e] = log2(x)`

- `pow2(f,e)`

## Enhanced Functions for Computational Geometry

The following functions, which perform geometric computations on a set of points in N-dimensional space, now provide many new options:

- `convhull` — Compute convex hulls
- `convhulln` — Compute N-dimensional convex hulls
- `delaunay` — Construct Delaunay triangulation
- `delaunay3` — Construct 3-dimensional Delaunay tessellations
- `delaunayn` — Construct N-dimensional Delaunay tessellations
- `griddata` — Data gridding and surface fitting
- `griddata3` — Data gridding and surface fitting for 3-dimensional data
- `griddatan` — Data gridding and hypersurface fitting (dimensions  $\geq 2$ )
- `voronoi` — Construct Voronoi diagrams
- `voronoin` — Construct N-dimensional Voronoi diagrams

These functions now accept an input cell array options that gives you greater control over how they perform calculations. These functions use the software Qhull, created at the National Science and Technology Research Center for Computation and Visualization of Geometric Structures (the Geometry Center). For more information on the available options, see <http://www.qhull.org/>.

## New Support for Interpolation Functions

The following interpolation functions now have enhanced features:

- `interp1` — The command `YI = interp1(X,Y,XI)` now accepts a multidimensional array `Y` and returns an array of the correct dimensions. If `Y` is an array of size `[n,m1,m2,...,mk]`, `interp1` performs interpolation for each `m1-by-m2-by-...-mk` value in `Y`. If `XI` is an array of size `[d1,d2,...,dj]`, `YI` has size `[d1,d2,...,dj,m1,m2,...,mk]`.

The command `pp = interp1(X,Y,'method','pp')` uses the specified method to generate the piecewise polynomial form (ppform) of `Y`. See the reference page for `interp1` for information about the available methods.

- `interp2`, `interp3`, and `interpn` — You can now pass in a scalar argument, `ExtrapVal`, which these functions return for any values of `XI` and `YI` that lie outside the range of values spanned by `X` and `Y` defining the grid. For example,

```
ZI = interp2(X,Y,Z,XI,YI,'method',ExtrapVal)
```

returns the value of `ExtrapVal` for any values of `XI` or `YI` that are outside the range of values spanned by `X` and `Y`.

- `ppval` now accepts multidimensional arrays returned by the `spline` function using the syntax

```
YY = ppval(spline(X,Y), XX)
```

Each entry of `YY` is obtained by evaluating `spline(X,Y)` at the corresponding value of `XX`.

- `spline` — The command `YY = spline(X,Y,XX)` now accepts a multidimensional array `Y` and returns an array of the correct dimensions. Note that `YY = spline(X,Y,XX)` is the same as `YY = ppval(spline(X,Y), XX)`.

If `spline(X, Y)` is scalar-valued, then `YY` is of the same size as `XX`. If `spline(X, Y)` is  $[D_1, \dots, D_r]$ -valued, and `XX` has size  $[N_1, \dots, N_s]$ , then `YY` has size  $[D_1, \dots, D_r, N_1, \dots, N_s]$ , where `YY(:, ..., :, J1, ..., Js)` is the value of `spline(X, Y)` at `XX(J1, ..., Js)`. There are two exceptions to this rule:

## New and Enhanced Functions for Ordinary Differential Equations (ODEs)

MATLAB 7.0 provides two new functions for solving implicit ODEs and extending solutions to ODEs, along with several enhancements to existing ODE-related functions:

- `ode15i`, which is new in Version 7.0, provides the capability to solve fully implicit ODE and DAE problems of the form  $f(t, y, y') = 0$  with consistent initial conditions, i.e.,  $f(t_0, y_0, y_0') = 0$ . `ode15i` provides an interface that is

similar to that of the other MATLAB ODE solvers and is as easy to use. A supporting function `decic` helps you calculate consistent initial conditions. The existing functions `odeset` and `odeget` enable you to set integration properties that affect the problem solution. `deval` evaluates the numerical solution obtained with `ode15i`.

- `odextend`, which is new in Version 7.0, enables you to extend the solution to an ODE created by an ODE solver.
- `bvp4c` can now solve multipoint boundary value problems. To see an example of how to solve a three-point boundary value problem, enter `threebvp`. To see the code for the example, enter `edit threebvp`. Enter `help bvp4c` to learn more about `bvp4c`.
- `deval` can now evaluate the derivative of the solution to an ODE as well as the solution itself. The command

```
[psxint, spxint] = deval(sol,xint)
```

returns `spxint`, the value of the derivative to `sol`.

## Enhancements to Discrete Fourier Transform Functions

The new function `fftw` enables you to optimize the speed of the discrete Fourier transform (DFT) functions `fft`, `ifft`, `fft2`, `ifft2`, `fftn`, and `ifftn`. You can use `fftw` to set options for a tuning algorithm that experimentally determines the fastest algorithm for computing a discrete Fourier transform of a particular size and dimension at run time.

The functions `ifft`, `ifft2`, and `ifftn` now accept the input argument `'symmetric'`, which causes these functions to treat the array `X` as conjugate symmetric. This option is useful when `X` is not exactly conjugate symmetric, merely because of round-off error.

## FFT Functions Applied to Integer Data Types are Becoming Obsolete

In previous releases, the following fast Fourier transform (FFT) and related functions cast integer inputs of type `uint8` and `uint16` to `double`, used the `double` algorithm, and returned a `double` result:

- `fft`

- `fftn`
- `ifft`
- `ifftn`
- `conv2`

In Version 7.0, these operations return warning messages that recommend convert the inputs to `double` before applying the function, for example, by `fft(double(x))`.

## New Output Function for Optimization Functions

In MATLAB 7.0, you can create an output function for several optimization functions in MATLAB. The optimization function calls the output function at each iteration of its algorithm. You can use the output function to obtain information about the data at each iteration or to stop the algorithm based on the current values of the data. You can use the output function with the following optimization functions:

- `fminbnd`
- `fminsearch`
- `fzero`
- `N1` is ignored if `XX` is a row vector, that is, if `N1` is 1 and `s` is 2.
- `spline` ignores any trailing singleton dimensions of `XX`.

## New Input Argument for Incomplete Gamma Function

The incomplete gamma function, `gammainc`, now accepts the input argument `tail`, using the syntax

```
Y = gammainc(X,A,tail)
```

`tail` specifies the tail of the incomplete gamma function when `X` is non-negative. The choices are for `tail` are `'lower'` (the default) and `'upper'`. The upper incomplete gamma function is defined as

1 - `gammainc(x,a)`

## Overriding the Default BLAS Library on Intel/Windows Systems

---

**Note** Intel has used aggressive optimization to compile MKL. This optimization causes NaNs to be treated as zeros in some situations. Calculations that do not involve NaNs are done correctly. In some calculations that do involve NaNs, the NaNs will not propagate.

---

MATLAB uses the Basic Linear Algebra Subroutines (BLAS) libraries to speed up matrix multiplication and LAPACK-based functions like `eig`, `svd`, and `\(mldivide)`. At start-up, MATLAB selects the BLAS library to use.

For R14, MATLAB still uses the ATLAS BLAS libraries, however, on Windows systems running on Intel processors, you can switch the BLAS library that MATLAB uses to the Math Kernel Library (MKL) BLAS, provided by Intel.

If you want to take advantage of the potential performance enhancements provided by the Intel BLAS, you can set the value of the environment variable `BLAS_VERSION` to the name of the MKL library, `mk1.d11`. MATLAB uses the BLAS specified by this environment variable, if it exists.

To set the `BLAS_VERSION` environment variable, follow this procedure:

- 1 Click the **Start** button, go to the **Settings** menu, and select **Control Panel**.
- 2 On the **Control Panel** menu, select **System**.
- 3 In the **System Properties** dialog box, click the **Advanced** tab.
- 4 On the **Advanced** panel, click the **Environment Variables** button.
- 5 In the **Environment Variables** dialog box, click the **New** button in the User variables section.

- 6 In the **New User Variable** dialog box, enter the name of the variable as `BLAS_VERSION` and set the value of the variable to the name of the MKL library: `mk1.dll`.

## **Multithreading Disabled in Intel Math Kernel Library (MKL) BLAS**

The Intel Math Kernel Library (MKL) is multithreaded in several areas. By default, this threading capability is disabled. To enable threading in the MKL library, set the value of the `OMP_NUM_THREADS` environment variable. Intel recommends setting the value of the `OMP_NUM_THREADS` variable to the number of processors you want to use in your application.

To set the value of this environment variable, follow the instructions outlined in “Overriding the Default BLAS Library on Intel/Windows Systems” on page 618.

Before enabling multithreading, read the Intel Math Kernel Library 6.1 for Windows Technical User Notes that explains certain limitations of this capability.

## **New Names for Demos `expm1`, `expm2`, and `expm3`**

The demos `expm1`, `expm2`, and `expm3` have been renamed `expdemo1`, `expdemo2`, and `expdemo3`, to avoid a name conflict with the new function `expm1`.

## **Compatibility Considerations**

If you have code that relies on these function names, you will need to change the names in your code.

## Programming, MATLAB Version 7 (R14)

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**Caution** If you have saved data to a MAT-file using MATLAB Release 14 Beta 2, please read “MAT-Files Generated By Release 14 Beta2 Must Be Reformatted” on page 624.

---

This version introduces the following new features and changes:

### Save and Load

- “MATLAB Stores Character Data As Unicode; Making Release 14 MAT-files Readable in Earlier Versions” on page 623
- “MAT-Files Generated By Release 14 Beta2 Must Be Reformatted” on page 624
- “Unicode-Based Character Classification” on page 625
- “Character Rendering on Linux” on page 625
- “Additional Bytes Reserved in MAT-File Header; Do Not Write To Reserved Space” on page 625
- “Compressed Data Support in MAT-Files” on page 626
- “Saving Structures with the save Function” on page 626

### Function Dispatching

- “Case-Sensitivity in Function and Directory Names; Can Affect Which Function MATLAB Selects” on page 626
- “Differences Between Built-Ins and M-Functions Removed; Can Affect Which Function MATLAB Selects” on page 631
- “Warning on Naming Conflict” on page 633
- “Change to How evalin Evaluates Dispatch Context” on page 633



## Functions and Scripts

- “Summary of New Functions” on page 634
- “New Function Type — Anonymous Functions” on page 635
- “New Function Type — Nested Functions” on page 637
- “Calling Private Functions From Scripts” on page 638
- “New Calling Syntax for Function Handles; Replace eval With New Syntax” on page 638
- “Arrays of Function Handles” on page 639
- “Calling nargin and narginout with Built-In Functions” on page 639
- “Comma Separators Not Required in Function Declaration” on page 640

## Changes to Specific Functions

- “getfield and setfield Not To Be Deprecated” on page 640
- “isglobal Function To Be Discontinued” on page 640
- “Recycle to Protect Files from Unwanted Deletion” on page 641
- “bin2dec Ignores Space Characters” on page 641
- “dbstop crashes Are Now Resolved” on page 641
- “Bit Functions on Unsigned Integers” on page 642
- “inmem Returns Path Information” on page 642

## Specific Data Types

- “New Features for Nondouble Data Types” on page 642
- “Mathematic Operations on Logical Values” on page 642
- “Accessing Cell and Structure Arrays Without deal” on page 642

## Characters and Strings

- “New Features in Regular Expression Support” on page 643

- “Functions that Use Regular Expressions” on page 644
- “Regular Expressions Accept String Vector; No Longer Support Character Matrix Input” on page 645
- “Cell Array Support for String Functions” on page 645
- “Additional Class Output From mat2str” on page 645
- “String Properties” on page 646
- “Using strtok on Cell Arrays of Strings” on page 646
- “Colon Operator on char Now Returns a char” on page 646

## **Dates and Times**

- “datestr Returns Date In Localized Format” on page 647
- “Form and Locale for weekday” on page 647
- “Freestyle Date String Format” on page 647
- “Reading Date Values with xlsread; Conversion No Longer Necessary” on page 647

## **File I/O**

- “Comprehensive Function for Reading Text Files” on page 648
- “New Inputs and Outputs to xlsread” on page 649
- “New Inputs and Syntax for dlmwrite” on page 649
- “Change in Output from xlsfinfo” on page 650
- “Importing Complex Arrays” on page 651
- “Using imread to Import Subsets of TIFF Images” on page 651
- “Getting Information about Multimedia Files” on page 652
- “All-Platform Audio Recording and Playback” on page 652
- “FTP File Operations” on page 653
- “Web Services (SOAP)” on page 653
- “64-Bit File Handling on MacIntosh” on page 653

## Error Handling

- “Changes to Error Message Format” on page 653
- “nargchk Has a New Format for Error Messages” on page 656
- “Enabling and Disabling Warning Messages” on page 657
- “Catching Ctrl+C in try-catch Statements” on page 657
- “Assignment Error Removed” on page 658

## Other Topics

- “MATLAB Performance Acceleration” on page 658
- ““Using MATLAB” Documentation Is Now Three Books” on page 659

## MATLAB Stores Character Data As Unicode; Making Release 14 MAT-files Readable in Earlier Versions

Prior releases of MATLAB represented character data in memory using a system default character encoding scheme that was padded out to 16-bits. This was the case both in memory and in MAT-files. If this data needed to be accessible to multiple users, each user’s system had to use the same character encoding scheme. For those users whose default encoding scheme differed, the exchange of character-oriented information was not possible.

In Release 14, this limitation is removed by adopting the Unicode character encoding scheme in `mxArrays` and their storage in MAT-files. For more information regarding Unicode, consult the Unicode Consortium web site at <http://www.unicode.org>.

For information on the internal formatting of MAT-files, see the "MAT-File Format" document in the MATLAB documentation available in PDF format

## Compatibility Considerations

Release 14 MATLAB writes character and figure data to MAT-files using Unicode character encoding by default. This is now the default encoding used by MATLAB when writing to MAT-files with the `save` and `hgsave` functions or with the MAT-file external interface functions.

Unicode encoded MAT-files are not readable by earlier versions of MATLAB. Thus, if you save data to a MAT-file using MATLAB Release 14, and you intend to load this MAT-file into an earlier release of MATLAB, you must override the default encoding during the save, as explained in this section.

You can override the default encoding by using the `-v6` switch with `save` and `hgsave`:

```
save filename -v6
hgsave filename -v6
```

or, when saving with MAT functions, by setting the mode to “wL” on the `matOpen` operation:

```
matOpen(filename, "wL");
```

## **MAT-Files Generated By Release 14 Beta2 Must Be Reformatted**

Any MAT-files that you created with Release 14 Beta 2 were written using an internal format that is no longer supported by MATLAB.

### **Compatibility Considerations**

If you need to import data from these files using any release besides Release 14 Beta 2, you must first regenerate the files as described in this section. You cannot read these files using other releases of MATLAB 7.0, and attempting to read them with MATLAB 6.5 or 6.5.1 will corrupt memory.

There are two ways in which you can regenerate your MAT-file:

- If you want to use the MAT-file with earlier versions of MATLAB, regenerate the file using the local character set for your system. To do this, run MATLAB R14 prerelease or MATLAB R14 Beta 2, load the MAT-file, and rewrite the file using the command

```
save filename -v6
```

- If you want to use the MAT-file with R14 LCS or later, regenerate the file using Unicode character encoding. To do this, run MATLAB R14 prerelease, load the MAT-file, and rewrite it using the following command that uses the `-unicode` default.

```
save filename
```

---

**Caution** The final R14 release of MATLAB does not allow you to import a MAT-file written with Release 14 Beta 2. You will get an error if you attempt to do this. To use a Beta 2 MAT-file with Release 14, you must first reformat the file with MATLAB R14 prerelease as described above.

---

If you no longer have access to Release 14 Beta2 or the R14 prerelease, then you must regenerate the data and save it again.

## Unicode-Based Character Classification

Unicode-based character classification APIs are now provided in MATLAB. The new character classification functions work with any locale or language and resolve all locale-specific issues that existed in prior releases.

## Character Rendering on Linux

Character data rendering has been improved for Linux operating systems that are configured with a UTF-8 default character set.

## Additional Bytes Reserved in MAT-File Header; Do Not Write To Reserved Space

In previous releases of MATLAB, the last 4 bytes of the 128-byte MAT-file header were reserved for use by the MathWorks. In Release 14, the last 12 bytes of this header are reserved. See the PDF file “MAT-File Format” for more information.

## Compatibility Considerations

If you have programs that write to any of the last 12 bytes of the MAT-file header, or if they rely on the state of the 8 additional header bytes that are reserved as of this release, you will probably need to change your code. These bytes are now used by MATLAB. If your code writes to these bytes, MATLAB is likely to overwrite this data. If your code reads these bytes, they might not be in the same state as they were in previous releases of MATLAB.

## Compressed Data Support in MAT-Files

The `save` function compresses your workspace variables as they are saved to a MAT-file. When writing a MAT-file that you will need to load using an earlier version of MATLAB, be sure to use the `save -v6` command. When you use the `-v6` switch, MATLAB saves the data without compression and without Unicode character encoding. This makes the resulting file compatible with MATLAB Version 6 and earlier.

You can also compress data when using MAT-file interface library functions (`matPut*`) to write to a MAT-file by opening the file with the command `matOpen wz`. See the section “MAT-File Versions” in the MATLAB Data Import and Export documentation for more information on this feature.

## Saving Structures with the `save` Function

Two new syntaxes for the `save` function enable you to save individual fields of a structure to a file. See the function reference for `save` for more information.

To save all fields of the scalar structure `s` as individual variables within the file, `myfile.mat`, use

```
save('myfile', '-struct', 's')
```

To save as individual variables only those structure fields specified (`s.f1`, `s.f2`, ...), use

```
save('myfile', '-struct', 's', 'f1', 'f2', ...)
```

## Case-Sensitivity in Function and Directory Names; Can Affect Which Function MATLAB Selects

Prior to this release, filenames for MATLAB functions and Simulink models, (M, P, MEX, DLL, and MDL files) and also directory names were interpreted somewhat differently by MATLAB with regards to case sensitivity, depending upon which platform you were running on. Specifically, earlier versions of MATLAB handled these names with case sensitivity on UNIX, but without case sensitivity on Windows.

This release addresses the issue of case sensitivity in an effort to make MATLAB consistent across all supported platforms. By removing these

differences, we hope to make it easier for MATLAB users to write platform independent code.

### **Case Sensitivity in MATLAB 6 and Earlier**

There are several rules regarding case sensitivity that were already consistent across all platforms in MATLAB 6, and remain in effect on all platforms in MATLAB 7. MATLAB interprets each of the following with case sensitivity on both Windows and UNIX:

- Function names that correspond to MATLAB built-ins
- M-file subfunction names
- The names of functions imported from another language environment, such as Java or COM

**UNIX.** On all UNIX platforms, including the new implementation on MacIntosh, all function, model, and directory names were case sensitive and required an exact match. This rule remains true for UNIX systems in MATLAB 7.

**Windows.** On Windows platforms, MATLAB 6 obeys the following rules. These rules are changing in MATLAB 7:

- Function and model names were not case sensitive.
- Directory names, including MATLAB class directory names (e.g., @MyClass) and private directory names (e.g., prIVAtE) were not case sensitive.

### **Case Sensitivity in MATLAB 7**

MATLAB 7 removes the platform specific behaviors by adopting its UNIX case sensitivity rules on Windows systems. MATLAB running on Windows now gives preference to an exact (case sensitive) name match, but falls back to an inexact (case insensitive) match when no exact match can be found.

### **Compatibility Considerations**

There are four main conditions under which MATLAB 7 interprets directory or function names differently in regards to case sensitivity:

- “Two Files of the Same Name” on page 628
- “Two Method Files of the Same Name” on page 629
- “One File with an Inexact Match” on page 629
- “Private Directory Names” on page 630

In any of these cases, each described below, there is a potential for MATLAB to select a file other than the one you had intended.

Whenever MATLAB 7 detects a potential naming conflict related to case sensitivity, it issues a warning. If you get one of these warnings when running a MATLAB program, you may want to modify the related code to eliminate the warning, or you may wish to simply disable the warning. To disable this type of warning, see “Turning Off Warnings Caused by Case Mismatch” on page 631.

**Two Files of the Same Name.** Consider the situation in which there are two or more directories on the MATLAB path that contain a function or model file of the same name. The names of these M-files differ only in letter case:

```
H:\released\myTestFun.m  
K:\under_test\mytestfun.m
```

Of these two directories, H:\released is closer to the beginning of the MATLAB path and, thus, has priority over the other:

```
path = H:\released; K:\under_test; ...
```

#### On Windows Platforms —

- In MATLAB 6, executing the function mytestfun invokes H:\released\myTestFun.m.
- In MATLAB 7, executing the function mytestfun invokes K:\under\_test\mytestfun.m and also displays the following warning:

```
Function call mytestfun invokes K:\under_test\mytestfun.m  
however, function H:\released\myTestFun.m, that differs only in  
case, precedes it on the path.
```



**On UNIX Platforms —**

MATLAB 7 does the same as on Windows, except that the warning message is disabled by default.

**Two Method Files of the Same Name.** In this case, there are two M-files of the same name that implement methods of a MATLAB base class and one of its subclasses:

```
@baseclass/my_method.m
@subclass/My_Method.m
```

**On Windows Platforms —**

- In MATLAB 6, the command `my_method(subclass)` invokes `@subclass/My_Method`.
- In MATLAB 7, the same command invokes `@baseclass/my_method` because it is an exact match.

**On UNIX Platforms —**

MATLAB 7 does the same as on Windows.

**One File with an Inexact Match.** Another situation that MATLAB now handles differently involves just one function or model file that matches the function being called:

```
H:\released\myTestFun.m
```

However, the name of this M-file does not match the called function (`mytestfun`) in letter case.

**On Windows Platforms —**

- In MATLAB 6, calling the function `mytestfun` invokes `H:\released\myTestFun.m`.
- In MATLAB 7, calling the function `mytestfun` invokes the same M-file but also displays the following warning:

```
Function call mytestfun invokes inexact match
```

H:\released\myTestFun.m.

#### On UNIX Platforms —

- In MATLAB 6, calling the function `mytestfun` results in an error.
- In MATLAB 7, calling `mytestfun` invokes `H:\released/myTestFun.m` and generates the following warning:

```
Function call mytestfun invokes inexact match
H:/released/myTestFun.m.
```

**Private Directory Names.** Private functions must reside in a directory named `private` that is one level down from the directory of any calling function. As of this release, the directory name `private` is case sensitive on Windows as it has always been on UNIX.

#### On Windows Platforms —

- In MATLAB 6, calling function `myprivfun` in an environment where only a subdirectory named `\Private` contains the M-file `myprivfun.m` invokes `\Private\myprivfun` without displaying a warning.
- MATLAB 7 does the same as MATLAB 6, except that it also displays the following warning:

```
Wrong case spelling of 'private' as a directory name in
\released\Private\myprivfun.m.
```

#### On UNIX Platforms —

- In MATLAB 6, calling function `myprivfun` in an environment where only a subdirectory named `\Private` contains the M-file `myprivfun.m` results in an error.
- In MATLAB 7, calling `myprivfun` in this same environment invokes `/Private/myprivfun` and also displays the following warning:

```
Wrong case spelling of 'private' as a directory name in
/released/Private/myprivfun.m.
```

## Turning Off Warnings Caused by Case Mismatch

You can disable most warnings caused by case mismatch with the following command:

```
warning off MATLAB:dispatcher:InexactMatch
```

To disable this warning for all of your MATLAB sessions, add this command to your `startup.m` or `matlabrc.m` file.

If you continue to get case sensitivity warnings after entering this command, you can disable a wider range of warnings with the following command:

```
warning off ...  
MATLAB:dispatcher:CaseInsensitiveFunctionPrecedesExactMatch
```

---

**Note** This latter warning alerts you when, for case sensitivity reasons, MATLAB may have selected a different M-file from the one you had intended to run. It is recommended that you leave this warning enabled.

---

## Differences Between Built-Ins and M-Functions Removed; Can Affect Which Function MATLAB Selects

MATLAB implements many of its core functions as built-ins. In previous releases of MATLAB, there have been several significant differences between the way MATLAB handles built-in and M-file functions. As of this release, MATLAB handles both types of functions the same. This change affects the following:

- “Function Dispatching” on page 631
- “Return Value from the functions Function” on page 632
- “Output from the which Function” on page 632

### Function Dispatching

MATLAB now dispatches both built-in and M-file functions according to the same precedence rules, (see “Function Precedence Order” in the MATLAB Programming documentation). In previous releases, subfunctions, private functions, and class constructor functions took precedence over M-functions

of the same name, but not over built-ins. In this release, built-in functions follow the same rules given to M-functions, and thus are lower in precedence than the three function types named above.

This change addresses a potential problem in that changes to the internal implementation of MATLAB functions could potentially affect the operation of your own M-code. For example, if a new version of MATLAB were to change an internal function from being M-based to being built-in, the function in the new version would now be subject to different precedence rules. If one of your M-code modules had a subfunction with the same name as this function (now obeying the built-in rules), then this subfunction would never be called.

This release resolves this potential conflict by using the same precedence rules for both M-functions and built-ins.

**Compatibility Considerations.** If any of your programs have subfunctions, private functions, or class constructor functions that have the same name as a built-in function that has the same function scope, MATLAB now gives precedence to the subfunction, private function, or constructor rather than the built-in. If this is not corrected, you may find instances where your program calls a function other than the one you had intended. You can avoid such problems by renaming any functions that may conflict with a MATLAB built-in function.

### **Return Value from the functions Function**

The MATLAB `functions` function returns information about a function handle such as the function name, type, and filename. In previous releases, functions returned the filename for a built-in function as the string

```
'MATLAB built-in function'
```

In this release, MATLAB associates each built-in function with a placeholder file that has a `.bi` extension (for example, `reshape.bi` for the built-in `reshape` function).

### **Output from the which Function**

The `which` function now displays the pathname for built-in functions, as well as for overloaded functions when only the overloaded functions are available.

## Warning on Naming Conflict

The following warning was added to identify the case when you first use a name as a function and later use it as a variable:

```
Warning: File: D:\Work\MATLAB XL\theworks\my_yprime.m Line: 17
Column: 1 Variable 'getdata' has been previously used as a
function name.
(Type "warning off MATLAB:mir_warning_variable_used_as_function:
to suppress this warning.)
```

For example, this code generates such a warning:

```
X = i; % Calls the function i() to get sqrt(-1)
for i = 1:10 % uses i as a variable. This produces the warning.
... end
```

## Change to How evalin Evaluates Dispatch Context

In Release 13 and earlier, the `evalin` function evaluated its input in the specified workspace, but not the workspace's corresponding dispatching context. Hence, running the following example used to succeed, calling the subfunction `MySubfun` but using the value of `x` from the base workspace:

```
function demo
evalin('base', 'MySubfun(x)')

function MySubfun(in)
disp(in)
```

When you call `evalin` in Release 14, MATLAB tries to find a function named `MySubfun` that is accessible in the base workspace, i.e. at the command prompt. Since `MySubfun` is a subfunction and therefore not in scope at the command prompt, MATLAB errors, reporting that `MySubfun` is undefined.

## Compatibility Considerations

There are two ways to change your existing code to work with this new behavior. First, if your code only needs to get the value of the subfunction's inputs from the base workspace (as `demo.m` does above), and does not care what context `MySubfun` is run in, then you can change your code to use `evalin` only to get the values of the inputs from the base workspace, like this:

```
function demo_workaround1
MySubfun(evalin('base', 'x'))
```

```
function MySubfun(in)
disp(in)
```

If, however, it is important that the subfunction itself be run in the context of the base workspace, you can place a function handle to the subfunction in the base workspace and then evaluate that:

```
function demo_workaround2
assignin('base', 'MySubfunHandle', @MySubfun);
evalin('base', 'MySubfunHandle(x)')
```

```
function MySubfun(in)
disp(in)
```

You can also substitute 'caller' for 'base' in the workaround code if your original code uses `evalin('caller', ...)`.

## Summary of New Functions

These functions are new in this release.

Function	Description
<code>addtodate</code>	Modify a particular field of a date number
<code>genvarname</code>	Construct valid variable name from string
<code>intmax</code>	Return largest possible integer value
<code>intmin</code>	Return smallest possible integer value
<code>intwarning</code>	Control state of integer warnings
<code>isfloat</code>	Detect floating-point arrays
<code>isinteger</code>	Detect whether an array has integer data type
<code>isscalar</code>	Determine if item is a scalar
<code>isstrprop</code>	Determine the content of each element of a string
<code>isvector</code>	Determine if item is a vector

Function	Description
<code>mmfileinfo</code>	Get information about multimedia file
<code>recycle</code>	Set option to move deleted files to recycle folder
<code>restoredefaultpath</code>	Restore default search path
<code>strtrim</code>	Remove leading and trailing whitespace from string
<code>textscan</code>	Read data from text file, convert and write to cell array
<code>xlswrite</code>	Write matrix to a Microsoft Excel spreadsheet

## New Function Type – Anonymous Functions

Anonymous functions give you a quick means of creating simple functions without having to create M-files each time. You can construct an anonymous function either at the MATLAB command line or from within another function or script.

Refer to “Anonymous Functions” in the MATLAB Programming documentation for more complete coverage of this topic. For more information on anonymous functions, open the M-file `anondemo.m` in the MATLAB Editor by typing

```
edit anondemo
```

### Syntax

The syntax for creating an anonymous function from an expression is

```
fhandle = @(arglist) expr
```

where `arglist` is a comma-separated list of input variables, and `expr` is any valid MATLAB expression. The constructor returns a function handle, `fhandle`, that is mapped to this new function. Creating a function handle for an anonymous function gives you a means of invoking the function. It is also useful when you want to pass your anonymous function in a call to some other function.

---

**Note** Function handles not only provide access to anonymous functions. You can create a function handle to any MATLAB function. The constructor uses a different syntax: `fhandle = @functionname` (e.g., `fhandle = @sin`). To find out more about function handles, see “Function Handles” in the MATLAB Programming documentation.

---

You can use the function handle for an anonymous function in the same way as any other MATLAB function handle.

### A Simple Example

To create a simple function `sqr` to calculate the square of a number, use

```
sqr = @(x) x.^2;
```

To execute the function, type the name of the function handle, followed by any input arguments enclosed in parentheses:

```
a = sqr(5)
a =
    25
```

Since `sqr` is a function handle, you can pass it to other functions. The code shown here passes the function handle for anonymous function `sqr` to the MATLAB `quad` function to compute its integral from zero to one:

```
quad(sqr, 0, 1)
ans =
    0.3333
```

### Arrays of Anonymous Functions

To store multiple anonymous functions in an array, use a cell array. See “Arrays of Anonymous Functions” in the MATLAB Programming documentation.

### Examples

You can find more examples of how to use anonymous functions in MATLAB under “Examples of Anonymous Functions”.



## New Function Type – Nested Functions

You can now define one or more functions within another function in MATLAB. These inner functions are said to be *nested* within the function that contains them. You can also nest functions within other nested functions.

Refer to “Nested Functions” in the MATLAB Programming documentation for more complete coverage of this topic. For more information on nested functions, open the M-file `nesteddemo.m` in the MATLAB Editor by typing

```
edit nesteddemo
```

### Writing a Nested Function

To write a nested function, simply define one function within the body of another function in an M-file. Like any M-file function, a nested function contains any or all of the usual function components. In addition, you must always terminate a nested function with an `end` statement:

```
function x = A(p1, p2)
...
    function y = B(p3)
        ...
    end
...
end
```

### Characteristics of Nested Functions

Two characteristics unique to nested functions are

- A nested function has access to the workspaces of all functions inside of which it is nested. A variable that has a value assigned to it by the primary function can be read or overwritten by a function nested at any level within the primary. Similarly, a variable that is assigned in a nested function can be read or overwritten by any of the functions containing that function.
- When you construct a function handle for a nested function, the handle not only stores the information needed to access the nested function; it also stores the values of all variables shared between the nested function and those functions that contain it. This means that these variables persist in memory between calls made by means of the function handle.

## Examples

You can find examples of how to use nested functions in MATLAB under “Examples of Nested Functions”.

## Calling Private Functions From Scripts

You can now invoke a private function from a script, provided that the script is called from another M-file function, and that the private function being called by the script is within the scope of this M-file function.

## New Calling Syntax for Function Handles; Replace `eval` With New Syntax

You can now call functions by means of their related function handles using standard calling syntax rather than having to use `feval`. When calling a function using its handle, specify the function handle name followed by any input arguments enclosed in parentheses.

For example, if the handle to a function was stored in variable `h`, you would call the function as if the handle `h` were a function name:

```
h(arg1, arg2, ...)
```

For the `parabola` function shown here, construct a function handle `h` and call the `parabola` function by means of the handle:

```
function y = parabola(a, b, c, x)
y = a*x.^2 + b*x + c;

parabHandle = @parabola;

parabHandle(1.3, .2, 30, 25)
```

When calling functions that take no input arguments, you must use empty parentheses after the function handle:

```
parabHandle()
```

## Compatibility Considerations

Using `feval` for the purpose of invoking functions via function handle is no longer necessary and is, in fact, slower. However, for purposes of backward compatibility, the use of `feval` to evaluate function handles is still supported in this release.

Parenthesis notation on a nonscalar function handle means subscripting, just as in Release 13, while the same notation on scalar function handles means function call, as described above. Incompatibility can arise only if you construct a scalar array of function handles and actually index it, necessarily with an index of 1.

## Arrays of Function Handles

Previous releases of MATLAB supported arrays of function handles. You created such an array using the `[]` operator, and indexed into the array with the `()` operator:

```
x = [@sin @cos @tan];
plot(feval(x(2), -pi:.01:pi));
```

In Release 14, MATLAB supports arrays of functions handles using cell arrays. You create and index into a function handle array using the `{}` operator:

```
x = {@sin @cos @tan};
plot(x{2}(-pi:.01:pi));
```

## Compatibility Considerations

For purposes of backward compatibility, standard arrays of function handles are still supported in this release.

## Calling `nargin` and `nargout` with Built-In Functions

When you pass the name of a function to `nargin` or `nargout`, MATLAB returns the number of declared inputs or outputs for that function. For example, passing the function name `'normest'` to `nargin` returns 2, (the number of inputs declared in `normest.m`:

```
nargin('normest')           % normest is an M-function.
```

```
ans =  
    2
```

In this release, you can also use this feature with MATLAB built-in functions. The following use of `nargin` returned an error in previous versions of MATLAB because `norm` is implemented as a built-in function. In this release, `nargin` returns the number of inputs declared by the `norm` function:

```
nargin('norm')           % norm is a built-in function.  
ans =  
    2
```

The same applies to `nargout`.

## Comma Separators Not Required in Function Declaration

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. This now makes the function definition syntax the same as the syntax used when calling an M-file function:

```
function [A B C] = myfun(x, y)
```

## Compatibility Considerations

This new syntax is not valid in MATLAB versions earlier than Release 14. When writing an M-file that you expect to run on versions both earlier and later than R14, be sure to separate any output variables in the function definition line with commas:

```
function [A, B, C] = myfun(x, y)
```

## getfield and setfield Not To Be Deprecated

There are no plans to remove the `getfield` and `setfield` functions from the MATLAB language, as stated in the release notes for MATLAB Release 13.

## isglobal Function To Be Discontinued

Support for the `isglobal` function will be removed in a future release of MATLAB. In Release 14, invoking `isglobal` generates the following warning:

Warning: `isglobal` is obsolete and will be discontinued.  
Type "help isglobal" for more details.

## Recycle to Protect Files from Unwanted Deletion

To protect yourself from unintentionally deleting any files that you want to keep, use the new `recycle` function to turn on file recycling. When file recycling is on, MATLAB moves all files that you delete with the `delete` function to either the recycle bin (on the PC or Macintosh) or a temporary folder (on UNIX). When file recycling is off, any files you delete are actually removed from the system.

You can turn recycling on for all of your MATLAB sessions using the **Preferences** dialog box. (Select **File > Preferences > General**.) Under the heading **Default behavior of the delete function**, select **Move files to the Recycle Bin**.

## bin2dec Ignores Space Characters

The `bin2dec` function now ignores any space ( ' ') characters in the input string. Thus, the binary string '010 111' now yields the same result as the string '010111'.

In Release 13, `bin2dec` interpreted space characters as zeros:

```
bin2dec('010 111')
ans =
    39
```

In this release, `bin2dec` ignores all space characters:

```
bin2dec('010 111')
ans =
    23
```

## dbstop crashes Are Now Resolved

In previous versions, a MATLAB session would terminate prematurely when attempting to execute certain P-code files if you had set a debugger breakpoint in the function represented by that file. For example, an attempt to run Guide would terminate your MATLAB session if you had used the `dbstop` function to set a breakpoint in the corresponding M-file:

```
dbstop in guide  
guide
```

This bug has been fixed in this release enabling you to debug these files successfully.

## Bit Functions on Unsigned Integers

MATLAB bit functions now work on unsigned integers. Instead of using flints (integer values stored in floating point) to do your bit manipulations, consider using unsigned integers. See “Bit Functions Now Work on Unsigned Integers” on page 607 in the MATLAB Mathematics release notes.

## inmem Returns Path Information

The `inmem` function now returns not only the names of the currently loaded M- and MEX-files, but the path and filename extension for each as well. Use the `-completenames` option to obtain this additional information:

```
inmem(' -completenames')
```

## New Features for Nondouble Data Types

The section “New Nondouble Mathematics Features” on page 598 describes new features affecting the nondouble (`single` and `integer`) data types. These changes affect `single` and `integer` arithmetic operations, and also conversion of `single` and `double` data types to integers.

## Mathematic Operations on Logical Values

Most mathematic operations are not supported on logical values.

## Accessing Cell and Structure Arrays Without deal

In many instances, you can access the data in cell arrays and structure fields without using the `deal` function. Here is an example that reads each of the cells of a cell array into a separate output:

```
C = {rand(3) ones(3,1) eye(3) zeros(3,1)};
```

Use either of the following to access the cells in `C`:

```
[a,b,c,d] = deal(C{:})
[a,b,c,d] = C{:}
```

Here is an example that reads each of the fields of a structure array into a separate output:

```
A.name = 'Pat'; A.number = 176554;
A(2).name = 'Tony'; A(2).number = 901325;
```

Use either of the following to access the name field:

```
[name1,name2] = deal(A(:).name)
[name1,name2] = A(:).name
```

## New Features in Regular Expression Support

This version of MATLAB introduces the following new features in regular expression support:

- **Multiple Input Strings** — You can use any of the MATLAB regular expression functions with cell arrays of strings as well as with single strings. Any or all of the input parameters (the string, expression, or replacement string) can be a cell array of strings.
- **Selective Outputs** — To select what type of data you want the `regexp` and `regexpi` to return (string indices or text, token indices or text, or token data by name) use one or more of the six qualifiers for these functions.
- **Lookaround Operators** — Lookahead and lookbehind operators enable you to match a pattern only if it is preceded, or followed, by another pattern.
- **New Logical Operators** — New operators for grouping, inserting comments, and finding alternative match patterns
- **New Quantifiers** — Lazy quantifiers match a minimum number of characters in a string. Possessive quantifiers do not reevaluate parts of the string that have already been evaluated
- **Element Grouping** — Group elements together using either `(...)` to group and capture, or `(?:...)` for grouping alone
- **Named Capture Grouping** — Capture characters in a token and assign a name to the token

- **Conditional Expressions** — Process a string in different ways depending on a stated condition
- **New Character Representations** — New symbolic representations such as `\e` for `escape`, or `\xN` for a character of hexadecimal value `N`, are available in this release.
- **Default Tokenizing** — The `regexprep` function now tokenizes by default. There is no longer a `'tokenize'` option

Refer to “Regular Expressions” on page 465 in the MATLAB Programming documentation.

## Functions that Use Regular Expressions

The `who`, `whos`, `save`, `load`, and `clear` functions now accept regular expressions as input. This feature enables you to be more selective concerning which variables they operate on.

For example, this statement saves to a MAT-file only those variables with a name that either starts with the letters `A` or `B`, or contains ten or more characters:

```
save('mydata.mat', '-regexp', '^([AB]).', '{10,}');
```

If the workspace contains the following four variables, two of the four meet the requirements of the regular expression:

```
whos
      Name                Size          Bytes  Class
      A_stats              10x5           400  double array
      X23456789            1x1            12  char array
      ab                   3x1           536  struct array
      longerVariableName   1x4             8  char array
```

When you perform the `save` operation and then check the contents of the MAT-file, you see that the variables with names that either start with `A` or have at least ten characters were saved:

```
save('mydata.mat', '-regexp', '^([AB]).', '{10,}');
```



```
whos -file mydata.mat
Name                               Size          Bytes  Class

A_stats                             10x5          400    double array
longerVariableName                  1x4           8      char array
```

Refer to the reference pages for these functions for more information and examples.

## Regular Expressions Accept String Vector; No Longer Support Character Matrix Input

You can now pass a vector of strings in a cell array to any of the MATLAB regular expression functions (`regexp`, `regexpi`, and `regexprep`).

### Compatibility Considerations

Because this is the preferred method of passing a string vector, MATLAB no longer supports using character matrices for this purpose.

## Cell Array Support for String Functions

You can now pass a cell array of strings to the `strfind` function. MATLAB searches each string in the cell array for occurrences of the pattern string, and returns the starting index of each such occurrence.

## Additional Class Output From `mat2str`

The statement `str = mat2str(A, 'class')` creates a string with the name of the class of `A` included. This option ensures that the result of evaluating `str` will also contain the class information.

Change the 16-bit integer matrix to a string that includes `'int16'`. Next, evaluate this string and verify that you get the same matrix that you started with:

```
x1 = int16([-300 407 213 418 32 -125]);

A = mat2str(x1, 'class')
A =
```

```
int16([-300 407 213 418 32 -125])
x2 = eval(A);

isa(x2, 'int16') && all(x2 == x1)
ans =
     1
```

## String Properties

Use the new `isstrprop` function to see what parts of a string or array of strings are alphabetic, alphanumeric, numeric digits, hexadecimal digits, lowercase, uppercase, white-space characters, punctuation characters, contain control characters, or contain graphic characters.

For example, to test for alphabetic characters in a two-dimensional cell array, use

```
A = isstrprop({'abc123def'; '456ghi789'}, 'alpha')
A =
     [1x9 logical]
     [1x9 logical]

A{:,:}
ans =
     1 1 1 0 0 0 1 1 1
     0 0 0 1 1 1 0 0 0
```

## Using `strtok` on Cell Arrays of Strings

You can now use the `strtok` function on a cell array of strings. When used with a cell array of strings, `strtok` returns a token output that is also a cell array of strings, each containing a token for its corresponding input string.

See the `strtok` reference page to see an example of how this works.

## Colon Operator on `char` Now Returns a `char`

Applying the colon operator to inputs of type `char` now returns a result of type `char`. For example,

```
'a':'g'
```

```
ans =  
  
abcdefg
```

## Compatibility Considerations

In previous releases, the same operation returned a result of type `double`. You may need to change your code if it relies on type `double` being returned.

## datestr Returns Date In Localized Format

The statement `str = datestr(..., 'local')` returns the date string in a localized format. See the `datestr` reference page for more information.

## Form and Locale for weekday

The `weekday` function now takes two new inputs that control the output format. These arguments enable you to get a full or abbreviated day name, and a local or US English output.

## Freestyle Date String Format

When converting between serial date numbers, date vectors, and date strings with the `datenum`, `datevec`, and `datestr` functions, you can specify a format for the date string from the “Symbolic Identifiers for Individual Fields” table shown in the Programming Fundamentals documentation.

## Reading Date Values with xlsread; Conversion No Longer Necessary

There are two changes that affect importing date information from Excel with the `xlsread` function:

- “Date Information Returned as Cell Array of Char” on page 647
- “Conversion of Date Values Is No Longer Necessary” on page 648

## Date Information Returned as Cell Array of Char

Prior to this release, `xlsread` imported date information from an Excel file and returned the results as a `double`. In Release 14, `xlsread` returns this

information as a cell array containing data of class `char`. The reason for this is that MATLAB now imports Excel files using an Excel COM server. Excel returns dates as strings, and there is really no indication that what is returned is a date.

**Compatibility Considerations.** You will need to change your program code to accept a cell array of type `char` instead of an array of `double` when using `xlsread` to import date information from Excel.

### **Conversion of Date Values Is No Longer Necessary**

When reading date fields from a Microsoft Excel file using earlier versions of MATLAB, it was necessary to convert the Excel date values into MATLAB date values. This was necessary because Excel and MATLAB calculated date values based on a different reference date.

With MATLAB 7.0, you no longer have to do this conversion because `xlsread` now imports dates as strings rather than as numerical values.

For more information, see “When to Convert Dates from Excel Files”.

**Compatibility Considerations.** If your existing code converts Excel date values to MATLAB values, you will need to remove this step so that you end up with the correct results.

### **Comprehensive Function for Reading Text Files**

The new `textscan` function reads data from an open text file into a cell array. MATLAB parses the data into fields and converts it according to conversion specifiers passed to `textscan` in the argument list.

The `textscan` function is similar to `textread` but differs from `textread` in the following ways:

- The `textscan` function offers better performance than `textread`, making it a better choice when reading large files.
- With `textscan`, you can start reading at any point in the file. Once the file is open, (`textscan` requires that you open the file first), you can seek to any position in the file and begin the `textscan` at that point. The `textread` function requires that you start reading from the beginning of the file.

- Subsequent `textscan` operations start reading the file at the point where the last `textscan` left off. The `textread` function always begins at the start of the file, regardless of any prior `textread`.
- `textscan` returns a single cell array regardless of how many fields you read. With `textscan`, you don't need to match the number of output arguments to the number of fields being read as you would with `textread`.
- `textscan` offers more choices in how the data being read is converted.
- `textscan` offers more user-configurable options.

## New Inputs and Outputs to `xlsread`

The table below shows new input and output arguments to the `xlsread` function. See the function reference for `xlsread` for more information. With the exception of the **basic** input argument, these arguments are supported only on computer systems capable of starting Excel as a COM server from MATLAB.

New Input Arguments	Description
-1	Opens the Excel file in an Excel window, enabling you to interactively select the worksheet to be read and the range of data to import from the worksheet.
range	Reads data from the rectangular region of a worksheet specified by <code>range</code> .
<b>basic</b>	Imports data from the spreadsheet in basic import mode.

New Output Argument	Description
rawdata	Returns unprocessed cell content in a cell array. This includes both numeric and text data.

## New Inputs and Syntax for `dlmwrite`

The `dlmwrite` function now has several new input arguments plus an optional attribute-value format in which to enter these arguments. You can now enter

input arguments to `dlmwrite` in an attribute-value format. This format enables you to specify just those arguments that you need and omit any others. This new syntax for `dlmwrite` is

```
dlmwrite('filename', M, attribute1, value1, ...
        attributeN, valueN)
```

The former syntax for `dlmwrite` is still supported for arguments that were available in earlier versions of MATLAB.

The table below shows new input arguments to the `dlmwrite` function. You must specify these new arguments using the attribute-value format. See the `dlmwrite` function reference for more information.

Attribute	Value
<b>delimiter</b>	Delimiter string to be used in separating matrix elements
<b>newline</b>	Character(s) to use in terminating each line
<b>roffset</b>	Offset, in rows, from the top of the destination file to where matrix data is to be written
<b>coffset</b>	Offset, in columns, from the left side of the destination file to where matrix data is to be written
<b>precision</b>	Numeric precision to use in writing data to the file

For example, to export matrix `M` to file `myfile.txt`, delimited by the tab character, and using a precision of six significant digits, type

```
dlmwrite('myfile.txt', M, 'delimiter', '\t', 'precision', 6)
```

## Change in Output from `xlsinfo`

`xlsinfo` now returns the names of all worksheets in an Excel file instead of just the ones with numbers in them (as in Release 13).

## Importing Complex Arrays

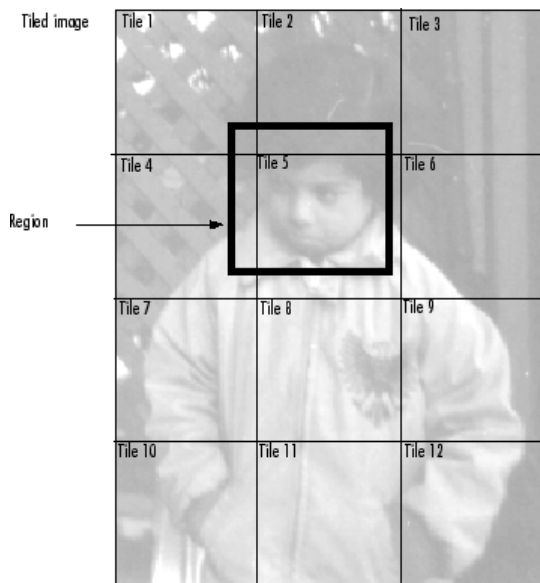
The `csvread`, `dlmread`, and `textscan` functions import any complex number as a whole into a complex numeric field, converting the real and imaginary parts to the specified numeric type. Valid forms for a complex number are

Form	Example
<code>-&lt;real&gt;-&lt;imag&gt;i j</code>	<code>5.7-3.1i</code>
<code>-&lt;imag&gt;i j</code>	<code>-7j</code>

## Using `imread` to Import Subsets of TIFF Images

When using the `imread` function with the `'PixelRegion'` parameter, you can now read in portions of an image stored in TIFF format. Specify a cell array containing two vectors, `ROWS` and `COLS`, for the value of this parameter. Each vector can either be a two-element vector specifying the extent of the region, `[START STOP]`, or a three-element vector that enables downsampling, `[START INCREMENT STOP]`.

When used with tiled images, `'PixelRegion'` subsetting can improve memory usage and performance because it only reads in the tiles that encompass the region. For example, in the following figure, if you specify the region defined by the box, `imread` would only read in tiles 1, 2, 4, and 5.



## Getting Information about Multimedia Files

MATLAB now includes a function, named `mmfileinfo`, that returns information about the contents of a multimedia file. The file can contain audio data, video data, or both.

This function is only available on Windows platforms.

## All-Platform Audio Recording and Playback

The MATLAB `audiorecorder` and `audioplayer` functions can now be used on Windows and UNIX platforms. These functions were previously only available on Windows systems.

---

**Note** The `audiorecorder` and `audioplayer` objects are now implemented as MATLAB objects on all platforms. The methods supported by these objects are overloaded functions. You must use standard MATLAB function calling syntax to call methods of these objects; you cannot use dot notation.

---



## FTP File Operations

From within MATLAB, you can connect to an FTP server to perform remote file operations. For more information, see the `ftp` reference page.

## Web Services (SOAP)

MATLAB can now consume Simple Object Access Protocol-based (SOAP) Web services with the `createClassFromWSDL` function. For more information, see “Using Web Services with MATLAB” in the online documentation.

## 64-Bit File Handling on Macintosh

The release notes for MATLAB Release 13 should have included Macintosh in the list of those platforms that support 64-bit file handling. This support is available on the following platforms:

- Windows
- Solaris
- Linux 2.4.x
- HP-UX 11.0, 9000/785
- Macintosh

## Changes to Error Message Format

The last two lines of MATLAB error messages have changed for Release 14. Error messages now

- Display functions and subfunctions differently than in R13.
- Display nested functions.
- Call out the error in a string that you can use as input to other functions, like `dbstop`.
- Have a hot link to the source of the error.

Each of these changes is discussed below. Examples show the errors generated by both the previous release (V6.5) and current release (7.0) of MATLAB for the purpose of comparison.

## Display of Functions and Subfunctions

MATLAB now calls out the source of the error using a consistent format. One of the features of this format is that you can place the string of the message into other MATLAB commands. See “Using the Error Message String as Input to Other Functions” on page 655.

**Errors Generated by the Primary Function.** Errors generated by the primary function of an M-file are displayed as shown below. In version 7.0, the path is not shown in most cases (private functions are one exception). Filename extension is also not shown. The failing line number is shown on third line.

### In MATLAB V6.5 —

```
??? Error using ==> strcmp
Too many input arguments.

Error in ==> B:\MATLAB_V70\work\errmsgtest.m
On line 11 ==> strcmp('aa','bb','cc');
```

### In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.

Error in ==> errmsgtest at 11
strcmp('aa','bb','cc');
```

**Errors Generated by a Subfunction.** Errors generated by a subfunction of an M-file are displayed in the previous release and current release of MATLAB as shown below. Comments for primary functions apply here as well. Also, the name of the failing subfunction follows the > character instead of being put in parentheses.

### In MATLAB V6.5 —

```
??? Error using ==> strcmp
Too many input arguments.

Error in ==> B:\MATLAB_V70\work\errmsgtest.m (subFun1)
```

```
On line 17 ==> strcmp('aa','bb','cc');
```

### In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.
```

```
Error in ==> errmsgtest>subFun1 at 17
strcmp('aa','bb','cc');
```

## Error Messages Display Nested Functions

This example shows an error that comes from a nested function (`nestFun2`) called by another nested function (`nestFun1`). It uses the following syntax, where the `>` character follows the name of the primary function and precedes the names of any nested functions.

```
fun>nestfun1/nestfun2/etc at lineno.
```

### In MATLAB V6.5 —

Nested functions are not supported prior to version 7.0.

### In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.
```

```
Error in ==> errmsgtest>nestFun1/nestFun2 at 6
strcmp('aa','bb','cc');
```

## Using the Error Message String as Input to Other Functions

You can copy the text of the line that calls out the source of an error and use this string as input to some of the MATLAB debugging functions. The example shown below uses the string in a call to the `dbstop` function.

Copy the text that begins after

```
Error in ==>
```

**In MATLAB V6.5 —**

This feature is not supported prior to version 7.0.

**In MATLAB V7.0 —**

```
??? Error using ==> strcmp
Too many input arguments.
```

```
Error in ==> errmsgtest>nestFun1/nestFun2 at 6
strcmp('aa','bb','cc');
```

Copy and paste text of this error message into the `dbstop` command:

```
dbstop errmsgtest>nestFun1/nestFun2 at 6
```

**Hot Link to the Source of an Error**

Error messages now contain a blue-underlined hot link to the failing line of the M-file being executed.

**Compatibility Considerations**

If any of your programs rely on specific text in the types of error messages described here, you may have to modify your program code.

**nargchk Has a New Format for Error Messages**

When the `nargchk` function detects an error condition, it returns information on the error in either a string or a MATLAB structure. Use one of these two command syntaxes to specify which format to return. If neither is specified, `nargchk` returns a string:

```
msgstring = nargchk(minargs, maxargs, numargs, 'string')
msgstruct = nargchk(minargs, maxargs, numargs, 'struct')
```

The return structure has two fields: the message string, and a message identifier . When too few inputs are supplied, these fields are

```
message: 'Not enough input arguments.'
identifier: 'MATLAB:nargchk:notEnoughInputs'
```

When too many inputs are supplied, the structure fields are

```
message: 'Too many input arguments.'
identifier: 'MATLAB:nargchk:tooManyInputs'
```

## Enabling and Disabling Warning Messages

The following message, which MATLAB appended to all warning messages in the previous release, is no longer displayed.

(Type "warning off <msgid:msgstr>" to suppress this warning.)

Use the `off` and `on` options of the `warning` function to control the display of all or selected warnings. This example disables a selected warning, and then enables all warnings:

```
% All warnings are enabled by default.
A = 5/0;
Warning: Divide by zero.

% Disable the most recent warning
[msgstr msgid] = lastwarn;
warning('off', msgid);

% Try it again. This time there is no warning.
A = 5/0;

% Enable all warnings
warning('on', 'all')

% Verify that the warning is reenabled.
A = 5/0;
Warning: Divide by zero.
```

## Catching Ctrl+C in try-catch Statements

In previous releases of MATLAB, typing **Ctrl+C** while executing the `try` part of a `try-catch` statement resulted in the program branching to the `catch` part of that statement. In this release, typing **Ctrl+C** is purposely not caught by `try-catch` statements.

The reason for this change is that, under certain circumstances, this behavior in try-catch statements was found to adversely affect internal MATLAB code. In these cases, this resulted in MATLAB code catching the **Ctrl+C** rather than responding appropriately to it by terminating the current operation.

## MATLAB Performance Acceleration

Release 13 introduced a new performance acceleration feature built into MATLAB. Enhancing performance in MATLAB is an ongoing development project that continues to show significant improvements in the performance of MATLAB programs.

The Performance Acceleration documentation written for Release 13 included suggestions on specific techniques to make the most of this feature. In this release, many of those techniques are no longer necessary. This documentation has been replaced with more general suggestions on how to improve the performance of your programs.

## Assignment Error Removed

In versions of MATLAB prior to V7.0 (R14), certain types of assignment generate an error. The error occurs if you attempt to assign a vector of one dimension (e.g., a row vector) to a vector of a different dimension (e.g., a column vector). The vector being assigned to can also be a series of elements along one dimension (e.g., row or column) of an array).

For example, running the following two statements in MATLAB Version 7.3.0 (R2006b) results in the error shown here:

```
A = eye(5,5);  
A(:,1) = [1 2 3 4 5]  
??? In an assignment A(:,matrix) = B, the number of elements in the sub  
of columns in B must be the same.
```

Starting with Version 7.0 (R14), you no longer see this error under these circumstances. Here is the same example run in MATLAB Version 7.0:

```
A = eye(5,5);  
A(:,1) = [1 2 3 4 5]  
A =  
    1    0    0    0    0
```

2	1	0	0	0
3	0	1	0	0
4	0	0	1	0
5	0	0	0	1

This new behavior is not a bug. It results from the fact that MATLAB 7.0 (R14) ignores singleton dimensions when performing dimension checks during assignment. This greatly simplifies the use of N-dimensional matrices.

### **Compatibility Considerations**

If your program code depends in any way on this error being thrown under the circumstances described above, you might need to modify it to run under MATLAB versions R14 and higher.

### **“Using MATLAB” Documentation Is Now Three Books**

Due to the increasing size of the printed “Using MATLAB” manual, we have divided it into three separate printed books in version 7.0 to make it more manageable. The titles for these books (and their corresponding headings in the MATLAB Help Browser) are

- Desktop Tools and Development Environment
- Mathematics
- Programming

The online structure of this documentation is very similar to what it has been in previous releases, although some topics are now covered more thoroughly. We hope that you find this new format easier to use.

## Graphics and 3-D Visualization, MATLAB Version 7 (R14)

This version introduces the following new features and changes:

- “Plotting Tools” on page 660
- “Code Generation” on page 661
- “Data Exploration Tools” on page 661
- “Annotation Features” on page 661
- “Plot Objects” on page 662
- “Group Objects” on page 664
- “Linking Graphics Object Properties” on page 664
- “New Behavior for Hold Command” on page 664
- “Enhancements to findobj” on page 664
- “New Ancestor Function Returns Object’s Ancestry” on page 664
- “New Axes Properties” on page 665
- “New Figure Properties” on page 665
- “New Root Object Property” on page 666

### Plotting Tools

If you are using the Help browser, watch the new Plotting Tools video demo for an overview of the major functionality.

The following list links to new or redesigned plotting tool features.

- “Anatomy of a Graph” — figure toolbars that provide data exploration, plot editing, and annotation tools
- Interactive Plotting Tools — overview of plotting tools
  - Figure Palette
  - Plot Browser
  - Property Editor



Related functions:

- `plottools`
- `figurepalette`
- `plotbrowser`
- `propertyeditor`

## Code Generation

You can save a graph as an M-file that contains the code to regenerate the graph. See “Generating a MATLAB File to Recreate a Graph” for more information.

## Data Exploration Tools

The following list links to the documentation for the data exploration tools.

- [Data Cursor](#) — displaying data values interactively
- [Zooming](#) — 2-D and 3-D zoom tools
- [Panning](#) — repositioning your view of the graph
- [Rotate 3D](#) — interactive rotation of 3-D views
- [Camera Toolbar](#) — mouse-controlled 3-D view manipulation.

## Annotation Features

The following list links to the documentation for annotation features and properties of the annotation objects.

- [Overview of annotation features](#)
- [Rectangles and ellipses](#)
  - [Rectangle properties](#)
  - [Ellipse properties](#)
- [Textbox annotations](#)
  - [Textbox properties](#)

- Lines and Arrows
  - Line properties
  - Arrow properties
  - Textarrow properties
  - Doublearrow properties
- Adding a Colorbar to a graph — new positioning options and colormap modification.  
`colorbar` — new command options
- Adding a legend to a graph — new positioning and appearance options  
`legend` — new command options
- Pinning — attaching annotation objects to a point in the figure
- Aligning and Distributing graphics objects

See the `annotation` function for information on programmatic access to annotation objects.

See “Annotation Objects” for an overview of this type of graphics object.

## Plot Objects

Plot Objects are composite graphics objects that simplify the modification of graphs that employ them. The following list links to reference pages for modified graphing functions and to property descriptions of the new plot objects.

See “Plot Objects” for an overview of this type of graphics object.

## Functions That Use Plot Objects

- `area`
- `bar`
- `contour`
- `errorbar`

- `plot`, `plot3`, `loglog`, `semilogx`, `semilogy`
- `quiver`, `quiver3`
- `scatter`, `scatter3`
- `stairs`
- `stem`, `stem3`
- `surf`, and mesh group

Note that all of the above functions have a 'v6' optional argument that causes each function to return the core graphics objects that were created in previous releases. See the reference pages for more information.

### **Plot Objects**

- `areaseries`
- `barseries`
- `contourgroup`
- `errorbarseries`
- `lineseries`
- `quivergroup`
- `scattergroup`
- `stairseries`
- `stemseries`
- `surfaceplot`

### **Refreshing Data Source Properties**

The `refreshdata` function enables you to take advantage of the `XDataSource`, `YDataSource`, and `ZDataSource` plot objects properties to update graph data when workspace variables change values.

See “Example — Specifying a Data Source” in the MATLAB Graphics documentation for more information.

## Group Objects

Group objects enable you to treat a number of objects as one, with respect to certain properties.

See “Group Objects” on page 664 for an overview of this type of graphics object.

## Group Object Functions

- `hgroup`
- `hgtransform`
- `makehgtform`

## Linking Graphics Object Properties

You can link the corresponding properties of graphics objects so that changing any one object’s properties makes the same change to all the linked objects.

See `linkprop` and `linkaxes` for more information.

## New Behavior for Hold Command

The `hold` command has a new option `all`. This option holds the plot and the current line color and line style so that subsequent graphing commands do not reset the `ColorOrder` or `LineStyleOrder` property values to the beginning to the list.

## Enhancements to `findobj`

The `findobj` function now supports logical operators and regular expressions. See the `findobj` reference page for more information.

## New Ancestor Function Returns Object’s Ancestry

The `ancestor` function enables you to determine an object’s direct parent, as well as its complete ancestry. This is particularly useful when you want to determine whether an object is contained in a `uipanel` or `hgroup`, for example, and need the handle of the container object or the top-level figure.

## New Axes Properties

You can control the behavior of an axes within a resized figure using the following new axes properties.

- **OuterPosition** — The boundary of the axes including the axis labels, title, and a margin. For figures with only one axes, this is the interior of the figure.
- **ActivePositionProperty** — Specifies whether to use the **OuterPosition** or the **Position** property as the size to preserve when resizing the figure containing the axes.
- **TightInset** — The margins added to the width and height of the **Position** property to include text labels, title, and axis labels.

See “Automatic Axes Resize” for more information.

## New Figure Properties

There are three new figure properties described below.

### Figure **KeyPressFcn** Property

The figure **KeyPressFcn** property now supports an event structure that returns information about the key press event. See the **KeyPressFcn** description for more information.

### **DockControls** and **WindowState** Properties

Figures now have a **DockControls** property that determines if the **Desktop** menu appears on the figure. Setting dockable to **on** causes the menu to be displayed, the default setting of **off** prevents the menu from being displayed. You can always dock and undock the figure by setting the figure **WindowState** property.

Note that, depending on your preference settings, the figure might first be grouped into a Document window, which can then be docked in the Desktop.

See “Docking Figures in the Desktop” for more information.

## **New Root Object Property**

The `MonitorPositions` property enables you to get the positions (width, height, and location) of multiple monitors connected to your computer.

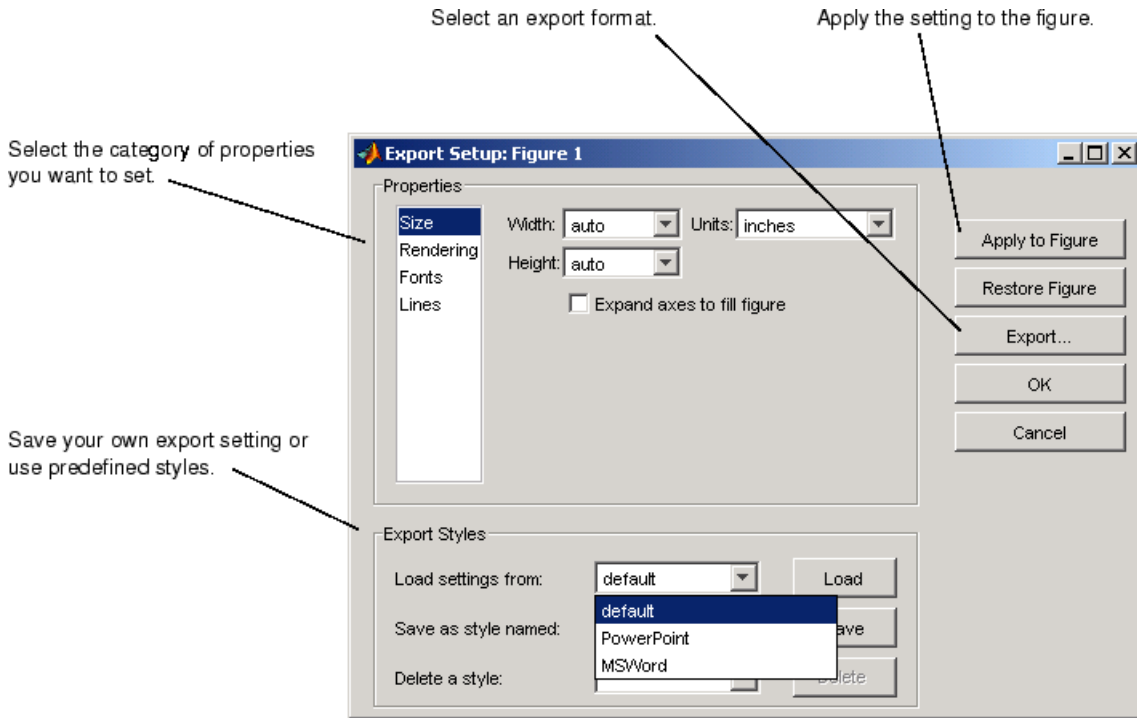
## **New Dialog for Exporting Figures**

You can export MATLAB figures to a variety of standard file formats using the Export Setup dialog. To display the dialog, select **Export Setup** from the figure **File** menu.

Export Setup provides easy access to the graphics properties that affect exported figures. For example, it enables you to control the size of the figure, the font size and type, whether to use line styles or solid lines, and so on.

You can save your own export setting as an export style, or you can use predefined options optimized for Microsoft PowerPoint and Microsoft Word.

The following picture shows the major components of the Export Setup dialog.



## Compatibility Considerations

### Plotting Tools Not Working on Macintosh Platform

The plotting tools not supported on the Macintosh platform. This means the Figure Palette, Plot Browser, and Property Editor do not work these platforms. To use the MATLAB 6 Property Editor, see the `propedit` command.

### Using `-nojvm` Option Prevents Plotting Tools Use

If you use the `-nojvm` option when starting MATLAB, the plotting tools are not available.

### **MATLAB 6 Version Property Editor**

The MATLAB 6 Property Editor is being replaced by a new Property Editor, which is available in this release. However, you can still access the MATLAB 6 Property Editor by issuing the following command.

```
propedit(object_handle, 'v6')
```

Without the `v6` argument, `propedit` displays the new Property Editor. See the `propedit` function for more information. Note that the Property Editor might not work with all objects.

### **Cannot Dock Figures on Macintosh Platform**

You cannot dock figures in the Desktop, because MATLAB uses native figure windows on the Macintosh platform.

### **Not All Macintosh System Fonts Are Available**

MATLAB figures do not support the same fonts as native Macintosh applications. Use the `uifont` functions to see which fonts are available in MATLAB.



# Creating Graphical User Interfaces (GUIs), MATLAB Version 7 (R14)

This version introduces the following new features and changes:

- “New Container Components” on page 669
- “ActiveX Controls” on page 670
- “New Toolbar Component” on page 670
- “Menu Editor Enhancements” on page 671
- “Layout Resize Behavior” on page 671
- “Key Press Detection” on page 672
- “Edit Text Box Scroll Bar” on page 672
- “Setting Uicontrol Focus” on page 672
- “Multiple Selection in uigetfile” on page 673
- “Program Suspension Time-Out” on page 673
- “Standard Dialog Box Push Buttons” on page 673
- “New Syntax for uigetfile and uiputfile” on page 673
- “Frames Not Available in GUIDE Layout Editor” on page 674

## New Container Components

MATLAB 7.0 introduces two new container components,

- Panel — Groups components
- Button group — Groups components and manages exclusive selection behavior for radio buttons and toggle buttons.

These components are available in the GUIDE Layout Editor and via the functions `uipanel` and `uibbuttongroup`.

A container component can be the child of a figure or another container. In general, containers can have as children the same components as figures, including other containers. However, they cannot have menu bars, toolbars,

or ActiveX controls as children. The `Position` property of the child of a panel or button group is interpreted relative to the panel or button group. If you move the panel or button group, the components it contains automatically move with it and maintain their positions.

Panel properties and button group properties enable you to control the color, size, border, and position of the panel or button group, assign a title, and specify a context menu. In general, panels and button groups have many of the same properties as `uicontrol` objects.

For information about working with panels and button groups in GUIDE, see the following topics in the *Creating Graphical User Interfaces* collection of the MATLAB documentation.

### **Compatibility Considerations**

You can export a GUI that contains a panel or button group from GUIDE to a single M-file that does not require a FIG-file. However, you will not be able to run that M-file in MATLAB versions earlier than 7.0.

### **ActiveX Controls**

GUIDE now enables you to insert an ActiveX control into your GUI if you are running MATLAB on Microsoft Windows. When you drag an ActiveX component from the component palette into the layout area, GUIDE displays a dialog in which you can select any registered ActiveX control on your system. When you select an ActiveX control and click **Create**, the control appears as a small box in the Layout Editor. You can then program the control to do what you want it to.

See “Creating COM Objects” in the online MATLAB documentation and ActiveX Controls in the GUIDE documentation to learn more about ActiveX controls.

### **New Toolbar Component**

A new function, `uitoolbar`, enables you to add a toolbar to a figure. You can add your own push tools and toggle tools to the toolbar with the `uipushtool` and `uitoggletool` functions.

Uipushtool properties enable you to provide a callback that responds to a mouse click. Uitoggletool properties enable you to provide callbacks that respond to the tool being set on, off, or toggled to either position. Properties for both uipushtools and uitoggletools provide for tooltip strings, separators, and truecolor images to display on the tools. In general, uitoolbar, uipushtool, and uitoggletool objects have many of the same properties as uicontrol objects.

## Menu Editor Enhancements

The GUIDE Menu Editor now enables you to:

- Choose a keyboard accelerator for a menu item from a pop-up menu.
- Set an item's Enabled property on or off when the menu is first opened. If the property value is off, the item appears dimmed and the user cannot select it.
- Open the Property Inspector where you can change all uimenu properties.
- Display the callback subfunction in an editor. If the callback does not yet exist, GUIDE creates it before displaying it.

The Menu Editor is now better synchronized with other GUIDE tools:

- Property changes made in the Menu Editor or in the Property Inspector are immediately reflected in the other.
- uimenu objects in the Menu Editor now also appear in the Object Browser. If you select a uimenu object in either, it is automatically selected in the other.
- If a component is selected in the Layout Editor and you select a menu item in the Menu Editor, the component is deselected in the Layout Editor.

See Menu Editor in the MATLAB documentation for more information.

## Layout Resize Behavior

In the GUIDE Layout Editor, components you have placed in the layout area now maintain their visual position relative to the upper left corner of their parent container (figure, panel, or button group) when you resize the

container in the Layout Editor. However, the values of the `Position` property are determined relative to the lower left corner, and these values will change accordingly when you increase or decrease the height of the container.

## Key Press Detection

A new `uicontrol` callback property, `KeyPressFcn`, specifies a key press callback function with which you can detect a key press when the callback's `uicontrol` object has focus. If no `uicontrol` has focus, the figure's key press callback function, if any, is invoked. This property is available in the `uicontrol` function and in GUIDE.

If you specify the `KeyPressFcn` property as an M-file, the callback routine can query the figure's `CurrentCharacter` property to determine what particular key was pressed and, thereby, limit the callback execution to specific keys. If you specify the `KeyPressFcn` property as a function handle, the callback routine can retrieve information about the key that was pressed from its  `eventdata` structure argument.

As an example, you can use this property to enable a user to press **Enter**, rather than the space bar, after giving focus to a `uicontrol` push button. Use the push button's key press callback function to determine if the user pressed the **Enter** key. If it was the **Enter** key, call the push button callback.

See the `Uicontrol Properties` for more information.

## Edit Text Box Scroll Bar

For `uicontrol` editable text fields, i.e. the `Style` property is set to `'edit'`, if `Max-Min>1`, then multiple lines are allowed. For multi-line edit boxes, a vertical scroll bar enables you to scroll the text. You can also use the arrow keys to scroll.

## Setting Uicontrol Focus

The `uicontrol` function now enables you to transfer focus programmatically to a specified `uicontrol` object. The syntax `uicontrol(uich)` transfers focus to the `uicontrol` object with handle `uich`.

## Multiple Selection in `uigetfile`

The `uigetfile` function can now create a dialog that enables the user to select and retrieve multiple files using the **Shift** and **Ctrl** keys. You can turn this capability on or off using the new `'MultiSelect'` parameter. The default setting is off.

## Program Suspension Time-Out

A new `uiwait` argument, `timeout`, enables you to specify the number of seconds after which program execution will resume, unless `uiresume` is called first or the specified figure is deleted. For example,

```
uiwait(h,5)
```

causes the suspended program to resume execution, if it has not already, after five seconds.

## Standard Dialog Box Push Buttons

For standard dialog boxes with more than one `uicontrol` push button, you can now give focus to another button while retaining the default button. Focus is denoted by a border or a dotted border, respectively, in UNIX and Microsoft Windows. The default button has a shadow.

In such a case, if the user presses the space bar, the button with focus gets the key press and can choose to execute its own callback or the callback of the default button. If the user presses **Enter**, the default push button gets the key press and its callback executes. This code provides an example.

```
ButtonName=questdlg('What is your wish?', ...
    'Genie Question', ...
    'Food', 'Clothing', 'Money', 'Money')
```

## New Syntax for `uigetfile` and `uiputfile`

The `uigetfile` and `uiputfile` syntax that enables you to position dialog boxes that are used to retrieve and save files is changed. The new syntaxes are `uigetfile('FilterSpec', 'DialogTitle', 'Location', [x y])` and `uiputfile('FilterSpec', 'DialogTitle', 'Location', [x y])`. Previously, the syntaxes were, `uigetfile('FilterSpec', 'DialogTitle', x, y)` and `uiputfile('FilterSpec', 'DialogTitle', x, y)`

### **Compatibility Considerations**

You are encouraged to change to the new `uigetfile` and `uiputfile` syntax. The earlier syntaxes continue to be valid but may be removed in a later release.

### **Frames Not Available in GUIDE Layout Editor**

The frame component no longer appears in the GUIDE Layout Editor component palette. It has been replaced by the panel and button group components. See “New Container Components” on page 669 for information about these new components.

### **Compatibility Considerations**

GUIDE continues to support frames in those GUIs that contain them, but it is recommended that you replace them with panels or button groups.

## External Interfaces/API, MATLAB Version 7 (R14)

New features and changes introduced in this version are organized by these topics:

- “Importing and Exporting” on page 675
- “Microsoft® ActiveX and COM Interface” on page 676
- “MATLAB Interface to Sun Java Programming Language” on page 683
- “General Features” on page 684

### Importing and Exporting

#### Saving Character Data with Unicode Encoding

The save function now saves character data to a MAT-file using Unicode® character encoding by default. You can use your system’s default character encoding scheme instead by specifying the -v6 option with save.

**Compatibility Considerations.** MAT-files saved in MATLAB version 7.0 without using the new -v6 flag will not be readable in previous versions of MATLAB.

#### Saving Data in Compressed Format

The save function now saves data to a MAT-file in a compressed format by default.

#### Large File I/O for MEX-Files

MATLAB supports the use of 64-bit file I/O operations in your MEX-file programs. This enables you to read and write data to files that are up to and greater than 2 GB ( $2^{31}-1$  bytes). Note that some operating systems or compilers may not support files larger than 2 GB.

See “Large File I/O” in the External Interfaces documentation for more information.

## Microsoft ActiveX and COM Interface

### Automatic Registration of Automation Server on Installation

When installing previous versions of MATLAB, system administrators also had to run MATLAB at least once on each machine to register the Automation server. In MATLAB 7.0, the MATLAB installation software does the Automation server installation for you.

### Support for Multiple COM Type Libraries

MATLAB now fully supports importing additional type libraries from within an IDL file. Any COM object that depends on an imported type library is now handled correctly.

### COM Interface Supports Custom Interfaces

MATLAB now supports custom interfaces to a server component in configurations where MATLAB is the client controlling an ActiveX control, or an in-process or out-of-process server. For those COM components that implement one or more custom interfaces, you can list the interfaces in MATLAB using the new `interfaces` function:

```
h = actxserver('ComponentA.CustomObject')
h =
    COM.componenta.customobject

customlist = interfaces(h)
customlist =
    ICustomObject1
    ICustomObject2
```

Once you select the custom interface that you want, use the `invoke` function to get a handle to it:

```
c1 = invoke(h, 'ICustomObject1')
c1 =
    Interface.componenta_Type_Library.ICustomObject1_Interface
```

You can now use this handle with most of the COM client functions to access the properties and methods of the object through this custom interface. For



example, to list the methods available through the `ICustomObject1` interface, use

```
invoke(c1)
Add = double Add(handle, double, double)
CustomMethod1 = HRESULT CustomMethod1(handle, int32)
CustomMethod2 = HRESULT CustomMethod2(handle, int32)
TripleAdd = [double, double] TripleAdd(handle, double, double)
method3 = [string, int32, string, string] method3(
    handle, int16, int32, double, string)
outin = [double, double, double, double] outin(
    handle, double, double)
strings = string strings(handle, string)
```

You can read more about this feature in the section, “Getting Interfaces to the Object” in the External Interfaces documentation.

## COM Data Type Support for Scripting Languages

In previous versions of MATLAB, a COM client program written in VBScript could not retrieve numeric data from or write data to the workspace of a MATLAB client. This was because VBScript does not support the `SAFEARRAY` data type used by MATLAB to pass numeric data to and from the server workspace using the `GetFullMatrix` and `PutFullMatrix` functions.

Release 14 adds two new functions, `GetWorkspaceData` and `PutWorkspaceData`, that pass data using the variant data type, a type that is supported by VBScript. You can use these new functions to pass either numeric or string data to any workspace in the COM server running MATLAB.

Refer to “Exchanging Data with the Server” in the External Interfaces documentation.

## Additional ProgIDs for Latest MATLAB Version

There are three additional COM programmatic identifiers (ProgIDs) in MATLAB 7.0:

```
MATLAB.Autoserver
MATLAB.Autoserver.Single
MATLAB.Autoserver.7
```

Using any of these identifiers with the `actxserver` function guarantees that the MATLAB server you create always runs the latest version of MATLAB (version 7.0).

---

**Note** These new ProgIDs do not replace the `MATLAB.Application` identifier used in previous versions of MATLAB. You can continue using this ProgID, but there is no guarantee that `actxserver` will create a server running MATLAB 7.0.

---

### Connecting to an Existing MATLAB Server

Instead of having to create new instances of a MATLAB server, clients can connect to an existing MATLAB automation server using the `GetObject` command. This sample Microsoft® Visual Basic® program connects to a running MATLAB automation server, returning a handle `h` to that server. It then executes a simple plot command in the server:

```
Dim h As Object

' Call GetObject (omit first argument).
Set h = GetObject(, "matlab.application")

' Handle h should be valid now. Test it by calling Execute
h.Execute ("plot([0 18], [7 23])")
```

### Graphical Interface to Listing Available ActiveX Controls

The `actxcontrollist` function enables you to see what COM controls are currently installed on your system. Type

```
list = actxcontrollist;
```

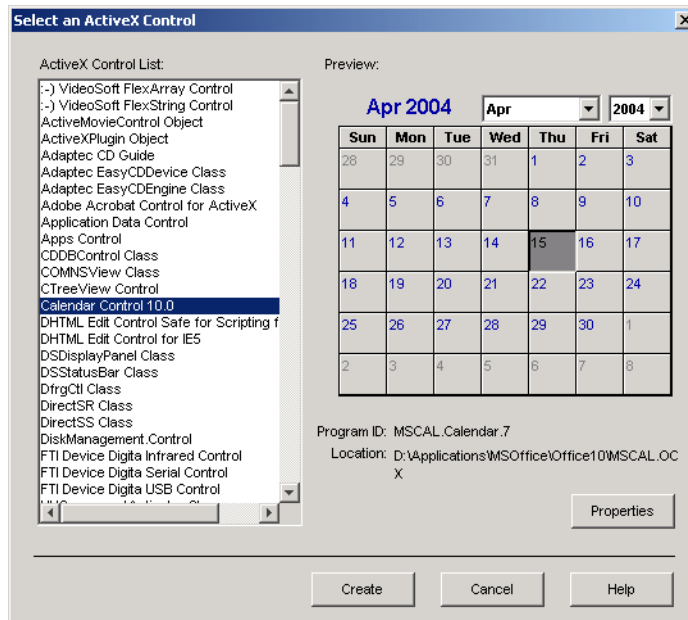
and MATLAB returns a list of each control, including its name, programmatic identifier (or ProgID), and filename, in the output cell array.

Refer to “Listing Installed Controls” in the External Interfaces documentation.

## Graphical Interface to Creating ActiveX Controls

The simplest way to create a control object is to use the `actxcontrolselect` function. This function displays a graphical interface that lists all controls installed on the system and creates the one that you select from the list.

The `actxcontrolselect` interface has a selection panel at the left of the window and a preview panel at the right. Click on one of the control names in the selection panel to see a preview of the control displayed. (If MATLAB cannot create the control, an error message is displayed in the preview panel.) Select an item from the list and click the **Create** button.



Refer to “Creating Control Objects Using a GUI” in the External Interfaces documentation.

## New Functions for the MATLAB COM Interface

There are five new COM client functions.

Function	Description
<code>actxcontrollist</code>	List all currently installed ActiveX controls
<code>actxcontrolselect</code>	Display graphical interface for creating an ActiveX control
<code>interfaces</code>	List custom interfaces to a COM server
<code>iscom</code>	Determine if input is a COM or ActiveX object
<code>isinterface</code>	Determine if input is a COM interface

There are three new COM server functions. When invoked by a MATLAB or Visual Basic® client, these functions execute in the server associated with the specified handle parameter.

Function	Description
<code>Feval</code>	Evaluate MATLAB function call in the server
<code>GetWorkspaceData</code>	Get data from server workspace
<code>PutWorkspaceData</code>	Store data in server workspace

See the function reference pages in the External Interfaces Reference documentation for more information.

### COM Interface Supports Dot Syntax in Commands

You can now use a simpler form of syntax when invoking either MATLAB COM functions or methods belonging to COM objects. In this *dot syntax* (as it is referred to in the MATLAB documentation), you specify the object name, a dot (`.`), and then the name of the function or method you are calling. Enclose any input arguments in parentheses after the function name. Specify output arguments to the left of the equals sign:

```
outputvalue = object.function(arg1, arg2, ...)
```

For example, Release 13 syntax for invoking the `addproperty` function on a COM object with handle `h` was

```
invoke(h, 'addproperty', 'Position');
```

You can now perform the same operation using

```
h.addproperty('Position');
```

The `get` and `set` operations are even simpler:

```
** R13 SYNTAX **
x = get(h, 'Radius');
set(h, 'Radius', 50);

** R14 SYNTAX **
x = h.Radius;
h.Radius = 50;
```

Refer to “Invoking Methods on an Object” in the External Interfaces documentation.

### Enumeration in COM Method Arguments

In addition to supporting enumeration for the properties of a COM object, MATLAB now supports enumeration for parameters passed to methods of a COM object. The only restriction is that the type library in use must report the parameter as `ENUM`, and only as `ENUM`.

Refer to “Specifying Enumerated Parameters” in the External Interfaces documentation.

### Event Handling for COM Servers

In addition to handling events from ActiveX controls, MATLAB now handles events fired by Automation servers as well. Use the same event handling functions that you have been using for events from controls.

Function	Description
<code>eventlisteners</code>	Return a list of events attached to listeners
<code>events</code>	List all events, both registered and unregistered, a control or server can generate
<code>isevent</code>	Determine if an item is an event of a COM object
<code>registerevent</code>	Register an event handler with a control or server event

Function	Description
<code>unregisterallevents</code>	Unregister all events for a control or server
<code>unregisterevent</code>	Unregister an event handler with a control or server event

Refer to “Responding to Events — an Overview” and in the External Interfaces documentation.

### Callbacks to COM Event Handlers Written as Subfunctions

Instead of having to maintain a separate `.m` file for every event handler routine you write, you can consolidate some or all of these routines into a single file using subfunctions.

Refer to “Writing Event Handlers as MATLAB File Subfunctions” in the External Interfaces documentation.

### Event Handlers Can Be Function Handles

In this release, you can now implement ActiveX event handlers as function handles.

### Optional Input Arguments to COM Methods

When calling a method that takes optional input arguments, you can skip any optional argument by specifying an empty array (`[]`) in its place. The syntax for `invoke` with the second argument (`arg2`) not specified is as follows:

```
invoke(handle, 'methodname', arg1, [], arg3);
```

See the section, “Optional Input Arguments” in the External Interfaces documentation for more information.

### Display of Interface Handles

MATLAB has changed the way it displays a COM interface in this release. For example, the string used to represent an interface in MATLAB 6.5 was

```
[1x1 Interface.excel.application.Workbooks]
```

MATLAB 7.0 represents this same interface with the following string:

```
[1x1 Interface.Microsoft_Excel_9.0_Object_Library.Workbooks]
```

**Compatibility Considerations.** You may need to change any code that depends on the previous behavior.

## MATLAB Interface to Sun Java Programming Language

### Java Interface Adds Dynamic Java Class Path

MATLAB loads Java class definitions from files that are on the Java class path. The Java class path now consists of two segments: the *static path*, and a new segment called the *dynamic path*.

The static path is loaded from the file `classpath.txt` at the start of each MATLAB session and cannot be changed without restarting MATLAB. This was the only path available in previous versions of MATLAB. Thus, there was no way to change the Java path without restarting MATLAB.

The dynamic Java class path can be loaded at any time during a MATLAB session using the `javaclasspath` function. You can define the dynamic path (using `javaclasspath`), modify the path (using `javaaddpath` and `javarmppath`), and refresh the Java class definitions for all classes on the dynamic path (using `clear java`) without restarting MATLAB. See the function reference pages for more information on how to use these functions.

The `javaclasspath` function, when used with no arguments, displays both the static and dynamic segments of the Java class path:

```
javaclasspath

      STATIC JAVA PATH

      D:\Sys0\Java\util.jar
      D:\Sys0\Java\widgets.jar
      D:\Sys0\Java\beans.jar
      .
      .
```

### DYNAMIC JAVA PATH

```
User4:\Work\Java\ClassFiles
User4:\Work\Java\mywidgets.jar
:
.
```

You can read more about this feature in the sections, “The Java Class Path” and “Making Java Classes Available in MATLAB Workspace” in the External Interfaces documentation.

### Locating Java Native Method DLLs with File `librarypath.txt`

Previous versions of MATLAB required that you set a system environment variable to enable Java to locate the shared libraries supporting any native methods you need to use. This environment variable was `PATH` on Microsoft Windows systems, and `LD_LIBRARY_PATH` on UNIX systems. This is no longer necessary.

Now you can enter the names of those directories that contain native method libraries in a new file called `librarypath.txt` using one line per directory. The `librarypath.txt` file resides adjacent to the similar file `classpath.txt` in the `$matlab/toolbox/local` directory.

## General Features

### New `mx` Functions

New functions `mxIsInt64` and `mxIsUInt64` return true if an `mxArray` represents its data as signed or unsigned 64-bit integers respectively.

### Identifying Dependencies When MEX-Files Do Not Load

If MEX-files don't load on a Windows system, the error message is not informative. The Dependency Walker is a useful tool distributed with MSVC. It is also freely available from <http://www.dependencywalker.com>.



### **Recompile MEX-Files on GLNX86 and Apple Macintosh**

In Release 14, MATLAB uses C++ exception handling. MEX-files built prior to R14 did not support C++ exceptions.

For example, write a C MEX-file that just calls `mexErrMsgTxt`. If you build this with a release prior to Release 14 and run it, the program aborts MATLAB. If you build this with Release 14 and run it, MATLAB will handle the exception correctly.

**Compatibility Considerations.** On GLNX86 and Macintosh systems, all MEX-files that can throw errors need to be recompiled for R14.

### **Shared Libraries Now In /bin/\$ARCH**

Shared libraries previously residing in directory `$MATLAB/extern/lib/$ARCH` are now in `$MATLAB/bin/$ARCH`.

**Compatibility Considerations.** You may need to change any code that depends on the previous behavior.



# Compatibility Summary for MATLAB Software

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These tables summarize new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided with the description of the new feature or change.

- “Version 7.13 (R2011b) MATLAB Software Compatibility Summary” on page 689
- “Version 7.12 (R2011a) MATLAB Software Compatibility Summary” on page 690
- “Version 7.11 (R2010b) MATLAB Software Compatibility Summary” on page 692
- “Version 7.10 (R2010a) MATLAB Software Compatibility Summary” on page 694
- “Version 7.9 (R2009b) MATLAB Software Compatibility Summary” on page 696
- “Version 7.8 (R2009a) MATLAB Software Compatibility Summary” on page 698
- “Version 7.7 (R2008b) MATLAB Software Compatibility Summary” on page 700
- “Version 7.6 (R2008a) MATLAB Software Compatibility Summary” on page 703
- “Version 7.5 (R2007b) MATLAB Software Compatibility Summary” on page 706

- “Version 7.4 (R2007a) MATLAB Software Compatibility Summary” on page 709
- “Version 7.3 (R2006b) MATLAB Software Compatibility Summary” on page 712
- “Version 7.2 (R2006a) MATLAB Software Compatibility Summary” on page 715
- “Version 7.1 (R14SP3) MATLAB Software Compatibility Summary” on page 717
- “Version 7.04 (R14SP2) MATLAB Software Compatibility Summary” on page 719
- “Version 7.01 (R14SP1) MATLAB Software Compatibility Summary” on page 721
- “Version 7 (R14) MATLAB Software Compatibility Summary” on page 723

## Version 7.13 (R2011b) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “Internationalization” on page 9</li> </ul>
Math	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “Functionality Being Removed or Changed” on page 12</li> </ul>
Data Analysis	None
Programming	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “Nonmatching Function Name Warning is Now an Error” on page 16</li> <li>• “Conversion of Error and Warning Message Identifiers” on page 17</li> <li>• “MATLAB Warns if Listener Defined for Nonobservable Property” on page 19</li> <li>• “Functionality Being Removed or Changed” on page 21</li> </ul>
Graphics and 3-D Visualization	None
Creating GUIs	None
External Interfaces	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “MEX Header File Does Not Define C++ Type char16_t” on page 25</li> <li>• “Support for Auto-Conversion of Multidimensional Arrays” on page 26</li> </ul>

## Version 7.12 (R2011a) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “Change to Tooltip and Behavior for M-Lint Messages” on page 32</li> </ul>
Math	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “Changes to qr” on page 37</li> <li>• “Functionality Being Removed” on page 37</li> </ul>
Data Analysis	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:  None
Programming	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"> <li>• “Regenerate P-code Files Built Before Version 7.5 ” on page 39</li> <li>• “audioplayer and audiorecorder Support Device Selection on All Platforms” on page 40</li> <li>• “New High-Level HDF5 Functions” on page 42</li> <li>• “Unrecognized Name Warning Changed to Error” on page 43</li> <li>• “Error Checking Improved” on page 45</li> <li>• “Functions and Function Elements Being Removed” on page 46</li> </ul>
Graphics and 3-D Visualization	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:  None

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Creating GUIs	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Do not Repopulate Menus on the Mac from Inside Their Callbacks” on page 50</li><li>• “Functions and Function Elements Being Removed” on page 51</li></ul>
External Interfaces	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Discontinued Compiler Support” on page 53</li><li>• “Changes to Shared Library Compiler Support” on page 53</li><li>• “Support for .NET System.Enum Objects” on page 53</li></ul>

## Version 7.11 (R2010b) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<ul style="list-style-type: none"> <li>• None</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Functions Being Removed” on page 67</li> <li>• “optimset Errors for Optimization Toolbox Options” on page 68</li> <li>• “atan Warning Being Removed” on page 68</li> </ul>
Data Analysis	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Arrays of Time Series Objects Supported” on page 69</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Functions isa and islogical Now Consistent for Objects” on page 73</li> <li>• “Comparing Object Arrays that Contain NaNs” on page 72</li> <li>• “mmreader Renamed VideoReader” on page 74</li> <li>• “sprintf and fprintf Print Null Characters in Strings” on page 77</li> <li>• “Functions and Function Elements Being Removed” on page 78</li> <li>• “MATLAB Did Not Pass struct to loadobj When Property Was Deleted” on page 79</li> </ul>



<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Graphics and 3-D Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Print –dmfile and printdmfile Issue Deprecation Warnings” on page 81</li> <li>• “The saveas ‘mmat’ option Issues a Deprecation Warning” on page 81</li> <li>• “The movie Function is No Longer a Built-in Function” on page 81</li> </ul>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <p>“Functions and Function Elements Being Removed” on page 82</p>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Discontinued Compiler Support” on page 85</li> <li>• “-largeArrayDims Option to MEX Will Become Default in Next Release of MATLAB” on page 85</li> <li>• “MEX Function -argcheck Option Removed” on page 86</li> <li>• “MEX Function -inline Option Removed” on page 87</li> </ul>

## Version 7.10 (R2010a) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Preference for Java Heap Memory” on page 91</li> <li>• “docopt Function Removed” on page 94</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Changes To qr” on page 100</li> <li>• “Change in Indexing for Sparse Matrix Input” on page 100</li> <li>• “Computational Geometry Functions Being Changed” on page 101</li> <li>• “Computational Geometry Functions Being Removed” on page 101</li> <li>• “lsqnonneg No Longer Uses Optional Starting Point Input” on page 101</li> <li>• “Function erfcore Removed” on page 102</li> <li>• “Integer Warning Messages Removed” on page 102</li> <li>• “Function intwarning Being Removed” on page 102</li> <li>• “atan Warning Being Removed” on page 103</li> <li>• “nextpow2 Returns Output the Same Size As Input” on page 103</li> <li>• “Math Libraries Not Available to Build MEX-Files with Compaq Visual Fortran” on page 117</li> </ul>
Data Analysis	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Operations on Timeseries Objects Sometimes Warn About the isTimeFirst Property” on page 105</li> </ul>

Area	New Features and Changes with Version Compatibility Impact
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Subscribing Into Function Return Values” on page 107</li> <li>• “Functions and Function Elements Being Removed” on page 110</li> </ul>
Graphics and 3-D Visualization	None
Creating GUIs	None
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Discontinued Compiler Support” on page 116</li> <li>• “-largeArrayDims Option to MEX Will Become Default in Next Release of MATLAB” on page 118</li> <li>• “Changes to Libraries on Linux with Debian Systems” on page 117</li> <li>• “Math Libraries Not Available to Build MEX-Files with Compaq Visual Fortran” on page 117</li> <li>• “Cannot Create MEX-Files with DLL File Extension” on page 117</li> </ul>

## Version 7.9 (R2009b) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Changes to -nodisplay and -noFigureWindows Startup Options” on page 123</li> <li>• “Changes to Memory Manager Startup Options” on page 124</li> <li>• “Ability to Customize Keyboard Shortcuts” on page 124</li> <li>• “Improved Contents Listing” on page 126</li> <li>• “Enhanced Current Folder (Directory) Browser” on page 131</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Computational Geometry Functions Being Changed” on page 138</li> <li>• “Computational Geometry Functions Being Removed” on page 138</li> <li>• “erfc core Being Removed” on page 139</li> </ul>
Data Analysis	None
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Use of lasterror, lasterr, rethrow(errStruct) Not Recommended” on page 144</li> <li>• “Use of maxNumCompThreads No Longer Recommended” on page 145</li> <li>• “Motion JPEG 2000 Files Supported by mmreader” on page 145</li> <li>• “Minimum Sample Rate for audioplayer” on page 146</li> <li>• “Ambiguity Error Now Reported” on page 148</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Graphics and 3-D Visualization	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Enhanced Plot Selector Simplifies Data Display” on page 150</li><li>• “Certain Print Options and Devices Now Warn When Used” on page 153</li><li>• “The view Function No Longer Supports 4-by-4 Transformation Matrices as Input” on page 154</li></ul>
Creating GUIs	None
External Interfaces	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Discontinued Support for Intel Visual Fortran Version 9.1” on page 158</li></ul>

## Version 7.8 (R2009a) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “New System Browser Preference Instead of docopt.m for MATLAB on UNIX Platforms” on page 164</li> <li>• “Help Browser No Longer Reopens at Startup” on page 165</li> <li>• “Block Indenting Option No Longer Provided” on page 172</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Changes To conv2 and convn” on page 176</li> <li>• “nextpow2 Changing to Element-By-Element Calculation in a Future Release” on page 177</li> <li>• “Function finite Being Removed” on page 177</li> <li>• “64-bit Support in LAPACK and BLAS” on page 177</li> </ul>
Data Analysis	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Data Brushing for Graphs and Linked Variables” on page 275 — refers to features introduced in Version 7.6 (R2008a)</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• Setting the Number of Threads Removed from Preferences Panel</li> <li>• Timer Objects Saved in New Format</li> <li>• MATLAB Upgrades Support for HDF5 to Version 1.8.1</li> <li>• Indirect Calls to Superclass Constructors Now Errors</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Graphics and 3-D Visualization	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Certain Printer Formats and Drivers Now Warn When Used” on page 231</li></ul>
Creating GUIs	None
External Interfaces	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Discontinued Compiler Support” on page 189</li><li>• “Do Not Use mxFree to Destroy mxArray” on page 189</li><li>• “Cannot Build MEX-Files Using MATLAB Version 5 API” on page 190</li><li>• “MEX-Files Calling BLAS or LAPACK Functions Must Be Updated On 64-Bit Platforms” on page 190</li><li>• “Improved Robustness of Web Services Functions” on page 192</li></ul>

## Version 7.7 (R2008b) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Macintosh Startup and Root Directory Enhancements and Changes” on page 196</li> <li>• “Changes to -nojvm Startup Option” on page 197</li> <li>• “Changes to matlab Memory Manager Startup Options” on page 198</li> <li>• “Current Directory Browser Enhanced, Including New Navigation and Grouping Features” on page 206</li> <li>• “Structure Results of dir for Nonexistent Files Now Include Empty Matrices” on page 210</li> <li>• “Semicolon (;) Path Separator Character Now Used on UNIX Platforms” on page 212</li> <li>• “Set Cursor to First Nonwhite Character on Line” on page 214</li> <li>• “File and Directory Comparisons Tool: Highlight Changes” on page 215</li> <li>• “Access Directory Reports” on page 216</li> <li>• “Publish Setting: Cascading Style Sheet Is Now XSL File” on page 217</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Upgrade to Random Number Generator” on page 218</li> <li>• “Functions and Properties Being Removed” on page 219</li> </ul>



<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Data Analysis	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Specialized Data Tips for the hist Function” on page 220</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “File Selection Restriction in Import Wizard” on page 225</li> <li>• “Function Handle Array Warning Is Now An Error” on page 226</li> <li>• “Two Types of issorted Warnings Are Now Errors” on page 227</li> <li>• “Possible Conflict with New Keyword: SPMD” on page 227</li> <li>• “isequal Is Now Called Explicitly for Contained Objects” on page 228</li> <li>• “Indexed Assignment with Objects of the Form p(:) = o Now Consistent with MATLAB Language” on page 229</li> <li>• “fopen No Longer Supports VAXD, VAXG, and Cray Machine Formats” on page 229</li> </ul>
Graphics and 3-D Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Certain Printer Formats and Drivers Now Warn When Used” on page 231</li> </ul>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Undocumented Functions Removed” on page 234</li> <li>• “New Menu Options to Hide or Show GUIDE Toolbar and Status Bar” on page 235</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Do Not Use DLL File Extensions for MEX-Files” on page 237</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
	<ul style="list-style-type: none"><li>• “MEX-Files Must Be Recompiled When -largeArrayDims Becomes Default MEX Option” on page 238</li><li>• “Use mxDestroyArray to Release Memory for mxArray” on page 239</li><li>• “New Functions to Catch Errors in MEX-Files Replace mexSetTrapFlag” on page 240</li><li>• “COM Objects Might Display Different Number of Supported Events” on page 241</li></ul>

## Version 7.6 (R2008a) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Windows Platforms — Startup Changes, Including Use of My Documents/MATLAB or Documents/MATLAB Directory” on page 246</li> <li>• “UNIX Platforms — Startup Changes” on page 246</li> <li>• “Macintosh Platforms — Startup Changes” on page 247</li> <li>• “Updated Version of JVM Software on Solaris Platform” on page 248</li> <li>• “Changes to Abnormal Termination Process” on page 249</li> <li>• “Command History Preference — Default Value Changed” on page 251</li> <li>• “Array Editor Renamed to Variable Editor; Offers Enhanced Support for Structures and Classes” on page 253</li> <li>• “Search Path — Changes to User Portion” on page 254</li> <li>• “New Context Menu Options in Current Directory Browser” on page 255</li> <li>• “Stand-Alone Editor No Longer Provided” on page 256</li> <li>• “Run/Continue Button Now Two Separate Buttons” on page 257</li> <li>• “Evaluate Entire File Button Off Toolbar by Default” on page 257</li> <li>• “mlint Function Uses Preference Settings when Java Software is Available” on page 258</li> <li>• “Nest Cells for Rapid Code Iteration; Includes Changes to Cell Highlighting” on page 261</li> <li>• “Publish Functions and Scripts Using Publish Configurations; Includes Replacement of Publishing Preferences” on page 262</li> </ul>

Area	New Features and Changes with Version Compatibility Impact
	<ul style="list-style-type: none"> <li>• “Nest Cells for Finer Control” on page 264</li> <li>• “Publish Button Moved” on page 270</li> <li>• “stopOnError Option No Longer Available with publish Function” on page 270</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Functions and Properties Being Removed” on page 274</li> </ul>
Data Analysis	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Data Brushing for Graphs and Linked Variables” on page 275</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Multithreaded Computations Enabled” on page 281</li> <li>• “Information on the State of Memory” on page 282</li> </ul>
Graphics and 3-D Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• ““v6” Plotting Option Update — Affected Functions” on page 285</li> </ul>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “GUIDE No Longer Copies Callbacks When You Duplicate Components” on page 391</li> <li>• “Changes to How uicontrols Set Figure SelectionType” on page 289</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Interface to Generic DLLs Supported on 64-bit Platforms” on page 292</li> <li>• “New Version of Perl on Windows Platforms” on page 294</li> </ul>

Area	New Features and Changes with Version Compatibility Impact
	<ul style="list-style-type: none"><li>• “Rebuild MEX-Files Created on Linux Platforms” on page 294</li><li>• “mex.bat File Removed from matlabroot\bin\%ARCH” on page 296</li><li>• “Discontinued Compiler Support” on page 293</li><li>• “Changes to Dynamic Data Exchange (DDE) Documentation” on page 298</li></ul>

## Version 7.5 (R2007b) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Windows Platforms Startup Changes” on page 301</li> <li>• “Changes to Look of Buttons in Desktop and Other Tools” on page 305</li> <li>• “Demos and Help Browser Contents Now Include New Category for Links and Targets” on page 306</li> <li>• “Help on Selection Enhanced in Command Window and Editor” on page 309</li> <li>• “Run/Continue Button Changes” on page 312</li> <li>• “Line Endings Removed in Files Provided with MATLAB Software for Windows Platforms; Impacts Viewing in Notepad Application” on page 315</li> <li>• “Stand-Alone Editor Will Not Be Included in Next Version” on page 318</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “finite Function Deprecated” on page 321</li> <li>• “Library for LAPACK and BLAS Symbols Separated” on page 322</li> <li>• “Colon Operations on Characters Return Character Type Data” on page 323</li> <li>• “Matrix Generating Functions No Longer Accept Complex Inputs” on page 323</li> </ul>
Data Analysis	None

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “New Internal Format for P-code” on page 327</li> <li>• “Change to Error Message from Anonymous Function” on page 329</li> <li>• “New Message In Response to Ctrl+C” on page 330</li> <li>• “hdfread Errors Instead of Warns on I/O Failures” on page 330</li> <li>• “Results From tempname Are More Unique” on page 331</li> <li>• “MATLAB Includes New Input Argument Validation Functions” on page 331</li> <li>• “Windows Current Working Directory Corrected” on page 331</li> <li>• “Compressed AVI Video Files in Windows Vista and Windows XP x64” on page 333</li> <li>• “mmfileinfo Reads Files on MATLAB Path” on page 333</li> <li>• “Removal of freeserial Function” on page 334</li> </ul>
Graphics and 3-D Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Datatips Are Now Saved to FIG-Files” on page 335</li> <li>• “The “v6” Option for Creating Plot Objects is Obsolete” on page 338</li> </ul>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Functions Being Removed” on page 342</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Support for 64-bit mxArray” on page 344</li> <li>• “Fortran MEX-Files Will Require mwSize and mwIndex” on page 345</li> <li>• “Rebuild MEX-Files Created with MATLAB Versions Earlier Than V7 (R14)” on page 346</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
	<ul style="list-style-type: none"><li>• “Discontinued Compiler Support” on page 347</li><li>• “Changes to Applications Built with Borland 5.5 or 5.6 C Compilers” on page 348</li><li>• “Changes to Dynamic Data Exchange (DDE) Documentation” on page 349</li><li>• “Documentation for Obsolete Functions To Be Phased Out” on page 350</li></ul>



## Version 7.4 (R2007a) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Double-Clicking Associated File Type in Explorer Now Opens File in Existing Session of MATLAB Software” on page 353</li> <li>• “Changes to Startup Directory (Folder) and Startup Options for MATLAB Application on Windows” on page 354</li> <li>• “JVM for Windows Updated” on page 357</li> <li>• “Confirm Exit Preference to be Enabled by Default in Future Version” on page 358</li> <li>• “Tabs for Tools Replaced by Title Bars” on page 364</li> <li>• “Macintosh Platforms—Some Key Bindings in Command Window Changed” on page 367</li> <li>• “Include Search Database for Your Own Help Files” on page 368</li> <li>• “Video Tutorials Now Accessed Via Web Site” on page 368</li> <li>• “Search Path Changes” on page 369</li> <li>• “Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version” on page 370</li> <li>• “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 372</li> <li>• “Macintosh Platforms—Some Key Bindings in Editor/Debugger Changed” on page 373</li> </ul>
Math	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “rand Function Uses the Mersenne Twister Algorithm as Default” on page 375</li> </ul>

Area	New Features and Changes with Version Compatibility Impact
	<ul style="list-style-type: none"> <li>• “mode of Empty Array Now Returns NaN” on page 377</li> <li>• “Change to Syntax for Setting BLAS Library Version on Linux” on page 377</li> </ul>
Data Analysis	None
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Using whos -file on Objects with Overloaded size or class Methods” on page 382</li> <li>• “mat2str Returns Correct Output for Strings” on page 382</li> <li>• “Warning Generated by try-catch” on page 383</li> <li>• “Functions Not Callable If in Directory Under Class Directory” on page 384</li> <li>• “ispuma Function Deprecated” on page 386</li> </ul>
Graphics and 3-D Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Movies No Longer Play During Loading” on page 387</li> <li>• “Ghostscript Printing Software Upgraded” on page 388</li> <li>• “Property Inspector Now Categorizes Graphic Object Properties” on page 388</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “GUIDE No Longer Copies Callbacks When You Duplicate Components” on page 391</li> <li>• “GUIDE M-File-Defined handles Structure Fields No Longer Become Permanent” on page 391</li> <li>• “UNIX: File Dialog 'Location' Property Is Obsolete” on page 392</li> <li>• “Functions Becoming Obsolete” on page 392</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “MEX-Files in MATLAB for Apple Macintosh (Intel)” on page 394</li> <li>• “MEX-Files in MATLAB for 64-bit Sun Solaris SPARC” on page 394</li> <li>• “MEX-Files Built in MATLAB R11 or Earlier Must Be Rebuilt” on page 395</li> <li>• “Fortran Compatibility Considerations” on page 397</li> <li>• “Discontinued Compiler Support” on page 397</li> </ul>

## Version 7.3 (R2006b) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Redirect Output on UNIX Now Sends Errors to Shell” on page 405</li> <li>• “M-Lint Preferences Added and Now Appear on M-Lint Panel” on page 406</li> <li>• “New Look and Feel on Linux and Solaris Platforms” on page 408</li> <li>• “Invalid info.xml File on Path Now Generates an Error” on page 408</li> <li>• “Exact Phrase and Wildcard Searching Added; Change to Search Database” on page 409</li> <li>• “File Comparison Directory Report Removed; Replaced by File Comparison Tool” on page 415</li> <li>• “M-Lint Code Check Report Enhancements and Changes” on page 415</li> <li>• “mlint Message IDs Changed and %#ok Syntax Enhanced” on page 415</li> </ul>
Mathematics	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “max and min Now Use Magnitudes and Phase Angle for Complex Input” on page 419</li> <li>• “FFTW Upgraded to Version 3.1.1 in MATLAB” on page 421</li> <li>• “Future Obsolete Functions” on page 422</li> <li>• “Obsolete Functions” on page 422</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
	<ul style="list-style-type: none"> <li>• “notebook Setup Arguments Removed” on page 417</li> <li>• “max and min No Longer Return Warning Messages for Inputs with Different Data Types” on page 423</li> </ul>
Data Analysis	None
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Saving to MAT-Files Larger than 2 GB” on page 425</li> <li>• “New Reserved MATLAB Keywords” on page 427</li> <li>• “Enhancements to Display Generated by whos” on page 428</li> <li>• “save Compression and Unicode Options Removed” on page 429</li> <li>• “Warning Generated by try-catch” on page 430</li> <li>• “Case-Sensitivity Warning Removed” on page 431</li> <li>• “fprintf(0,...) Now Throws an Error” on page 431</li> <li>• “Assigning Nonscalar Structure Array Fields to a Single Variable” on page 432</li> <li>• “Comma Separators Not Required in Function Declaration” on page 433</li> </ul>
Graphics and 3-D Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Version 6 Property Editor Has Been Removed” on page 434</li> <li>• “New Desktop Printing GUI” on page 435</li> <li>• “Customizing Zoom, Pan, and Rotate3D Data Explore Modes” on page 436</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Creating GUIs	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Functions Are Now Obsolete” on page 438</li><li>• “Colored Buttons on Windows XP” on page 438</li></ul>
External Interfaces	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Sparse Arrays on 64-bit Systems” on page 441</li><li>• “New MAT-File Format Based on HDF5” on page 442</li><li>• “-V5 Option to MEX to Be Removed” on page 443</li><li>• “Location of mex.bat File Changed” on page 443</li><li>• “Changes to Compiler Support” on page 443</li><li>• “Actxcontrol Command Now Validates ProgID” on page 443</li></ul>

## Version 7.2 (R2006a) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Installation Directory Structure on Windows Platforms” on page 447</li> <li>• “Preferences Reorganized and New Keyboard Pane Added to Support Command Window and Editor/Debugger” on page 448</li> <li>• “Tab Completion — Tab Now Completes Function and Variable Names” on page 451</li> <li>• “Go Menu Added; Bookmark and Go To Items Moved from Edit Menu to Go Menu” on page 452</li> <li>• “Cell Mode On by Default — Shows Cell Toolbar and Possibly Horizontal Lines and Yellow Highlighting; Cell Information Bar and Button Added” on page 455</li> <li>• “M-Lint and mlint Enhancements and Changes” on page 458</li> <li>• “Visual Directory View Removed from Current Directory Browser” on page 459</li> <li>• “PVCS Source Control System Name Change” on page 460</li> </ul>
Mathematics	None
Data Analysis	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Linux 64 Platform Fully Enabled for Time Series Tools” on page 463</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Using avifile and movie2avi on Windows XP 64” on page 464</li> <li>• “Regular Expressions” on page 465</li> <li>• “MATLAB Warns on Invalid Input to str2func” on page 467</li> <li>• “Changes to Character Encoding in File I/O” on page 467</li> </ul>
Graphics and 3-D Visualization	<ul style="list-style-type: none"> <li>• “Pasting Cut or Copied Graphic Objects Can Create an Axes” on page 471</li> </ul>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Treatment of &amp; in Menu Label Is Changed” on page 473</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “MEX-Files Built with gcc on Linux Must Be Rebuilt” on page 475</li> <li>• “MEX-Files in MATLAB for Microsoft Windows x64” on page 476</li> <li>• “Compaq Visual Fortran Engine and MAT Options File Renamed” on page 477</li> <li>• “Options Files Removed for Unsupported Compilers” on page 477</li> <li>• “Obsolete Functions No Longer Documented” on page 478</li> </ul>



## Version 7.1 (R14SP3) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Startup Option, –nodesktop, on Windows Platforms No Longer has Menu Bar and Toolbar; Use Function Equivalents Instead” on page 487</li> <li>• “Preferences Directory Added for R14SP3; Supplements R14 Directory” on page 489</li> <li>• “info.xml File Automatic Validation; Shows Warnings for Invalid Constructs” on page 491</li> <li>• “Hyperlink Color Preference Moved” on page 492</li> <li>• “Demos Run in Command Window as Scripts and Their Variables Now Created in Base Workspace” on page 493</li> <li>• “echodemo Function Added to Replace playshow function” on page 494</li> <li>• “Visual Directory View to be Removed” on page 495</li> <li>• “HTML File Indenting Feature Added as the Default” on page 497</li> <li>• “Notebook Setup Changes; Some Arguments Removed” on page 499</li> <li>• “Versions of Microsoft Word Application Supported by Notebook; Microsoft Word 97 No Longer Supported” on page 500</li> </ul>
Mathematics	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “New Functions” on page 501</li> </ul>
Data Analysis	None

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “New Functions” on page 507</li> <li>• “Modified Functions” on page 508</li> <li>• “isfield Function Supports Cell Arrays; Results Might Differ from Previous Version” on page 509</li> <li>• “Seconds Field Now Truncated; Results Might Differ” on page 512, “Built-in Functions No Longer Use .bi; Impacts Output of which Function” on page 512, “New Warning About Potential Naming Conflict” on page 513</li> </ul>
Graphics and 3-D Visualization	None
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Plans for Obsolete Functions” on page 515</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “New File Extension for MEX-Files on Windows Systems” on page 518</li> <li>• “New Preferences Directory and MEX Options” on page 520</li> <li>• “Compiler Support” on page 521</li> <li>• “Import Libraries Moved” on page 521</li> </ul>

## Version 7.04 (R14SP2) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “JVM Software Updated” on page 525</li> <li>• “Subfunction Help Syntax Changed” on page 526</li> <li>• “Bug Fixes and Known Problems Now on Web; No Longer Found Via Help Search” on page 526</li> <li>• “Workspace Browser Preference Panel Removed” on page 527</li> <li>• “Preference for Editor/Debugger Dialog Moved” on page 528</li> <li>• “Register Project Feature Added; Add to Source Control Behavior Changed” on page 529</li> <li>• “Cell Publishing: File Extension Changes” on page 529</li> <li>• “Notebook Support for Microsoft Word 97 Application to be Discontinued” on page 530</li> </ul>
Mathematics	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “max and min on Complex Integers Not Supported” on page 531</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “xlsread Imported Date Format Changes” on page 533</li> <li>• “Nonscalar Arrays of Function Handles to Become Invalid” on page 534</li> <li>• “Assigning Nonstructure Variables As Structures Displays Warning” on page 534</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Graphics and 3-D Visualization	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Cannot Dock Figures on Macintosh” on page 538</li><li>• “Plotting Tools Not Working on Macintosh” on page 538</li><li>• “Not All Macintosh System Fonts Are Available” on page 538</li><li>• “XDisplay Property Setable on Motif-Based Systems” on page 538</li></ul>
Creating GUIs	None
External Interfaces	None

## Version 7.01 (R14SP1) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Construction of Classpath for Java Software Now Uses librarypath” on page 542</li> <li>• “Notebook Support for Word 97 to Be Discontinued” on page 547</li> </ul>
Mathematics	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Different Results When Solving Singular Linear Systems on Intel Systems; Inconsistent NaN Propagation” on page 550</li> <li>• “funm Returns Status Information; New Output Might Result In Error” on page 551</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “datevec Support of Empty String Argument” on page 553</li> <li>• “ftell Returning Invalid Position in Rare Cases” on page 553</li> <li>• “Logical OR Operator   in regexp Expressions Might Yield Different Results from Previous Version” on page 555</li> <li>• “Multiple Declarations of Persistent Variables No Longer Supported” on page 556</li> </ul>

<b>Area</b>	<b>New Features and Changes with Version Compatibility Impact</b>
Graphics and 3-D Visualization	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “Cannot Dock Figures on Macintosh Systems” on page 558</li><li>• “Plotting Tools Not Working on Macintosh Systems” on page 558</li><li>• “Not All Macintosh System Fonts Are Available” on page 558</li><li>• “Preview Java Figures on the Macintosh Platform” on page 558</li></ul>
Creating GUIs	See the <b>Compatibility Considerations</b> subheading for each of these new features or changes: <ul style="list-style-type: none"><li>• “FIG-File Format Change” on page 559</li><li>• “Panels, Button Groups, and ActiveX Components” on page 559</li><li>• “Windows XP Display of Push and Toggle Buttons” on page 560</li></ul>
External Interfaces	See the <b>Compatibility Considerations</b> subheading for this new feature or change: <ul style="list-style-type: none"><li>• “Specifying the Search Path for Sun Java Native Method DLLs” on page 562</li></ul>

## Version 7 (R14) MATLAB Software Compatibility Summary

For other versions, see the “Compatibility Summary for MATLAB Software”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “terminal Function Removed” on page 570</li> <li>• “license Function Results Modified Slightly” on page 571</li> <li>• “Tab Completion Graphical Interface Added; Removed Preference to Limit Completions” on page 571</li> <li>• “Parentheses Matching Support Removed” on page 573</li> <li>• “Documentation Now Automatically Installed; Not Accessible from CD-ROMs and docroot Not Supported” on page 575</li> <li>• “web Function Now Opens MATLAB Web Browser By Default” on page 577</li> <li>• “HTML Documentation Not Viewable with -nojvm Startup Option” on page 577</li> <li>• “Built-In Functions Now Treated Like Other M-Files on Search Path” on page 579</li> <li>• “savepath Function Added to Replace path2rc” on page 580</li> <li>• “Create Block Comments Using %{ and %}” on page 585</li> <li>• “dbstack Function Supports Nested Functions” on page 587</li> <li>• “dbstatus Function Supports Conditional Breakpoints” on page 588</li> <li>• “Rapid Code Iteration Using Cells” on page 588</li> <li>• “Profiler for Measuring Performance” on page 592</li> <li>• “Source Control Changes” on page 593</li> </ul>
Mathematics	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Obsolete Functions” on page 598</li> </ul>

Area	New Features and Changes with Version Compatibility Impact
	<ul style="list-style-type: none"> <li>• “Integer Data Type Functions Now Round Instead of Truncate” on page 602</li> <li>• “Changes to Behavior of Concatenation” on page 603</li> <li>• “New Class Inputs for sum” on page 606</li> <li>• “max and min Now Have Restrictions on Inputs of Different Data Types” on page 609</li> <li>• “Matrix, Trigonometric, and Other Math Functions No Longer Accept Inputs of Type char” on page 613</li> <li>• “New Names for Demos expm1, expm2, and expm3” on page 619</li> </ul>
Programming	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “MATLAB Stores Character Data As Unicode; Making Release 14 MAT-files Readable in Earlier Versions” on page 623</li> <li>• “MAT-Files Generated By Release 14 Beta2 Must Be Reformatted” on page 624</li> <li>• “Additional Bytes Reserved in MAT-File Header; Do Not Write To Reserved Space” on page 625</li> <li>• “Case-Sensitivity in Function and Directory Names; Can Affect Which Function MATLAB Selects” on page 626</li> <li>• “Differences Between Built-Ins and M-Functions Removed; Can Affect Which Function MATLAB Selects” on page 631</li> <li>• “Change to How evalin Evaluates Dispatch Context” on page 633</li> <li>• “New Calling Syntax for Function Handles; Replace eval With New Syntax” on page 638</li> <li>• “Arrays of Function Handles” on page 639</li> <li>• “Regular Expressions Accept String Vector; No Longer Support Character Matrix Input” on page 645</li> <li>• “Colon Operator on char Now Returns a char” on page 646</li> </ul>



Area	New Features and Changes with Version Compatibility Impact
	<ul style="list-style-type: none"> <li>• “Reading Date Values with xlsread; Conversion No Longer Necessary” on page 647</li> <li>• “Changes to Error Message Format” on page 653</li> </ul>
3-D Graphics and Visualization	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Plotting Tools Not Working on Macintosh Platform” on page 667</li> <li>• “Using -nojvm Option Prevents Plotting Tools Use” on page 667</li> <li>• “MATLAB 6 Version Property Editor” on page 668</li> <li>• “Cannot Dock Figures on Macintosh Platform” on page 668</li> <li>• “Not All Macintosh System Fonts Are Available” on page 668</li> </ul>
Creating GUIs	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “New Container Components” on page 669</li> <li>• “New Syntax for uigetfile and uiputfile” on page 673</li> <li>• “Frames Not Available in GUIDE Layout Editor” on page 674</li> </ul>
External Interfaces	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> <li>• “Saving Character Data with Unicode Encoding” on page 675</li> <li>• “Display of Interface Handles” on page 682</li> <li>• “Recompile MEX-Files on GLNX86 and Apple Macintosh” on page 685</li> <li>• “Shared Libraries Now In /bin/\$ARCH” on page 685</li> </ul>