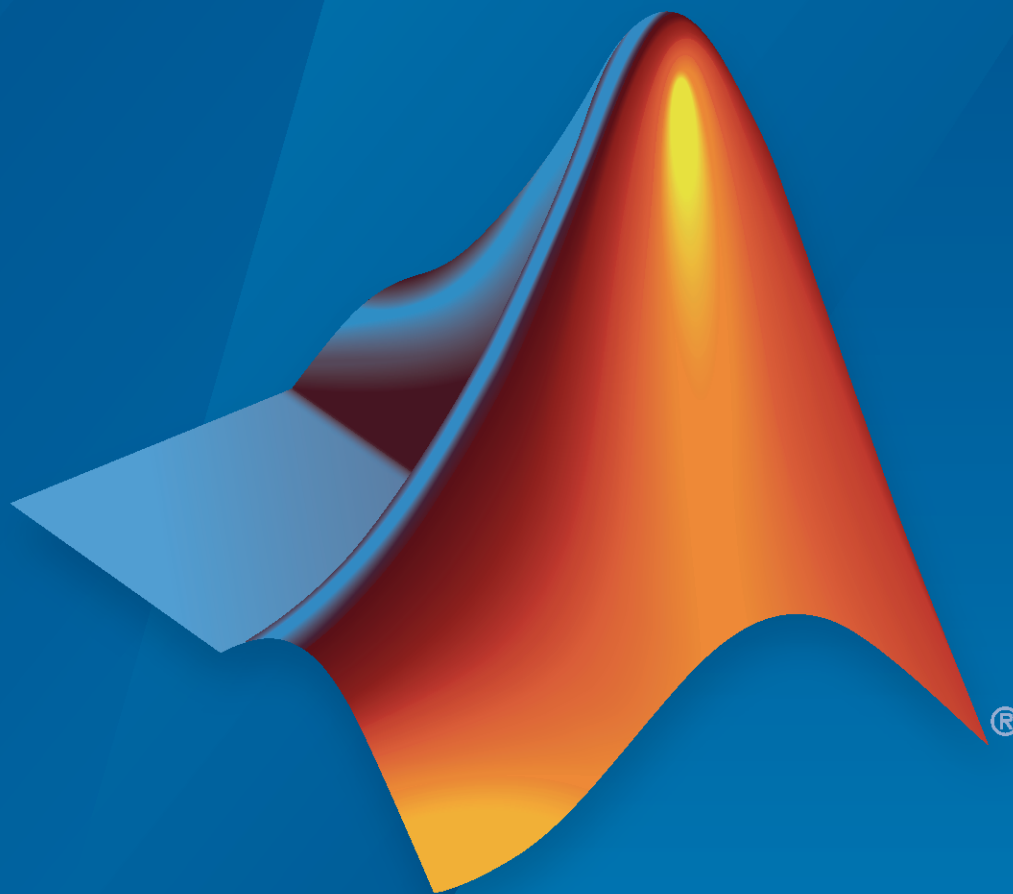


MATLAB[®] Compiler[™]

MATLAB[®] Compiler[™] Excel[®] Add-In User's Guide



MATLAB[®]

R2022a



How to Contact MathWorks



Latest news: www.mathworks.com
Sales and services: www.mathworks.com/sales_and_services
User community: www.mathworks.com/matlabcentral
Technical support: www.mathworks.com/support/contact_us



Phone: 508-647-7000



The MathWorks, Inc.
1 Apple Hill Drive
Natick, MA 01760-2098

MATLAB® Compiler™ Excel® Add-In User's Guide

© COPYRIGHT 2015–2022 by The MathWorks, Inc.

The software described in this document is furnished under a license agreement. The software may be used or copied only under the terms of the license agreement. No part of this manual may be photocopied or reproduced in any form without prior written consent from The MathWorks, Inc.

FEDERAL ACQUISITION: This provision applies to all acquisitions of the Program and Documentation by, for, or through the federal government of the United States. By accepting delivery of the Program or Documentation, the government hereby agrees that this software or documentation qualifies as commercial computer software or commercial computer software documentation as such terms are used or defined in FAR 12.212, DFARS Part 227.72, and DFARS 252.227-7014. Accordingly, the terms and conditions of this Agreement and only those rights specified in this Agreement, shall pertain to and govern the use, modification, reproduction, release, performance, display, and disclosure of the Program and Documentation by the federal government (or other entity acquiring for or through the federal government) and shall supersede any conflicting contractual terms or conditions. If this License fails to meet the government's needs or is inconsistent in any respect with federal procurement law, the government agrees to return the Program and Documentation, unused, to The MathWorks, Inc.

Trademarks

MATLAB and Simulink are registered trademarks of The MathWorks, Inc. See www.mathworks.com/trademarks for a list of additional trademarks. Other product or brand names may be trademarks or registered trademarks of their respective holders.

Patents

MathWorks products are protected by one or more U.S. patents. Please see www.mathworks.com/patents for more information.

Revision History

March 2015	Online only	New for Version 6.0 (Release 2015a)
September 2015	Online only	Revised for Version 6.1 (Release 2015b)
October 2015	Online only	Rereleased for Version 6.0.1 (Release 2015aSP1)
March 2016	Online only	Revised for Version 6.2 (Release 2016a)
September 2016	Online Only	Revised for Version 6.3 (Release 2016b)
March 2017	Online only	Revised for Version 6.4 (Release R2017a)
September 2017	Online only	Revised for Version 6.5 (Release R2017b)
March 2018	Online only	Revised for Version 6.6 (Release R2018a)
September 2018	Online only	Revised for Version 7.0 (Release R2018b)
March 2019	Online only	Revised for Version 7.0.1 (Release R2019a)
September 2019	Online only	Revised for Version 7.1 (Release R2019b)
March 2020	Online only	Revised for Version 8.0 (Release R2020a)
September 2020	Online only	Revised for Version 8.1 (Release R2020b)
March 2021	Online only	Revised for Version 8.2 (Release R2021a)
September 2021	Online only	Revised for Version 8.3 (Release R2021b)
March 2022	Online only	Revised for Version 8.4 (Release R2022a)

Create Excel Add-Ins

1

Create Excel Add-In	1-2
----------------------------------	------------

Getting Started

2

How Excel Add-In Compilation Works	2-2
Excel Target Requirements and Limitations for MATLAB Compiler	2-3
Compiler Prerequisites	2-3
Macro Execution Security Levels in Microsoft Excel	2-3
MATLAB Compiler Excel Add-In Limitations	2-3
Work with Struct Arrays	2-4
Deployment Target Architectures and Compatibility	2-4
Choose Function Deployment Workflow	2-5
Is Your Function Ready for Deployment?	2-5
Create Excel Add-In from MATLAB	2-6
Create Function in MATLAB	2-6
Create Excel Add-In Using Library Compiler App	2-6
Package the Application	2-9
Create Excel Add-in Using compiler.build.excelAddIn	2-9
Install Add-In in Excel	2-10
Test Add-In	2-10
Distribute Add-In	2-11
Distribute Add-Ins and Integrate into Microsoft Excel	2-12
Files for Excel Add-In Deployment	2-12
Install MATLAB Runtime	2-12
Register Add-Ins and COM Components	2-13
Register MATLAB Utility Libraries	2-13
Install Excel Add-Ins	2-14
Use MATLAB Functions in Excel Spreadsheet	2-14

3

Customize an Application	3-2
Customize the Installer	3-2
Determine Data Type of Command-Line Input (For Packaging Standalone Applications Only)	3-4
Manage Required Files in Compiler Project	3-4
Sample Driver File Creation	3-5
Specify Files to Install with Application	3-6
Additional Runtime Settings	3-7
Manage Support Packages	3-9
Using a Compiler App	3-9
Using the Command Line	3-9

The Function Wizard

4

Install and Use Function Wizard	4-2
Install Function Wizard	4-2
Start Function Wizard	4-2
Define Functions to Execute	4-2
Define Input Arguments	4-3
Define Output Arguments	4-7
Test and Save Macro	4-7
Execute Macro in Excel	4-8
Access Microsoft Visual Basic Code (Optional)	4-8
Map Macro to Button (Optional)	4-8
End-to-End Deployment of MATLAB Function	4-10
mymagic Testing	4-10
Function Wizard Start-Up	4-11
Workflow Selection for Prototyping and Debugging MATLAB Functions .	4-11
New MATLAB Function Definition	4-12
MATLAB Function Prototyping and Debugging	4-16
Function Execution from MATLAB	4-17
Microsoft Excel Add-In and Macro Creation Using the Function Wizard .	4-17
Function Execution from the Deployed Component	4-19
Microsoft Excel Add-In and Macro Packaging using the Function Wizard	4-19

MATLAB Code Deployment

5

How Does MATLAB Deploy Functions?	5-2
--	------------

Dependency Analysis Using MATLAB Compiler	5-3
Function Dependency	5-3
Data File Dependency	5-3
Exclude Files From Package	5-4
MEX-Files, DLLs, or Shared Libraries	5-5
Deployable Archive	5-6
Additional Details	5-7
Write Deployable MATLAB Code	5-9
Packaged Applications Do Not Process MATLAB Files at Run Time	5-9
Do Not Rely on Changing Directory or Path to Control the Execution of MATLAB Files	5-10
Use isdeployed Functions To Execute Deployment-Specific Code Paths ..	5-10
Gradually Refactor Applications That Depend on Noncompilable Functions	5-10
Do Not Create or Use Nonconstant Static State Variables	5-10
Get Proper Licenses for Toolbox Functionality You Want to Deploy	5-11
Calling Shared Libraries in Deployed Applications	5-12
MATLAB Data Files in Compiled Applications	5-13
Explicitly Including MATLAB Data files Using the %#function Pragma ..	5-13
Load and Save Functions	5-13

Microsoft Excel Add-In Creation, Function Execution, and Deployment

6

The Library Compiler and the Command Line Interface	6-2
Using Graphical Interface	6-2
Using Command Line Interface	6-2
Create Macro Using Multiple MATLAB Functions	6-3
Create Add-In In MATLAB	6-3
Create Excel Macro Using Function Wizard	6-4
(Optional) Inspect Microsoft Visual Basic Code	6-5
For Additional Examples	6-5
Create Macros with Graphical Functions	6-7
Create Macro that Displays Graphical Output	6-7
Create Macro that Displays Error Message	6-8

Microsoft Excel Add-In Integration

7

Integrate Components Using VBA	7-2
When to Use Formula Functions or Subroutines	7-2

Initialize MATLAB Compiler Libraries with Microsoft Excel	7-2
Create an Instance of a Class	7-3
Call the Methods of a Class Instance	7-4
Program with Variable Arguments	7-6
Modify Flags	7-7
Handle Errors During a Method Call	7-10
Implement User Interface Using Visual Basic Form Controls	7-11
Overview	7-11
Build Excel Add-In	7-11
Implement VBA code	7-12
Test the Add-In	7-18
For More Information	7-21

Distribution to End Users

8

Assign Multiple MATLAB Functions to Excel Class	8-2
Create Add-In In MATLAB	8-2
Deploy Add-In to Microsoft Excel	8-2
Improve Data Access Using the MATLAB Runtime User Data Interface and COM Components	8-4
Overview	8-4
MATLAB Runtime Component Cache and Deployable Archive Embedding	8-8
Overriding Default Behavior	8-9
For More Information	8-9
MATLAB Runtime Options for Excel Add-Ins	8-10
What MATLAB Runtime Options are Supported by MATLAB Compiler? ..	8-10
How Do I Specify MATLAB Runtime Options?	8-10
For More Information	8-11

Functions

9

Utility Library for Microsoft COM Components

10

Reference Utility Classes	10-2
--	-------------

Class MWUtil	10-3
Sub MWInitApplication(pApp As Object)	10-3
Sub MWInitApplicationWithMCROptions(pApp As Object, [mcrOptionList])	10-4
Function IsMCRJVMEEnabled() As Boolean	10-5
Function IsMCRInitialized() As Boolean	10-5
Sub MWPack(pVarArg, [Var0], [Var1], ... ,[Var31])	10-5
Sub MWUnpack(VarArg, [nStartAt As Long], [bAutoSize As Boolean = False], [pVar0], [pVar1], ..., [pVar31])	10-7
Sub MWDate2VariantDate(pVar)	10-8
Class MWFlags	10-10
Property ArrayFormatFlags As MWArrayFormatFlags	10-10
Property DataConversionFlags As MWDataConversionFlags	10-12
Sub Clone(ppFlags As MWFlags)	10-13
Class MWStruct	10-15
Sub Initialize([varDims], [varFieldNames])	10-15
Property Item([i0], [i1], ..., [i31]) As MWField	10-16
Property NumberOfFields As Long	10-17
Property NumberOfDims As Long	10-18
Property Dims As Variant	10-18
Property FieldNames As Variant	10-18
Sub Clone(ppStruct As MWStruct)	10-18
Class MWField	10-20
Property Name As String	10-20
Property Value As Variant	10-20
Property MWFlags As MWFlags	10-20
Sub Clone(ppField As MWField)	10-20
Class MWComplex	10-21
Property Real As Variant	10-21
Property Imag As Variant	10-21
Property MWFlags As MWFlags	10-21
Sub Clone(ppComplex As MWComplex)	10-22
Class MWSparse	10-23
Property NumRows As Long	10-23
Property NumColumns As Long	10-23
PropertyRowIndex As Variant	10-23
Property ColumnIndex As Variant	10-23
Property Array As Variant	10-23
Property MWFlags As MWFlags	10-23
Sub Clone(ppSparse As MWSparse)	10-23
Class MWArg	10-26
Property Value As Variant	10-26
Property MWFlags As MWFlags	10-26
Sub Clone(ppArg As MWArg)	10-26
Enum mwArrayFormat	10-27
Enum mwDataType	10-28

Enum mwDateFormat	10-29
--------------------------------	--------------

Apps

11

Data Conversion

A

Data Conversion Rules	A-2
Array Formatting Flags	A-10
Data Conversion Flags	A-12
CoerceNumericToType	A-12
InputDateFormat	A-13
OutputAsDate As Boolean	A-13
DateBias As Long	A-13


Troubleshooting

B

Errors and Solutions	B-2
Excel Add-Ins Errors and Suggested Solutions	B-3
Required Locations to Develop and Use Components	B-5
Microsoft Excel Errors and Suggested Solutions	B-5
Function Wizard Problems	B-6
Deployment Product Terms	B-8

Create Excel Add-Ins

Create Excel Add-In

- 1 Type `libraryCompiler` at the MATLAB command line to open the **Library Compiler** app.
- 2 In the **Library Compiler** app project window, specify the files of the MATLAB application that you want to deploy.
 - a In the **Exported Functions** section of the toolstrip, click .
 - b In the **Add Files** window, browse to the example folder, and select the function you want to package. Click **Open**.

The function is added to the list of exported function files. Repeat this step to package multiple files in the same application.

- 3 In the **Packaging Options** section of the toolstrip, decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the options:
 - **Runtime downloaded from web** — Generate an installer that downloads the MATLAB Runtime and installs it along with the deployed MATLAB application. You can specify the file name of the installer.
 - **Runtime included in package** — Generate an application that includes the MATLAB Runtime installer. You can specify the file name of the installer.

Note The first time you select this option, you are prompted to download the MATLAB Runtime installer.

- 4 Verify that the MATLAB function you are packing into an Excel add-in is mapped onto a class. You can change the name from the default name `Class 1` to something more meaningful.
- 5 Customize the packaged application and its appearance:
 - **Library information** — Editable information about the deployed application. You can also customize the standalone applications appearance by changing the application icon and splash screen. The generated installer uses this information to populate the installed application metadata. See “Customize the Installer”.
 - **Additional installer options** — Edit the default installation path for the generated installer and selecting custom logo. See “Change the Installation Path” .
 - **Files required for your library to run** — Additional files required by the generated application to run. These files are included in the generated application installer. See “Manage Required Files in Compiler Project”.
 - **Files installed for your end user** — Files that are installed with your application.

See “Specify Files to Install with Application”.

- **Additional runtime settings** — Platform-specific options for controlling the generated executable. See “Additional Runtime Settings”.
- 6 When you are finished selecting your packaging options, save your **Library Compiler** project and generate the packaged application.

- 1 Click **Package**.

In the Save Project dialog box, specify the location to save the project.

- 2 In the **Package** dialog box, verify that **Open output folder when process completes** is selected.

When the packaging process is complete, examine the generated output in the target folder.

- Three folders are generated: `for_redistribution`, `for_redistribution_files_only`, and `for_testing`.

For more information about the files generated in these folders, see “Files Generated After Packaging MATLAB Functions”.

- The log file `PackagingLog.html` contains packaging results.

See Also

More About

- “Create Excel Add-In from MATLAB” on page 2-6

Getting Started

- “How Excel Add-In Compilation Works” on page 2-2
- “Excel Target Requirements and Limitations for MATLAB Compiler” on page 2-3
- “Choose Function Deployment Workflow” on page 2-5
- “Create Excel Add-In from MATLAB” on page 2-6
- “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12

How Excel Add-In Compilation Works

With MATLAB Compiler, you create deployable add-ins that run in Microsoft® Excel applications from MATLAB code. To convert MATLAB functions for use in an Excel add-in, you use the **Library Compiler** app, the `compiler.build.excelAddIn` function, or the `mcc` function.

When you compile your MATLAB code, MATLAB Compiler generates two primary artifacts, a COM component (`.dll`) and a VBA module (`.bas`), which it then integrates into a Microsoft Excel add-in (`.xla`).

To support integration with Microsoft Excel, MATLAB Compiler builds each Excel add-in as a COM object based on the component object model, a Microsoft binary standard for object interoperability. COM components use a common integration architecture that provides a consistent model across multiple applications, including Microsoft Office applications.

To integrate the COM component with your application, you access the COM object from Microsoft Excel through Microsoft Visual Basic® for Applications (VBA). The COM object exposes a single *class* to the Visual Basic programming environment. This class provides the interface to the MATLAB functions in the form of methods, which correspond to the original MATLAB functions that you include in your project. The VBA module contains simple call wrappers, each implemented as a function procedure for each method of the class.

See Also

Related Examples

- “Write Deployable MATLAB Code”
- “How Does MATLAB Deploy Functions?” on page 5-2
- “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12

Excel Target Requirements and Limitations for MATLAB Compiler

In this section...

“Compiler Prerequisites” on page 2-3

“Macro Execution Security Levels in Microsoft Excel” on page 2-3

“MATLAB Compiler Excel Add-In Limitations” on page 2-3

“Work with Struct Arrays” on page 2-4

“Deployment Target Architectures and Compatibility” on page 2-4

Compiler Prerequisites

To generate Microsoft Excel add-ins using MATLAB, you must have the following installed on a Windows® system:

- MATLAB
- MATLAB Compiler
- A supported C or C++ compiler
- Microsoft Excel, to generate the Visual Basic code

For instructions on deploying Microsoft Excel add-ins, see “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12.

Macro Execution Security Levels in Microsoft Excel

To generate add-ins and create macros with MATLAB Compiler, you must adjust the security settings accordingly in Microsoft Excel. Failure to do so may result in VBA code not being generated or warning messages sent to MATLAB Compiler.

- For Microsoft Excel 2010 or newer:
 - 1 Click **File > Options > Trust Center > Trust Center Settings > Macro Settings**.
 - 2 In **Developer Macro Settings**, select **Trust access to the VBA project object model**.

MATLAB Compiler Excel Add-In Limitations

MATLAB Compiler supports the following function outputs for Excel add-ins:

- No outputs
- Figure (graphical) output
- Scalar output
- Multidimensional matrix output
- Structure array output

It does not support MATLAB objects as inputs or outputs for compiled or deployed functions with Excel add-ins.

Dependencies on MATLAB objects or functions that are not compatible with MATLAB Compiler can prevent your code from compiling. For a list of functions that cannot be compiled, see “Functions Not Supported for Compilation by MATLAB Compiler and MATLAB Compiler SDK”. For detailed information about how MATLAB Compiler evaluates MATLAB code dependencies during compilation, see “Dependency Analysis Using MATLAB Compiler”. For information on ensuring your code is deployable, see “Write Deployable MATLAB Code”.

Work with Struct Arrays

To deploy a MATLAB function with structure arrays as input or output arguments, build Microsoft Excel macros and pass them (with the Excel add-in) to the end users. For more details on using struct array arguments in the Function Wizard, see “Define Input Arguments” on page 4-3.

If you do not create a macro, let your end users know:

- Which arguments are structure arrays
- Field names of the structure arrays

Deployment Target Architectures and Compatibility

Applications developed on one architecture must be compatible with the architecture on the system where they are deployed. For example, if you have a 64-bit system, you usually install a 64-bit version of MATLAB (and most other applications) by default.

Add-ins created with MATLAB Compiler are compatible with both 32-bit and 64-bit versions of Microsoft Excel. MATLAB Compiler itself is in 64-bit only.

See Also

Related Examples

- “Create Excel Add-In from MATLAB” on page 2-6
- “Write Deployable MATLAB Code”
- “How Excel Add-In Compilation Works” on page 2-2
- “Deployment Product Terms” on page B-8

Choose Function Deployment Workflow

Is Your Function Ready for Deployment?

If These Statements are True...	See...
<ul style="list-style-type: none">• I have a MATLAB function that conforms to guidelines in “Write Deployable MATLAB Code”.• I want to create a Microsoft Excel compatible add-in from my existing MATLAB function.• I have tested and debugged my MATLAB function with MATLAB.	See “Create Excel Add-In from MATLAB” on page 2-6 to build your add-in and “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12 to execute the newly built add-in and create macros and associated GUIs with the Function Wizard and Microsoft Excel.

Create Excel Add-In from MATLAB

Supported Platform: Microsoft Windows only.

This example shows how to use MATLAB Compiler to generate a Microsoft Excel add-in containing a custom function for use within Excel. The function `mymagic` returns an n-by-n magic square matrix that has equal row and column sums. The target system does not require a licensed copy of MATLAB to run the add-in.

Before you begin, verify that you have met all of the Excel target requirements for MATLAB Compiler. For details, see “Excel Target Requirements and Limitations for MATLAB Compiler” on page 2-3.

Note To generate the Visual Basic files, enable **Trust access to the VBA project object model** in Excel. If you do not do this, you can manually create the add-in by importing the `.bas` file into Excel.

Create Function in MATLAB

In MATLAB, locate the MATLAB code that you want to deploy as an Excel add-in.

For this example, compile the function `mymagic.m` located in `matlabroot\toolbox\matlabxl\examples\xlmagic`.

```
function y = mymagic(x)
y = magic(x)
```

At the MATLAB command prompt, enter `mymagic(5)`.

The output is a 5-by-5 square.

```
17    24     1     8    15
23     5     7    14    16
 4     6    13    20    22
10    12    19    21     3
11    18    25     2     9
```

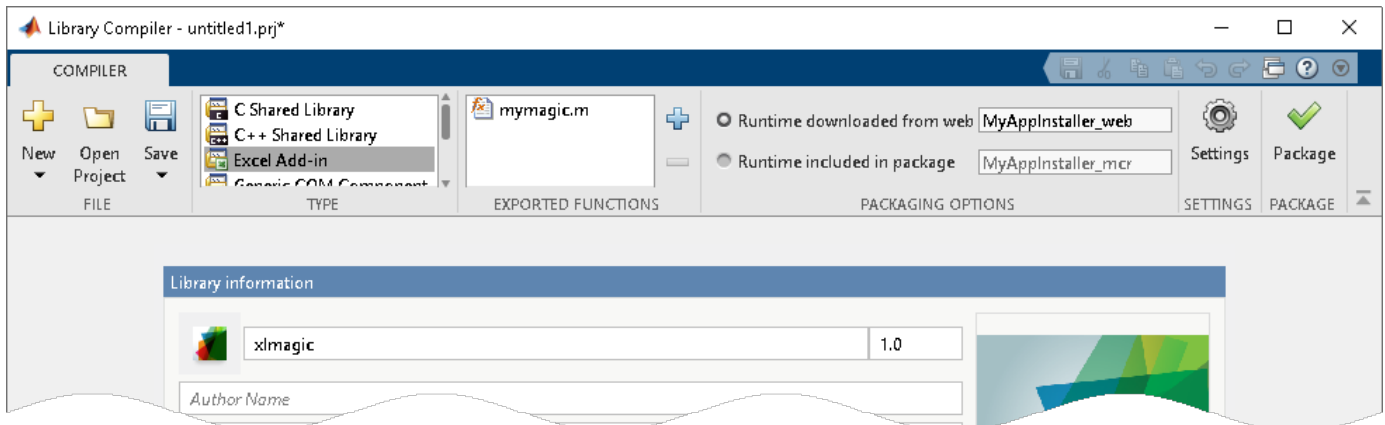
Create Excel Add-In Using Library Compiler App


Package the function into an Excel add-in using the **Library Compiler** app. Alternatively, if you want to create an Excel add-in from the MATLAB command window using a programmatic approach, see “Create Excel Add-in Using `compiler.build.excelAddIn`” on page 2-9.

- 1 To open the Library Compiler app, type `libraryCompiler` at the MATLAB prompt.

Alternatively, on the **MATLAB Apps** tab, on the far right of the **Apps** section, click the arrow. In **Application Deployment**, click **Library Compiler**.

- 2 In the **MATLAB Compiler** project window, select **Excel Add-in** in the **TYPE** section.



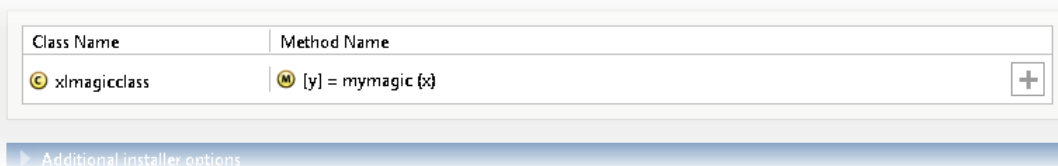
- 3 In the **Library Compiler** app project window, specify the files of the MATLAB application that you want to deploy.
 - a In the **Exported Functions** section of the toolbar, click .
 - b In the **Add Files** window, browse to the example folder, and select the function you want to package. Click **Open**.

The function is added to the list of exported function files. Repeat this step to package multiple files in the same application.

- 4 In the **Packaging Options** section of the toolbar, decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the options:
 - **Runtime downloaded from web** — Generate an installer that downloads the MATLAB Runtime and installs it along with the deployed MATLAB application. You can specify the file name of the installer.
 - **Runtime included in package** — Generate an application that includes the MATLAB Runtime installer. You can specify the file name of the installer.

Note The first time you select this option, you are prompted to download the MATLAB Runtime installer.

- 5 Next, define the name of your add-in and verify the class mapping for the `.m` file that you are building into your application.
 - a The **Library Name** field is automatically populated with `mymagic` as the name of the assembly. Rename it as `xlmagic`. The same name is followed through in the implementation of the add-in.
 - b Verify that the function defined in `mymagic.m` is mapped into `xlmagicclass`. Double-click on the class to change the class name.

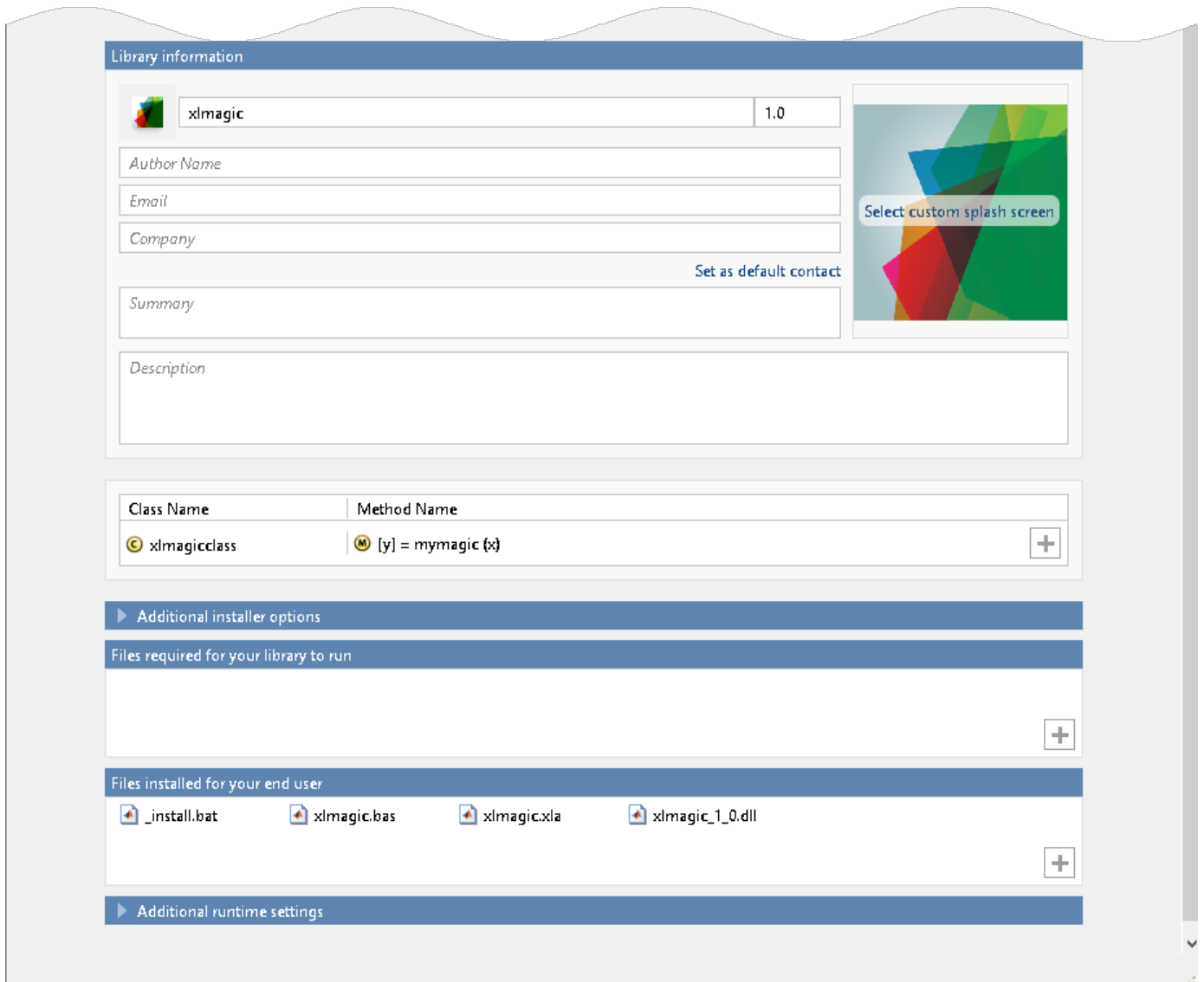


- 6 Customize the packaged application and its appearance:

- **Library information** — Editable information about the deployed application. The generated installer uses this information to populate the installed application metadata. See “Customize the Installer”.
- **Additional installer options** — Edit the default installation path for the generated installer and selecting custom logo. See “Change the Installation Path” .
- **Files required for your library to run** — Additional files required by the generated application to run. These files are included in the generated application installer. See “Manage Required Files in Compiler Project”.
- **Files installed for your end user** — Files that are installed with your application.

See “Specify Files to Install with Application”.

- **Additional runtime settings** — Platform-specific options for controlling the generated executable. See “Additional Runtime Settings”.



Package the Application

When you are finished selecting your packaging options, save your **Library Compiler** project and generate the packaged application.

1 Click **Package**.

In the Save Project dialog box, specify the location to save the project.

2 In the **Package** dialog box, verify that **Open output folder when process completes** is selected.

When the packaging process is complete, examine the generated output in the target folder.

- Three folders are generated: `for_redistribution`, `for_redistribution_files_only`, and `for_testing`.

For more information about the files generated in these folders, see “Files Generated After Packaging MATLAB Functions”.

- The log file `PackagingLog.html` contains packaging results.

Create Excel Add-in Using `compiler.build.excelAddIn`

As an alternative to the **Library Compiler** app, you can create an Excel add-in using a programmatic approach. If you have already created an add-in using the **Library Compiler**, see “Install Add-In in Excel” on page 2-10.

1 In MATLAB, locate the MATLAB code that you want to deploy as a standalone application. For this example, compile using the file `mymagic.m` located in `matlabroot\toolbox\matlabxl\examples\xlmagic`.

```
appFile = fullfile(matlabroot, 'toolbox', 'matlabxl', 'examples', 'xlmagic', 'mymagic.m');
```

2 Build the Excel add-in using the `compiler.build.excelAddIn` function. Use name-value arguments to set the library and class names, and enable the generation of Visual Basic files.

```
buildResults = compiler.build.excelAddIn(appFile, ...
    'AddInName', 'xlmagic', ...
    'ClassName', 'xlmagicclass', ...
    'GenerateVisualBasicFile', 'on');
```

You can specify additional options in the `compiler.build` command by using name-value arguments. For details, see `compiler.build.excelAddIn`.

The `compiler.build.Results` object `buildResults` contains information on the build type, generated files, included support packages, and build options.

The function generates the following files within a folder named `mymagicexcelAddIn` in your current working directory:

- `dlldata.c`
- `GettingStarted.html`
- `includedSupportPackages.txt`
- `xlmagic.def`
- `xlmagic.bas`
- `xlmagic.rc`

- xlmagic.xla
- xlmagic_1_0.dll
- xlmagic_dll.cpp
- xlmagic_idl.h
- xlmagic_idl.idl
- xlmagic_idl.tlb
- xlmagic_idl_i.c
- xlmagic_idl_p.c
- xlmagicClass_com.cpp
- xlmagicClass_com.hpp
- mccExcludedFiles.log
- mwcomtypes.h
- mwcomtypes_i.c
- mwcomtypes_p.c
- readme.txt
- requiredMCRProducts.txt
- unresolvedSymbols.txt

Note The generated add-in does not include MATLAB Runtime or an installer. To create an installer using the `buildResults` object, see `compiler.package.installer`.

Install Add-In in Excel

- 1 Open Microsoft Excel.
- 2 Click the **File** tab, click **Options**, and then click the **Add-Ins** category.
- 3 In the **Manage** box, click **Excel Add-ins**, and then click **Go**. The **Add-Ins** dialog box appears.
- 4 Click **Browse** and locate the add-in `xlmagic.xla`.
- 5 You are prompted to copy `xlmagic.xla` to the Addins folder associated with your user name. You can choose to copy the add-in or run it directly. For this example, select, **YES**. The add-in is copied and added to your workbook.
- 6 Click **OK** to close the **Add-Ins** dialog box

Test Add-In

- 1 Select a grid of 3-by-3 cells in the Excel workbook.
- 2 Enter the following custom function in the formula bar:

```
=mymagic(3)
```

As you type `my` in the formula bar, `mymagic` appears as a custom function in Excel.

- 3 Press **Ctrl+Shift+Enter** on the keyboard.

The selected cells display the following output:

```
8   1   6
3   5   7
4   9   2
```

- 4 For additional examples, open the file `xlmagic.xls` located in `matlabroot\toolbox\matlabxl\examples\xlmagic`. This spreadsheet contains three custom VBA macros that demonstrate various ways of using the compiled MATLAB function.

Distribute Add-In

To distribute your add-in to end users, see “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12.

See Also

`libraryCompiler` | `compiler.build.excelAddIn`

More About

- “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12
- “How Excel Add-In Compilation Works” on page 2-2

Distribute Add-Ins and Integrate into Microsoft Excel

In this section...

“Files for Excel Add-In Deployment” on page 2-12
“Install MATLAB Runtime” on page 2-12
“Register Add-Ins and COM Components” on page 2-13
“Register MATLAB Utility Libraries” on page 2-13
“Install Excel Add-Ins” on page 2-14
“Use MATLAB Functions in Excel Spreadsheet” on page 2-14

To create a Microsoft Excel add-in, see “Create Excel Add-In from MATLAB” on page 2-6.

After you have created your Excel add-in, follow these steps to deploy the add-in on another machine.

- 1 Verify that you have received all the files necessary for deployment.
- 2 Install MATLAB Runtime.
- 3 Register your add-in DLL using the generated installer, the `_install.bat` installation script, or `mwregsvr`.
- 4 Register the utility libraries `mwcomutil.dll` and `mwcommgr.dll` using `mwregsvr`.
- 5 Install the add-in in Excel.
- 6 Call the add-in functions directly in your worksheet.
- 7 (Optional) Create macros using the Function Wizard or custom VBA code.

Files for Excel Add-In Deployment

If you create your Excel add-in using the Library Compiler or create an installer using `compiler.package.installer`, distribute the generated installer to your end user. The installer installs the Excel add-in and MATLAB Runtime and registers the add-in DLL on the target machine. The Library Compiler also generates an installation script named `_install.bat` that registers the add-in DLL. To register the DLL without using the installer or script, see “Register Add-Ins and COM Components” on page 2-13 below.

If you do not create an installer, distribute the files that the Library Compiler generates in the `for_redistribution_files_only` folder. For a list of files generated in each folder, see “Files Generated After Packaging MATLAB Functions”.

Install MATLAB Runtime

MATLAB Runtime contains the libraries needed to use compiled MATLAB code on a target system without a licensed copy of MATLAB. For instructions, see “Install and Configure MATLAB Runtime”.

The MATLAB Runtime installer for Windows automatically sets the system path and registers the MATLAB Runtime DLLs required for Excel add-ins. To perform these steps manually, see “Run Applications Using a Network Installation of MATLAB Runtime”.

Register Add-Ins and COM Components

When you create your COM component, it is registered in either HKEY_LOCAL_MACHINE or HKEY_CURRENT_USER, based on your log-in privileges.

If you find you need to change your run-time permissions due to security standards imposed by Microsoft or your installation, you can do one of the following before deploying your COM component or add-in:

- Log on as **administrator** before running your COM component or add-in
- Run the following `mwregsvr` command prior to running your COM component or add-in, as follows:

```
mwregsvr [/u] [/s] [/useronly] project_name.dll
```

where:

- `/u` allows any user to unregister a COM component or add-in for this server
- `/s` runs this command silently, generating no messages. This is helpful for use in silent installations.
- `/useronly` allows only the currently logged-in user to run the COM component or add-in on this server

Caution If your COM component is registered in the USER hive, it will not be visible to Windows Vista™ or Windows 7 users running as administrator on systems with UAC (**User Access Control**) enabled.

If you register a component to the USER hive under Windows 7 or Windows Vista, your COM component may fail to load when running with elevated (**administrator**) privileges.

If this occurs, do the following to re-register the component to the LOCAL MACHINE hive:

- 1 Unregister the component with this command:

```
mwregsvr /u /useronly my_dll.dll
```

- 2 Reregister the component to the LOCAL MACHINE hive with this command:

```
mwregsvr my_dll.dll
```

Register MATLAB Utility Libraries

To handle data conversion, the VBA code that you generate with MATLAB Compiler references the `mwcomutil.dll` and `mwcommgr.dll` utility libraries. To register these libraries:

- 1 Open a system command prompt
- 2 Navigate to `matlabroot\bin\win64`, where `matlabroot` represents the location of MATLAB or MATLAB Runtime that corresponds to the MATLAB release that you used to compile the Excel add-in.
- 3 Run the following commands:

```
mwregsvr mwcomutil.dll
```

```
mwregsvr mwcommgr.dll
```


Install Excel Add-Ins

Install the add-in in Microsoft Excel by following the steps for your Excel version.

Excel 2010 or Newer

- 1 In Excel, click the **File** tab.
- 2 On the left navigation pane, select **Options**.
- 3 In the Excel Options dialog box, on the left navigation pane, select **Add-ins**.
- 4 In the Manage drop-down list, select **Excel Add-ins**, and click **Go**.
- 5 In the Add-ins dialog box, click **Browse**.
- 6 Browse to and select your add-in. Click **OK**.
- 7 In the Excel Add-ins dialog box, verify that the entry containing your add-in is selected. Click **OK**.

Excel 2007

- 1 Start Microsoft Excel.
- 2 Click the **Office** button
() and select **Excel Options**.
- 3 In the left pane of the Excel Options dialog box, click **Add-ins**.
- 4 In the right pane of the Excel Options dialog box, select **Excel Add-ins** from the **Manage** drop-down list.
- 5 Click **Go**.
- 6 Click **Browse**.
- 7 Browse to and select your add-in. Click **OK**.
- 8 In the Excel Add-ins dialog box, verify that the entry containing your add-in is selected. Click **OK**.

Use MATLAB Functions in Excel Spreadsheet

After you have installed the add-in in Excel, invoke the add-in function directly with a method call in the form of an Excel custom function.

Optionally, use an Excel macro to specify input and output cells, execute multiple functions at a time, or handle multiple outputs. Create a macro using the Function Wizard add-in provided with MATLAB Compiler. For additional functionality, create or modify macros using custom VBA code.

Call Method Directly in Spreadsheet

To run the MATLAB function in the Excel spreadsheet, invoke the function with a method call in the target output cells. For example, if you deployed MATLAB code called `mymagic.m` or a figure called `mymagic.fig`, invoke that code by entering the following function in a cell in the spreadsheet:

```
=mymagic()
```

If your function returns an array, select a range of cells to match the array size.

Tip If the method call does not evaluate immediately, press **Ctrl**, **Shift**, and **Enter** simultaneously.

Create Excel Macros Using Function Wizard

The Function Wizard provides a control panel for creating macros using one or more compiled MATLAB functions. Use the Function Wizard to control the placement of MATLAB input and output data in Excel worksheets.

For more details, see “Install and Use Function Wizard” on page 4-2.

Create Excel Macros Using VBA

Use VBA code to create Excel macros with more functionality than the Function Wizard allows. You can use variables, loops, forms, controls, and other programming techniques to create custom Excel programs.

For an example on using VBA code to create a custom graphical Excel application, see “Implement User Interface Using Visual Basic Form Controls” on page 7-11.

See Also

Related Examples

- “How Excel Add-In Compilation Works” on page 2-2
- “Integrate Components Using VBA” on page 7-2
- “Reference Utility Classes” on page 10-2
- “Errors and Solutions” on page B-2

Customizing a Compiler Project

- “Customize an Application” on page 3-2
- “Manage Support Packages” on page 3-9

Customize an Application

You can customize an application in several ways: customize the installer, manage files in the project, or add a custom installer path using the **Application Compiler** app or the **Library Compiler** app.

Customize the Installer

Change Application Icon

To change the default icon, click the graphic to the left of the **Library name** or **Application name** field to preview the icon.



Click **Select icon**, and locate the graphic file to use as the application icon. Select the **Use mask** option to fill any blank spaces around the icon with white or the **Use border** option to add a border around the icon.

To return to the main window, click **Save and Use**.

Add Library or Application Information

You can provide further information about your application as follows:

- **Library/Application Name:** The name of the installed MATLAB artifacts. For example, if the name is `foo`, the installed executable is `foo.exe`, and the Windows start menu entry is **foo**. The folder created for the application is `InstallRoot/foo`.

The default value is the name of the first function listed in the **Main File(s)** field of the app.

- **Version:** The default value is 1.0.
- **Author name:** Name of the developer.
- **Support email address:** Email address to use for contact information.
- **Company name:** The full installation path for the installed MATLAB artifacts. For example, if the company name is `bar`, the full installation path would be `InstallRoot/bar/ApplicationName`.
- **Summary:** Brief summary describing the application.
- **Description:** Detailed explanation about the application.

All information is optional and, unless otherwise stated, is only displayed on the first page of the installer. On Windows systems, this information is also displayed in the Windows **Add/Remove Programs** control panel.

Library information



[Set as default contact](#)



Change the Splash Screen

The installer splash screen displays after the installer has started. It is displayed along with a status bar while the installer initializes.

You can change the default image by clicking the **Select custom splash screen**. When the file explorer opens, locate and select a new image.

You can drag and drop a custom image onto the default splash screen.

Change the Installation Path

This table lists the default path the installer uses when installing the packaged binaries onto a target system.

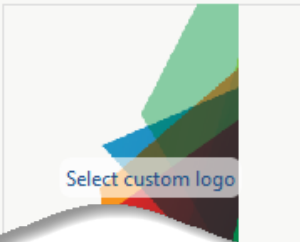
Windows	C:\Program Files\ <i>companyName</i> \ <i>appName</i>
Mac OS X	/Applications/ <i>companyName</i> / <i>appName</i>
Linux®	/usr/ <i>companyName</i> / <i>appName</i>

You can change the default installation path by editing the **Default installation folder** field under **Additional installer options**.

Additional installer options

Default installation folder:

Installation notes



A text field specifying the path appended to the root folder is your installation folder. You can pick the root folder for the application installation folder. This table lists the optional custom root folders for each platform:

Windows	C:\Users\ <i>userName</i> \AppData
Linux	/usr/local

Change the Logo

The logo displays after the installer has started. It is displayed on the right side of the installer.

You change the default image in **Additional Installer Options** by clicking **Select custom logo**. When the file explorer opens, locate and select a new image. You can drag and drop a custom image onto the default logo.

Edit the Installation Notes

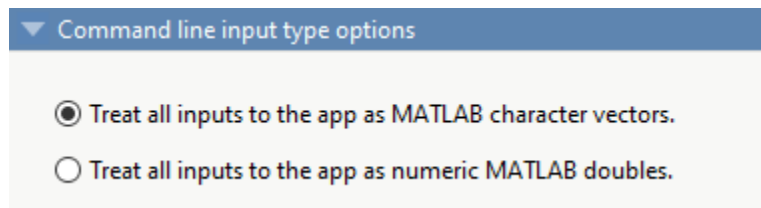
Installation notes are displayed once the installer has successfully installed the packaged files on the target system. You can provide useful information concerning any additional setup that is required to use the installed binaries and instructions for how to run the application.

Determine Data Type of Command-Line Input (For Packaging Standalone Applications Only)

When an executable standalone application is run in the command prompt, the default input type is char. You can keep this default, or choose to interpret all inputs as numeric MATLAB doubles.

To pass inputs to the standalone application as MATLAB character vectors, select **Treat all inputs to the app as MATLAB character vectors**. In this case, you must include code to convert char to a numeric MATLAB type in the MATLAB function to be deployed as a standalone application.

To pass inputs to the standalone application as numeric MATLAB variables, select **Treat all inputs to the app as numeric MATLAB doubles**. option in the Application Compiler App. Thus, you do not need to include code to convert char to a numeric MATLAB type. Non numeric inputs to the application may result in an error.



Manage Required Files in Compiler Project

The compiler uses a dependency analysis function to automatically determine what additional MATLAB files are required for the application to package and run. These files are automatically packaged into the generated binary. The compiler does not generate any wrapper code that allows direct access to the functions defined by the required files.

If you are using one of the compiler apps, the required files discovered by the dependency analysis function are listed in the **Files required for your application to run** or **Files required for your library to run** field.

To add files, click the plus button in the field, and select the file from the file explorer. To remove files, select the files, and press the **Delete** key.

Caution Removing files from the list of required files may cause your application to not package or not to run properly when deployed.

Using mcc

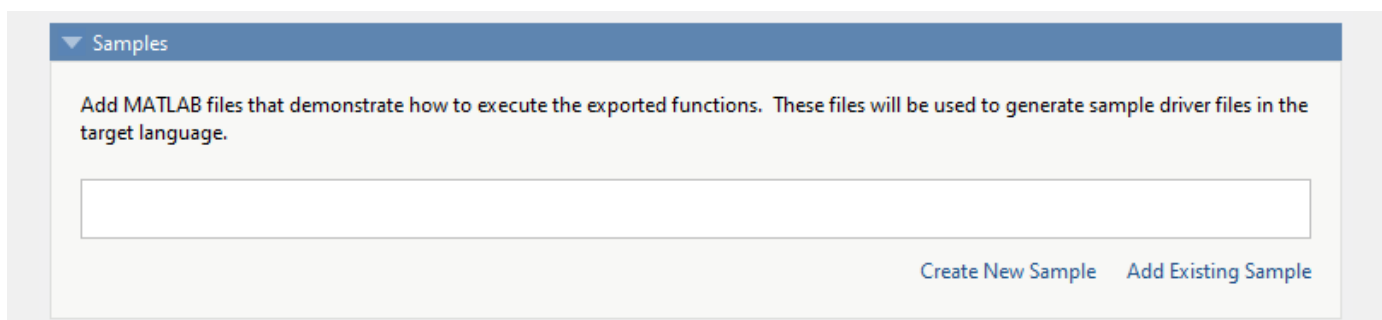
If you are using `mcc` to package your MATLAB code, the compiler does not display a list of required files before running. Instead, it packages all the required files that are discovered by the dependency analysis function and adds them to the generated binary file.

You can add files to the list by passing one or more `-a` arguments to `mcc`. The `-a` arguments add the specified files to the list of files to be added into the generated binary. For example, `-a hello.m` adds the file `hello.m` to the list of required files and `-a ./foo` adds all the files in `foo` and its subfolders to the list of required files.

Sample Driver File Creation

The following target types support sample driver file creation in MATLAB Compiler SDK™:

- C++ shared library
- Java® package
- .NET assembly
- Python® package



The sample driver file creation feature in **Library Compiler** uses MATLAB code to generate sample driver files in the target language. The sample driver files are used to implement the generated shared libraries into an application in the target language. In the app, click **Create New Sample** to automatically generate a new MATLAB script, or click **Add Existing Sample** to upload a MATLAB script that you have already written. After you package your functions, a sample driver file in the target language is generated from your MATLAB script and is saved in `for_redistribution_files_only\samples`. Sample driver files are also included in the installer in `for_redistribution`.

To automatically generate a new MATLAB file, click **Create New Sample**. This opens up a MATLAB file for you to edit. The sample file serves as a starting point, and you can edit it as necessary based on the behavior of your exported functions. The sample MATLAB files must follow these guidelines:

- The sample file code must use only exported functions.
- Each exported function must be in a separate sample file.
- Each call to the same exported function must be a separate sample file.
- The output of the exported function must be an n-dimensional numeric, char, logical, struct, or cell array.
- Data must be saved as a local variable and then passed to the exported function in the sample file code.
- Sample file code should not require user interaction.

Additional considerations specific to the target language are as follows:

- C++ `mwArray` API — `varargin` and `varargout` are not supported.
- .NET — Type-safe API is not supported.
- Python — Cell arrays and char arrays must be of size 1xN and struct arrays must be scalar. There are no restrictions on numeric or logical arrays, other than that they must be rectangular, as in MATLAB.

To upload a MATLAB file that you have already written, click **Add Existing Sample**. The MATLAB code should demonstrate how to execute the exported functions. The required MATLAB code can be only a few lines:

```
input1 = [1 4 7; 2 5 8; 3 6 9];  
input2 = [1 4 7; 2 5 8; 3 6 9];  
addoutput = addmatrix(input1,input2);
```


This code must also follow all the same guidelines outlined for the **Create New Sample** option.

You can also choose not to include a sample driver file at all during the packaging step. If you create your own driver code in the target language, you can later copy and paste it into the appropriate directory once the MATLAB functions are packaged.

Specify Files to Install with Application

The compiler packages files to install along with the ones it generates. By default, the installer includes a readme file with instructions on installing the MATLAB Runtime and configuring it.

These files are listed in the **Files installed for your end user** section of the app.

To add files to the list, click , and select the file from the file explorer.

JAR files are added to the application class path as if you had called `javaaddpath`.

Caution Removing the binary targets from the list results in an installer that does not install the intended functionality.

When installed on a target computer, the files listed in the **Files installed for your end user** are saved in the application folder.

Additional Runtime Settings

Type of Packaged Application	Description	Additional Runtime Settings Options
Standalone Applications	<ul style="list-style-type: none"> • Do not display the Windows Command Shell (console) for execution — If you select this option on a Windows platform, when you double-click the application from the file explorer, the application window opens without a command prompt. • Create log file — Generate a MATLAB log file for the application. The packaged application can't create a log file if installed in the C : folder on Windows because the application does not have write permission in that folder. 	<div data-bbox="862 499 1479 548" style="background-color: #4a7ebb; color: white; padding: 2px;"> ▼ Additional runtime settings </div> <div data-bbox="862 548 1479 751"> <p><input checked="" type="checkbox"/> Do not display the Windows Command Shell (console) for execution</p> <p><input type="checkbox"/> Create log file</p> </div>

Type of Packaged Application	Description	Additional Runtime Settings Options
Excel Add-Ins	<ul style="list-style-type: none"> • Register the component for the current user (Recommended for non-admin users) — This option enables registering the component for the current user account. It is provided for users without admin rights. • Create log file — Generate a MATLAB log file for the application. The packaged application can't create a log file if installed in the C : folder on Windows because the application does not have write permission in that folder. 	<div style="background-color: #e0e0e0; padding: 5px;"> <p>▼ Additional runtime settings</p> <p><input type="checkbox"/> Register the component for the current user (Recommended for non-admin users)</p> <p><input type="checkbox"/> Create log file</p> </div>

See Also

applicationCompiler | libraryCompiler

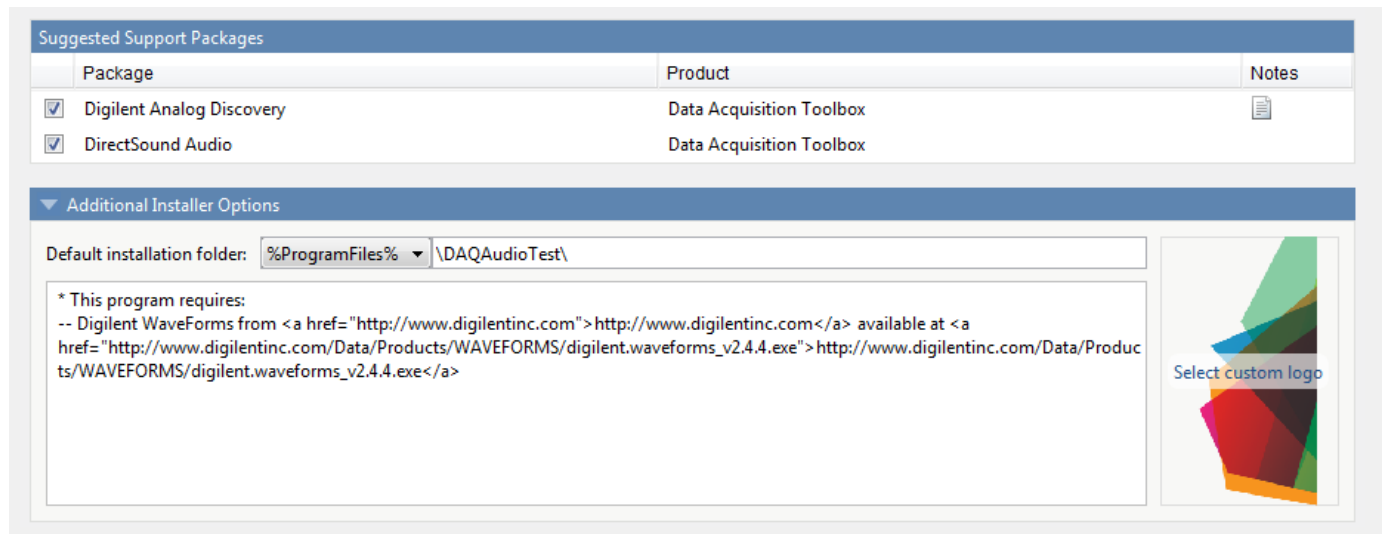
More About

- “Create Standalone Application from MATLAB”
- “Create Excel Add-In from MATLAB” on page 2-6
- “Generate a C++ mxArray API Shared Library and Build a C++ Application” (MATLAB Compiler SDK)
- “Generate a C++ MATLAB Data API Shared Library and Build a C++ Application” (MATLAB Compiler SDK)

Manage Support Packages

Using a Compiler App

Many MATLAB toolboxes use support packages to interact with hardware or to provide additional processing capabilities. If your MATLAB code uses a toolbox with an installed support package, the app displays a **Suggested Support Packages** section.



The list displays all installed support packages that your MATLAB code requires. The list is determined using these criteria:

- the support package is installed
- your code has a direct dependency on the support package
- your code is dependent on the base product of the support package
- your code is dependent on at least one of the files listed as a dependency in the `mcc.xml` file of the support package, and the base product of the support package is MATLAB

Deselect support packages that are not required by your application.

Some support packages require third-party drivers that the compiler cannot package. In this case, the compiler adds the information to the installation notes. You can edit installation notes in the **Additional Installer Options** section of the app. To remove the installation note text, deselect the support package with the third-party dependency.

Caution Any text you enter beneath the generated text will be lost if you deselect the support package.

Using the Command Line

Many MATLAB toolboxes use support packages to interact with hardware or to provide additional processing capabilities. If your MATLAB code uses a toolbox with an installed support package, use the `-a` flag with `mcc` command when packaging your MATLAB code to specify supporting files in the

support package folder. For example, if your function uses the OS Generic Video Interface support package, run the following command:

```
mcc -m -v test.m -a C:\MATLAB\SupportPackages\R2016b\toolbox\daq\supportpackages\daqaudio -a 'C:
```

Some support packages require third-party drivers that the compiler cannot package. In this case, you are responsible for downloading and installing the required drivers.

The Function Wizard

- “Install and Use Function Wizard” on page 4-2
- “End-to-End Deployment of MATLAB Function” on page 4-10

Install and Use Function Wizard

The Function Wizard add-in, available with MATLAB Compiler, provides a control panel that you use in Microsoft Excel to create custom Excel macros using one or more MATLAB Compiler Excel add-ins. The generated macro consists of Microsoft Visual Basic for Applications (VBA) code that you can modify for additional customization. To use the wizard, you do not need knowledge of VBA programming.

The Function Wizard enables you to create Excel macros that specify the placement and output of data from compiled MATLAB functions to the worksheets. You pass Excel worksheet values to a compiled MATLAB model, and then return model output to a cell or range of cells in the worksheet. Use the Function Wizard to handle MATLAB functions that have structure array arguments or multiple outputs.

For a complete example on creating an Excel macro using the Function Wizard, see “Create Macro Using Multiple MATLAB Functions” on page 6-3.

Install Function Wizard

You install the Function Wizard in Excel the same way you install MATLAB Compiler generated add-ins. For instructions, see “Install Excel Add-Ins” on page 2-14.

The add-in file for the Function Wizard is located at *matlabroot*\toolbox\matlabxl\matlabxl\win64\FunctionWizard.xlam. For example, if you compiled your add-in using MATLAB R2022a, install the file C:\Program Files\MATLAB\R2022a\toolbox\matlabxl\matlabxl\win64\FunctionWizard.xlam. This file contains a macro that adds the **Function Wizard** add-in button to the Home tab.

Start Function Wizard

Note Before you can use the Function Wizard add-in, you must first register the MATLAB utility libraries. For details, see “Register MATLAB Utility Libraries” on page 2-13.

Click the **Function Wizard** add-in button on the Home tab to start the Function Wizard. When the wizard has initialized, the control panel opens.

Function Wizard Control Panel

Note Closing the Function Wizard control panel does not remove any MATLAB functions or arguments that you add in an Excel session, but closing Excel resets the Function Wizard.

Define Functions to Execute

Add the MATLAB function you want to execute with the Function Wizard.

- 1 In the control panel, click **Add Function** in the **Setup Functions** area. The MATLAB Components dialog box opens.

- 2 In the Available Components area, select the name of your component from the drop-down list.

Note If your component is not listed, make sure you have registered its DLL. For details, see “Register Add-Ins and COM Components” on page 2-13.

- 3 From **Functions for Class *classname***, select the function you want to execute.
- 4 Click **Add Function**. The Function Properties dialog box opens.

Tip The **Function Syntax and Help** area in the Function Properties dialog box displays the first help text line in a MATLAB function. This description can be helpful for end users who are unfamiliar with the MATLAB function.

Define Input Arguments

Note The Function Wizard does not currently support the MATLAB `sparse` or `complex` data types.

From the Function Properties dialog box, define input argument properties for your MATLAB function.

- 1 On the **Input** tab, click **Set Input Data**. The Input Data for *x* dialog box opens, where *x* is the name of the input variable.

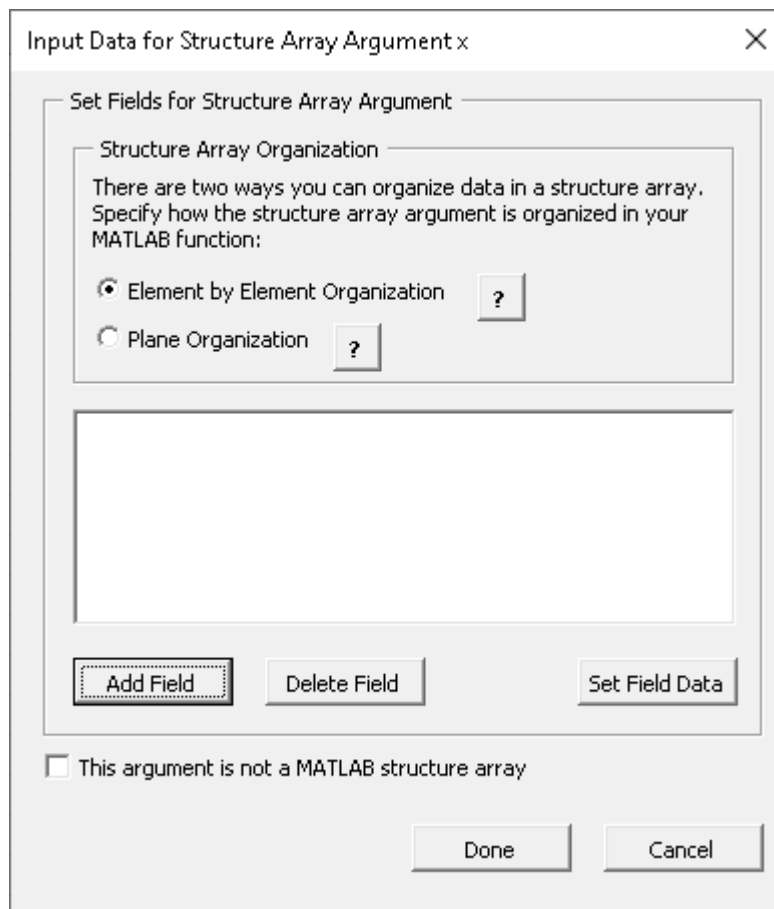
- 2 Select the type of input argument.

- **Range** refers to a range of cells in the worksheet. Click the text box or the cell select button on the right, then choose the cells from your worksheet that contain input data.

To automatically recalculate the spreadsheet data each time it changes, select the **Auto recalculate on change** option.

Caution Avoid selecting ranges using arrow keys. If you must use arrow keys to select ranges, apply the necessary fix from the Microsoft site: <https://mskb.pkisolutions.com/kb/291110>.

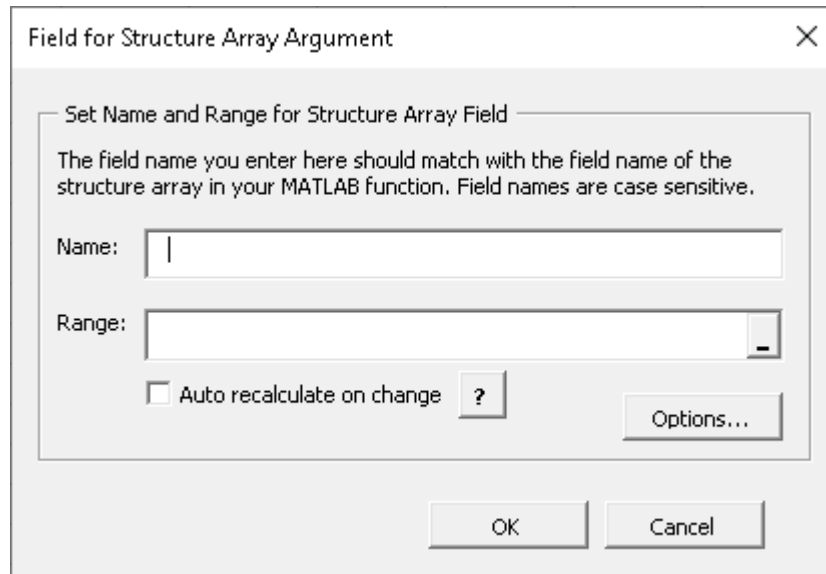
- **Value** refers to a value you specify in the text box. Enter a value to use as the input data and select the data type in the dropdown list.
- If the argument refers to a structure array (struct), select **This is a MATLAB structure array argument** and click **OK**. The Input Data for Structure Array Argument x dialog box opens.



The Function Wizard supports one and two-dimensional structure arrays for both input and output.

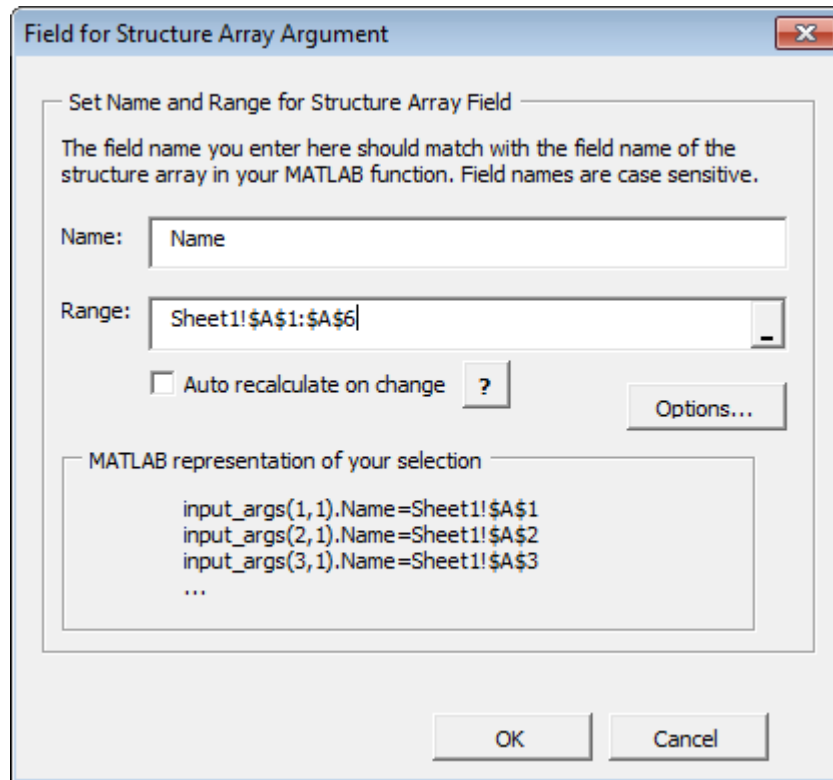
When you deploy a function with struct array arguments, let end users know which arguments are structure arrays and list their field names.

- a In the Structure Array Organization area, select either **Element by Element Organization** or **Plane Organization**. For more information, see “Ways to Organize Data in Structure Arrays”.
- b To add fields for each of your struct array arguments, click **Add Field**. The Field for Structure Array Argument dialog box opens.



The dialog box is titled "Field for Structure Array Argument" and has a close button (X) in the top right corner. Inside the dialog, there is a section titled "Set Name and Range for Structure Array Field". Below this title, there is a text instruction: "The field name you enter here should match with the field name of the structure array in your MATLAB function. Field names are case sensitive." There are two input fields: "Name:" followed by a text box with a vertical cursor, and "Range:" followed by a text box with a dropdown arrow on the right. Below these fields, there is a checkbox labeled "Auto recalculate on change" with a question mark icon to its right. To the right of the checkbox is an "Options..." button. At the bottom of the dialog, there are "OK" and "Cancel" buttons.

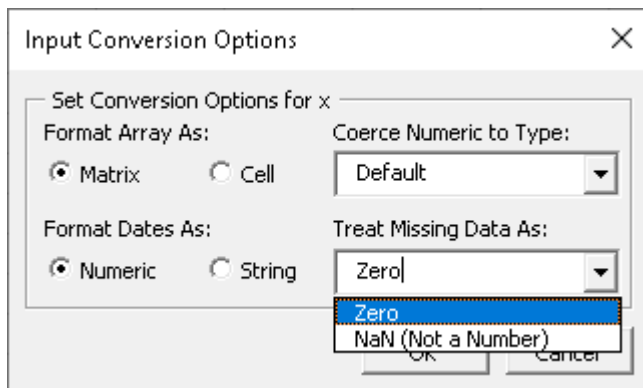
- c In the **Name** field, define the name for the structure array field. The name you specify must exactly match the field name of the structure array in your MATLAB function.
- d In the **Range** field, specify the range of the field for the structure array.



- e Click **OK** to add the field.

Repeat these steps for each field in the structure array.

- 3 To specify how to format dates and handle empty cells for this input data, click **Options** in the Input Data for x dialog box. The Input Conversion Options dialog box opens.



- From the **Coerce Numeric to Type** drop-down list, select a data type to control the conversion of numeric data.
 - From the **Treat Missing Data As** drop-down list, specify either **Zero** or **NaN (Not a Number)**.
- 4 Click **OK** to add the input argument.

Repeat the procedure for each input argument for your function.

Define Output Arguments

In the Function Properties dialog box, define output argument properties for your MATLAB function.

- 1 On the **Output** tab, click **Set Output Data**. The Output Data for *y* dialog box appears, where *y* is the name of the output variable.

Tip You can also specify MATLAB Compiler to automatically resize output data (**Auto Resize**), transpose it (**Transpose**), or output it in date format (**Output as date**).

- 2 In the **Range** field, specify the type of output argument as either a range of cells or a MATLAB structure array.

For details on using structure array arguments, see “Define Input Arguments” on page 4-3.

- 3 To enable Excel to dynamically select the number of output cells, select **Auto Resize** if it is not already selected.
- 4 Click **Done** in the Output Data for *y* dialog box to add the output argument.

Repeat the procedure for each output argument for your MATLAB function.

Note When working with functions that have multiple outputs, define a separate output range for each argument.

Test and Save Macro

Once you are finished adding arguments to your MATLAB function, click **Done** in the Function Properties dialog box. Your function appears in the **Active Functions** list of the control panel in the

Function Wizard. You can edit function arguments at any time by selecting your function in the list and then clicking **Edit/Set Data**.

To test your macro, click **Execute** in the Execute Functions area. Cell ranges defined as output arguments are automatically populated with your function output on the current Excel sheet.

To save your macro:

- 1 In the **Create Macros** area of the control panel, enter a name for your macro in the **Macro Name** field.
- 2 From the **Store Macro In** drop-down list, select the workbook to store the macro.
- 3 In the **Description** field, enter a brief description of the macro functionality.
- 4 Click **Create Macro**.

A macro is created and saved in the target Excel workbook.

Execute Macro in Excel

Run the macro in Microsoft Excel.

Tip You may need to enable the proper security settings before running macros in Microsoft Excel. For information about macro permissions and related error messages, see “Errors and Solutions” on page B-2.

- 1 In Microsoft Excel, click **View > Macros > View Macros**.
- 2 Select the macro from the **Macro name** drop-down list.
- 3 Click **Run**. Cell ranges defined as output arguments are automatically populated with your function output.

Access Microsoft Visual Basic Code (Optional)

To access or modify the Visual Basic code in your macro:

- 1 From the Excel **Developer** tab, click **Visual Basic**, or press **ALT+F11** to open the **Visual Basic Editor**. In older versions of Excel, it may be located under **Tools > Macro > Visual Basic Editor**.
- 2 In the **Project - VBAProject** window, double-click to expand **VBAProject (Book1)**.
- 3 Expand the **Modules** folder and double-click the **Matlab Macros** module.

The Visual Basic Code window opens with the code for this project.

Map Macro to Button (Optional)

To create a form control button that runs the macro when you click the button:

- 1 From the Excel **Developer** tab, click **Insert**.
- 2 From the **Form Controls** menu, select the **Button (Form Control)** icon.

Tip To see the various control labels, point your mouse over the Form Controls menu.

- 3 In the Assign Macros dialog box, select the macro you want to assign the button to and click **OK**.

See Also

Related Examples

- “Create Macro Using Multiple MATLAB Functions” on page 6-3
- “Create Macros with Graphical Functions” on page 6-7

End-to-End Deployment of MATLAB Function

In this section...

“mymagic Testing” on page 4-10

“Function Wizard Start-Up” on page 4-11

“Workflow Selection for Prototyping and Debugging MATLAB Functions” on page 4-11

“New MATLAB Function Definition” on page 4-12

“MATLAB Function Prototyping and Debugging” on page 4-16

“Function Execution from MATLAB” on page 4-17

“Microsoft Excel Add-In and Macro Creation Using the Function Wizard” on page 4-17

“Function Execution from the Deployed Component” on page 4-19

“Microsoft Excel Add-In and Macro Packaging using the Function Wizard” on page 4-19

Warning The option to build and package MATLAB code from within the Function Wizard for Excel add-ins has been removed in R2022a. To create an Excel add-in, see “Create Excel Add-In from MATLAB” on page 2-6.

Not recommended starting in R2020a

If you are still in the process of developing a MATLAB function that is not yet ready to be deployed, you may find this example to be an appropriate introduction to using MATLAB Compiler for Excel add-ins.

Developing your function in an interactive environment ensures that it works in an expected manner, prior to deployment to larger-scale applications. Usually, these applications are programmed by the Excel Developer using an enterprise language like Microsoft Visual Basic.

Similar to the Magic Square example, the Prototyping and Debugging example develops a function named `mymagic`, which wraps a MATLAB function, `magic`, which computes a magic square, a function with a single multidimensional matrix output.

If your MATLAB function is ready to be deployed on page 5-9 and you have already built your add-in and COM component with the Deployment Tool on page 6-2, see “Install and Use Function Wizard” on page 4-2.

mymagic Testing

In this example, you test a MATLAB file (`mymagic.m`) containing the predefined MATLAB function `magic`. You test to have a baseline to compare to the results of the function when it is ready to deploy.

- 1 In MATLAB, examine `mymagic.m`.

```
function y = mymagic(x)
%MYMAGIC Magic square of size x.
% Y = MYMAGIC(X) returns a magic square of size x.
% This file is used as an example for the MATLAB Compiler product.
% Copyright 2001-2012 The MathWorks, Inc.
```



```
y = magic(x)
```

- At the MATLAB command prompt, enter `mymagic(5)`. View the resulting output, which appears as follows:

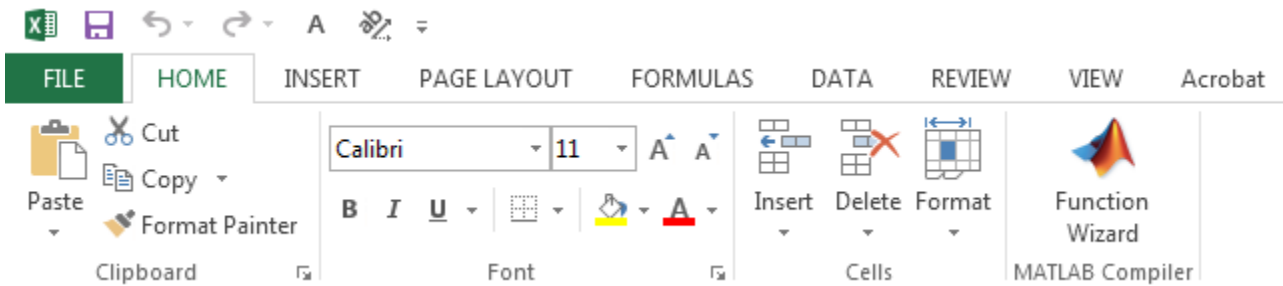
```
17 24  1  8 15
23  5  7 14 16
 4  6 13 20 22
10 12 19 21  3
11 18 25  2  9
```

Function Wizard Start-Up

Start the Function Wizard in one of the following ways. When the wizard has initialized, the Function Wizard Start Page dialog box displays.

Using Excel 2007 or newer versions of Excel

In Microsoft Excel, on the Microsoft Office ribbon, on the **Home** tab, select **Function Wizard**.



The Home Tab of the Microsoft Office Ribbon with Function Wizard Installed

You can also access Function Wizard from the File tab.

- Select **File > Options > Add-Ins** from the Excel main menu.
- Select **Function Wizard**.

Workflow Selection for Prototyping and Debugging MATLAB Functions

- The Function Wizard Control Panel displays with the **Add Function** button enabled.

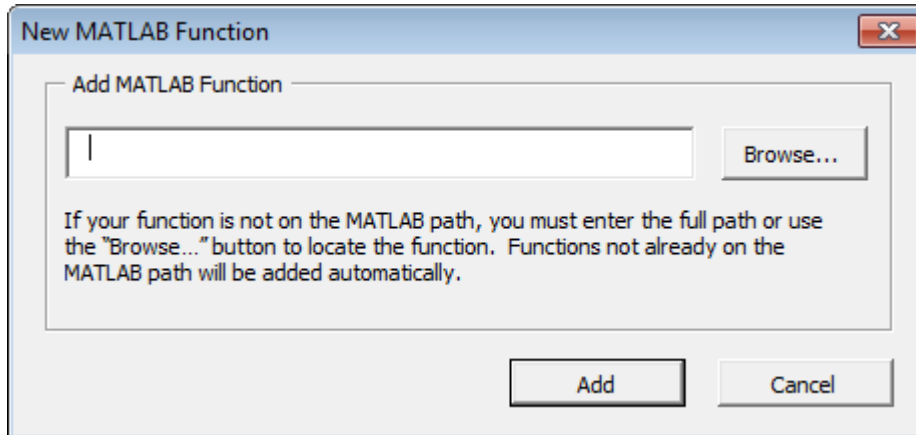
About Project Files

Keep in mind the following information about project files when working with the Function Wizard:

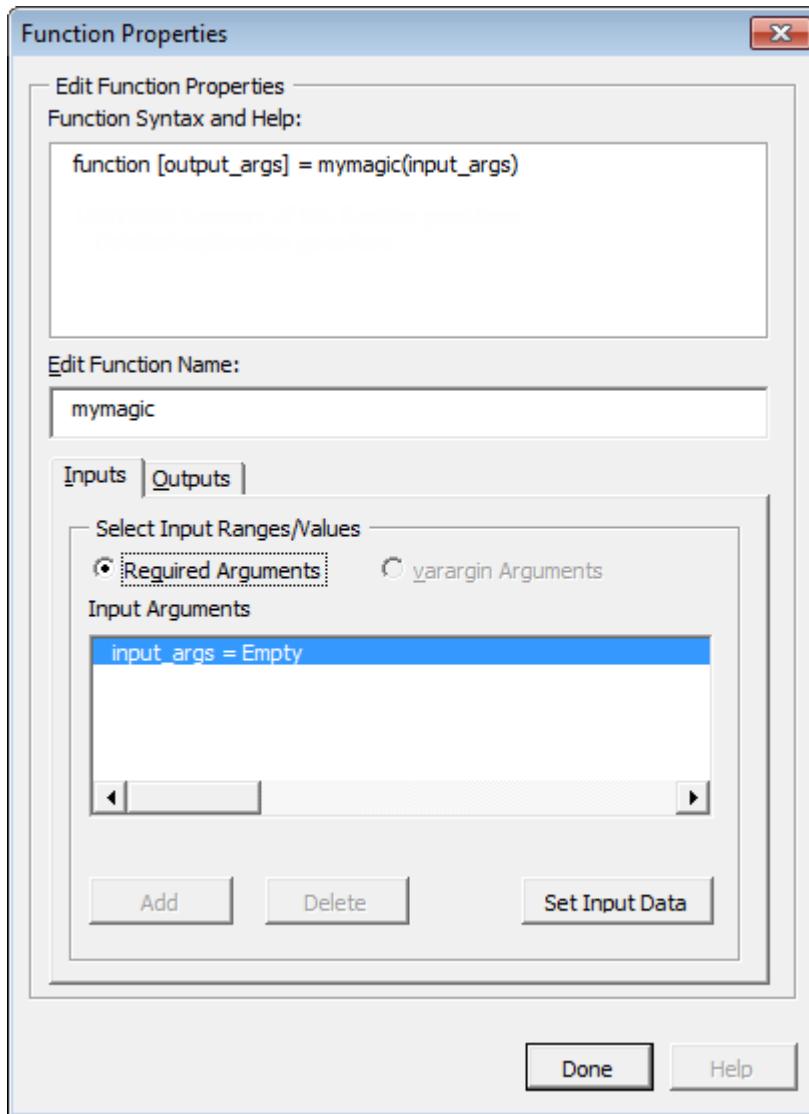
- The project files created by the Function Wizard are the same project files created and used by the Deployment Tool (`deploytool`).
- The Function Wizard prompts you to specify a location for your project files when you open your first new project. Project files are auto-saved to this location and may be opened in the future through either the Deployment Tool or the Function Wizard.
- If you previously built a component using the Function Wizard, the wizard will prompt you to load it.

New MATLAB Function Definition

- 1 Add the function you want to deploy to the Function Wizard. Click **Add** in the Set Up Functions area of the Function Wizard Control Panel. The New MATLAB Function dialog box appears.

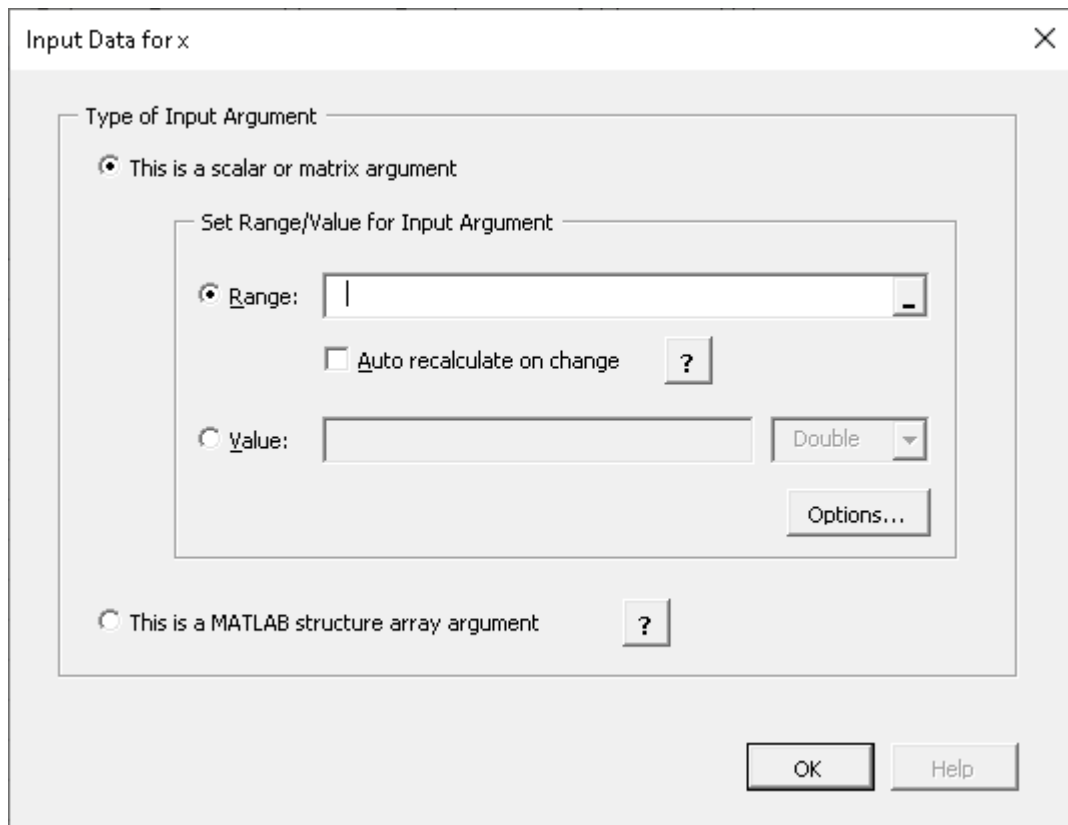


- 2 Browse to locate your MATLAB function. Select the function and click **Open**.
- 3 In the New MATLAB Function dialog box, click **Add**. The Function Properties dialog box appears.



Tip The **Function Syntax and Help** area, in the Function Properties dialog box, displays the first help text line (sometimes called the H1 line) in a MATLAB function. Displaying these comments in the Function Properties dialog box can be helpful when deploying new or unfamiliar MATLAB functions to end-users.

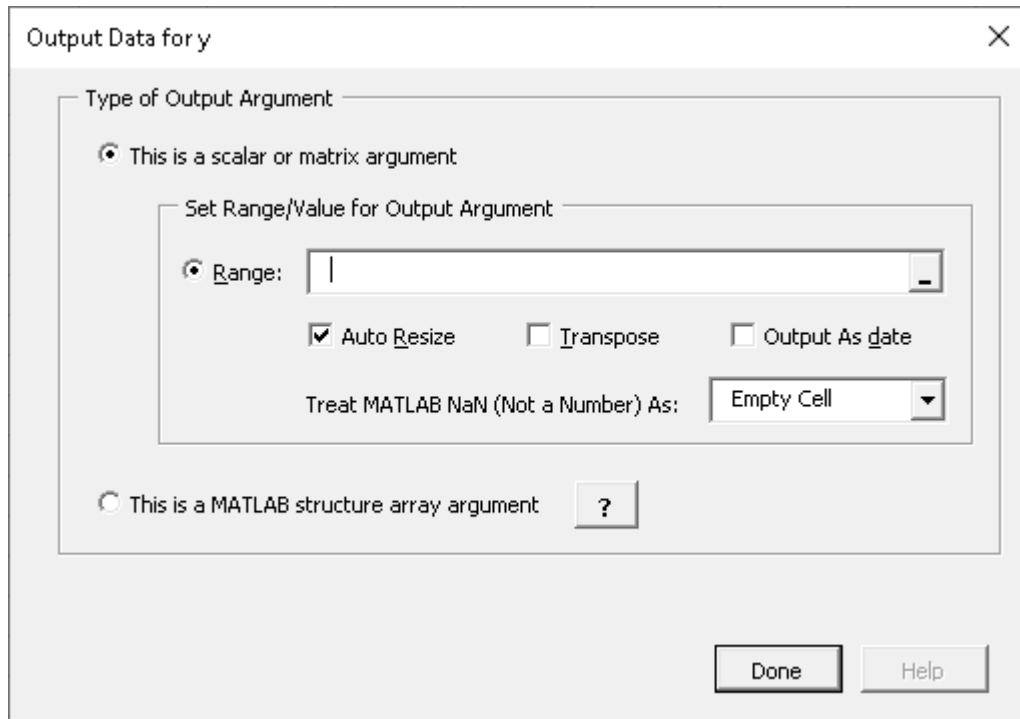
- 4 Define input argument properties as follows.
 - a On the **Input** tab, click **Set Input Data**. The Input Data for x dialog box appears.



- b** Specify a **Range** or **Value** by selecting the appropriate option and entering the value.

Caution Avoid selecting ranges using arrow keys. If you must use arrow keys to select ranges, apply the necessary fix from the Microsoft site: <https://mskb.pkisolutions.com/kb/291110>.

- c** Click **Done**.
- 5** Define output argument properties as follows.
- a** On the **Output** tab, click **Set Output Data**. The Output Data for *y* dialog box appears, where *x* is the name of the output variable you are defining properties of.

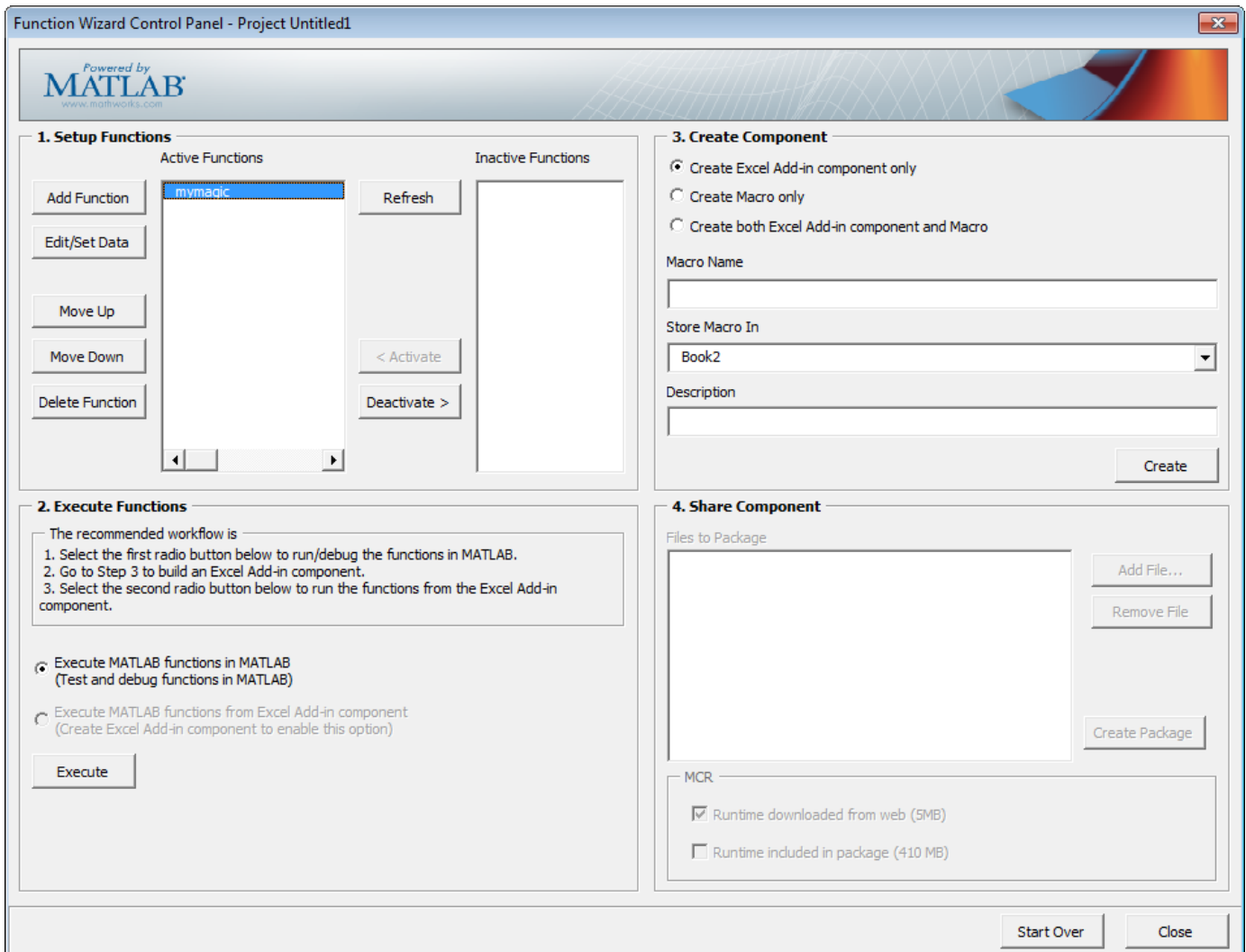


Tip You can also specify MATLAB Compiler to **Auto Resize**, **Transpose** or output your data in date format (**Output as date**). To do so, select the appropriate option in the Argument Properties For *y* dialog box.

- b** Specify a **Range**. Alternately, select a range of cells on your Excel sheet; the range will be entered for you in the **Range** field.

Caution Avoid selecting ranges using arrow keys. If you must use arrow keys to select ranges, apply the necessary fix from the Microsoft site: <https://mskb.pkisolutions.com/kb/291110>.

- c** Select **Auto Resize** if it is not already selected.
- d** Click **Done** in the Argument Properties For *y* dialog box.
- e** Click **Done** in the Function Properties dialog box. `mymagic` now appears in the **Active Functions** list of the Function Wizard Control Panel.



MATLAB Function Prototyping and Debugging

Use the Function Wizard to interactively prototype and debug a MATLAB function.

Since `mymagic` calls the prewritten MATLAB `magic` function directly, it does not provide an illustrative example of how to use the prototyping and debugging feature of MATLAB Compiler.

Following is an example of how you might use this feature with `myprimes`, a function containing multiple lines of code.

Prototyping and Debugging with `myprimes`

For example, say you are in the process of prototyping code that uses the equation $P = \text{myprimes}(n)$. This equation returns a row vector of prime numbers less than or equal to n (a prime number has no factors other than 1 and the number itself).

Your code uses $P = \text{myprimes}(n)$ as follows:

```

function [p] = myprimes(n)

if length(n)~=1, error('N must be a scalar'); end
if n < 2, p = zeros(1,0); return, end
p = 1:2:n;
q = length(p);
p(1) = 2;
for k = 3:2:sqrt(n)

    if p((k+1)/2)
        p(((k*k+1)/2):k:q) = 0;
    end

end

p = (p(p>0));

```

In designing your code, you want to handle various use cases. For example, you want to experiment with scenarios that may assign a column vector value to the output variable `p` (`myprimes` only returns a row vector, as stated previously). You follow this general workflow:

- 1 Set a breakpoint in `myprimes` at the first `if` statement, using the GUI or `dbstop`, for instance.
- 2 On the Function Wizard Control Panel, in the Execute Functions area, click **Execute**. Execution will stop at the previously set breakpoint. Note the value of `p`. Step-through and debug your code as you normally would using the MATLAB Editor.

For more information about debugging MATLAB code, see “Debug MATLAB Code Files”.

Function Execution from MATLAB

Test your deployable MATLAB function by executing it in MATLAB:

- 1 From the Function Wizard Control Panel, in the Execute Functions area, select **Execute MATLAB Functions in MATLAB**.
- 2 Click **Execute**. In Excel, the Magic Square function executes, producing results similar to the following.

A	B	C	D	E
17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

Microsoft Excel Add-In and Macro Creation Using the Function Wizard

The Function Wizard can automatically create a deployable Microsoft Excel add-in and macro. To create your add-in in this manner, use one of the following procedures.

Creating an Add-In and Associated Excel Macro

To create both a deployable add-in and an associated Excel macro:

- 1 In the Function Wizard Control Panel dialog box, in the Create Component area, select **Create Both Excel Add-in Component and Excel Macro**.
- 2 Enter `mymagic` in the **Macro Name** field.
- 3 Select the location of where to store the macro, using the **Store Macro In** drop-down box.
- 4 Enter a brief description of the macro's functionality in the **Description** field.
- 5 Click **Create** to build both the add-in (as well as the underlying COM component) and the associated macro. The Deployment Tool Build dialog box appears, indicating the status of the add-in and COM component compilation (build).

```

C:\USERS\XLIU\APPDATA\LOCAL\TEMP\MBUILD~1\tempLib.def
--> mt.exe -outputresource:"S:\ADEPLO~1.15\MATLAB\TESTMY~1\SRC\testmymagic_1_0.dll";2
-manifest "S:\ADEPLO~1.15\MATLAB\TESTMY~1\SRC\testmymagic_1_0.msvc.manifest"
Microsoft (R) Manifest Tool version 5.2.3790.2075
Copyright (c) Microsoft Corporation 2005.
All rights reserved.
--> del "S:\ADEPLO~1.15\MATLAB\TESTMY~1\SRC\testmymagic_1_0.msvc.manifest"
--> S:\ADEPLO~1.15\matlab\runtime\win32\mmregsvr.exe
S:\Adeploy.10.15\matlab\testmymagic\src\testmymagic_1_0.dll
DllRegisterServer in S:\Adeploy.10.15\matlab\testmymagic\src\testmymagic_1_0.dll
succeeded
DEMO Compiler license.
The generated application will expire 30 days from today,
on Thu Nov 18 09:59:49 2010.
copy 'S:\Adeploy.10.15\matlab\testmymagic\src\readme.txt'
'S:\Adeploy.10.15\matlab\testmymagic\distrib\readme.txt'
copy 'S:\Adeploy.10.15\matlab\testmymagic\src\testmymagic_1_0.dll'
'S:\Adeploy.10.15\matlab\testmymagic\distrib\testmymagic_1_0.dll'
copy 'S:\Adeploy.10.15\matlab\testmymagic\src\testmymagic.xla'
'S:\Adeploy.10.15\matlab\testmymagic\distrib\testmymagic.xla'
copy 'S:\Adeploy.10.15\matlab\testmymagic\src\testmymagic.bas'

```

The Build Dialog

Creating a COM Component or a Macro Only Without Creating an Add-In

To create either a COM component or a macro without also creating the Excel add-in, do the following

- 1 In the Function Wizard Control Panel dialog box, in the Create Component area, select either **MATLAB Excel Add-in Component Only** or **Create Excel Macro Only**.
- 2 Enter `mymagic` in the **Macro Name** field.
- 3 Select the location of where to store the macro, using the **Store Macro In** drop-down box.
- 4 Enter a brief description of the macro's functionality in the **Description** field.
- 5 Click **Create**.

Function Execution from the Deployed Component

Execute your function as you did similarly in “Function Execution from MATLAB” on page 4-17, but this time execute it from the deployed component to ensure it matches your previous output.

- 1 From the Function Wizard Control Panel, in the Execute Functions area, select **Execute MATLAB Functions from Deployed Component**.
- 2 Click **Execute**. In Excel, the Magic Square function executes, producing results similar to the following.

A	B	C	D	E
17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

Microsoft Excel Add-In and Macro Packaging using the Function Wizard

The Function Wizard can automatically package a deployable Microsoft Excel add-in and macro for sharing. To package your add-in in this manner, use one of the following procedures.

- 1 After successfully building your component and add-in on page 4-17, in the Share Component area of the Function Wizard Control Panel dialog box, review the files listed in the **Files to include in packaging** field. **Add Files** or **Remove Files** to and from the package by clicking the appropriate buttons.
- 2 To add access to the MATLAB Runtime installer to your package, select one of the options in the MATLAB Runtime area. For information about the MATLAB Runtime and the MATLAB Runtime installer, see “Install and Configure MATLAB Runtime”.
- 3 When you are ready to create your package, click **Create Package**.

MATLAB Code Deployment

- “How Does MATLAB Deploy Functions?” on page 5-2
- “Dependency Analysis Using MATLAB Compiler” on page 5-3
- “MEX-Files, DLLs, or Shared Libraries” on page 5-5
- “Deployable Archive” on page 5-6
- “Write Deployable MATLAB Code” on page 5-9
- “Calling Shared Libraries in Deployed Applications” on page 5-12
- “MATLAB Data Files in Compiled Applications” on page 5-13

How Does MATLAB Deploy Functions?

To deploy MATLAB functions, the compiler performs these tasks:

- 1** Analyzes files for dependencies using a dependency analysis function. Dependencies are files included in the generated package and originate from functions called by the file. Dependencies are affected by:
 - File type — MATLAB, Java, MEX, and so on.
 - File location — MATLAB, MATLAB toolbox, user code, and so on.

For more information about dependency analysis, see “Dependency Analysis Using MATLAB Compiler” on page 5-3.

- 2** Validates MEX-files. In particular, `mexFunction` entry points are verified.

For more details about MEX-file processing, see “MEX-Files, DLLs, or Shared Libraries” on page 5-5.

- 3** Creates a deployable archive from the input files and their dependencies.

For more details about deployable archives, see “Deployable Archive” on page 5-6.

- 4** Generates target-specific wrapper code.
- 5** Generates target-specific binary package.

For library targets such as C++ shared libraries, Java packages, or .NET assemblies, the compiler invokes the required third-party compiler.

Dependency Analysis Using MATLAB Compiler

In this section...

“Function Dependency” on page 5-3
 “Data File Dependency” on page 5-3
 “Exclude Files From Package” on page 5-4

MATLAB Compiler uses a dependency analysis function to determine the list of necessary files to include in the generated package. Sometimes, this process generates a large list of files, particularly when MATLAB object classes exist in the compilation and the dependency analyzer cannot resolve overloaded methods at package time. Dependency analysis also processes `include/exclude` files on each pass.

Tip To improve package time performance and lessen application size, prune the path with the `mcc` command's `-N` and `-p` flags. You can also specify **Files required for your application to run** in the compiler app or use the `AdditionalFiles` option in a `compiler.build` function.

Function Dependency

The dependency analyzer searches for executable content such as:

- MATLAB files
- P-files

Note If the MATLAB file corresponding to the p-file is not available, the dependency analysis cannot determine the p-file's dependencies.

- `.fig` files
- MEX-files

Data File Dependency

In addition to executable content listed above, MATLAB Compiler can detect and automatically include files that your MATLAB functions access by calling any of these functions: `audioinfo`, `audioread`, `csvread`, `daqread`, `dlmread`, `fileread`, `fopen`, `imfinfo`, `importdata`, `imread`, `load`, `matfile`, `mmfileinfo`, `open`, `readtable`, `type`, `VideoReader`, `xlsfinfo`, `xlsread`, `xmlread`, and `xslt`.

To ensure that a specific file is included, specify the full path to the file as a character array in the function.

```
fileread('D:\Work\MATLAB\Project\myfile.ext')
```

The compiler app automatically adds these data files to the **Files required for your application to run** area.

Exclude Files From Package

To ignore data files during dependency analysis, use one or more of the following options. For examples on how to use these options together, see `%#exclude`.

- Use the `%#exclude` pragma in your MATLAB code to ignore a file or function during dependency analysis.
- Use the `-X` flag in your `mcc` command to ignore all data files detected during dependency analysis.
- Use the `AutoDetectDataFiles` option in a `compiler.build` function to control whether data files are automatically included in the package. Setting this to `false`/`'off'`/`0` is equivalent to using `-X`.

See Also

`mcc` | `applicationCompiler` | `compiler.build.standaloneApplication`

More About

- [Application Compiler](#)

MEX-Files, DLLs, or Shared Libraries

When you compile MATLAB functions containing MEX-files, ensure that the dependency analyzer can find them. Doing so allows you to avoid many common compilation problems. In particular, note that:

- Since the dependency analyzer cannot examine MEX-files, DLLs, or shared libraries to determine their dependencies, explicitly include all executable files these files require. To do so, use either the `mcc -a` option or the **Files required for your application to run** field in the compiler app.
- If you have any doubts that the dependency analyzer can find a MATLAB function called by a MEX-file, DLL, or shared library, then manually include that function. To do so, use either the `mcc -a` option or the **Files required for your application to run** field in the compiler app.
- Not all functions are compatible with the compiler. Check the file `mccExcludedFiles.log` after your build completes. This file lists all functions called from your application that you cannot deploy.

Deployable Archive

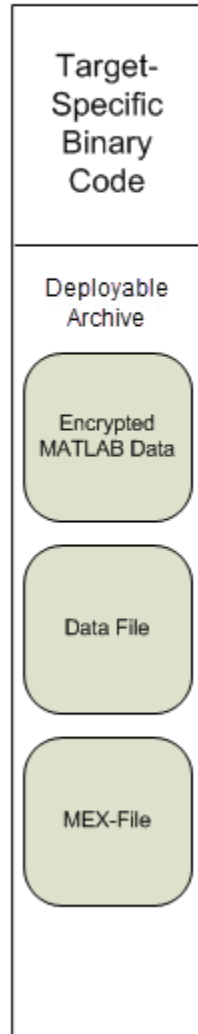
Each application or shared library you produce using the compiler has an embedded deployable archive. The archive contains all the MATLAB based content (MATLAB files, MEX-files, and so on). All MATLAB files in the deployable archive are encrypted using the Advanced Encryption Standard (AES) cryptosystem.

If you choose to extract the deployable archive as a separate file, the files remain encrypted. For more information on how to extract the deployable archive refer to the references in the following table.

Information on Deployable Archive Embedding/Extraction and Component Cache

Product	Refer to
MATLAB Compiler SDK C/C++ integration	"MATLAB Runtime Component Cache and Deployable Archive Embedding" (MATLAB Compiler SDK)
MATLAB Compiler SDK .NET integration	"MATLAB Runtime Component Cache and Deployable Archive Embedding" (MATLAB Compiler SDK)
MATLAB Compiler SDK Java integration	"Define Embedding and Extraction Options for Deployable Java Archive" (MATLAB Compiler SDK)
MATLAB Compiler Excel integration	"MATLAB Runtime Component Cache and Deployable Archive Embedding" on page 8-8

Generated Component (EXE, DLL, SO, etc)



Additional Details

Multiple deployable archives, such as those generated with COM components, .NET assemblies, or Excel add-ins, can coexist in the same user application. You cannot, however, mix and match the MATLAB files they contain. You cannot combine encrypted and compressed MATLAB files from multiple deployable archives into another deployable archive and distribute them.

All the MATLAB files from a given deployable archive associate with a unique cryptographic key. MATLAB files with different keys, placed in the same deployable archive, do not execute. If you want to generate another application with a different mix of MATLAB files, recompile these MATLAB files into a new deployable archive.

The compiler deletes the deployable archive and generated binary following a failed compilation, but only if these files did not exist before compilation initiates. Run `help mcc -K` for more information.

Caution Release Engineers and Software Configuration Managers: Do not use build procedures or processes that strip shared libraries on deployable archives. If you do, you can possibly strip the deployable archive from the binary, resulting in run-time errors for the driver application.

Write Deployable MATLAB Code

In this section...

“Packaged Applications Do Not Process MATLAB Files at Run Time” on page 5-9

“Do Not Rely on Changing Directory or Path to Control the Execution of MATLAB Files” on page 5-10

“Use isdeployed Functions To Execute Deployment-Specific Code Paths” on page 5-10

“Gradually Refactor Applications That Depend on Noncompilable Functions” on page 5-10

“Do Not Create or Use Nonconstant Static State Variables” on page 5-10

“Get Proper Licenses for Toolbox Functionality You Want to Deploy” on page 5-11

Packaged Applications Do Not Process MATLAB Files at Run Time

The compiler secures your code against unauthorized changes. Deployable MATLAB files are suspended or frozen at the time of compilation. This does not mean that you cannot deploy a flexible application—it means that *you must design your application with flexibility in mind*. If you want the end user to be able to choose between two different methods, for example, both methods must be available in the deployable archive.

MATLAB Runtime only works on MATLAB code that was encrypted when the deployable archive was built. Any function or process that dynamically generates new MATLAB code will not work against MATLAB Runtime.

Some MATLAB toolboxes, such as the Deep Learning Toolbox™ product, generate MATLAB code dynamically. Because MATLAB Runtime only executes encrypted MATLAB files, and the Deep Learning Toolbox generates unencrypted MATLAB files, some functions in the Deep Learning Toolbox cannot be deployed.

Similarly, functions that need to examine the contents of a MATLAB function file cannot be deployed. HELP, for example, is dynamic and not available in deployed mode. You can use LOADLIBRARY in deployed mode if you provide it with a MATLAB function prototype.

Instead of compiling the function that generates the MATLAB code and attempting to deploy it, perform the following tasks:

- 1 Run the code once in MATLAB to obtain your generated function.
- 2 Package the MATLAB code, including the generated function.

Tip Another alternative to using EVAL or FEVAL is using anonymous function handles.

If you require the ability to create MATLAB code for dynamic run-time processing, your end users must have an installed copy of MATLAB.

Do Not Rely on Changing Directory or Path to Control the Execution of MATLAB Files

In general, good programming practices advise against redirecting a program search path dynamically within the code. Many developers are prone to this behavior since it mimics the actions they usually perform on the command line. However, this can lead to problems when deploying code.

For example, in a deployed application, the MATLAB and Java paths are fixed and cannot change. Therefore, any attempt to change these paths (using the `cd` command or the `addpath` command) fails.

If you find you cannot avoid placing `addpath` calls in your MATLAB code, use `ismcc` and `isdeployed`. See “Use `isdeployed` Functions To Execute Deployment-Specific Code Paths” on page 5-10 for details.

Use `isdeployed` Functions To Execute Deployment-Specific Code Paths

The `isdeployed` function allows you to specify which portion of your MATLAB code is deployable, and which is not. Such specification minimizes your compilation errors and helps create more efficient, maintainable code.

For example, you find it unavoidable to use `addpath` when writing your `startup.m`. Using `ismcc` and `isdeployed`, you specify when and what is packaged and executed.

```
if ~(ismcc || isdeployed)
    addpath(mypath);
end
```

Gradually Refactor Applications That Depend on Noncompilable Functions

Over time, refactor, streamline, and modularize MATLAB code containing non-compilable or non-deployable functions that use `isdeployed`. Your eventual goal is “graceful degradation” of non-deployable code. In other words, the code must present the end user with as few obstacles to deployment as possible until it is practically eliminated.

Partition your code into design-time and run-time code sections:

- Design-time code is code that is currently evolving. Almost all code goes through a phase of perpetual rewriting, debugging, and optimization. In some toolboxes, such as the Deep Learning Toolbox product, the code goes through a period of self-training as it reacts to various data permutations and patterns. Such code is almost never designed to be deployed.
- Run-time code, on the other hand, has solidified or become stable—it is in a finished state and is ready to be deployed by the end user.

Consider creating a separate directory for code that is not meant to be deployed or for code that calls undeployable code.

Do Not Create or Use Nonconstant Static State Variables

Avoid using the following:

- Global variables in MATLAB code
- Static variables in MEX-files
- Static variables in Java code

The state of these variables is persistent and shared with everything in the process.

When deploying applications, using persistent variables can cause problems because the MATLAB Runtime process runs in a single thread. You cannot load more than one of these non-constant, static variables into the same process. In addition, these static variables do not work well in multithreaded applications.

When programming against packaged MATLAB code, you should be aware that an instance of MATLAB Runtime is created for each instance of a new class. If the same class is instantiated again using a different variable name, it is attached to the MATLAB Runtime instance created by the previous instance of the same class. In short, if an assembly contains n unique classes, there will be maximum of n instances of MATLAB Runtime created, each corresponding to one or more instances of one of the classes.

If you must use static variables, bind them to instances. For example, defining instance variables in a Java class is preferable to defining the variable as `static`.

Get Proper Licenses for Toolbox Functionality You Want to Deploy

You must have a valid MathWorks® license for toolboxes you use to create deployable MATLAB code.

See Also

`isdeployed` | `ismcc`

More About

- MATLAB Compiler support for MATLAB and toolboxes

Calling Shared Libraries in Deployed Applications

The `loadlibrary` function in MATLAB allows you to load shared library into MATLAB.

Loading libraries using header files is not supported in compiled applications. Therefore, to create an application that uses the `loadlibrary` function with a header file, follow these steps:

- 1 Create a prototype MATLAB file. Suppose that you call `loadlibrary` with the following syntax.

```
loadlibrary(library, header)
```

Run the following command in MATLAB only once to create the prototype file:

```
loadlibrary(library, header, 'mfilename', 'mylibrarymfile');
```

This creates `mylibrarymfile.m` in the current folder. If you are on Windows, another file named `library_thunk_pcwin64.dll` is also created in the current folder.

- 2 Change the call to `loadlibrary` in your MATLAB to the following:

```
loadlibrary(library, @mylibrarymfile)
```

- 3 Compile and deploy the application.

- If you are integrating the library into a deployed application, specify the library's `.dll` along with `library_thunk_pcwin64.dll`, if created, using the `-a` option of `mcc` command. If you are using Application Compiler or Library Compiler apps, add the `.dll` files to the **Files required for your application to run** section of the app.
- If you are providing the library as an external file that is not integrated with the deployed application, place the library `.dll` file in the same folder as the compiled application. If you are on Windows, you must integrate `library_thunk_pcwin64.dll` into your compiled application.

The benefit of this approach is that you can replace the library with an updated version without recompiling the deployed application. Replacing the library with a different version works only if the function signatures of the function in the library are not altered. This is because `mylibrarymfile.m` and `library_thunk_pcwin64.dll` are tied to the function signatures of the functions in the library.

Note You cannot use `loadlibrary` inside MATLAB to load a shared library built with MATLAB. For more information on `loadlibrary`, see “Limitations to Shared Library Support”.

Note Operating systems have a `loadlibrary` function, which loads specified Windows operating system module into the address space of the calling process.

See Also

`loadlibrary`

Related Examples

- “Call Functions in C Library Loaded with `loadlibrary`”

MATLAB Data Files in Compiled Applications

In this section...

“Explicitly Including MATLAB Data files Using the %#function Pragma” on page 5-13

“Load and Save Functions” on page 5-13

Explicitly Including MATLAB Data files Using the %#function Pragma

The compiler excludes MATLAB data files (MAT-files) from dependency analysis by default. See “Dependency Analysis Using MATLAB Compiler” on page 5-3.

If you want the compiler to explicitly inspect data within a MAT file, you need to specify the %#function pragma when writing your MATLAB code.

For example, if you are creating a solution with Deep Learning Toolbox, you need to use the %#function pragma within your code to include a dependency on the `gmdistribution` class, for instance.

Load and Save Functions

If your deployed application uses MATLAB data files (MAT-files), it is helpful to code `LOAD` and `SAVE` functions to manipulate the data and store it for later processing.

- Use `isdeployed` to determine if your code is running in or out of the MATLAB workspace.
- Specify the data file by either using `WHICH` (to locate its full path name) define it relative to the location of `ctfroot`.
- All MAT-files are unchanged after `mcc` runs. These files are not encrypted when written to the deployable archive.

For more information about deployable archives, see “Deployable Archive” on page 5-6.

See the `ctfroot` reference page for more information about `ctfroot`.

Use the following example as a template for manipulating your MATLAB data inside, and outside, of MATLAB.

Using Load/Save Functions to Process MATLAB Data for Deployed Applications

The following example specifies three MATLAB data files:

- `user_data.mat`
- `userdata\extra_data.mat`
- `..\externdata\extern_data.mat`

- 1 Navigate to `matlab_root\extern\examples\compiler\Data_Handling`.
- 2 Compile `ex_loadsave.m` with the following `mcc` command:

```
mcc -mv ex_loadsave.m -a 'user_data.mat' -a ...
    '\userdata\extra_data.mat' -a ...
    '..\externdata\extern_data.mat'
```

ex_loadsave.m

```

function ex_loadsave
% This example shows how to work with the
% "load/save" functions on data files in
% deployed mode. There are three source data files
% in this example.
%   userdata.mat
%   userdata\extra_data.mat
%   ..\externdata\extern_data.mat
%
% Compile this example with the mcc command:
%   mcc -m ex_loadsave.m -a 'userdata.mat' -a
%     '\userdata\extra_data.mat'
%     -a '..\externdata\extern_data.mat'
% All the folders under the current main MATLAB file directory will
% be included as
% relative path to ctroot; All other folders will have the
% folder
% structure included in the deployable archive file from root of the
% disk drive.
%
% If a data file is outside of the main MATLAB file path,
% the absolute path will be
% included in deployable archive and extracted under ctroot. For example:
% Data file
%   "c:\$matlabroot\examples\externdata\extern_data.mat"
% will be added into deployable archive and extracted to
% "$ctroot\$matlabroot\examples\externdata\extern_data.mat".
%
% All mat/data files are unchanged after mcc runs. There is
% no encryption on these user included data files. They are
% included in the deployable archive.
%
% The target data file is:
%   .\output\saved_data.mat
% When writing the file to local disk, do not save any files
% under ctroot since it may be refreshed and deleted
% when the application is next started.

%==== load data file =====
if isdeployed
% In deployed mode, all file under CTFroot in the path are loaded
% by full path name or relative to $ctroot.
% LOADFILENAME1=which(fullfile(ctroot,mfilename,'user_data.mat'));
% LOADFILENAME2=which(fullfile(ctroot,'userdata','extra_data.mat'));
LOADFILENAME1=which(fullfile('user_data.mat'));
LOADFILENAME2=which(fullfile('extra_data.mat'));
% For external data file, full path will be added into deployable archive;
% you don't need specify the full path to find the file.
LOADFILENAME3=which(fullfile('extern_data.mat'));
else
%running the code in MATLAB
LOADFILENAME1=fullfile(matlabroot,'extern','examples','compiler',
'Data_Handling','user_data.mat');
LOADFILENAME2=fullfile(matlabroot,'extern','examples','compiler',
'Data_Handling','userdata','extra_data.mat');
LOADFILENAME3=fullfile(matlabroot,'extern','examples','compiler',
'externdata','extern_data.mat');
end

% Load the data file from current working directory
disp(['Load A from : ',LOADFILENAME1]);
load(LOADFILENAME1,'data1');
disp('A= ');
disp(data1);

% Load the data file from sub directory
disp(['Load B from : ',LOADFILENAME2]);
load(LOADFILENAME2,'data2');
disp('B= ');
disp(data2);

```



```
% Load extern data outside of current working directory
disp(['Load extern data from : ',LOADFILENAME3]);
load(LOADFILENAME3);
disp('ext_data= ');
disp(ext_data);

%==== multiple the data matrix by 2 =====
result = data1*data2;
disp('A * B = ');
disp(result);

%==== save the new data to a new file =====
SAVEPATH=strcat(pwd,filesep,'output');
if ( ~isdir(SAVEPATH))
    mkdir(SAVEPATH);
end
SAVEFILENAME=strcat(SAVEPATH,filesep,'saved_data.mat');
disp(['Save the A * B result to : ',SAVEFILENAME]);
save(SAVEFILENAME, 'result');
```


Microsoft Excel Add-In Creation, Function Execution, and Deployment

The Library Compiler and the Command Line Interface

In this section...
“Using Graphical Interface” on page 6-2
“Using Command Line Interface” on page 6-2

Using Graphical Interface

For a complete example of how to create an Excel add-in using the Library Compiler app, see “Create Excel Add-In from MATLAB” on page 2-6.

Using Command Line Interface

As an alternative to using the Library Compiler, you can use the command line to create your deployable executable. Use `compiler.build.excelAddIn` or the `mcc` function.

Create Macro Using Multiple MATLAB Functions

This example shows you how to create macros with functions that have variable-length inputs and outputs.

Before you begin, verify that you have met all of the MATLAB Compiler Excel target requirements. For details, see “Excel Target Requirements and Limitations for MATLAB Compiler” on page 2-3.

Create Add-In In MATLAB

- 1 Copy the `xlmulti` example folder that ships with MATLAB to your work folder:

```
copyfile(fullfile(matlabroot, 'toolbox', 'matlabxl', 'examples', 'xlmulti'), 'xlmulti')
```

At the MATLAB command prompt, navigate to the `xlmulti` folder in your work folder.

- 2 Examine the `myplot`, `myprimes`, and `mysum` functions.

`myplot` takes a single integer input and plots a line from 1 to that number.

```
function myplot(x)
plot(1:x)
```

`myprimes` takes a single integer input `n` and returns all the prime numbers less than or equal to `n`.

```
function p = primes(n)
if length(n)~=1, error('N must be a scalar'); end
if n < 2, p = zeros(1,0); return, end
p = 1:2:n;
q = length(p);
p(1) = 2;
for k = 3:2:sqrt(n)
    if p((k+1)/2)
        p(((k*k+1)/2):k:q) = 0;
    end
end
p = p(p>0);
```

`mysum` takes an input of `varargin` of type `integer`, adds all the numbers, and returns the result.

```
function y = mysum(varargin)
y = sum([varargin{:}])
```

- 3 Build the Excel add-in with the **Library Compiler** app or `compiler.build.excelAddIn` using the following information:

Field	Value
Library Name	<code>xlmulti</code>
Class Name	<code>xlmulticlass</code>
Files to compile	<code>myplot.m</code> <code>myprimes.m</code> <code>mysum.m</code>

For example, if you are using `compiler.build.excelAddIn`, type:

```
buildResults = compiler.build.excelAddIn(["myplot.m","myprimes.m","mysum.m"], ...
    'AddInName','xlmulti', ...
    'ClassName','xlmulticlass', ...
    'GenerateVisualBasicFile','on');
```

For more details, see the instructions in “Create Excel Add-In from MATLAB” on page 2-6.

Create Excel Macro Using Function Wizard

Start Microsoft Excel on your system and create a new spreadsheet.

If you have not already done so, install and launch the Function Wizard add-in provided with MATLAB Compiler. For instructions, see “Install Function Wizard” on page 4-2.

Add myplot Function

- 1 On the Function Wizard Control Panel, click **Add Function** in the **Setup Functions** area. The MATLAB Components dialog box opens.
- 2 In the Available Components area of the MATLAB Components dialog box, select **xlmulti 1.0** from the drop-down box.
- 3 Select the function **myplot** from the box labeled **Functions for Class xlmulticlass**.
- 4 Click **Add**. The Function Properties dialog box opens.
- 5 On the **Input** tab, click **Set Input Data**. The Input Data for x dialog box opens.
- 6 Select **Value** and enter the value 4. Click **OK**.
- 7 Click **Done**. If you execute the macro at this point, the function `myplot` plots a line from 1 through 4 in a MATLAB Figure window. This graphic can be manipulated similarly to the way one would manipulate a figure in MATLAB. Some functionality, such as the ability to change line style or color, is not available.

Add mysum Function

- 1 Enter 1 into cell A1.
- 2 Select the cells B1:J1. Enter the formula = A1 + 1, then press **CTRL+Enter** to apply the formula to the selected cells.

This procedure fills the range B1:J1 with the interval 1-10 incremented by 1.

- 3 On the Function Wizard Control Panel, click **Add Function** and add the function **mysum** from the **xlmulti 1.0** component.
- 4 On the **Inputs** tab, click **Add** and then **Set Input Data**. The **Input Data for varargin[1]** dialog box opens.
- 5 Click the button at the end of the **Range** field and select the cell range A1:J1 in your worksheet. The range `Sheet1!A1:J1` is entered in the text box.
- 6 Select **Auto recalculate on change** to allow Excel to dynamically update the sum if the input cells change.
- 7 Click **OK**. The input argument `varargin[1] = Sheet1!A1:J1` is added to the Select Input Ranges/Values area.

Optionally, you can add additional cell ranges or values as input arguments. Cell ranges do not need to be the same size, and selected cells do not require a value.

- 8 On the **Outputs** tab, click **Set Output Data** and select cell A2 in the range field.
- 9 Click **Done**. The function `mysum` is added to the Active Functions list with the specified input and output arguments.
- 10 Once the macro runs, the cell A2 displays the sum 55. Changing any cells in the input range automatically updates the output cell.

Add myprimes Function

- 1 Enter 10 into cell A4.
- 2 On the Function Wizard Control Panel, click **Add Function** and add the function **myprimes** from the **xlmulti 1.0** component.

- 3 On the **Inputs** tab, click **Set Input Data** and select the cell A4 in the range field.
- 4 Select **Auto recalculate on change** to allow Excel to dynamically update when the input cell changes.
- 5 Click **OK**. The input argument $n = \text{Sheet1!}\$A\4 is added to the Select Input Ranges/Values area.
- 6 On the **Outputs** tab, click **Set Output Data** and select cell B4 in the range field.

Ensure **Auto Resize** is checked to enable the output to fill neighboring cells.
- 7 Click **Done**. The function `myprimes` is added to the Active Functions list.
- 8 Once the macro runs, the cells in row 4 display all prime numbers less than the value in A4. Changing this cell automatically updates the output.

Create and Run Macro

- 1 In the **Create Macros** area, enter a name for your macro in the Macro Name field.
- 2 Choose where to store your macro by using the dropdown menu in the **Store Macro In** field.
- 3 (Optional) Add a description for your macro.
- 4 Click **Create Macro** to save your macro in the selected workbook.

The Function Wizard generates VBA code that call your functions with the specified arguments.

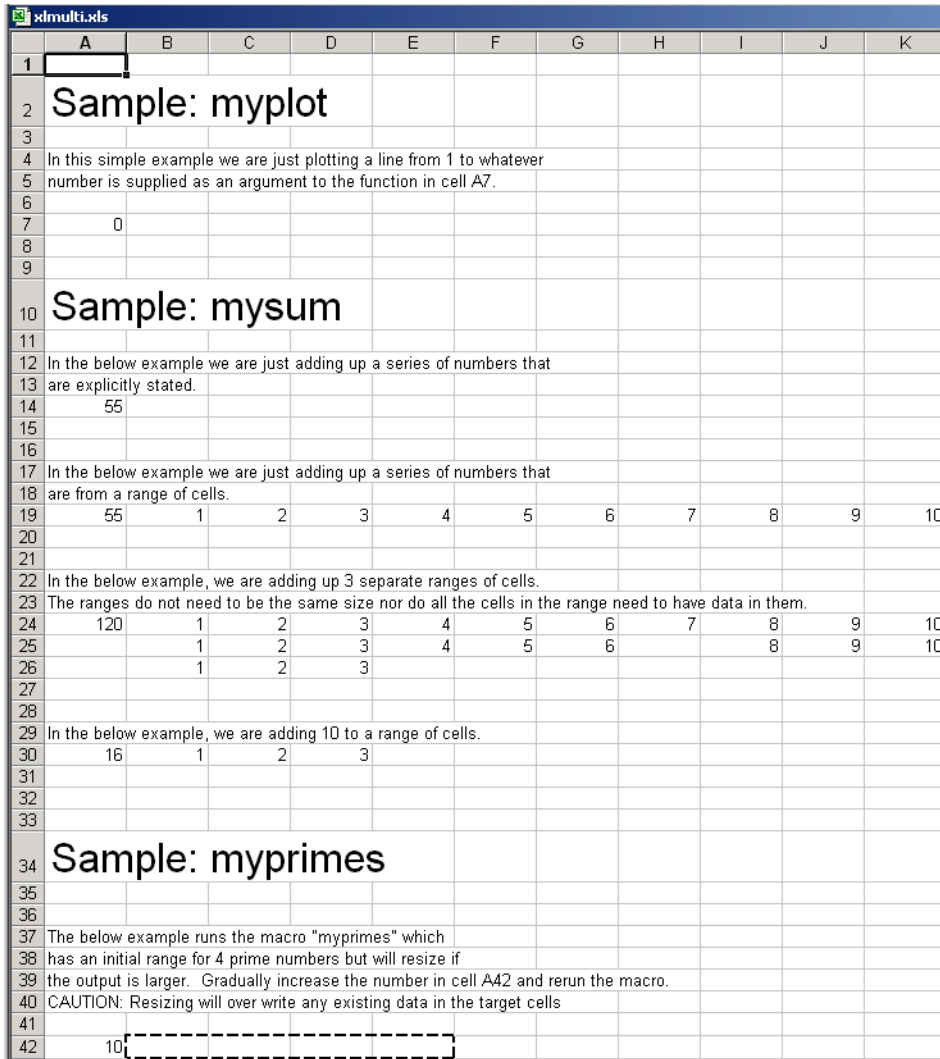
- 5 To execute the macro, from the main Excel window, open the Macro dialog box by pressing **Alt + F8**, or by selecting **Macros** in the Developer tab.

(Optional) Inspect Microsoft Visual Basic Code

- 1 From the **Developer** tab, click **Visual Basic**, or press **ALT+F11** to open the **Visual Basic Editor**. In older versions of Excel, it may be located under **Tools > Macro > Visual Basic Editor**.
- 2 In the Project - VBAProject window, double-click to expand VBAProject (Book1).
- 3 Expand the **Modules** folder and double-click the `matlabMacros` module. This opens the VB Code window with the code for this project. You can use this code to develop your own custom VBA macros.

For Additional Examples

The Microsoft Excel spreadsheet `xlmulti.xls` located in `matlabroot\toolbox\matlabxl\examples\xlmulti` demonstrates these functions in several ways.



In this example, the `myplot` and `mysum` functions are called directly in the worksheet using the custom function syntax. The macro `myprimes` executes the `myprimes` function and dynamically resizes the output.

See Also

`libraryCompiler` | `compiler.build.excelAddIn` | `deploytool`

Related Examples

- “Create Excel Add-In from MATLAB” on page 2-6
- “Install and Use Function Wizard” on page 4-2

Create Macros with Graphical Functions

The “Create Macro that Displays Graphical Output” on page 6-7 example shows you how to create an add-in and macro using a function that displays graphical output. For an example that uses a MATLAB function that displays a dialog box, see “Create Macro that Displays Error Message” on page 6-8.

Create Macro that Displays Graphical Output

Create an add-in and macro using a function that displays graphical output.

Create Add-In Using Function with Graphical Output

Build your COM component and add-in with MATLAB Compiler.

- 1 Create a MATLAB function with a graphical output. For this example, create a function named `mysurf.m`.

```
function mysurf
surf(peaks);
```

- 2 Build the Excel add-in using the `mysurf` function with the **Library Compiler** app or `compiler.build.excelAddIn`.

For example, if you are using `compiler.build.excelAddIn`, type:

```
buildResults = compiler.build.excelAddIn('mysurf.m', ...
'GenerateVisualBasicFile','on');
```

For more details, see the instructions in “Create Excel Add-In from MATLAB” on page 2-6.

Create Graphical Macro Using Function Wizard

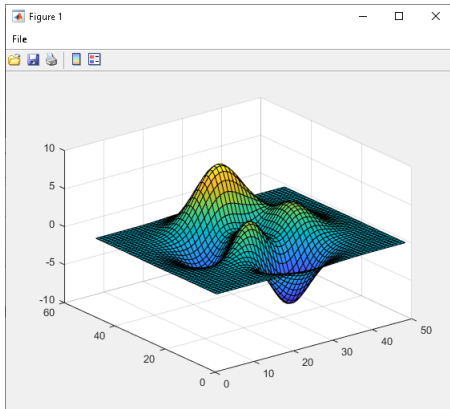
Note For complete Function Wizard workflows, see “Install and Use Function Wizard” on page 4-2.

Create a macro that executes a graphical function on a Microsoft Excel spreadsheet using the Function Wizard.

- 1 Install and start the Function Wizard in Microsoft Excel. For details, see “Install Function Wizard” on page 4-2.
- 2 Click **Add**. Select the function `mysurf` in the **Functions for Class `mysurfClass`** box.
- 3 Click **Add**. The Function Properties dialog box appears.
- 4 Click **Done**. Since `mysurf.m` does not have any inputs or outputs, there is no need to specify **Properties**.

The Function Wizard Control Panel appears with `mysurf` selected in the list of **Active Functions**.

- 5 In the Execute Functions area of the Function Wizard Control Panel, click **Execute**. The graphical output for `mysurf` appears in a separate window.



- 6 Try interacting with the generated figure. For example, try dragging the figure window or inserting color bars and legends using the toolbar.

Save and Execute Macro

Once you are satisfied that your macro is usable, save the macro to execute it at your convenience.

- 1 In the Function Wizard Control Panel, label the macro by entering `mysurf` in the **Macro Name** field of the Create Macros area.
- 2 If desired, change the default value in the **Store Macro In** field.
- 3 Click **Create Macro**.
- 4 For details on executing macros, see “Execute Macro in Excel” on page 4-8. When the macro runs, you should see output similar to the surf peaks image above.

Create Macro that Displays Error Message

Create an add-in and macro using a function that displays an error message dialog box.

Create Add-In Using Function with Dialog Box

Build your COM component and add-in with MATLAB Compiler.

- 1 Create a MATLAB function that displays a dialog box. For this example, create a function named `myerror.m`.

```
function out = myerror(in)
if (in < 0)
    error('Negative input not expected');
else
    out = sqrt(in);
end
```

- 2 Build the Excel add-in using the `myerror` function with the **Library Compiler** app or `compiler.build.excelAddIn`.

For example, if you are using `compiler.build.excelAddIn`, type:

```
buildResults = compiler.build.excelAddIn('myerror.m', ...
'GenerateVisualBasicFile','on');
```

For more details, see the instructions in “Create Excel Add-In from MATLAB” on page 2-6.

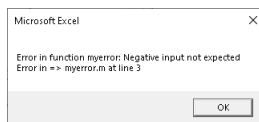
Create Macro Using Function Wizard

Set arguments for the function using the Function Wizard.

- 1 Install and start the Function Wizard in Microsoft Excel. For details, see “Install Function Wizard” on page 4-2.
- 2 Click **Add**. Select the function `myerror` in the **Functions for Class myerrorClass** box.
- 3 Click **Add**. The Function Properties dialog box appears.
- 4 Add an argument with an input value of -1 to `myerror`.
 - a On the **Inputs** tab, click **Set Input Data**. The **Input Data for in** dialog box appears.
 - b Select **Value** and enter -1.
 - c Click **Done**.
- 5 Define the output of `myerror` — in this case, choose any empty spreadsheet cell.
 - a Navigate to the **Outputs** tab and click **Set Output Data**. The **Output Data for out** dialog box appears.
 - b Select **Range** and select a spreadsheet cell value, C1, for example. The range field is automatically populated with `Sheet1!C1`.
 - c Click **Done**. The Function Wizard Control Panel appears with `myerror` selected in the list of **Active Functions**.

Tip If you have functions besides `myerror` listed in the **Active Functions** list that you don't want to execute when you test `myerror`, deactivate these functions by selecting them and clicking **Deactivate**.

- 6 Click **Execute**. The following dialog box is displayed.



Save and Execute Macro

Create a macro to display your error message on demand.

- 1 In the Function Wizard Control Panel, label the macro by entering `myerror` in the **Macro Name** field of the Create Macros area.
- 2 If desired, change the default value in the **Store Macro In** field.
- 3 Click **Create Macro**.
- 4 For details on executing macros, see “Execute Macro in Excel” on page 4-8.

Microsoft Excel Add-In Integration

- “Integrate Components Using VBA” on page 7-2
- “Implement User Interface Using Visual Basic Form Controls” on page 7-11
- “For More Information” on page 7-21

Integrate Components Using VBA

In this section...

“When to Use Formula Functions or Subroutines” on page 7-2

“Initialize MATLAB Compiler Libraries with Microsoft Excel” on page 7-2

“Create an Instance of a Class” on page 7-3

“Call the Methods of a Class Instance” on page 7-4

“Program with Variable Arguments” on page 7-6

“Modify Flags” on page 7-7

“Handle Errors During a Method Call” on page 7-10

When to Use Formula Functions or Subroutines

VBA provides two basic procedure types: functions and subroutines.

You access a VBA function directly from a cell in a worksheet as a formula function. Use function procedures when the original MATLAB function returns one or no outputs.

You access a subroutine as a general macro. Use a subroutine procedure when the original MATLAB function returns an array of values or multiple outputs, because you need to map these outputs into multiple cells/ranges in the worksheet.

When you create a component, MATLAB Compiler produces a VBA module (.bas file). This file contains simple call wrappers, each implemented as a function procedure for each method of the class. For more information, see “How Excel Add-In Compilation Works” on page 2-2.

Initialize MATLAB Compiler Libraries with Microsoft Excel

Before you use any MATLAB Compiler component, initialize the supporting libraries with the current instance of Microsoft Excel. Do this once for an Excel session that uses the MATLAB Compiler components.

To do this initialization, call the utility library function `MWInitApplication`, which is a member of the `MWUtil` class. This class is part of the `MWComUtil` library. For details, see “Class `MWUtil`” on page 10-3.

One way to add this initialization code into a VBA module is to provide a subroutine that does the initialization once, and simply exits for all subsequent calls. The following Microsoft Visual Basic code sample initializes the libraries with the current instance of Excel. A global variable of type `Object` named `MCLUtil` holds an instance of the `MWUtil` class, and another global variable of type `Boolean` named `bModuleInitialized` stores the status of the initialization process. The private subroutine `InitModule()` creates an instance of the `MWComUtil` class and calls the `MWInitApplication` method with an argument of `Application`. Once this function succeeds, all subsequent calls exit without reinitializing.

```
Dim MCLUtil As Object
Dim bModuleInitialized As Boolean

Private Sub InitModule()
    If Not bModuleInitialized Then
```

```

    On Error GoTo Handle_Error
    If MCLUtil Is Nothing Then
        Set MCLUtil = CreateObject("MWComUtil.MWUtil")
    End If
    Call MCLUtil.MWInitApplication(Application)
    bModuleInitialized = True
    Exit Sub
Handle_Error:
    bModuleInitialized = False
End If
End Sub

```

This code is similar to the default initialization code generated in the VBA module created when the component is built. Each function that uses MATLAB Compiler components can include a call to `InitModule` at the beginning to ensure that the initialization always gets performed as needed.

Create an Instance of a Class

Before calling a class method (compiled MATLAB function), you must create an instance of the class that contains the method. VBA provides two techniques for doing this:

- `CreateObject` on page 7-3 function
- `New` on page 7-3 operator

CreateObject Function

This method uses the Microsoft Visual Basic application programming interface (API) `CreateObject` function to create an instance of the class. Microsoft refers to calling `CreateObject` as late binding and using `new` as early binding.

To use this method, declare a variable of type `Object` using `Dim` to hold a reference to the class instance and call `CreateObject` using the class programmatic identifier (`ProgID`) as an argument, as shown in the next example:

```

Function foo(x1 As Variant, x2 As Variant) As Variant
    Dim aClass As Object

    On Error Goto Handle_Error
    Set aClass = CreateObject("mycomponent.myclass.1_0")
    ' (call some methods on aClass)
    Exit Function
Handle_Error:
    foo = Err.Description
End Function

```

New Operator

This method uses the Visual Basic `New` operator on a variable explicitly dimensioned as the class to be created. Before using this method, you must reference the type library containing the class in the current VBA project. Do this by selecting the **Tools** menu from the Visual Basic Editor, and then selecting **References** to display the **Available References** list. From this list, select the necessary type library.

The following example illustrates using the `New` operator to create a class instance. It assumes that you have selected **mycomponent 1.0 Type Library** from the **Available References** list before calling this function.

```
Function foo(x1 As Variant, x2 As Variant) As Variant
    Dim aClass As mycomponent.myclass

    On Error Goto Handle_Error
    Set aClass = New mycomponent.myclass
    ' (call some methods on aClass)
    Exit Function
Handle_Error:
    foo = Err.Description
End Function
```

In this example, the class instance can be dimensioned as simply `myclass`. The full declaration in the form `<component-name>.<class-name>` guards against name collisions that can occur if other libraries in the current project contain types named `myclass`.

Using both `CreateObject` and `New` produce a dimensioned class instance. The first method does not require a reference to the type library in the VBA project; the second results in faster code execution. The second method has the added advantage of enabling the **Auto-List-Members** and **Auto-Quick-Info** capabilities of the Microsoft Visual Basic editor to work with your classes. The default function wrappers created with each built component all use the first method for object creation.

In the previous two examples, the class instance used to make the method call was a local variable of the procedure. This creates and destroys a new class instance for each call. An alternative approach is to declare one single module-scoped class instance that is reused by all function calls, as in the initialization code of the previous example.

The following example illustrates this technique with the second method:

```
Dim aClass As mycomponent.myclass

Function foo(x1 As Variant, x2 As Variant) As Variant
    On Error Goto Handle_Error
    If aClass Is Nothing Then
        Set aClass = New mycomponent.myclass
    End If
    ' (call some methods on aClass)
    Exit Function
Handle_Error:
    foo = Err.Description
End Function
```

How MATLAB Runtime Is Shared Among Classes

MATLAB Compiler creates a single MATLAB Runtime instance when the first Microsoft COM class is instantiated in an application. This MATLAB Runtime is reused and shared among all subsequent class instances within the component, resulting in more efficient memory usage and eliminating the MATLAB Runtime startup cost in each subsequent class instantiation.

All class instances share a single MATLAB workspace and share global variables in the MATLAB files used to build the component. This makes properties of a COM class behave as static properties instead of instance-wise properties.

Call the Methods of a Class Instance

After you have created a class instance, you can call the class methods to access the compiled MATLAB functions. MATLAB Compiler applies a standard mapping from the original MATLAB

function syntax to the method's argument list. For a detailed description of the mapping from MATLAB functions to COM class method calls, see "Reference Utility Classes" on page 10-2.

When a method has output arguments, the first argument is always `nargout`, which is of type `Long`. This input parameter passes the normal MATLAB `nargout` parameter to the compiled function and specifies how many outputs are requested. Methods that do not have output arguments do not pass a `nargout` argument. Following `nargout` are the output parameters listed in the same order as they appear on the left side of the original MATLAB function. Next come the input parameters listed in the same order as they appear on the right side of the original MATLAB function. All input and output arguments are typed as `Variant`, the default Visual Basic data type.

The `Variant` type can hold any of the basic VBA types, arrays of any type, and object references. For a detailed description of how to convert `Variant` types of any basic type to and from MATLAB data types, see "Data Conversion Rules" on page A-2. In general, you can supply any Visual Basic type as an argument to a class method, with the exception of Visual Basic UDTs. You can also pass Microsoft Excel Range objects directly as input and output arguments.

When you pass a simple `Variant` type as an output parameter, the called method allocates the received data and frees the original contents of the `Variant`. In this case it is sufficient to dimension each output argument as a single `Variant`. When an object type (like an Excel Range) is passed as an output parameter, the object reference is passed in both directions, and the object's `Value` property receives the data.

The following examples illustrate the process of passing input and output parameters from VBA to the MATLAB Compiler component class methods.

The first example is a formula function that takes two inputs and returns one output. This function dispatches the call to a class method that corresponds to a MATLAB function of the form `function y = foo(x1,x2)`.

```
Function foo(x1 As Variant, x2 As Variant) As Variant
    Dim aClass As Object
    Dim y As Variant

    On Error Goto Handle_Error
    Set aClass = New mycomponent.myclass
    aClass = CreateObject("mycomponent.myclass.1_0")
    Call aClass.foo(1,y,x1,x2)
    foo = y
    Exit Function
Handle_Error:
    foo = Err.Description
End Function
```

The second example rewrites the same function as a subroutine and uses Excel ranges for input and output.

```
Sub foo(Rout As Range, Rin1 As Range, Rin2 As Range)
    Dim aClass As Object

    On Error Goto Handle_Error
    aClass = CreateObject("mycomponent.myclass.1_0")
    Call aClass.foo(1,Rout,Rin1,Rin2)
    Exit Sub
Handle_Error:
```

```
    MsgBox(Err.Description)
End Sub
```

Program with Variable Arguments

Process varargin and varargout Arguments

When `varargin` and/or `varargout` are present in the MATLAB function that you are using for the Excel component, these parameters are added to the argument list of the class method as the last input/output parameters in the list. You can pass multiple arguments as a `varargin` array by creating a `Variant` array, assigning each element of the array to the respective input argument.

The following example creates a `varargin` array to call a method resulting from a MATLAB function of the form `y = foo(varargin)`:

```
Function foo(x1 As Variant, x2 As Variant, x3 As Variant, _
            x4 As Variant, x5 As Variant) As Variant
    Dim aClass As Object
    Dim v As Variant
    Dim y As Variant
    Dim MCLUtil As Object

    On Error GoTo Handle_Error
    set aClass = CreateObject("mycomponent.myclass.1_0")
    Set MCLUtil = CreateObject("MWComUtil.MWUtil")
    Call MCLUtil.MWPack(v, x1, x2, x3, x4, x5)
    Call aClass.foo(1, y, v)
    foo = y
    Exit Function
Handle_Error:
    foo = Err.Description
End Function
```

The `MWUtil` class included in the `MWComUtil` utility library provides the `MWPack` helper function to create `varargin` parameters. See “Class `MWUtil`” on page 10-3 for more details.

The next example processes a `varargout` parameter into three separate Excel Ranges. This function uses the `MWUnpack` function in the utility library. The MATLAB function used is `varargout = foo(x1,x2)`.

```
Sub foo(Rout1 As Range, Rout2 As Range, Rout3 As Range, _
        Rin1 As Range, Rin2 As Range)
    Dim aClass As Object
    Dim aUtil As Object
    Dim v As Variant

    On Error Goto Handle_Error
    aUtil = CreateObject("MWComUtil.MWUtil")
    aClass = CreateObject("mycomponent.myclass.1_0")
    Call aClass.foo(3,v,Rin1,Rin2)
    Call aUtil.MWUnpack(v,0,True,Rout1,Rout2,Rout3)
    Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub
```

Pass an Empty varargin from Microsoft Visual Basic Code

In MATLAB, varargin inputs to functions are optional, and may be present or omitted from the function call. However, from Microsoft Visual Basic, function signatures are more strict—if varargin is present among the MATLAB function inputs, the VBA call must include varargin, even if you want it to be empty. To pass in an empty varargin, pass the Null variant, which is converted to an empty MATLAB cell array when passed.

Pass an Empty varargin from VBA Code

The following example illustrates how to pass the null variant in order to pass an empty varargin:

```
Function foo(x1 As Variant, x2 As Variant, x3 As Variant, _
            x4 As Variant, x5 As Variant) As Variant
    Dim aClass As Object
    Dim v(1 To 5) As Variant
    Dim y As Variant

    On Error Goto Handle_Error
    v(1) = x1
    v(2) = x2
    v(3) = x3
    v(4) = x4
    v(5) = x5
    aClass = CreateObject("mycomponent.myclass.1_0")

    'Call aClass.foo(1,y,v)
    Call aClass.foo(1,y,Null)

    foo = y
    Exit Function
Handle_Error:
    foo = Err.Description
End Function
```

For More Information

For more information about working with variable-length arguments, see “Create Macro Using Multiple MATLAB Functions” on page 6-3.

Modify Flags

Each MATLAB Compiler component exposes a single read/write property named `MWFlags` of type `MWFlags`. The `MWFlags` property consists of two sets of constants: array formatting flags on page 7-8 and data conversion flags on page 7-9. Array formatting flags affect the transformation of arrays, whereas data conversion flags deal with type conversions of individual array elements.

The data conversion flags change selected behaviors of the data conversion process from `Variants` to MATLAB types and vice versa. By default, the MATLAB Compiler components allow setting data conversion flags at the class level through the `MWFlags` class property. This holds true for all Visual Basic types, with the exception of the MATLAB Compiler `MWStruct`, `MWField`, `MWComplex`, `MWSparse`, and `MWArg` types. Each of these types exposes its own `MWFlags` property and ignores the properties of the class whose method is being called. The `MWArg` class is supplied specifically for the case when a particular argument needs different settings from the default class properties.

This section provides a general discussion of how to set these flags and what they do. For a detailed discussion of the `MWFlags` type, as well as additional code samples, see “Class `MWFlags`” (MATLAB Compiler SDK).

Array Formatting Flags

Array formatting flags guide the data conversion to produce either a MATLAB cell array or matrix from general `Variant` data on input or to produce an array of `Variants` or a single `Variant` containing an array of a basic type on output.

The following examples assume that you have referenced the `MWComUtil` library in the current project by selecting **Tools > References** and selecting **MWComUtil 7.5 Type Library** from the list:

```
Sub foo( )
    Dim aClass As mycomponent.myclass
    Dim var1(1 To 2, 1 To 2), var2 As Variant
    Dim x(1 To 2, 1 To 2) As Double
    Dim y1,y2 As Variant

    On Error Goto Handle_Error
    var1(1,1) = 11#
    var1(1,2) = 12#
    var1(2,1) = 21#
    var1(2,2) = 22#
    x(1,1) = 11
    x(1,2) = 12
    x(2,1) = 21
    x(2,2) = 22
    var2 = x
    Set aClass = New mycomponent.myclass
    Call aClass.foo(1,y1,var1)
    Call aClass.foo(1,y2,var2)
    Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub
```

In addition, these examples assume you have referenced the COM object (DLL file) created with MATLAB Compiler (`mycomponent`) as mentioned in “New Operator” on page 7-3.

Here, two `Variant` variables, `var1` and `var2` are constructed with the same numerical data, but internally they are structured differently: `var1` is a 2-by-2 array of `Variants` with each element containing a 1-by-1 `Double`, while `var2` is a 1-by-1 `Variant` containing a 2-by-2 array of `Doubles`.

In MATLAB Compiler, when using the default settings, both of these arrays will be converted to 2-by-2 arrays of `doubles`. This does not follow the general convention listed in COM VARIANT to the MATLAB Conversion Rules. According to these rules, `var1` converts to a 2-by-2 cell array with each cell occupied by a 1-by-1 `double`, and `var2` converts directly to a 2-by-2 `double` matrix.

The two arrays both convert to `double` matrices because the default value for the `InputArrayFormat` flag is `mwArrayFormatMatrix`. The `InputArrayFormat` flag controls how arrays of these two types are handled. This default is used because array data originating from Excel ranges is always in the form of an array of `Variants` (like `var1` of the previous example), and MATLAB functions most often deal with matrix arguments.

But what if you want a cell array? In this case, you set the `InputArrayFormat` flag to `mwArrayFormatCell`. Do this by adding the following line after creating the class and before the method call:

```
aClass.MWFlags.ArrayFormatFlags.InputArrayFormat =
mwArrayFormatCell
```

Setting this flag presents all array input to the compiled MATLAB function as cell arrays.

Similarly, you can manipulate the format of output arguments using the `OutputArrayFormat` flag. You can also modify array output with the `AutoResizeOutput` and `TransposeOutput` flags.

`AutoResizeOutput` is used for Excel Range objects passed directly as output parameters. When this flag is set, the target range automatically resizes to fit the resulting array. If this flag is not set, the target range must be at least as large as the output array or the data is truncated.

The `TransposeOutput` flag transposes all array output. This flag is useful when dealing with MATLAB functions that output one-dimensional arrays. By default, MATLAB realizes one-dimensional arrays as 1-by-n matrices (row vectors) that become rows in an Excel worksheet.

Tip If your MATLAB function is specifically returning a row vector, for example, ensure you assign a similar row vector of cells in Excel.

You may prefer worksheet columns from row vector output. This example auto-resizes and transposes an output range:

```
Sub foo(Rout As Range, Rin As Range )
    Dim aClass As mycomponent.myclass

    On Error Goto Handle_Error
    Set aClass = New mycomponent.myclass
    aClass.MWFlags.ArrayFormatFlags.AutoResizeOutput = True
    aClass.MWFlags.ArrayFormatFlags.TransposeOutput = True
    Call aClass.foo(1,Rout,Rin)
    Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub
```

Data Conversion Flags

Data conversion flags deal with type conversions of individual array elements. The two data conversion flags, `CoerceNumericToType` and `InputDateFormat`, govern how numeric and date types are converted from VBA to MATLAB. Consider the example:

```
Sub foo( )
    Dim aClass As mycomponent.myclass
    Dim var1, var2 As Variant
    Dim y As Variant

    On Error Goto Handle_Error
    var1 = 1
    var2 = 2#
    Set aClass = New mycomponent.myclass
    Call aClass.foo(1,y,var1,var2)
```

```
Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub
```

This example converts `var1` of type `Variant/Integer` to an `int16` and `var2` of type `Variant/Double` to a `double`.

If the original MATLAB function expects `doubles` for both arguments, this code might cause an error. One solution is to assign a `double` to `var1`, but this may not be possible or desirable. In such a case set the `CoerceNumericToType` flag to `mwTypeDouble`, causing the data converter to convert all numeric input to `double`. In the previous example, place the following line after creating the class and before calling the methods:

```
aClass.MWFlags.DataConversionFlags.CoerceNumericToType =
mwTypeDouble
```

The `InputDateFormat` flag controls how the VBA `Date` type is converted. This example sends the current date and time as an input argument and converts it to a string:

```
Sub foo( )
    Dim aClass As mycomponent.myclass
    Dim today As Date
    Dim y As Variant

    On Error Goto Handle_Error
    today = Now
    Set aClass = New mycomponent.myclass
    aClass.MWFlags.DataConversionFlags.InputDateFormat =
mwDateFormatString
    Call aClass.foo(1,y,today)
    Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub
```

Handle Errors During a Method Call

Errors that occur while creating a class instance or during a class method create an exception in the current procedure. Microsoft Visual Basic provides an exception handling capability through the `On Error Goto <label>` statement, in which the program execution jumps to `<label>` when an error occurs. (`<label>` must be located in the same procedure as the `On Error Goto` statement). All errors are handled this way, including errors within the original MATLAB code. An exception creates a Visual Basic `ErrObject` object in the current context in a variable called `Err`. (See the Visual Basic for Applications documentation for a detailed discussion on VBA error handling.) All of the examples in this section illustrate the typical error trapping logic used in function call wrappers for MATLAB Compiler components.

Implement User Interface Using Visual Basic Form Controls

Overview

This example illustrates the creation of a comprehensive Excel application to perform spectral analysis. It requires knowledge of Visual Basic forms and controls, and Excel workbook events. See the VBA documentation for a complete discussion of these topics.

You create an Excel add-in using functions that perform a fast Fourier transform (FFT) on an input data set and plot the power spectral density. The function returns the FFT results, an array of frequency points, and the power spectral density of the input data. You then create a custom VBA macro with form controls to designate input and output ranges in the current worksheet. Invoke the spectral analysis application from the Excel **Tools** menu.

To create the add-in:

- 1 Build an Excel add-in from MATLAB code.
- 2 Implement the necessary VBA code to collect input and dispatch the calls to your component. This code also creates a menu item for the application in Excel.
- 3 Create the UI using form controls.
- 4 Save the finished Excel add-in and package all necessary components for application deployment.

Before creating Excel add-ins, verify that you have met all of the MATLAB Compiler Excel target requirements. For details, see “Excel Target Requirements and Limitations for MATLAB Compiler” on page 2-3.

Build Excel Add-In

- 1 Save the path to the `xlspectral` folder that ships with MATLAB.

```
copyfile(fullfile(matlabroot, 'toolbox', 'matlabxl', 'examples', 'xlspectral'))
```

- 2 Examine the MATLAB functions `computefft.m` and `plotfft.m`.

`computefft.m`

```
function [fftdata, freq, powerspect] = computefft(data, interval)
    if (isempty(data))
        fftdata = [];
        freq = [];
        powerspect = [];
        return;
    end
    if (interval <= 0)
        error('Sampling interval must be greater than zero');
        return;
    end
    fftdata = fft(data);
    freq = (0:length(fftdata)-1)/(length(fftdata)*interval);
    powerspect = abs(fftdata)/(sqrt(length(fftdata)));
```

`plotfft.m`

```
function [fftdata, freq, powerspect] = plotfft(data, interval)
    [fftdata, freq, powerspect] = computefft(data, interval);
```

```
len = length(fftdata);  
if (len <= 0)  
    return;  
end  
t = 0:interval:(len-1)*interval;  
subplot(2,1,1), plot(t, data)  
xlabel('Time'), grid on  
title('Time domain signal')  
subplot(2,1,2), plot(freq(1:len/2), powerspect(1:len/2))  
xlabel('Frequency (Hz)'), grid on  
title('Power spectral density')
```

- 3 Build the Excel add-in with the **Library Compiler** app or `compiler.build.excelAddIn`.

Use the following information for your project:

Project Name	Fourier
Class Name	Fourier
File to compile	plotfft.m

Note In this example, the application that uses the `fourier` class does not call `computefft` directly. The `computefft` method is required only by the `plotfft` method. Thus, you do not need to manually add the `computefft` function to the package, as the compiler automatically includes it during dependency analysis.

For example, if you are using `compiler.build.excelAddIn`, type:

```
buildResults = compiler.build.excelAddIn('plotfft.m', ...  
'AddInName','Fourier', ...  
'ClassName','Fourier', ...  
'GenerateVisualBasicFile','on', ...  
'Verbose','on');
```

Your component has one class with two methods:

- `computefft` — Computes the FFT and power spectral density of the input data, and computes a vector of frequency points based on the length of the data entered and the sampling interval.
- `plotfft` — Performs the same operations as `computefft`, and also plots the input data and the power spectral density in a MATLAB figure window.

Implement VBA code

Having built your component, implement the necessary VBA code to integrate it into Excel.

Note The shipped Excel add-in `Fourier.xla` in the `xlspectral` folder already contains the following VBA code. To use the shipped add-in, open it in Excel, add references to **Fourier 1.0 Type Library** and **MWComUtil X.X Type Library** in the Excel Visual Basic Editor, and save the add-in. You can then skip to “Test the Add-In” on page 7-18.

- 1 Start Excel.
- 2 Open your generated Excel add-in.

- 3 From the **Developer** tab, click **Visual Basic**, or press **ALT+F11** to open the **Visual Basic Editor**. In older versions of Excel, it may be located under **Tools > Macro > Visual Basic Editor**.
- 4 In the Visual Basic Editor, select **Tools > References** to open the Project References dialog box.
- 5 Select the **Fourier 1.0 Type Library** entry that corresponds to your generated Excel add-in and **MWComUtil X.X Type Library** that corresponds to your version of MATLAB or MATLAB Runtime. Click **OK** to add the references.

Create Main VB Code Module

The add-in requires initialization code and global variables to hold the application state between function invocations. Implement a Visual Basic code module to manage these tasks.

- 1 If there is not already a module present under **Modules**, right-click the **VBAProject** item in the project window and select **Insert > Module**.

A new module appears under **Modules** in the **VBA Project**.

- 2 In the module property page, change the Name property from **Module1** to **FourierMain**. You may need to show the property window by pressing **F4**.
- 3 Enter the following code in the **FourierMain** module and close the code window.

```

'
' FourierMain - Main module stores global state of controls
' and provides initialization code
'
Public theFourier As Fourier.Fourier 'Global instance of Fourier object
Public theFFTDData As MWComplex    'Global instance of MWComplex to accept FFT
Public InputData As Range          'Input data range
Public Interval As Double           'Sampling interval
Public Frequency As Range          'Output frequency data range
Public PowerSpect As Range         'Output power spectral density range
Public bPlot As Boolean             'Holds the state of plot flag
Public theUtil As MWUtil           'Global instance of MWUtil object
Public bInitialized As Boolean      'Module-is-initialized flag

Private Sub LoadFourier()
'Initializes globals and Loads the Spectral Analysis form
    Dim MainForm As frmFourier
    On Error GoTo Handle_Error
    Call InitApp
    Set MainForm = New frmFourier
    Call MainForm.Show
    Exit Sub
Handle_Error:
    MsgBox (Err.Description)
End Sub

Private Sub InitApp()
'Initializes classes and libraries. Executes once
'for a given session of Excel
    If bInitialized Then Exit Sub
    On Error GoTo Handle_Error
    If theUtil Is Nothing Then
        Set theUtil = New MWUtil
        Call theUtil.MWInitApplication(Application)
    End If
    If theFourier Is Nothing Then
        Set theFourier = New Fourier.Fourier
    End If
    If theFFTDData Is Nothing Then
        Set theFFTDData = New MWComplex
    End If
    bInitialized = True
    Exit Sub
Handle_Error:

```

```
MsgBox (Err.Description)  
End Sub
```

Create Visual Basic Form

Develop a user interface for your add-in using the Visual Basic Editor.

- 1** Right-click **VBAProject** in the VBA project window and select **Insert** and then **UserForm**.

A new form appears under **Forms** in the VBA project window.

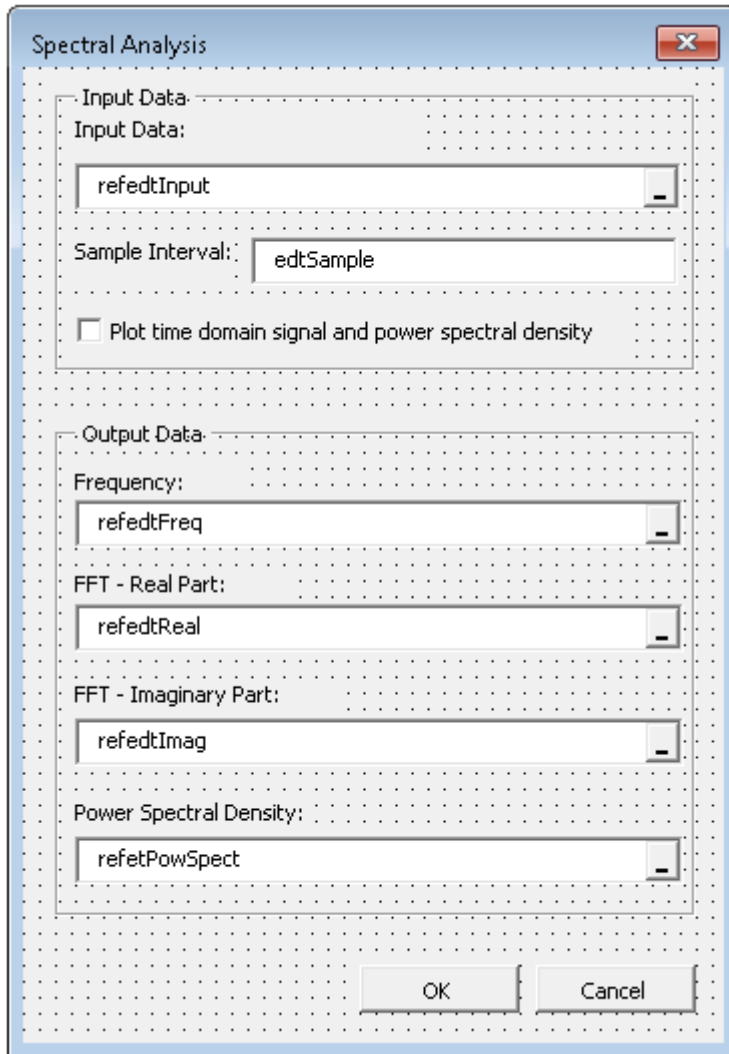
- 2** In the form property page, set the **Name** property to `frmFourier` and the **Caption** property to `Spectral Analysis`.
- 3** Add the following controls to the blank form:

Controls for Spectral Analysis

Control Type	Control Name	Properties	Purpose
CheckBox	chkPlot	Caption = Plot time domain signal and power spectral density	Plot input data and power spectral density.
CommandButton	btnOK	Caption = OK Default = True	Execute the function and dismiss the dialog box.
CommandButton	btnCancel	Caption = Cancel Cancel = True	Dismiss the dialog box without executing the function.
Frame	Frame1	Caption = Input Data	Group all input controls.
Frame	Frame2	Caption = Output Data	Group all output controls.
Label	Label1	Caption = Input Data:	Label the RefEdit for input data.
RefEdit	refedtInput		Select range for input data.
Label	Label2	Caption = Sampling Interval:	Label the TextBox for sampling interval.
TextBox	edtSample		Select sampling interval.
Label	Label3	Caption = Frequency:	Label the RefEdit for frequency output.
RefEdit	refedtFreq		Select output range for frequency points.
Label	Label4	Caption = FFT - Real Part:	Label the RefEdit for real part of FFT.
RefEdit	refedtReal		Select output range for real part of FFT of input data.
Label	Label5	Caption = FFT - Imaginary Part:	Label the RefEdit for imaginary part of FFT.
RefEdit	refedtImag		Select output range for imaginary part of FFT of input data.
Label	Label6	Caption = Power Spectral Density	Label the RefEdit for power spectral density.

Control Type	Control Name	Properties	Purpose
RefEdit	refedtPowSpect		Select output range for power spectral density of input data.

Your form should look similar to the following image. The text in the boxes is for your reference only.



- 4 When the form and controls are complete, right-click the form and select **View code**.

Enter the following code in the form code window. If you used different names for any of the controls or any global variable, change this code to reflect those differences.

```

'frmFourier Event handlers
Private Sub UserForm_Activate()
'UserForm Activate event handler. This function gets called before
'showing the form, and initializes all controls with values stored
'in global variables.

```

```

On Error GoTo Handle_Error
If theFourier Is Nothing Or theFFTData Is Nothing Then Exit Sub
'Initialize controls with current state
If Not InputData Is Nothing Then
    refedtInput.Text = InputData.Address
End If
edtSample.Text = Format(Interval)
If Not Frequency Is Nothing Then
    refedtFreq.Text = Frequency.Address
End If
If Not IsEmpty (theFFTData.Real) Then
If IsObject(theFFTData.Real) And TypeOf theFFTData.Real Is Range Then
    refedtReal.Text = theFFTData.Real.Address
    End If
End If
If Not IsEmpty (theFFTData.Imag) Then
If IsObject(theFFTData.Imag) And TypeOf theFFTData.Imag Is Range Then
    refedtImag.Text = theFFTData.Imag.Address
    End If
End If
If Not PowerSpect Is Nothing Then
    refedtPowSpect.Text = PowerSpect.Address
End If
chkPlot.Value = bPlot
Exit Sub
Handle_Error:
    MsgBox (Err.Description)
End Sub

Private Sub btnCancel_Click()
'Cancel button click event handler. Exits form without computing fft
'or updating variables.
    Unload Me
End Sub
Private Sub btnOK_Click()
'OK button click event handler. Updates state of all variables from controls
'and executes the computefft or plotfft method.
    Dim R As Range

    If theFourier Is Nothing Or theFFTData Is Nothing Then GoTo Exit_Form
    On Error Resume Next
    'Process inputs
    Set R = Range(refedtInput.Text)
    If Err <> 0 Then
        MsgBox ("Invalid range entered for Input Data")
        Exit Sub
    End If
    Set InputData = R
    Interval = Cdbl(edtSample.Text)
    If Err <> 0 Or Interval <= 0 Then
        MsgBox ("Sampling interval must be greater than zero")
        Exit Sub
    End If
    'Process Outputs
    Set R = Range(refedtFreq.Text)
    If Err = 0 Then
        Set Frequency = R
    End If
    Set R = Range(refedtReal.Text)
    If Err = 0 Then
        theFFTData.Real = R
    End If
    Set R = Range(refedtImag.Text)
    If Err = 0 Then
        theFFTData.Imag = R
    End If
    Set R = Range(refedtPowSpect.Text)
    If Err = 0 Then
        Set PowerSpect = R
    End If
    bPlot = chkPlot.Value
    'Compute the fft and optionally plot power spectral density

```

```

If bPlot Then
    Call theFourier.plotfft(3, theFFTDData, Frequency, PowerSpect, _
        InputData, Interval)
Else
    Call theFourier.computefft(3, theFFTDData, Frequency, PowerSpect, _
        InputData, Interval)
End If
GoTo Exit_Form
Handle_Error:
MsgBox (Err.Description)
Exit_Form:
Unload Me
End Sub

```

Add Event Handlers to Workbook

- 1 Right-click the **ThisWorkbook** item in the VBA project window and select **View code**.
- 2 Place the following code into ThisWorkbook.

```

Private Sub Workbook_AddinInstall()
'Called when Addin is installed
    Call AddFourierMenuItem
End Sub

Private Sub Workbook_AddinUninstall()
'Called when Addin is uninstalled
    Call RemoveFourierMenuItem
End Sub

Private Sub AddFourierMenuItem()
    Dim ToolsMenu As CommandBarPopup
    Dim NewMenuItem As CommandBarButton

    'Remove if already exists
    Call RemoveFourierMenuItem
    'Find Tools menu
    Set ToolsMenu = Application.CommandBars(1).FindControl(ID:=30007)
    If ToolsMenu Is Nothing Then Exit Sub
    'Add Spectral Analysis menu item
    Set NewMenuItem = ToolsMenu.Controls.Add(Type:=msoControlButton)
    NewMenuItem.Caption = "Spectral Analysis..."
    NewMenuItem.OnAction = "LoadFourier"
End Sub

Private Sub RemoveFourierMenuItem()
    Dim CmdBar As CommandBar
    Dim Ctrl As CommandBarButton
    On Error Resume Next
    'Find tools menu and remove Spectral Analysis menu item
    Set CmdBar = Application.CommandBars(1)
    Set Ctrl = CmdBar.FindControl(ID:=30007)
    Call Ctrl.Controls("Spectral Analysis...").Delete
End Sub

```

The code adds event handlers for the workbook events `AddinInstall` and `AddinUninstall` that install and uninstall menu items. The menu item calls the `LoadFourier` function in the `FourierMain` module.

- 3 When you are finished, click the save icon or press **CTRL + S** to save the add-in.

Test the Add-In

Before distributing the add-in, test it with a sample problem. Spectral analysis is commonly used to find the frequency components of a signal buried in a noisy time domain signal. Create a data representation of a signal containing two distinct components and add to it a random component. This data, along with the output, is stored in columns of an Excel worksheet, and you plot the time-domain signal along with the power spectral density.

Create Test Problem

- 1 Start a new session of Excel with a blank workbook.
- 2 From the **Developer** tab, select **Excel Add-Ins**.
- 3 In the Add-Ins dialog box, click **Browse**.
- 4 Browse to `Fourier.xla` and click **OK**.

The **Spectral Analysis** add-in appears in the available **Add-Ins** list with a checked box.

- 5 Click **OK** to load the add-in.

This add-in installs a menu item under the Excel **Add-ins** menu.

Create Data

Before invoking the add-in, create test data that contains a signal with components at 15 Hz and 40 Hz. Sample the signal for 10 seconds at a sampling rate of 0.01 s. Put the time points into column A and the signal points into column B.

- 1 Enter 0 into cell A1 in the current worksheet.
- 2 Press **F5** or **CTRL+G** to launch the **Go To** dialog. Add the reference A2:A1001 and click **OK** to select the cells.
- 3 Enter the formula = $A1 + 0.01$, then press **CTRL+Enter** to apply the formula to the selected cells.

This procedure fills the range A1:A1001 with the interval 0-10 incremented by 0.01.

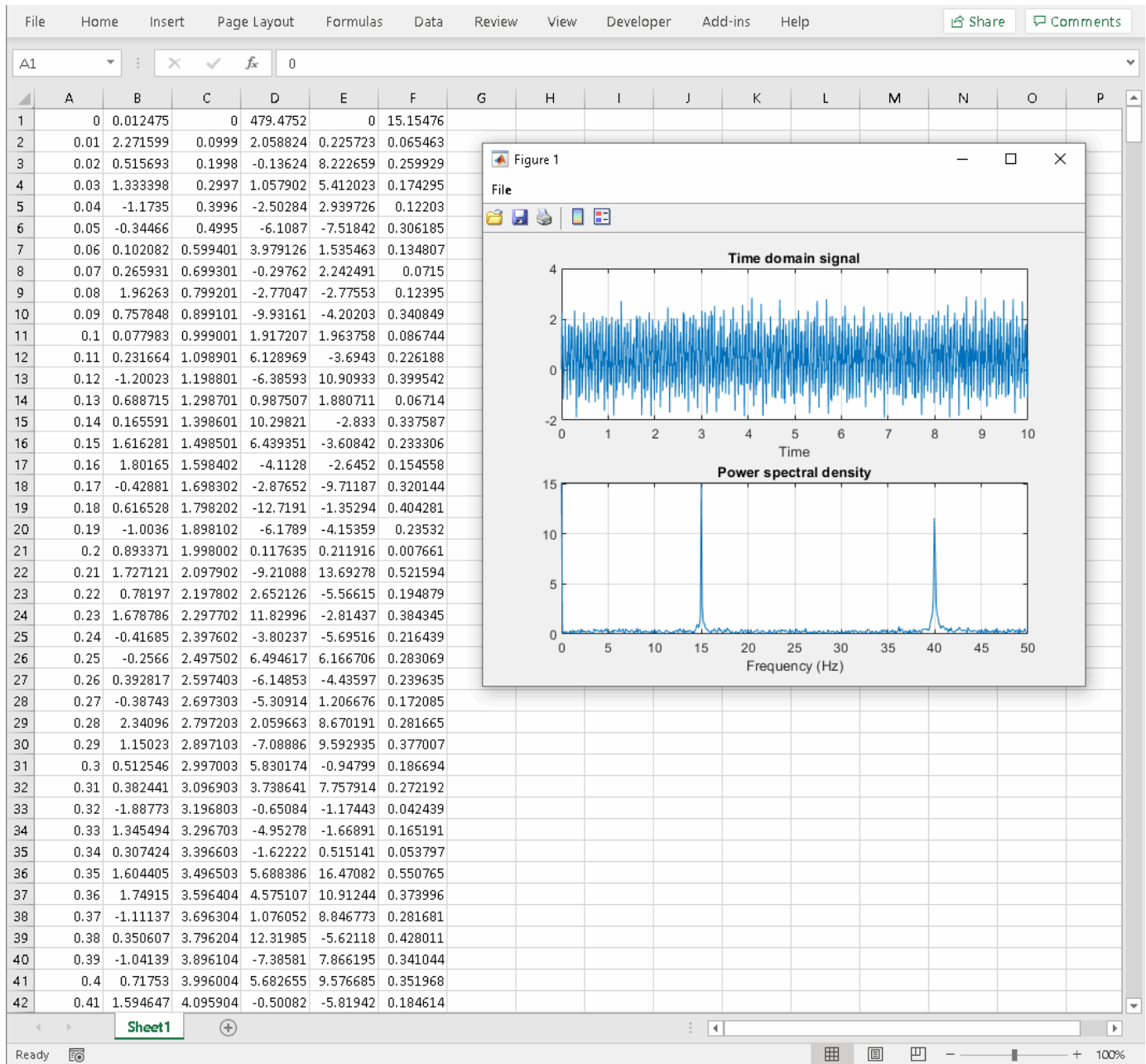
- 4 Repeat the **Go To** procedure to enter the following formula into each cell in the range B1:B1001:
- $$= \text{SIN}(2*\text{PI}()*15*A1) + \text{SIN}(2*\text{PI}()*40*A1) + \text{RAND}()$$

Run Test

Using the column of data (column B), test the add-in.

- 1 To display the Spectral Analysis UI, select **Add-ins > Spectral Analysis**.
- 2 Click the **Input Data** box.
- 3 Select the B1:B1001 range from the worksheet, or type this range into the **Input Data** field.
- 4 In the **Sampling Interval** field, type 0.01.
- 5 Select **Plot time domain signal and power spectral density**.
- 6 Enter C1:C1001 for frequency output, and likewise enter D1:D1001, E1:E1001, and F1:F1001 for the FFT real part, FFT imaginary part, and spectral density.
- 7 Click **OK** to run the analysis.

The following figure shows an example of the output.



The power spectral density reveals the two signals at 15 Hz and 40 Hz.

For More Information

For more information about...	See...
Functions available through MATLAB Compiler	Function reference in MATLAB Compiler documentation
Utility functions you can use to customize COM components created with MATLAB Compiler	"Reference Utility Classes" on page 10-2

Distribution to End Users

- “Assign Multiple MATLAB Functions to Excel Class” on page 8-2
- “Improve Data Access Using the MATLAB Runtime User Data Interface and COM Components” on page 8-4
- “MATLAB Runtime Component Cache and Deployable Archive Embedding” on page 8-8
- “MATLAB Runtime Options for Excel Add-Ins” on page 8-10
- “For More Information” on page 8-11

Assign Multiple MATLAB Functions to Excel Class

Create Add-In In MATLAB

Note In order to call a MATLAB function using the Microsoft Excel function syntax (=myfunction(input)), the MATLAB function must return a single scalar output argument. To specify multiple outputs, create a macro using the Function Wizard or custom VBA code.

- 1 Copy the xlbasic folder that ships with MATLAB to your work folder:

```
copyfile(fullfile(matlabroot, 'toolbox', 'matlabxl', 'examples', 'xlbasic'), 'xlbasic')
```

At the MATLAB command prompt, navigate to the new xlbasic folder in your work folder.

- 2 Examine the MATLAB functions doubleit.m, incrementit.m, and powerit.m.

```
function output = doubleit(input)
    output = input * 2;

function output = incrementit(input1, input2)
    output = input1 + input2;

function output = powerit(input1, input2)
    output = power(input1, input2);
```

- 3 Build the Excel add-in with the **Library Compiler** app or `compiler.build.excelAddIn`.

Use the following information for your project:

Add-in Name	myexcelfunctions
Class Name	myexcelfunctionsclass
Files to Compile	doubleit.m incrementit.m powerit.m

For example, if you are using `compiler.build.excelAddIn`, type:

```
buildResults = compiler.build.excelAddIn(["doubleit.m", "incrementit.m", "powerit.m"], ...
    'AddInName', 'myexcelfunctions', ...
    'ClassName', 'myexcelfunctionsclass', ...
    'GenerateVisualBasicFile', 'on', ...
    'Verbose', 'on');
```

For more details, see the instructions in “Create Excel Add-In from MATLAB” on page 2-6.

Deploy Add-In to Microsoft Excel

- 1 To deploy your add-in to end users, see “Distribute Add-Ins and Integrate into Microsoft Excel” on page 2-12.

After you register the component and install the add-in, you can use the `doubleit`, `incrementit`, and `powerit` functions in your spreadsheet.

- 2 Open Microsoft Excel with a blank workbook.
- 3 Test the functions by doing the following:

- a Enter `=doubleit(2.5)` in cell A1.
- b Enter `=incrementit(11,17)` in cell A2.
- c Enter `=powerit(7,2)` in cell A3.

You should see the values **5**, **28**, and **49** in cells **A1**, **A2**, and **A3**, respectively.

- 4** (Optional) Use the `doubleit`, `powerit`, and `incrementit` functions in new Microsoft Excel spreadsheets by saving it as a template.

- a Select **File > Save As** and select the file type **.xlt (Template)**.
- b Browse to the *Office_Installation_folder\XLSTART* folder.
- c Save the file as *Office_Installation_folder\XLSTART\Book.xlt*.

Note Your Microsoft Excel Macro Security level must be set at **Medium** or **Low** to save this template.

Improve Data Access Using the MATLAB Runtime User Data Interface and COM Components

Overview

The MATLAB Runtime user data interface is a lightweight interface to easily access MATLAB Runtime data. It allows data to be shared between the MATLAB Runtime instance, the MATLAB code running on that MATLAB Runtime instance, and the wrapper code that created the MATLAB Runtime instance. Through calls to the MATLAB Runtime user data interface API, you access the MATLAB Runtime data by creating a per MATLAB Runtime instance associative array of `mxArrays`, consisting of a mapping from string keys to `mxArray` values. Reasons for doing this include, but are not limited to:

- You need to supply run-time profile information to a client running an application created with the Parallel Computing Toolbox™. Profile information may be supplied (and change) on a per-execution basis. For example, two instances of the same application may run simultaneously with different profiles.
- You want to initialize MATLAB Runtime with constant values that can be accessed by all your MATLAB applications.
- You want to set up a global workspace — a global variable or variables that the MATLAB and your client can access.
- You want to store the state of any variable or group of variables.

MATLAB Compiler supports per the MATLAB Runtime instance state access through an object-oriented API. Unlike MATLAB Compiler, access to per the MATLAB Runtime instance state is optional, rather than on by default. You can access this state by adding `setmcruserdata.m` and `getmcruserdata.m` to your deployment project or by specifying them on the command line. Alternately, you use a helper function to call these methods, as shown in “Supply Run-Time Profile Information for Parallel Computing Toolbox Applications” on page 8-4.

For more information, see the MATLAB Compiler User's Guide.

Supply Run-Time Profile Information for Parallel Computing Toolbox Applications

Following is a complete example of how you can use the MATLAB Runtime User Data Interface as a mechanism to specify a profile for Parallel Computing Toolbox applications.

Note Standalone executables and shared libraries generated from MATLAB Compiler or MATLAB Compiler SDK for parallel applications can now launch up to twelve local workers without MATLAB Parallel Server™.

Step 1: Write Your Parallel Computing Toolbox Code

- 1 Create `sample_pct.m` in MATLAB.

This example code uses the cluster defined in the default profile for Parallel Computing Toolbox.

```
function speedup = sample_pct (n)
warning off all;
tic
```

```

if(ischar(n))
    n=str2double(n);
end
for ii = 1:n
    (cov(sin(magic(n)+rand(n,n))));
end
time1 =toc;
parpool;
tic
parfor ii = 1:n
    (cov(sin(magic(n)+rand(n,n))));
end
time2 =toc;
disp(['Normal loop time: ' num2str(time1) ...
    ', parallel loop time: ' num2str(time2) ]);
disp(['parallel speedup: ' num2str(1/(time2/time1)) ...
    ' times faster than normal']);
delete(gcf);
disp('done');
speedup = (time1/time2);

```

- 2 Run the function with the input 400.

```
a = sample_pct(400)
```

- 3 The following is an example of the output, assuming the default profile is set to local:

```

Starting parallel pool (parpool) using the 'local' profile ...
Connected to the parallel pool (number of workers: 6).
Normal loop time: 2.5651, parallel loop time: 1.6371
parallel speedup: 1.5668 times faster than normal
Parallel pool using the 'local' profile is shutting down.
done

```

```
ans =
```

```
1.5668
```

Step 2: Set the Parallel Computing Toolbox Profile

In order to compile MATLAB code to a COM component and utilize the Parallel Computing Toolbox, the `mcruserdata` must be set directly from MATLAB. There is no API available to access the `MCRUserdata` as there is for C and C++ applications built with MATLAB Compiler.

To set the `mcruserdata` from MATLAB, create an `init` function in your COM class. This is a separate MATLAB function that uses `setmcruserdata` to set the Parallel Computing Toolbox profile once. You then call your other functions to utilize the Parallel Computing Toolbox functions.

Create the following `init` function:

```

function init_sample_pct
% Set the Parallel Profile:
if(isdeployed)
    [profile] = uigetfile('*.settings');
    % let the USER select file
    setmcruserdata('ParallelProfile',[profile]);
end

```

Step 3: Compile Your Function with the Deploytool or the Command Line

You can compile your function from the command line by entering the following:

```
mcc -B 'cexcel:exPctComp,exPctClass,1.0' init_sample_pct.m sample_pct.m
```

Alternately, you can use the deploytool as follows:

- 1 Follow the steps in “Create Excel Add-In from MATLAB” on page 2-6 to compile your application.

When the compilation finishes, a new folder (with the same name as the project) is created.

Project Name	exPctComp
Class Name	exPctClass
File to compile	sample_pct.m and init_sample_pct.m

Note If you are using the GPU feature of Parallel Computing Toolbox, you must manually add the PTX and CU files.

- If you are using the Library Compiler app, click **Add files/directories** on the **Build** tab.
- If you are using a compiler .build function, use the AdditionalFiles option.
- If you are using the mcc command, use the -a option.

- 2 To deploy the compiled application, copy the for_redistribution_files_only folder, which contains the following, to your end users.

- exPctComp.dll
- VBA module (.bas file)
- MATLAB Runtime installer
- Cluster profile

Note The end-user's target machine must have access to the cluster.

Step 4: Modify the generated VBA Driver Application (the BAS File)

After registering the COM DLL on the deployment machine and importing the BAS file into Excel, modify the generated BAS file code as needed.

```
Dim MCLUtil As Object
Dim bModuleInitialized As Boolean
Dim exPctClass As Object

Private Sub InitModule()
    If Not bModuleInitialized Then
        On Error GoTo Handle_Error
        If MCLUtil Is Nothing Then
            Set MCLUtil = CreateObject("MWComUtil.MWUtil7.10")
        End If
        Call MCLUtil.MWInitApplication(Application)
        bModuleInitialized = True
        Exit Sub
    Handle_Error:
```



```

        bModuleInitialized = False
    End If
End Sub

Function init_sample_pct() As Variant

    On Error GoTo Handle_Error
    Call InitModule
    If exPctClass Is Nothing Then
        Set exPctClass = CreateObject("exPctComp.exPctClass.1_0")
    End If
    Call exPctClass.init_sample_pct
    init_sample_pct = Empty

    Exit Function
Handle_Error:
    init_sample_pct = "Error in " &
        Err.Source & ": " & Err.Description
End Function

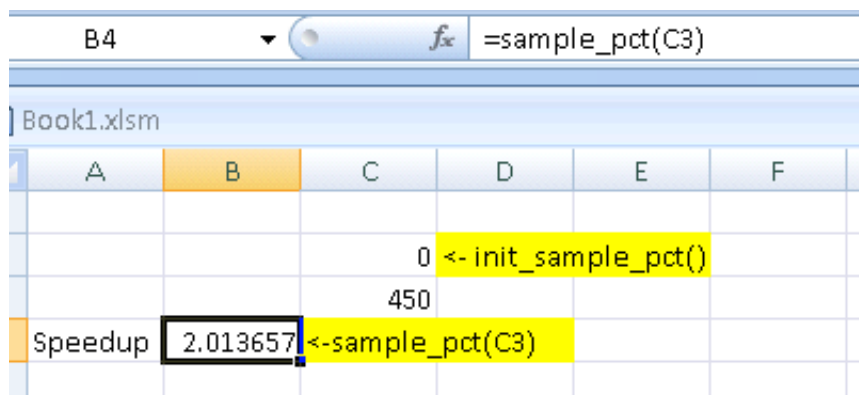
Function sample_pct(Optional pelle As Variant) As Variant
    Dim speedup As Variant

    On Error GoTo Handle_Error
    Call InitModule
    If exPctClass Is Nothing Then
        Set exPctClass = CreateObject("exPctComp.exPctClass.1_0")
    End If
    Call exPctClass.sample_pct(1, speedup, pelle)
    sample_pct = speedup

    Exit Function
Handle_Error:
    sample_pct = "Error in " & Err.Source
        & ": " & Err.Description
End Function

```

The output is as follows:



MATLAB Runtime Component Cache and Deployable Archive Embedding

Deployable archive data is automatically embedded directly in MATLAB Compiler components by default and extracted to a temporary folder.

Automatic embedding enables usage of MATLAB Runtime Component Cache features through environment variables.

These variables allow you to specify the following:

- Define the default location where you want the deployable archive to be automatically extracted
- Add diagnostic error printing options that can be used when automatically extracting the deployable, for troubleshooting purposes
- Tuning the MATLAB Runtime component cache size for performance reasons.

Use the following environment variables to change these settings.

Environment Variable	Purpose	Notes
MCR_CACHE_ROOT	When set to the location of where you want the deployable archive to be extracted, this variable overrides the default per-user component cache location. This is true for embedded <code>.ctf</code> files only.	On macOS, this variable is ignored in MATLAB R2020a and later. The app bundle contains the files necessary for runtime.
MCR_CACHE_SIZE	When set, this variable overrides the default component cache size.	The initial limit for this variable is 32M (megabytes). This may, however, be changed after you have set the variable the first time. Edit the file <code>.max_size</code> , which resides in the file designated by running the <code>mcrcachedir</code> command, with the desired cache size limit.

You can override this automatic embedding and extraction behavior by compiling with the `-C` option. See “Overriding Default Behavior” on page 8-9 for details.

Note If you run `mcc` specifying conflicting wrapper and target types, the deployable archive will not be embedded into the generated component. For example, if you run:

```
mcc -W lib:myLib -T link:exe test.m test.c
```

the generated `test.exe` will not have the deployable archive embedded in it, as if you had specified a `-C` option to the command line.

Caution Do not extract the files within the `.ctf` file and place them individually under version control. Since the `.ctf` file contains interdependent MATLAB functions and data, the files within it must be accessed only by accessing the `.ctf` file. For best results, place the entire `.ctf` file under version control.

Overriding Default Behavior

To extract the deployable archive in a manner prior to R2008b, alongside the compiled COM component, compile using the `mcc -c` option.

You can also implement this override by adding the `-c` flag in the **Settings** section of the compiler app.

If you are using a `compiler.build` function, disable the `EmbedArchive` option.

You might want to use this option to troubleshoot problems with the deployable archive, for example, as the log and diagnostic messages are much more visible.

For More Information

For more information about the deployable archive, see “Deployable Archive” on page 5-6.

MATLAB Runtime Options for Excel Add-Ins

What MATLAB Runtime Options are Supported by MATLAB Compiler?

- `-logfile` — Creates a named log file.

How Do I Specify MATLAB Runtime Options?

If You Compiled the Add-In in MATLAB or used `mcc`

If you are building your add-in using the MATLAB Library Compiler, select **Create log file** under **Additional Runtime Settings**.

If you are building your add-in using `mcc`, simply specify `-logfile` with the `mcc -R` command

If You Created a Function From Scratch Using the Function Wizard

If you created a function from scratch using the Function Wizard, and want to specify MATLAB Runtime options, you have to manually modify the `.bas` file code.

You do this by invoking the following `MWUtil` API calls, detailed with examples in “Class `MWUtil`” on page 10-3:

- Sub `MWInitApplicationWithMCROptions(pApp As Object, [mcrOptionList])` on page 10-4
- Function `IsMCRJVMEEnabled()` As Boolean on page 10-5
- Function `IsMCRInitialized()` As Boolean on page 10-5

For More Information

For more information about...	See...
Functions available through MATLAB Compiler	Function Reference pages in MATLAB Compiler documentation
Utility functions you can use to customize COM components created with MATLAB Compiler	"Reference Utility Classes" on page 10-2

Functions

compiler.build.excelAddIn

Create Microsoft Excel add-in

Syntax

```
compiler.build.excelAddIn(FunctionFiles)
compiler.build.excelAddIn(FunctionFiles,Name,Value)
compiler.build.excelAddIn(opts)
results = compiler.build.excelAddIn( ___ )
```

Description

Caution This function is only supported on Windows operating systems.

`compiler.build.excelAddIn(FunctionFiles)` creates an Excel add-in using MATLAB functions specified by `FunctionFiles`. Before creating Excel add-ins, install a supported compiler.

`compiler.build.excelAddIn(FunctionFiles,Name,Value)` creates an Excel add-in with options specified using one or more name-value arguments. Options include the add-in name, the output directory, and whether to generate a Microsoft Visual Basic file.

`compiler.build.excelAddIn(opts)` creates an Excel add-in with options specified using a `compiler.build.excelAddInOptions` object `opts`. You cannot specify any other options using name-value arguments.

`results = compiler.build.excelAddIn(___)` returns build information as a `compiler.build.Results` object using any of the input argument combinations in previous syntaxes. The build information consists of the build type, paths to the compiled files, and build options.

Examples

Create Excel Add-In

Create an Excel add-in on a Windows system using a function file that generates a magic square.

Ensure that you have the following installed:

- The Windows 10 SDK kit. For details, see Windows 10 SDK.
- MinGW-w64. To install it from the MathWorks File Exchange, see MATLAB Support for MinGW-w64 C/C++ Compiler.

Use `mbuild -setup -client mbuild_com` to ensure that MATLAB is able to create Excel add-ins.

In MATLAB, locate the MATLAB function that you want to deploy as an Excel add-in. For this example, use the file `magicsquare.m` located in `matlabroot\extern\examples\compiler`.


```
appFile = fullfile(matlabroot, 'extern', 'examples', 'compiler', 'magicsquare.m');
```

Build an Excel add-in using the `compiler.build.excelAddIn` command.

```
compiler.build.excelAddIn(appFile);
```

The function generates the following files within a folder named `magicsquareexcelAddIn` in your current working directory:

- `dlldata.c`
- `GettingStarted.html`
- `includedSupportPackages.txt`
- `magicsquare.def`
- `magicsquare.bas` (Only if you enable the 'GenerateVisualBasicFile' option)
- `magicsquare.rc`
- `magicsquare.xla` (Only if you enable the 'GenerateVisualBasicFile' option)
- `magicsquare_1_0.dll`
- `magicsquare_dll.cpp`
- `magicsquare_idl.h`
- `magicsquare_idl.idl`
- `magicsquare_idl.tlb`
- `magicsquare_idl_i.c`
- `magicsquare_idl_p.c`
- `magicsquareClass_com.cpp`
- `magicsquareClass_com.hpp`
- `mccExcludedFiles.log`
- `mwcomtypes.h`
- `mwcomtypes_i.c`
- `mwcomtypes_p.c`
- `readme.txt`
- `requiredMCRProducts.txt`
- `unresolvedSymbols.txt`

Customize Excel Add-In

Create an Excel add-in on a Windows system and customize it using name-value arguments.

For this example, use the file `magicsquare.m` located in `matlabroot\extern\examples\compiler`.

```
appFile = fullfile(matlabroot, 'extern', 'examples', 'compiler', 'magicsquare.m');
```

Build an Excel add-in using the `compiler.build.excelAddIn` command. Use name-value arguments to specify the add-in name and version, generate a Microsoft Visual Basic file, and enable verbose output.

```
compiler.build.excelAddIn(appFile, 'AddInName', 'MyMagicSquare', ...
    'AddInVersion', '2.0', ...
```

```
'GenerateVisualBasicFile', 'on', ...
'Verbose', 'on');
```

The function generates the following files within a folder named `MyMagicSquareexcelAddIn` in your current working directory:

- `dlldata.c`
- `GettingStarted.html`
- `includedSupportPackages.txt`
- `magicsquareClass_com.cpp`
- `magicsquareClass_com.hpp`
- `mccExcludedFiles.log`
- `mwcomtypes.h`
- `mwcomtypes_i.c`
- `mwcomtypes_p.c`
- `MyMagicSquare.bas`
- `MyMagicSquare.def`
- `MyMagicSquare.rc`
- `MyMagicSquare.xla`
- `MyMagicSquare_2_0.dll`
- `MyMagicSquare_dll.cpp`
- `MyMagicSquare_idl.h`
- `MyMagicSquare_idl.idl`
- `MyMagicSquare_idl.tlb`
- `MyMagicSquare_idl_i.c`
- `MyMagicSquare_idl_p.c`
- `readme.txt`
- `requiredMCRProducts.txt`
- `unresolvedSymbols.txt`

Create Multiple Add-Ins Using Options Object

Create multiple Excel add-ins on a Windows system using a `compiler.build.ExcelAddInOptions` object.

For this example, use the file `magicsquare.m` located in `matlabroot\extern\examples\compiler`.

```
appFile = fullfile(matlabroot, 'extern', 'examples', 'compiler', 'magicsquare.m');
```

Create an `ExcelAddInOptions` object using `appFile`. Use name-value arguments to specify a common output directory, generate a Visual Basic file, and enable verbose output.

```
opts = compiler.build.excelAddInOptions(appFile, ...
    'OutputDir', 'D:\Documents\MATLAB\work\ExcelAddInBatch', ...
    'GenerateVisualBasicFile', 'on', ...
    'Verbose', 'on')
```

```
opts =
```

```
ExcelAddInOptions with properties:
```

```

    AddInName: 'magicsquare'
    AddInVersion: '1.0.0.0'
    ClassName: 'magicsquareClass'
    DebugBuild: off
    EmbedArchive: on
    FunctionFiles: {'C:\Program Files\MATLAB\R2022a\extern\examples\compiler\magicsqua
GenerateVisualBasicFile: on
    AdditionalFiles: {}
    AutoDetectDataFiles: on
    SupportPackages: {'autodetect'}
    Verbose: on
    OutputDir: 'D:\Documents\MATLAB\work\ExcelAddInBatch'
```

Build the add-in using the `ExcelAddInOptions` object.

```
compiler.build.excelAddIn(opts);
```

To create a new add-in using the function file `myMagic2.m` with the same options, use dot notation to modify the `FunctionFiles` argument of the existing `ExcelAddInOptions` object before running the build function again.

```
opts.FunctionFiles = 'myMagic2.m';
compiler.build.excelAddIn(opts);
```

By modifying the `FunctionFiles` argument and recompiling, you can create multiple add-ins using the same options object.

Get Build Information from Excel Add-In

Create an Excel add-in and save information about the build type, generated files, included support packages, and build options to a `compiler.build.Results` object.

Compile using the file `magicsquare.m` located in `matlabroot\extern\examples\compiler`.

```
results = compiler.build.excelAddIn('magicsquare.m')
```

```
results =
```

```
Results with properties:
```

```

    BuildType: 'excelAddIn'
    Files: {2×1 cell}
IncludedSupportPackages: {}
    Options: [1×1 compiler.build.ExcelAddInOptions]
```

The `Files` property contains the paths to the following compiled files:

- `magicsquare_1_0.dll`
- `GettingStarted.html`

Note The files `magicsquare.bas` and `magicsquare.xla` are included in `Files` only if you enable the `'GenerateVisualBasicFile'` option in the build command.

Input Arguments

FunctionFiles — Files implementing MATLAB functions

character vector | string scalar | cell array of character vectors | string array

Files implementing MATLAB functions, specified as a character vector, a string scalar, a string array, or a cell array of character vectors. File paths can be relative to the current working directory or absolute. Files must have a `.m` extension.

Example: `["myfunc1.m", "myfunc2.m"]`

Data Types: `char` | `string` | `cell`

opts — Excel add-in build options

`compiler.build.ExcelAddInOptions` object

Excel add-in build options, specified as a `compiler.build.ExcelAddInOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1, ..., NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` in quotes.

Example: `'Verbose', 'on'`

AddInName — Name of Excel add-in

character vector | string scalar

Name of the Excel add-in, specified as a character vector or string scalar. The default name of the generated add-in is the first entry of the `FunctionFiles` argument. The name must begin with a letter and contain only alphabetic characters and underscores.

Example: `'AddInName', 'myAddIn'`

Data Types: `char` | `string`

AddInVersion — Add-in version

`'1.0.0.0'` (default) | character vector | string scalar

Add-in version, specified as a character vector or a string scalar.

Example: `'AddInVersion', '4.0'`

Data Types: `char` | `string`

AdditionalFiles — Additional files

character vector | string scalar | cell array of character vectors | string array

Additional files and folders to include in the Excel add-in, specified as a character vector, a string scalar, a string array, or a cell array of character vectors. Paths can be relative to the current working directory or absolute.

Example: 'AdditionalFiles', ["myvars.mat", "data.txt"]

Data Types: char | string | cell

AutoDetectDataFiles — Flag to automatically include data files

'on' (default) | on/off logical value

Flag to automatically include data files, specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then data files that you provide as inputs to certain functions (such as `load` and `fopen`) are automatically included in the add-in.
- If you set this property to 'off', then you must add data files to the add-in using the `AdditionalFiles` property.

Example: 'AutoDetectDataFiles', 'Off'

Data Types: logical

ClassName — Name of class

character vector | string scalar

Name of the class, specified as a character vector or a string scalar. Class names must match Excel add-in class name requirements.

The default value is the name of the first file listed in the `FunctionFiles` argument appended with `Class`.

Example: 'ClassName', 'magicsquareClass'

Data Types: char | string

DebugBuild — Flag to enable debug symbols

'on' (default) | on/off logical value

Flag to enable debug symbols, specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then the add-in is compiled with debug symbols.
- If you set this property to 'off', then the add-in is not compiled with debug symbols.

Example: 'DebugSymbols', 'On'

Data Types: logical

EmbedArchive — Flag to embed deployable archive

'on' (default) | on/off logical value

Flag to embed the deployable archive, specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then the function embeds the deployable archive in the Excel add-in.
- If you set this property to 'off', then the function generates the deployable archive as a separate file.

Example: 'EmbedArchive', 'Off'

Data Types: logical

GenerateVisualBasicFile — Flag to generate Visual Basic file

'off' (default) | on/off logical value

Flag to generate a Visual Basic file (.bas) and an Excel add-in file (.xla), specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type matlab.lang.OnOffSwitchState.

- If you set this property to 'on', then the function generates an Excel add-in XLA file and a Visual Basic BAS file containing the Microsoft Excel Formula Function interface to the add-in.
- If you set this property to 'off', then the function does not generate a Visual Basic file or an Excel add-in file.

Note To generate the Excel add-in file (.xla), you must enable "Trust access to the VBA project object model" in your Excel settings.

Example: 'GenerateVisualBasicFile', 'On'

Data Types: logical

OutputDir — Path to output directory

character vector | string scalar

Path to the output directory where the build files are saved, specified as a character vector or a string scalar. The path can be relative to the current working directory or absolute.

The default name of the build folder is the add-in name appended with excelAddIn.

Example: 'OutputDir', 'D:\Documents\MATLAB\work\mymagicexcelAddIn'

Data Types: char | string

SupportPackages — Support packages

'autodetect' (default) | 'none' | string scalar | cell array of character vectors | string array

Support packages to include, specified as one of the following options:

- 'autodetect' (default) — The dependency analysis process detects and includes the required support packages automatically.
- 'none' — No support packages are included. Using this option can cause runtime errors.
- A string scalar, character vector, or cell array of character vectors — Only the specified support packages are included. To list installed support packages or those used by a specific file, see `compiler.codetools.deployableSupportPackages`.

Example: 'SupportPackages',{ 'Deep Learning Toolbox Converter for TensorFlow Models', 'Deep Learning Toolbox Model for Places365-GoogLeNet Network' }

Data Types: char | string | cell

Verbose — Flag to control build verbosity

'off' (default) | on/off logical value

Flag to control build verbosity, specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then the MATLAB command window displays progress information indicating compiler output during the build process.
- If you set this property to 'off', then the command window does not display progress information.

Example: 'Verbose', 'On'

Data Types: logical

Output Arguments

results — Build results

`compiler.build.Results` object

Build results, returned as a `compiler.build.Results` object. The Results object contains:

- Build type, which is 'excelAddIn'
- Paths to the following files:
 - `GettingStarted.html`
 - `AddInName_AddInVersion.dll`
 - `AddInName.bas` (if you enable the 'GenerateVisualBasicFile' option)
 - `AddInName.xla` (if you enable the 'GenerateVisualBasicFile' option)
- A list of included support packages
- Build options, specified as an `ExcelAddInOptions` object

Limitations

- This function is only supported on Windows operating systems.

See Also

`compiler.build.ExcelAddInOptions` | **Library Compiler** | `mcc`

Introduced in R2021a

compiler.build.ExcelAddInOptions

Options for building Excel add-ins

Syntax

```
opts = compiler.build.ExcelAddInOptions(FunctionFiles)
opts = compiler.build.ExcelAddInOptions(FunctionFiles,Name,Value)
```

Description

`opts = compiler.build.ExcelAddInOptions(FunctionFiles)` creates an `ExcelAddInOptions` object using the MATLAB functions specified by `FunctionFiles`. Use the `ExcelAddInOptions` object as an input to the `compiler.build.excelAddIn` function.

`opts = compiler.build.ExcelAddInOptions(FunctionFiles,Name,Value)` creates an `ExcelAddInOptions` object with options specified using one or more name-value arguments. Options include the add-in name, additional files to include, and the output directory.

Examples

Create Excel Add-In Options Object

Create an `ExcelAddInOptions` object using file input.

For this example, use the file `magicsquare.m` located in `matlabroot\extern\examples\compiler`.

```
appFile = fullfile(matlabroot,'extern','examples','compiler','magicsquare.m');
opts = compiler.build.ExcelAddInOptions(appFile)
```

`opts =`

`ExcelAddInOptions` with properties:

```

        AddInName: 'magicsquare'
        AddInVersion: '1.0.0.0'
        ClassName: 'magicsquareClass'
        DebugBuild: off
        EmbedArchive: on
        FunctionFiles: {'C:\Program Files\MATLAB\R2022a\extern\examples\compiler\magicsqua
GenerateVisualBasicFile: off
        AdditionalFiles: {}
        AutoDetectDataFiles: on
        SupportPackages: {'autodetect'}
        Verbose: off
        OutputDir: '.\magicsquareexcelAddIn'
```

You can modify the property values of an existing `ExcelAddInOptions` object using dot notation. For example, enable verbose output.

```
opts.Verbose = 'on'
```



```
opts =
```

```
ExcelAddInOptions with properties:
```

```

    AddInName: 'magicsquare'
    AddInVersion: '1.0.0.0'
    ClassName: 'magicsquareClass'
    DebugBuild: off
    EmbedArchive: on
    FunctionFiles: {'C:\Program Files\MATLAB\R2022a\extern\examples\compiler\magicsqua
GenerateVisualBasicFile: off
    AdditionalFiles: {}
    AutoDetectDataFiles: on
    SupportPackages: {'autodetect'}
    Verbose: on
    OutputDir: '.\magicsquareexcelAddIn'
```

Use the `ExcelAddInOptions` object as an input to the `compiler.build.excelAddIn` function to build the Excel add-in.

```
buildResults = compiler.build.excelAddIn(opts);
```

Customize Excel Add-In Options Object

Create an `ExcelAddInOptions` object and customize it using name-value arguments.

For this example, use the file `magicsquare.m` located in `matlabroot\extern\examples\compiler`. Use name-value arguments to specify the output directory, generate a Visual Basic file, and enable verbose output.

```
appFile = fullfile(matlabroot, 'extern', 'examples', 'compiler', 'magicsquare.m');
opts = compiler.build.ExcelAddInOptions(appFile, ...
    'OutputDir', 'D:\Documents\MATLAB\work\MagicSquareAddIn', ...
    'GenerateVisualBasicFile', 'On')
```

```
opts =
```

```
ExcelAddInOptions with properties:
```

```

    AddInName: 'magicsquare'
    AddInVersion: '1.0.0.0'
    ClassName: 'magicsquareClass'
    DebugBuild: off
    EmbedArchive: on
    FunctionFiles: {'C:\Program Files\MATLAB\R2022a\extern\examples\compiler\magicsqua
GenerateVisualBasicFile: on
    AdditionalFiles: {}
    AutoDetectDataFiles: on
    SupportPackages: {'autodetect'}
    Verbose: off
    OutputDir: 'D:\Documents\MATLAB\work\MagicSquareAddIn'
```

Use the `ExcelAddInOptions` object as an input to the `compiler.build.excelAddIn` function to build the Excel add-in.

```
buildResults = compiler.build.excelAddIn(opts);
```

Input Arguments

FunctionFiles — MATLAB function files

character vector | string scalar | cell array of character vectors | string array

List of files implementing MATLAB functions, specified as a character vector, a string scalar, a string array, or a cell array of character vectors. Files must have a `.m` extension.

Example: `{'myFunction1.m', 'myFunction2.m'}`

Data Types: `char` | `string` | `cell`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1, ..., NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` in quotes.

Example: `'Verbose', 'on'`

AddInName — Name of Excel add-in

character vector | string scalar

Name of the Excel add-in, specified as a character vector or string scalar. The default name of the generated add-in is the first entry of the `FunctionFiles` argument. The name must begin with a letter and contain only alphabetic characters and underscores.

Example: `'AddInName', 'myAddIn'`

Data Types: `char` | `string`

AddInVersion — Add-in version

'1.0.0.0' (default) | character vector | string scalar

Add-in version, specified as a character vector or a string scalar.

Example: `'AddInVersion', '4.0'`

Data Types: `char` | `string`

AdditionalFiles — Additional files

character vector | string scalar | cell array of character vectors | string array

Additional files and folders to include in the Excel add-in, specified as a character vector, a string scalar, a string array, or a cell array of character vectors. Paths can be relative to the current working directory or absolute.

Example: `'AdditionalFiles', ["myvars.mat", "data.txt"]`

Data Types: `char` | `string` | `cell`

AutoDetectDataFiles — Flag to automatically include data files

'on' (default) | on/off logical value

Flag to automatically include data files, specified as `'on'` or `'off'`, or as numeric or logical `1` (`true`) or `0` (`false`). A value of `'on'` is equivalent to `true`, and `'off'` is equivalent to `false`. Thus, you can

use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then data files that you provide as inputs to certain functions (such as `load` and `fopen`) are automatically included in the add-in.
- If you set this property to 'off', then you must add data files to the add-in using the `AdditionalFiles` property.

Example: `'AutoDetectDataFiles','Off'`

Data Types: `logical`

ClassName — Name of class

character vector | string scalar

Name of the class, specified as a character vector or a string scalar. Class names must match Excel add-in class name requirements.

The default value is the name of the first file listed in the `FunctionFiles` argument appended with `Class`.

Example: `'ClassName','magicsquareClass'`

Data Types: `char` | `string`

DebugBuild — Flag to enable debug symbols

'on' (default) | on/off logical value

Flag to enable debug symbols, specified as 'on' or 'off', or as numeric or logical 1 (`true`) or 0 (`false`). A value of 'on' is equivalent to `true`, and 'off' is equivalent to `false`. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then the add-in is compiled with debug symbols.
- If you set this property to 'off', then the add-in is not compiled with debug symbols.

Example: `'DebugSymbols','On'`

Data Types: `logical`

EmbedArchive — Flag to embed deployable archive

'on' (default) | on/off logical value

Flag to embed the deployable archive, specified as 'on' or 'off', or as numeric or logical 1 (`true`) or 0 (`false`). A value of 'on' is equivalent to `true`, and 'off' is equivalent to `false`. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then the function embeds the deployable archive in the Excel add-in.
- If you set this property to 'off', then the function generates the deployable archive as a separate file.

Example: `'EmbedArchive','Off'`

Data Types: `logical`

GenerateVisualBasicFile — Flag to generate Visual Basic file

'off' (default) | on/off logical value

Flag to generate a Visual Basic file (.bas) and an Excel add-in file (.xla), specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type matlab.lang.OnOffSwitchState.

- If you set this property to 'on', then the function generates an Excel add-in XLA file and a Visual Basic BAS file containing the Microsoft Excel Formula Function interface to the add-in.
- If you set this property to 'off', then the function does not generate a Visual Basic file or an Excel add-in file.

Note To generate the Excel add-in file (.xla), you must enable "Trust access to the VBA project object model" in your Excel settings.

Example: 'GenerateVisualBasicFile','On'

Data Types: logical

OutputDir — Path to output directory

character vector | string scalar

Path to the output directory where the build files are saved, specified as a character vector or a string scalar. The path can be relative to the current working directory or absolute.

The default name of the build folder is the add-in name appended with excelAddIn.

Example: 'OutputDir','D:\Documents\MATLAB\work\mymagicexcelAddIn'

Data Types: char | string

SupportPackages — Support packages

'autodetect' (default) | 'none' | string scalar | cell array of character vectors | string array

Support packages to include, specified as one of the following options:

- 'autodetect' (default) — The dependency analysis process detects and includes the required support packages automatically.
- 'none' — No support packages are included. Using this option can cause runtime errors.
- A string scalar, character vector, or cell array of character vectors — Only the specified support packages are included. To list installed support packages or those used by a specific file, see `compiler.codetools.deployableSupportPackages`.

Example: 'SupportPackages',{'Deep Learning Toolbox Converter for TensorFlow Models','Deep Learning Toolbox Model for Places365-GoogLeNet Network'}

Data Types: char | string | cell

Verbose — Flag to control build verbosity

'off' (default) | on/off logical value

Flag to control build verbosity, specified as 'on' or 'off', or as numeric or logical 1 (true) or 0 (false). A value of 'on' is equivalent to true, and 'off' is equivalent to false. Thus, you can use the value of this property as a logical value. The value is stored as an on/off logical value of type `matlab.lang.OnOffSwitchState`.

- If you set this property to 'on', then the MATLAB command window displays progress information indicating compiler output during the build process.
- If you set this property to 'off', then the command window does not display progress information.

Example: 'Verbose', 'On'

Data Types: logical

Output Arguments

opts — Excel add-in build options

ExcelAddInOptions object

Excel add-in build options, returned as an ExcelAddInOptions object.

See Also

`compiler.build.excelAddIn` | `mcc`

Introduced in R2021a

componentinfo

Query system registry about component created with MATLAB Compiler

Syntax

```
info = componentinfo
info = componentinfo(component_name)
info = componentinfo(component_name, major_revision_number)
info = componentinfo(component_name, major_revision_number,
minor_revision_number)
```

Arguments

<i>component_name</i>	MATLAB character vector or string scalar providing the name of a MATLAB Compiler component. Names are case sensitive. If this argument is not supplied, the function returns information on all installed components.
<i>major_revision_number</i>	Component major revision number. If this argument is not supplied, the function returns information on all major revisions.
<i>minor_revision_number</i>	Component minor revision number. Default value is 0.

Description

`info = componentinfo` returns information for all components installed on the system.

`info = componentinfo(component_name)` returns information for all revisions of *component_name*.

`info = componentinfo(component_name, major_revision_number)` returns information for the most recent minor revision corresponding to *major_revision_number* of *component_name*.

`info = componentinfo(component_name, major_revision_number, minor_revision_number)` returns information for the specific major and minor version of *component_name*.

The return value is an array of structures representing all the registry and type information needed to load and use the component.

When you supply a component name, *major_revision_number* and *minor_revision_number* are interpreted as shown below.

Value	Information Returned
> 0	Information on a specific major and minor revision
0	Information on the most recent revision. When omitted, <i>minor_revision_number</i> is assumed to be equal to 0.

Value	Information Returned
< 0	Information on all versions

Note Although properties and events may appear in the output for `componentinfo`, they are not supported by MATLAB Compiler SDK.

Registry Information

The information about a component has the fields shown in the following table.

Registry Information Returned by `componentinfo`

Field	Description
Name	Component name.
TypeLib	Component type library.
LIBID	Component type library GUID.
MajorRev	Major version number.
MinorRev	Minor version number.
FileName	Type library file name and path. Since all the MATLAB Compiler components have the type library bound into the DLL, this file name is the same as the DLL name and path.
Interfaces	An array of structures defining all interface definitions in the type library. Each structure contains two fields: <ul style="list-style-type: none"> Name - Interface name. IID - Interface GUID.

Registry Information Returned by componentinfo (Continued)

CoClasses	<p>An array of structures defining all COM classes in the component. Each structure contains these fields:</p> <ul style="list-style-type: none"> • Name - Class name. • CLSID - GUID of the class. • ProgID - Version-dependent program ID. • VerIndProgID - Version-independent program ID. • InprocServer32 - Full name and path to component DLL. • Methods - A structure containing function prototypes of all class methods defined for this interface. This structure contains four fields: <ul style="list-style-type: none"> • IDL - An array of Interface Description Language function prototypes. • M - An array of MATLAB function prototypes. • C - An array of C-language function prototypes. • VB - An array of VBA function prototypes. • Properties - A cell array containing the names of all class properties. • Events - A structure containing function prototypes of all events defined for this class. This structure contains four fields: <ul style="list-style-type: none"> • IDL - An array of Interface Description Language function prototypes. • M - An array of MATLAB function prototypes. • C - An array of C-language function prototypes. • VB - An array of VBA function prototypes.
-----------	---

Examples

Function Call	Returns
Info = componentinfo	Information for all installed components.
Info = componentinfo('mycomponent')	Information for all revisions of mycomponent.
Info = componentinfo('mycomponent',1,0)	Information for revision 1.0 of mycomponent.

Introduced in R2015a

deploytool

Open a list of application deployment apps

Syntax

```
deploytool  
deploytool project_name
```

Description

deploytool opens a list of application deployment apps.

deploytool project_name opens the appropriate deployment app with the project preloaded.

Examples

Open a List of Application Deployment Apps

Open the list of apps.

```
deploytool
```

Input Arguments

project_name — name of the project to be opened

character array or string

Name of the project to be opened by the appropriate deployment app, specified as a character array or string. The project must be on the current path.

Compatibility Considerations

-build and -package options will be removed

Warns starting in R2020a

The `-build` and `-package` options will be removed. To build applications, use one of the `compiler.build` family of functions or the `mcc` command; and to package and create an installer, use the `compiler.package.installer` function.

Introduced in R2006b

libraryCompiler

Open the Library Compiler app

Syntax

```
libraryCompiler  
libraryCompiler project_name
```

Description

`libraryCompiler` opens the Library Compiler app for the creation of a new compiler project

`libraryCompiler project_name` opens the Library Compiler app with the project preloaded.

Examples

Create a New Project

Open the Library Compiler app to create a new project.

```
libraryCompiler
```

Input Arguments

project_name — name of the project to be compiled

character array or string

Specify the name of a previously saved project. The project must be on the current path.

Compatibility Considerations

-build and -package options will be removed

Warns starting in R2020a

The `-build` and `-package` options will be removed. To build applications, use one of the `compiler.build` family of functions or the `mcc` command; and to package and create an installer, use the `compiler.package.installer` function.

Introduced in R2013b

mcc

Compile MATLAB functions for deployment

Syntax

```
mcc options mfilename1 mfilename2...mfilenameN
```

```
mcc -m options mfilename
```

```
mcc -e options mfilename
```

```
mcc -W 'excel:addin_name,className,version=version_number' -T link:lib
options mfilename1 mfilename2...mfilenameN
```

```
mcc -H -W hadoop:archiveName,CONFIG:configFile mfilename
```

```
mcc -m options mfilename
```

Description

General Usage

`mcc options mfilename1 mfilename2...mfilenameN` compiles the functions as specified by the options. The options used depend on the intended results of the compilation.

For information on compiling:

- C/C++ shared libraries, .NET assemblies, Java packages, or Python packages, see `mcc` for MATLAB Compiler SDK
- MATLAB Production Server™ deployable archives or Excel add-ins for MATLAB Production Server, see `mcc` for MATLAB Compiler SDK

Standalone Application

`mcc -m options mfilename` compiles the function into a standalone application.

This is equivalent to `mcc -W main -T link:exe`.

`mcc -e options mfilename` compiles the function into a standalone application that does not open a Windows command prompt on execution. The `-e` option works only on Windows operating systems.

This syntax is equivalent to `-W WinMain -T link:exe`.

Excel Add-In

`mcc -W 'excel:addin_name,className,version=version_number' -T link:lib options mfilename1 mfilename2...mfilenameN` creates a Microsoft Excel add-in from the specified files.

- *addin_name* — Specifies the name of the add-in.

- *className* — Specifies the name of the class to be created. If you do not specify the class name, `mcc` uses the *addin_name* as the default. If specified, *className* needs to be different from *mfilename*.
- *version_number* — Specifies the version number of the add-in file as *major.minor.bug.build* in the file system. You are not required to specify a version number. If you do not specify a version number, `mcc` sets the version number to `1.0.0.0` by default.
 - *major* — Specifies the major version number. If you do not specify a number, `mcc` sets *major* to `0`.
 - *minor* — Specifies the minor version number. If you do not specify a number, `mcc` sets *minor* to `0`.
 - *bug* — Specifies the bug fix maintenance release number. If you do not specify a number, `mcc` sets *bug* to `0`.
 - *build* — Specifies the build number. If you do not specify a number, `mcc` sets *build* to `0`.

Note Excel add-ins can be created only in MATLAB running on Windows.

Note Remove the single quotes around `'excel:addin_name,className,version'` when executing the `mcc` command from a DOS prompt.

MapReduce Applications on Hadoop

`mcc -H -W hadoop:archiveName,CONFIG:configFile mfilename` generates a deployable archive from *mfilename* that can be run as a job by Hadoop®.

- *archiveName* — Specifies the name of the generated archive.
- *configFile* — Specifies the path to the configuration file for creating a deployable archive. For more information, see “Configuration File for Creating Deployable Archive Using the `mcc` Command”.

Tip You can issue the `mcc` command either at the MATLAB command prompt or the Windows or Linux system command-line.

Simulink Simulations (Requires Simulink Compiler)

`mcc -m options mfilename` compiles a MATLAB application containing a Simulink® simulation into a standalone application. For more information, see “Create and Deploy a Script with Simulink Compiler” (Simulink Compiler).

Examples

Create a standalone application

```
mcc -m magic.m
```

Create a standalone application that does not open the Command shell (Windows only)

```
mcc -e magic.m
```

Create a standalone application with a system-level file version number (Windows only)

Create a standalone application in Windows with version number 3.4.1.5.

```
mcc -W 'main:mymagic,version=3.4.1.5' -T link:exe mymagic.m
```

Create a standalone application and include MATLAB preferences

```
mcc -m helloWorld.m -a C:\Users\someuser\AppData\Roaming\MathWorks\MATLAB\R2022a\matlab.mlsetting
```

Create an Excel add-in

```
mcc -W 'excel:myAddin,myClass,1.0' -T link:lib magic.m
```

Create an Excel add-in with a system-level file version number (Windows only)

Create an Excel add-in in Windows with version number 5.2.1.7.

```
mcc -W 'excel:myAddin,myClass,version=5.2.1.7' -T link:lib -b mymagic.m
```

Create an Excel add-in for MATLAB Production Server

```
mcc -W 'mpsxl:myDeployableArchvie,myExcelClass,version=1.0' -T link:lib mymagic.m
```

Create a Standalone Application for a Simulink Simulation (Requires Simulink Compiler)

To create a standalone application for a Simulink simulation:

Create a Simulink model using Simulink. This example uses the model `sldemo_suspn_3dof`.

Create a MATLAB application that uses APIs from Simulink Compiler to simulate the model. For more information, see “Deploy Simulations with Tunable Parameters” (Simulink Compiler).

```
function deployParameterTuning(outputFile, mbVariable)
    if ischar(mbVariable) || isstring(mbVariable)
        mbVariable = str2double(mbVariable);
    end

    if isnan(mbVariable) || ~isa(mbVariable, 'double') || ~isscalar(mbVariable)
        disp('mb must be a double scalar or a string or char that can be converted to a double scalar');
    end

    in = Simulink.SimulationInput('sldemo_suspn_3dof');
    in = in.setVariable('Mb', mbVariable);
    in = simulink.compiler.configureForDeployment(in);
    out = sim(in);

    save(outputFile, 'out');
end
```

Use `mcc` to create a standalone application from the MATLAB application.

```
mcc -m deployParameterTuning.m
```

Input Arguments

mfilename — File to be compiled

file name

File to be compiled, specified as a character vector or string scalar.

mfilename1 mfilename2...mfilenameN — Files to be compiled

list of file names

One or more files to be compiled, specified as a space-separated list of file names.

options — Options for customizing the output

-a | -b | -B | -c | -C | -d | -f | -g | -G | -I | -K | -m | -M | -n | -N | -o | -p | -r | -R | -s | -S | -T | -u | -U | -v | -w | -W | -X | -Y | -Z

Options for customizing the output, specified as a list of character vectors or string scalars.

- **-a**

Add files to the deployable archive using `-a path` to specify the files to be added. Multiple `-a` options are permitted.

Also, add MATLAB preferences to a deployed application using `-a path \my matlab.mlsettings` to specify the preferences to be added.

If a file name is specified with `-a`, the compiler looks for these files on the MATLAB path, so specifying the full path name is optional. These files are not passed to `mbuild`, so you can include files such as data files.

If a folder name is specified with the `-a` option, the entire contents of that folder are added recursively to the deployable archive. For example,

```
mcc -m hello.m -a ./testdir
```

specifies that all files in `testdir`, as well as all files in its subfolders, are added to the deployable archive. The folder subtree in `testdir` is preserved in the deployable archive.

If the filename includes a wildcard pattern, only the files in the folder that match the pattern are added to the deployable archive and subfolders of the given path are not processed recursively. For example,

```
mcc -m hello.m -a ./testdir/*
```

specifies that all files in `./testdir` are added to the deployable archive and subfolders under `./testdir` are not processed recursively.

```
mcc -m hello.m -a ./testdir/*.m
```

specifies that all files with the extension `.m` under `./testdir` are added to the deployable archive and subfolders of `./testdir` are not processed recursively.

Note * is the only supported wildcard.

When you add files to the archive using `-a` that do not appear on the MATLAB path at the time of compilation, a path entry is added to the application's run-time path so that they appear on the path when the deployed code executes.

When you use the `-a` option to specify a full path to a resource, the basic path is preserved, with some modifications, but relative to a subdirectory of the runtime cache directory, not to the user's local folder. The cache directory is created from the deployable archive the first time the

application is executed. You can use the `isdeployed` function to determine whether the application is being run in deployed mode, and adjust the path accordingly. The `-a` option also creates a `.auth` file for authorization purposes.

Caution If you use the `-a` flag to include a file that is not on the MATLAB path, the folder containing the file is added to the MATLAB dependency analysis path. As a result, other files from that folder might be included in the compiled application.

Note If you use the `-a` flag to include custom Java classes, standalone applications work without any need to change the `classpath` as long as the Java class is not a member of a package. The same applies for JAR files. However, if the class being added is a member of a package, the MATLAB code needs to make an appropriate call to `javaaddpath` to update the `classpath` with the parent folder of the package.

- **-b**

Generate a Visual Basic file (`.bas`) containing the Microsoft Excel Formula Function interface to the COM object generated by MATLAB Compiler. When imported into the workbook Visual Basic code, this code allows the MATLAB function to be seen as a cell formula function.

- **-B**

Replace the file on the `mcc` command line with the contents of the specified file. Use

```
-B filename[:<a1>,<a2>,...,<an>]
```

The bundle `filename` should contain only `mcc` command-line options and corresponding arguments and/or other file names. The file might contain other `-B` options. A bundle can include replacement parameters for compiler options that accept names and version numbers. See “Using Bundles to Build MATLAB Code” (MATLAB Compiler SDK).

- **-c**

When used in conjunction with the `-l` option, suppresses compiling and linking of the generated C wrapper code. The `-c` option cannot be used independently of the `-l` option.

- **-C**

Do not embed the deployable archive in binaries.

Note The `-C` flag is ignored for Java libraries.

- **-d**

Place output in a specified folder. Use

```
-d outFolder
```

to direct the generated files to `outFolder`. The specified folder must already exist.

- **-e**

Use `-e` in place of the `-m` option to generate a standalone Windows application that does not open a Windows command prompt on execution. `-e` is equivalent to `-W WinMain -T link:exe`.

This option works only on Windows operating systems.

- **-f**

Override the default options file with the specified options file. It specifically applies to the C/C++ shared libraries, COM, and Excel targets. Use

`-f filename`

to specify `filename` as the options file when calling `mbuild`. This option lets you use different ANSI compilers for different invocations of the compiler. This option is a direct pass-through to `mbuild`.

- **-g, -G**

Include debugging symbol information for the C/C++ code generated by MATLAB Compiler SDK. It also causes `mbuild` to pass appropriate debugging flags to the system C/C++ compiler. The debug option lets you backtrace up to the point where you can identify if the failure occurred in the initialization of MATLAB Runtime, the function call, or the termination routine. This option does not let you debug your MATLAB files with a C/C++ debugger.

- **-I**

Add a new folder path to the list of included folders. Each `-I` option appends the folder to the end of the list of paths to search. For example,

`-I <directory1> -I <directory2>`

sets up the search path so that `directory1` is searched first for MATLAB files, followed by `directory2`. This option is important for standalone compilation where the MATLAB path is not available.

If used in conjunction with the `-N` option, the `-I` option adds the folder to the compilation path in the same position where it appeared in the MATLAB path rather than at the head of the path.

- **-K**

Direct `mcc` to not delete output files if the compilation ends prematurely due to error.

The default behavior of `mcc` is to dispose of any partial output if the command fails to execute successfully.

- **-m**

Direct `mcc` to generate a standalone application.

- **-M**

Define compile-time options. Use

`-M string`

to pass `string` directly to `mbuild`. This option provides a useful mechanism for defining compile-time options, for example, `-M "-Dmacro=value"`.

Note Multiple `-M` options do not accumulate; only the rightmost `-M` option is used.

To pass options such as `/bigobj`, delineate the string according to your platform.

Platform	Syntax
MATLAB	-M 'COMPFLAGS=\$COMPFLAGS /bigobj'
Windows command prompt	-M COMPFLAGS="\$COMPFLAGS /bigobj"
Linux and macOS command line	-M CFLAGS='\$CFLAGS /bigobj'

- **-n**

The `-n` option automatically identifies numeric command line inputs and treats them as MATLAB doubles.

- **-N**

Passing `-N` clears the path of all folders except the following core folders (this list is subject to change over time):

- `matlabroot\toolbox\matlab`
- `matlabroot\toolbox\local`
- `matlabroot\toolbox\compiler`
- `matlabroot\toolbox\shared\bigdata`

Passing `-N` also retains all subfolders in this list that appear on the MATLAB path at compile time. Including `-N` on the command line lets you replace folders from the original path, while retaining the relative ordering of the included folders. All subfolders of the included folders that appear on the original path are also included. In addition, the `-N` option retains all folders that you included on the path that are not under `matlabroot\toolbox`.

When using the `-N` option, use the `-I` option to force inclusion of a folder, which is placed at the head of the compilation path. Use the `-p` option to conditionally include folders and their subfolders; if they are present in the MATLAB path, they appear in the compilation path in the same order.

- **-o**

Specify the name of the final executable (standalone applications only). Use

`-o outputfile`

to name the final executable output of MATLAB Compiler. A suitable platform-dependent extension is added to the specified name (for example, `.exe` for Windows standalone applications).

- **-p**

Use in conjunction with the option `-N` to add specific folders and subfolders under `matlabroot\toolbox` to the compilation MATLAB path. The files are added in the same order in which they appear in the MATLAB path. Use the syntax

`-N -p directory`

where `directory` is the folder to be included. If `directory` is not an absolute path, it is assumed to be under the current working folder.

- If a folder is included with `-p` that is on the original MATLAB path, the folder and all its subfolders that appear on the original path are added to the compilation path in the same order.

- If a folder is included with `-p` that is not on the original MATLAB path, that folder is ignored. (You can use `-I` to force its inclusion.)
- **-r**

Embed resource icon in binary. The syntax is as follows:

```
-r 'path/to/my_icon.ico'
```

- **-R**

Provide MATLAB Runtime options that are passed to the application at initialization time.

Note This option is relevant only when building standalone applications or Excel add-ins using MATLAB Compiler.

The syntax is as follows:

`-R option`

Option	Description	Target
'-logfile, filename'	Specify a log file name. The file is created in the application folder at runtime. Option must be in single quotes. Use double quotes when executing the command from a Windows Command Prompt.	MATLAB Compiler
-nodisplay	Suppress the MATLAB <code>nodisplay</code> run-time warning.	MATLAB Compiler
-nojvm	Do not use the Java Virtual Machine (JVM).	MATLAB Compiler
-startmsg	Customizable user message displayed at initialization time.	MATLAB Compiler Standalone Applications
-complete msg	Customizable user message displayed when initialization is complete.	MATLAB Compiler Standalone Applications
-singleCompThread	Limit MATLAB to a single computational thread.	MATLAB Compiler
-software opengl	Use Mesa Software OpenGL [®] for rendering.	MATLAB Compiler

Caution When running on macOS, if you use `-nodisplay` as one of the options included in `mclInitializeApplication`, then the call to `mclInitializeApplication` must occur before calling `mclRunMain`.

Note If you specify the `-R` option for libraries created from MATLAB Compiler SDK, `mcc` still compiles and generates the results, but the `-R` option doesn't apply to these libraries and does not do anything.

- **-s**

Obfuscate folder structures and file names in the deployable archive (.ctf file) from the end user. Optionally encrypt additional file types.

The `-s` option directs `mcc` to place user code and data contained in `.m`, `.p`, v7.3 `.mat`, and MEX files into a user package within the CTF. During runtime, MATLAB code and data is decrypted and loaded directly from the user package rather than extracted to the file system. MEX files are temporarily extracted from the user package before being loaded.

To manually include additional file types in the user package, add each file type in a separate extension tag to the file `matlabroot/toolbox/compiler/advanced_package_supported_files.xml`.

The following is not supported:

- `ver` function
 - Out-of-process MATLAB Runtime (C++ shared library for MATLAB Data Array)
 - Out-of-process MEX file execution (`mexhost`, `feval`, `matlab.mex.MexHost`)
- **-S**

The standard behavior for the MATLAB Runtime is that every instance of a class gets its own MATLAB Runtime context. The context includes a global MATLAB workspace for variables, such as the path and a base workspace for each function in the class. If multiple instances of a class are created, each instance gets an independent context. This ensures that changes made to the global or base workspace in one instance of the class does not affect other instances of the same class.

In a singleton MATLAB Runtime, all instances of a class share the context. If multiple instances of a class are created, they use the context created by the first instance which saves startup time and some resources. However, any changes made to the global workspace or the base workspace by one instance impacts all class instances. For example, if `instance1` creates a global variable `A` in a singleton MATLAB Runtime, then `instance2` can use variable `A`.

Singleton MATLAB Runtime is only supported by the following products on these specific targets:

Target supported by Singleton MATLAB Runtime	Create a Singleton MATLAB Runtime by....
Excel add-in	Default behavior for target is singleton MATLAB Runtime. You do not need to perform other steps.
.NET assembly	Default behavior for target is singleton MATLAB Runtime. You do not need to perform other steps.
COM component	<ul style="list-style-type: none"> • Using the Library Compiler app, click Settings and add <code>-S</code> to the Additional parameters passed to MCC field. • Using <code>mcc</code>, pass the <code>-S</code> flag.
Java package	

- **-T**

Specify the output target phase and type.

Use the syntax `-T target` to define the output type.

Target	Description
compile:exe	Generate a C/C++ wrapper file, and compile C/C++ files to an object form suitable for linking into a standalone application.
compile:lib	Generate a C/C++ wrapper file, and compile C/C++ files to an object form suitable for linking into a shared library or DLL.
link:exe	Same as compile:exe and also link object files into a standalone application.
link:lib	Same as compile:lib and also link object files into a shared library or DLL.

- **-u**

Register COM component for the current user only on the development machine. The argument applies only to the generic COM component and Microsoft Excel add-in targets.

- **-U**

Build deployable archive (.ctf file) for MATLAB Production Server.

- **-v**

Display the compilation steps, including:

- MATLAB Compiler version number
- The source file names as they are processed
- The names of the generated output files as they are created
- The invocation of mbuild

The -v option passes the -v option to mbuild and displays information about mbuild.

- **-w**

Display warning messages. Use the syntax

`-w option [:<msg>]`

to control the display of warnings.

Syntax	Description
<code>-w list</code>	List the compile-time warnings that have abbreviated identifiers, together with their status.
<code>-w enable</code>	Enable all compile-time warnings.
<code>-w disable[:<string>]</code>	Disable specific compile-time warnings associated with <string>. Omit the optional <string> to apply the disable action to all compile-time warnings.
<code>-w enable[:<string>]</code>	Enable specific compile-time warnings associated with <string>. Omit the optional <string> to apply the enable action to all compile-time warnings.

Syntax	Description
<code>-w error[:<string>]</code>	Treat specific compile-time and runtime warnings associated with <i><string></i> as an error. Omit the optional <i><string></i> to apply the error action to all compile-time and runtime warnings.
<code>-w off[:<string>]</code>	Turn off warnings for specific error messages defined by <i><string></i> . Omit the optional <i><string></i> to apply the off action to all runtime warnings.
<code>-w on[:<string>]</code>	Turn on runtime warnings associated with <i><string></i> . Omit the optional <i><string></i> to apply the on action to all runtime warnings. This option is enabled by default.

You can also turn warnings on or off in your MATLAB code.

For example, to turn off warnings for deployed applications (specified using `isdeployed`) in `startup.m`, you write:

```
if isdeployed
    warning off
end
```

To turn on warnings for deployed applications, you write:

```
if isdeployed
    warning on
end
```

You can also specify multiple `-w` options.

For example, if you want to disable all warnings except `repeated_file`, you write:

```
-w disable -w enable:repeated_file
```

When you specify multiple `-w` options, they are processed from left to right.

- **-W**

Control the generation of function wrappers. Use the syntax

```
-W type
```

to control the generation of function wrappers for a collection of MATLAB files generated by the compiler. You provide a list of functions, and the compiler generates the wrapper functions and any appropriate global variable definitions.

Target	Syntax
Standalone Application	<code>-W 'main:appName,version=version'</code>
Standalone Application (no Windows console)	<code>-W 'WinMain:appName,version=version'</code>
Excel Add-In	<code>-W 'excel:addinName,className,version=version'</code>

Target	Syntax
Hadoop MapReduce Application	-W 'hadoop: <i>archiveName</i> ,CONFIG: <i>configFile</i> '
Spark Application	-W 'spark: <i>appName</i> , <i>version</i> '

Note Replace single quotes with double when executing the command from a Windows Command Prompt.

- **-X**

Use **-X** to ignore data files read by common MATLAB file I/O functions during dependency analysis. For more information, see “Dependency Analysis Using MATLAB Compiler”. For examples on how to use the **-X** option, see `%#exclude`.

- **-Y**

Use

`-Y license.lic`

to override the default license file with the specified argument.

Note The **-Y** flag works only with the command-line mode.

```
>>!mcc -m foo.m -Y license.lic
```

- **-Z**

Use

`-Z option`

to specify the method of adding support packages to the deployable archive.

Syntax	Description
<code>-Z 'autodetect'</code>	The dependency analysis process detects and includes the required support packages automatically. This is the default behavior of <code>mcc</code> .
<code>-Z 'none'</code>	No support packages are included. Using this option can cause runtime errors.
<code>-Z packagename</code>	Only the specified support package is included. To specify multiple support packages, use multiple <code>-Z</code> inputs.

Note To list installed support packages or those used by a specific file, see `compiler.codetools.deployableSupportPackages`.

Tips

- On Windows, you can generate a system-level file version number for your target file by appending `version=version_number` to the target generating `mcc` syntax. For an example, see “Create a standalone application with a system-level file version number (Windows only)”.

version_number — Specifies the version of the target file as *major.minor.bug.build* in the file system. You are not required to specify a version number. If you do not specify a version number, `mcc` sets the version number, by default, to `1.0.0.0`.

- *major* — Specifies the major version number. If you do not specify a version number, `mcc` sets *major* to `1`.
- *minor* — Specifies the minor version number. If you do not specify a version number, `mcc` sets *minor* to `0`.
- *bug* — Specifies the bug fix maintenance release number. If you do not specify a version number, `mcc` sets *bug* to `0`.
- *build* — Specifies build number. If you do not specify a version number, `mcc` sets *build* to `0`.

This functionality is supported for standalone applications and Excel add-ins in MATLAB Compiler. For supported targets in MATLAB Compiler SDK, see the **Tips** section in `mcc`.

See Also

Introduced before R2006a

Utility Library for Microsoft COM Components

- “Reference Utility Classes” on page 10-2
- “Class MWUtil” on page 10-3
- “Class MWFlags” on page 10-10
- “Class MWStruct” on page 10-15
- “Class MWField” on page 10-20
- “Class MWComplex” on page 10-21
- “Class MWSparse” on page 10-23
- “Class MWArg” on page 10-26
- “Enum mwArrayFormat” on page 10-27
- “Enum mwDataType” on page 10-28
- “Enum mwDateFormat” on page 10-29

Reference Utility Classes

This section describes the `MWComUtil` library. This library is freely distributable and includes several functions used in array processing, as well as type definitions used in data conversion. This library is contained in the file `matlabroot\bin\win64\mwcomutil.dll`. You must register it on each machine that uses Microsoft COM components created by MATLAB Compiler or MATLAB Compiler SDK.

For instructions on registering the `MWComUtil` library at the command prompt, see “Register MATLAB Utility Libraries” on page 2-13.

The `MWComUtil` library includes seven classes and three enumerated types. Before using these types, you must make explicit references to the `MWComUtil` type libraries in the Microsoft Visual Basic IDE.

See Also

Related Examples

- “Class `MWUtil`” on page 10-3
- “Class `MWFlags`” on page 10-10
- “Class `MWStruct`” on page 10-15
- “Class `MWField`” on page 10-20
- “Class `MWComplex`” on page 10-21
- “Class `MWSparse`” on page 10-23
- “Class `MWArg`” on page 10-26
- “Enum `mwArrayFormat`” on page 10-27
- “Enum `mwDataType`” on page 10-28
- “Enum `mwDateFormat`” on page 10-29

Class MWUtil

The `MWUtil` class contains a set of static utility methods used in array processing and application initialization. This class is implemented internally as a singleton (only one global instance of this class per instance of Microsoft Excel). It is most efficient to declare one variable of this type in global scope within each module that uses it. The methods of `MWUtil` are listed below.

The function prototypes use Visual Basic syntax.

Sub MWInitApplication(pApp As Object)

Initializes the library with the current instance of Microsoft Excel.

Parameters

Argument	Type	Description
pApp	Object	A valid reference to the current Excel application

Return Value

None.

Remarks

This function must be called once for each session of Excel that uses COM components created by MATLAB Compiler. An error is generated if a method call is made to a member class of any MATLAB Compiler SDK COM component, and the library has not been initialized.

Example

This Visual Basic sample initializes the `MWComUtil` library with the current instance of Excel. A global variable of type `Object` named `MCLUtil` holds an instance of the `MWUtil` class, and another global variable of type `Boolean` named `bModuleInitialized` stores the status of the initialization process. The private subroutine `InitModule()` creates an instance of the `MWComUtil` class and calls the `MWInitApplication` method with an argument of `Application`. Once this function succeeds, all subsequent calls exit without recreating the object.

```
Dim MCLUtil As Object
Dim bModuleInitialized As Boolean

Private Sub InitModule()
    If Not bModuleInitialized Then
        On Error GoTo Handle_Error
        If MCLUtil Is Nothing Then
            Set MCLUtil = CreateObject("MWComUtil.MWUtil")
        End If
        Call MCLUtil.MWInitApplication(Application)
        bModuleInitialized = True
    Exit Sub
Handle_Error:
    bModuleInitialized = False
End If
End Sub
```

Note If you are developing concurrently with multiple versions of MATLAB and `MWComUtil.dll`, for example, using the following syntax requires you to recompile your COM modules every time you upgrade.

```
Set MCLUtil = CreateObject("MWComUtil.MWUtil")
```

To avoid this, make your call to the `MWUtil` module version-specific, where `x.x` is the specific version number.

```
Set MCLUtil = CreateObject("MWComUtil.MWUtilx.x")
```

Sub MWInitApplicationWithMCROptions(pApp As Object, [mcrOptionList])

Start MATLAB Runtime with MATLAB Runtime options. Similar to `mclInitializeApplication` (MATLAB Compiler SDK).

Parameters

Argument	Type	Description
pApp	Object	A valid reference only when called from an Excel application Non Excel COM clients pass in Empty.

Return Value

None.

Remarks

Call this function to pass in MATLAB Runtime options (`nojvm`, `logfile`, etc.). Call this function once per process.

Example

This Visual Basic sample initializes the `MWComUtil` library with the current instance of Excel. A global variable of type `Object` named `MCLUtil` holds an instance of the `MWUtil` class, and another global variable of type `Boolean` named `bModuleInitialized` stores the status of the initialization process. The private subroutine `InitModule()` creates an instance of the `MWComUtil` class and calls the `MWInitApplicationWithMCROptions` method with an argument of `Application` and a string array that contains the options. Once this function succeeds, all subsequent calls exit without recreating the object. When this function successfully executes, the MATLAB Runtime starts up with no JVM™ and a logfile named `logfile.txt`.

```
Dim MCLUtil As Object
Dim bModuleInitialized As Boolean

Private Sub InitModule()
    If Not bModuleInitialized Then
        On Error GoTo Handle_Error
        If MCLUtil Is Nothing Then
```

```

        Set MCLUtil = CreateObject("MWComUtil.MWUtil")
    End If
    Dim mcrOptions(1 To 3) as String
    mcrOptions(1) = "-nojvm"
    mcrOptions(2) = "-logfile"
    mcrOptions(3) = "logfile.txt"
    Call MCLUtil.MWInitApplicationWithMCROptions(Application, mcrOptions)
    bModuleInitialized = True
    Exit Sub
Handle_Error:
    bModuleInitialized = False
End If
End Sub

```

Note If you are not using Excel, pass in Nothing instead of Application to MWInitApplicationWithMCROptions.

Function IsMCRJVMEnabled() As Boolean

Returns true if MATLAB Runtime is launched with JVM; otherwise returns false.

Parameters

None.

Return Value

Boolean

Function IsMCRInitialized() As Boolean

Returns true if MATLAB Runtime is initialized; otherwise returns false

Parameters

None.

Return Value

Boolean

Sub MWPack(pVarArg, [Var0], [Var1], ... ,[Var31])

Packs a variable length list of Variant arguments into a single Variant array. This function is typically used for creating a varargin cell from a list of separate inputs. Each input in the list is only added to the array if it is not empty or missing. (In Visual Basic, a missing parameter is denoted by a Variant type of vbError with a value of &H80020004.)

Parameters

Argument	Type	Description
pVarArg	Variant	Receives the resulting array

Argument	Type	Description
[Var0], [Var1], ...	Variant	Optional list of Variants to pack into the array. From 0 to 32 arguments can be passed.

Return Value

None.

Remarks

This function always frees the contents of `pVarArg` before processing the list.

Example

This example uses `MWPack` in a formula function to produce a `varargin` cell to pass as an input parameter to a method compiled from a MATLAB function with the following signature:

```
function y = mysum(varargin)
    y = sum([varargin{:}]);
```

The function returns the sum of the elements in `varargin`. Assume that this function is a method of a class named `myclass` that is included in a component named `mycomponent` with a version of 1.0. The Visual Basic function allows up to 10 inputs, and returns the result `y`. If an error occurs, the function returns the error message. This function assumes that `MWInitApplication` has been previously called.

```
Function mysum(Optional V0 As Variant, _
               Optional V1 As Variant, _
               Optional V2 As Variant, _
               Optional V3 As Variant, _
               Optional V4 As Variant, _
               Optional V5 As Variant, _
               Optional V6 As Variant, _
               Optional V7 As Variant, _
               Optional V8 As Variant, _
               Optional V9 As Variant) As Variant
Dim y As Variant
Dim varargin As Variant
Dim aClass As Object
Dim aUtil As Object

    On Error Goto Handle_Error
    Set aClass = CreateObject("mycomponent.myclass.1_0")
    Set aUtil = CreateObject("MWComUtil.MWUtil")
    Call aUtil.MWPack(varargin,V0,V1,V2,V3,V4,V5,V6,V7,V8,V9)
    Call aClass.mysum(1, y, varargin)
    mysum = y
    Exit Function
Handle_Error:
    mysum = Err.Description
End Function
```

Sub MWUnpack(VarArg, [nStartAt As Long], [bAutoSize As Boolean = False], [pVar0], [pVar1], ..., [pVar31])

Unpacks an array of Variants into individual Variant arguments. This function provides the reverse functionality of MWPack and is typically used to process a varargout cell into individual Variants.

Parameters

Argument	Type	Description
VarArg	Variant	Input array of Variants to be processed
nStartAt	Long	Optional starting index (zero-based) in the array to begin processing. Default = 0.
bAutoSize	Boolean	Optional auto-resize flag. If this flag is True, any Excel range output arguments are resized to fit the dimensions of the Variant to be copied. The resizing process is applied relative to the upper left corner of the supplied range. Default = False.
[pVar0],[pVar1], ...	Variant	Optional list of Variants to receive the array items contained in VarArg. From 0 to 32 arguments can be passed.

Return Value

None.

Remarks

This function can process a Variant array in one single call or through multiple calls using the nStartAt parameter.

Example

This example uses MWUnpack to process a varargout cell into several Excel ranges, while auto-resizing each range. The varargout parameter is supplied from a method that has been compiled from the MATLAB function.

```
function varargout = randvectors
    for i=1:nargout
        varargout{i} = rand(i,1);
    end
```

This function produces a sequence of nargout random column vectors, with the length of the ith vector equal to i. Assume that this function is included in a class named myclass that is included in a component named mycomponent with a version of 1.0. The Visual Basic subroutine takes no

arguments and places the results into Excel columns starting at A1, B1, C1, and D1. If an error occurs, a message box displays the error text. This function assumes that `MWInitApplication` has been previously called.

```
Sub GenVectors()
    Dim aClass As Object
    Dim aUtil As Object
    Dim v As Variant
    Dim R1 As Range
    Dim R2 As Range
    Dim R3 As Range
    Dim R4 As Range

    On Error GoTo Handle_Error
    Set aClass = CreateObject("mycomponent.myclass.1_0")
    Set aUtil = CreateObject("MWComUtil.MWUtil")
    Set R1 = Range("A1")
    Set R2 = Range("B1")
    Set R3 = Range("C1")
    Set R4 = Range("D1")
    Call aClass.randvectors(4, v)
    Call aUtil.MWUnpack(v,0,True,R1,R2,R3,R4)
    Exit Sub
Handle_Error:
    MsgBox (Err.Description)
End Sub
```

Sub MWDate2VariantDate(pVar)

Converts output dates from MATLAB to Variant dates.

Parameters

Argument	Type	Description
pVar	Variant	Variant to be converted

Return Value

None.

Remarks

MATLAB handles dates as double-precision floating-point numbers with 0.0 representing 0/0/00 00:00:00. By default, numeric dates that are output parameters from compiled MATLAB functions are passed as Doubles that need to be decremented by the COM date bias as well as coerced to COM dates. The `MWDate2VariantDate` method performs this transformation and additionally converts dates in character vector form to COM date types.

Example

This example uses `MWDate2VariantDate` to process numeric dates returned from a method compiled from the following MATLAB function.

```
function x = getdates(n, inc)
    y = now;
```



```
for i=1:n
    x(i,1) = y + (i-1)*inc;
end
```

This function produces an n-length column vector of numeric values representing dates starting from the current date and time with each element incremented by `inc` days. Assume that this function is included in a class named `myclass` that is included in a component named `mycomponent` with a version of 1.0. The subroutine takes an Excel range and a `Double` as inputs and places the generated dates into the supplied range. If an error occurs, a message box displays the error text. This function assumes that `MWInitApplication` has been previously called.

```
Sub GenDates(R As Range, inc As Double)
    Dim aClass As Object
    Dim aUtil As Object

    On Error GoTo Handle_Error
    Set aClass = CreateObject("mycomponent.myclass.1_0")
    Set aUtil = CreateObject("MWComUtil.MWUtil")
    Call aClass.getdates(1, R, R.Rows.Count, inc)
    Call aUtil.MWDate2VariantDate(R)
    Exit Sub
Handle_Error:
    MsgBox (Err.Description)
End Sub
```

Class MWFlags

The MWFlags class contains a set of array formatting and data conversion flags. For more information on conversion between MATLAB and COM Automation types, see “Rules for Data Conversion Between .NET and MATLAB” (MATLAB Compiler SDK). All MATLAB Compiler SDK COM components contain a reference to an MWFlags object that can modify data conversion rules at the object level. This class contains these properties and method:

Property ArrayFormatFlags As MWArrayFormatFlags

The ArrayFormatFlags property controls array formatting (as a matrix or a cell array) and the application of these rules to nested arrays. The MWArrayFormatFlags class is a noncreatable class accessed through an MWFlags class instance. This class contains six properties:

- “Property InputArrayFormat As mwArrayFormat” on page 10-10
- “Property InputArrayIndFlag As Long” on page 10-10
- “Property OutputArrayFormat As mwArrayFormat” on page 10-11
- “Property OutputArrayIndFlag As Long” on page 10-11
- “Property AutoResizeOutput As Boolean” on page 10-11
- “Property TransposeOutput As Boolean” on page 10-11

Property InputArrayFormat As mwArrayFormat

This property of type mwArrayFormat controls the formatting of arrays passed as input parameters to MATLAB Compiler SDK class methods. The default value is mwArrayFormatMatrix. The behaviors indicated by this flag are listed in the next table.

Array Formatting Rules for Input Arrays

Value	Behavior
mwArrayFormatAsIs	Converts arrays according to the default conversion rules listed in “Rules for Data Conversion Between .NET and MATLAB” (MATLAB Compiler SDK).
mwArrayFormatCell	Coerces all arrays into cell arrays. Input scalar or numeric array arguments are converted to cell arrays with each cell containing a scalar value for the respective index.
mwArrayFormatMatrix	Coerces all arrays into matrices. When an input argument is encountered that is an array of Variants (the default behavior is to convert it to a cell array), the data converter converts this array to a matrix if each Variant is single valued, and all elements are homogeneous and of a numeric type. If this conversion is not possible, creates a cell array.

Property InputArrayIndFlag As Long

This property governs the level at which to apply the rule set by the InputArrayFormat property for nested arrays (an array of Variants is passed and each element of the array is an array itself). It

is not necessary to modify this flag for `varargin` parameters. The data conversion code automatically increments the value of this flag by 1 for `varargin` cells, thus applying the `InputArrayFormat` flag to each cell of a `varargin` parameter. The default value is 0.

Property `OutputArrayFormat` As `mwArrayFormat`

This property of type `mwArrayFormat` controls the formatting of arrays passed as output parameters to class methods. The default value is `mwArrayFormatAsIs`. The behaviors indicated by this flag are listed in the next table.

Array Formatting Rules for Output Arrays

Value	Behavior
<code>mwArrayFormatAsIs</code>	Converts arrays according to the default conversion rules listed in “Rules for Data Conversion Between .NET and MATLAB” (MATLAB Compiler SDK).
<code>mwArrayFormatMatrix</code>	Coerces all arrays into matrices. When an output cell array argument is encountered (the default behavior converts it to an array of <code>Variants</code>), the data converter converts this array to a <code>Variant</code> that contains a simple numeric array if each cell is single valued, and all elements are homogeneous and of a numeric type. If this conversion is not possible, an array of <code>Variants</code> is created.
<code>mwArrayFormatCell</code>	Coerces all output arrays into arrays of <code>Variants</code> . Output scalar or numeric array arguments are converted to arrays of <code>Variants</code> , each <code>Variant</code> containing a scalar value for the respective index.

Property `OutputArrayIndFlag` As Long

This property is similar to the `InputArrayIndFlag` property, as it governs the level at which to apply the rule set by the `OutputArrayFormat` property for nested arrays. As with the input case, this flag is automatically incremented by 1 for a `varargout` parameter. The default value of this flag is 0.

Property `AutoSizeOutput` As Boolean

This flag applies to Excel ranges only. When the target output from a method call is a range of cells in an Excel worksheet, and the output array size and shape is not known at the time of the call, setting this flag to `True` instructs the data conversion code to resize each Excel range to fit the output array. Resizing is applied relative to the upper left corner of each supplied range. The default value for this flag is `False`.

Property `TransposeOutput` As Boolean

Setting this flag to `True` transposes the output arguments. This flag is useful when processing an output parameter from a method call on a COM component, where the MATLAB function returns outputs as row vectors, and you desire to place the data into columns. The default value for this flag is `False`.

Property DataConversionFlags As MWDataConversionFlags

The `DataConversionFlags` property controls how input variables are processed when type coercion is needed. The `MWDataConversionFlags` class is a noncreatable class accessed through an `MWFlags` class instance. This class contains these properties:

- “Property `CoerceNumericToType As mwDataType`” on page 10-12
- “Property `DateBias As Long`” on page 10-12
- “Property `InputDateFormat As mwDateFormat`” on page 10-13
- “Property `OutputAsDate As Boolean`” on page 10-13
- “Property `ReplaceMissing As mwReplaceMissingData`” on page 10-13

Property `CoerceNumericToType As mwDataType`

This property converts all numeric input arguments to one specific MATLAB type. This flag is useful is when variables maintained within the Visual Basic code are different types, e.g., `Long`, `Integer`, etc., and all variables passed to the compiled MATLAB code must be doubles. The default value for this property is `mwTypeDefault`, which uses the default rules in “Rules for Data Conversion Between .NET and MATLAB” (MATLAB Compiler SDK).

Property `DateBias As Long`

This property sets the date bias for performing COM to MATLAB numeric date conversions. The default value of this property is 693960, representing the difference between the COM `Date` type and MATLAB numeric dates. This flag allows existing MATLAB code that already performs the increment of numeric dates by 693960 to be used unchanged with COM components. To process dates with such code, set this property to 0.

This example uses data conversion flags to reshape the output from a method compiled from a MATLAB function that produces an output vector of unknown length.

```
function p = myprimes(n)
if length(n)~=1, error('N must be a scalar'); end
if n < 2, p = zeros(1,0); return, end
p = 1:2:n;
q = length(p);
p(1) = 2;
for k = 3:2:sqrt(n)
    if p((k+1)/2)
        p(((k*k+1)/2):k:q) = 0;
    end
end
p = (p(p>0));
```

This function produces a row vector of all the prime numbers between 0 and n. Assume that this function is included in a class named `myclass` that is included in a component named `mycomponent` with a version of 1.0. The subroutine takes an Excel range and a `Double` as inputs, and places the generated prime numbers into the supplied range. The MATLAB function produces a row vector, although you want the output in column format. It also produces an unknown number of outputs, and you do not want to truncate any output. To handle these issues, set the `TransposeOutput` flag and the `AutoSizeOutput` flag to `True`. In previous examples, the Visual Basic `CreateObject` function creates the necessary classes. This example uses an explicit type declaration for the `aClass` variable. As with previous examples, this function assumes that `MWInitApplication` has been previously called.

```

Sub GenPrimes(R As Range, n As Double)
    Dim aClass As mycomponent.myclass

    On Error GoTo Handle_Error
    Set aClass = New mycomponent.myclass
    aClass.MWFlags.ArrayFormatFlags.AutoSizeOutput = True
    aClass.MWFlags.ArrayFormatFlags.TransposeOutput = True
    Call aClass.myprimes(1, R, n)
    Exit Sub
Handle_Error:
    MsgBox (Err.Description)
End Sub

```

Property InputDateFormat As mwDateFormat

This property converts dates passed as input parameters to method calls on MATLAB Compiler SDK classes. The default value is `mwDateFormatNumeric`. The behaviors indicated by this flag are shown in the following table.

Conversion Rules for Input Dates

Value	Behavior
<code>mwDateFormatNumeric</code>	Convert dates to numeric values as indicated by the rule listed in “Rules for Data Conversion Between .NET and MATLAB” (MATLAB Compiler SDK).
<code>mwDateFormatString</code>	Convert input dates to strings.

Property OutputAsDate As Boolean

This property processes an output argument as a date. By default, numeric dates that are output parameters from compiled MATLAB functions are passed as `Doubles` that need to be decremented by the COM date bias (693960) as well as coerced to COM dates. Set this flag to `True` to convert all output values of type `Double`.

Property ReplaceMissing As mwReplaceMissingData

This property is an enumeration and can have two possible values: `mwReplaceNaN` and `mwReplaceZero`.

To treat empty cells referenced by input parameters as zeros, set the value to `mwReplaceZero`. To treat empty cells referenced by input parameters as NaNs (Not a Number), set the value to `mwReplaceNaN`.

By default, the value is `mwReplaceZero`.

Sub Clone(ppFlags As MWFlags)

Creates a copy of an `MWFlags` object.

Parameters

Argument	Type	Description
ppFlags	MwFlags	Reference to an uninitialized MwFlags object that receives the copy

Return Value

None

Remarks

Clone allocates a new MwFlags object and creates a deep copy of the object's contents. Call this function when a separate object is required instead of a shared copy of an existing object reference.

Class MWStruct

The MWStruct class passes or receives a Struct type to or from a compiled class method. This class contains seven properties/methods:

Sub Initialize([varDims], [varFieldNames])

This method allocates a structure array with a specified number and size of dimensions and a specified list of field names.

Parameters

Argument	Type	Description
varDims	Variant	Optional array of dimensions
varFieldNames	Variant	Optional array of field names

Return Value

None.

Remarks

When created, an MWStruct object has a dimensionality of 1-by-1 and no fields. The Initialize method dimensions the array and adds a set of named fields to each element. Each time you call Initialize on the same object, it is redimensioned. If you do not supply the varDims argument, the existing number and size of the array's dimensions unchanged. If you do not supply the varFieldNames argument, the existing list of fields is not changed. Calling Initialize with no arguments leaves the array unchanged.

Example

The following Visual Basic code illustrates use of the Initialize method to dimension struct arrays.

```
Sub foo ()
    Dim x As MWStruct
    Dim y As MWStruct

    On Error Goto Handle_Error
    'Create 1X1 struct arrays with no fields for x, and y
    Set x = new MWStruct
    Set y = new MWStruct

    'Initialize x to be 2X2 with fields "red", "green",
    '                                     and "blue"
    Call x.Initialize(Array(2,2), Array("red", "green", "blue"))
    'Initialize y to be 1X5 with fields "name" and "age"
    Call y.Initialize(5, Array("name", "age"))

    'Re-dimension x to be 3X3 with the same field names
    Call x.Initialize(Array(3,3))

    'Add a new field to y
    Call y.Initialize(, Array("name", "age", "salary"))
End Sub
```

```

Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub

```

Property Item([i0], [i1], ..., [i31]) As MWField

The `Item` property is the default property of the `MWStruct` class. This property is used to set/get the value of a field at a particular index in the structure array.

Parameters

Argument	Type	Description
i0,i1, ..., i31	Variant	Optional index arguments. Between 0 and 32 index arguments can be entered. To reference an element of the array, specify all indexes as well as the field name.

Remarks

When accessing a named field through this property, you must supply all dimensions of the requested field as well as the field name. This property always returns a single field value, and generates a bad index error if you provide an invalid or incomplete index list. Index arguments have four basic formats:

- Field name only

This format may be used only in the case of a 1-by-1 structure array and returns the named field's value. For example:

```

x("red") = 0.2
x("green") = 0.4
x("blue") = 0.6

```

In this example, the name of the `Item` property was neglected. This is possible because the `Item` property is the default property of the `MWStruct` class. In this case, the two statements are equivalent:

```

x.Item("red") = 0.2
x("red") = 0.2

```

- Single index and field name

This format accesses array elements through a single subscripting notation. A single numeric index `n` followed by the field name returns the named field on the `n`th array element, navigating the array linearly in column-major order. For example, consider a 2-by-2 array of structures with fields "red", "green", and "blue" stored in a variable `x`. These two statements are equivalent:

```

y = x(2, "red")
y = x(2, 1, "red")

```

- All indices and field name

This format accesses an array element of an multidimensional array by specifying n indices. These statements access all four of the elements of the array in the previous example:

```
For I From 1 To 2
  For J From 1 To 2
    r(I, J) = x(I, J, "red")
    g(I, J) = x(I, J, "green")
    b(I, J) = x(I, J, "blue")
  Next
Next
```

- Array of indices and field name

This format accesses an array element by passing an array of indices and a field name. The next example rewrites the previous example using an index array:

```
Dim Index(1 To 2) As Integer

For I From 1 To 2
  Index(1) = I
  For J From 1 To 2
    Index(2) = J
    r(I, J) = x(Index, "red")
    g(I, J) = x(Index, "green")
    b(I, J) = x(Index, "blue")
  Next
Next
```

With these four formats, the `Item` property provides a very flexible indexing mechanism for structure arrays.

- You can combine the last two indexing formats. Several index arguments supplied in either scalar or array format are concatenated to form one index set. The combining stops when the number of dimensions has been reached. For example:

```
Dim Index1(1 To 2) As Integer
Dim Index2(1 To 2) As Integer

Index1(1) = 1
Index1(2) = 1
Index2(1) = 3
Index2(2) = 2
x(Index1, Index2, 2, "red") = 0.5
```

The last statement resolves to

```
x(1, 1, 3, 2, 2, "red") = 0.5
```

- The field name must be the last index in the list. The following statement produces an error:

```
y = x("blue", 1, 2)
```
- Field names are case sensitive.

Property NumberOfFields As Long

The read-only `NumberOfFields` property returns the number of fields in the structure array.

Property NumberOfDims As Long

The read-only `NumberOfDims` property returns the number of dimensions in the struct array.

Property Dims As Variant

The read-only `Dims` property returns an array of length `NumberOfDims` that contains the size of each dimension of the struct array.

Property FieldNames As Variant

The read-only `FieldNames` property returns an array of length `NumberOfFields` that contains the field names of the elements of the structure array.

Example

The next Visual Basic code sample illustrates how to access a two-dimensional structure array's fields when the field names and dimension sizes are not known in advance.

```
Sub foo ()
    Dim x As MWStruct
    Dim Dims as Variant
    Dim FieldNames As Variant

    On Error Goto Handle_Error
    '
    '... Call a method that returns an MWStruct in x
    '
    Dims = x.Dims
    FieldNames = x.FieldNames
    For I From 1 To Dims(1)
        For J From 1 To Dims(2)
            For K From 1 To x.NumberOfFields
                y = x(I,J,FieldNames(K))
                ' ... Do something with y
            Next
        Next
    Next
Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub
```

Sub Clone(ppStruct As MWStruct)

Creates a copy of an `MWStruct` object.

Parameters

Argument	Type	Description
ppStruct	MWStruct	Reference to an uninitialized MWStruct object to receive the copy

Return Value

None

Remarks

Clone allocates a new MWStruct object and creates a deep copy of the object's contents. Call this function when a separate object is required instead of a shared copy of an existing object reference.

Example

The following Visual Basic example illustrates the difference between assignment and Clone for MWStruct objects.

```

Sub foo ()
    Dim x1 As MWStruct
    Dim x2 As MWStruct
    Dim x3 As MWStruct

    On Error Goto Handle_Error
    Set x1 = new MWStruct
    x1("name") = "John Smith"
    x1("age") = 35

    'Set reference of x1 to x2
    Set x2 = x1
    'Create new object for x3 and copy contents of x1 into it
    Call x1.Clone(x3)
    'x2's "age" field is
    'also modified 'x3's "age" field unchanged
    x1("age") = 50
    .
    .
    .
    Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub

```

Class MWField

The MWField class holds a single field reference in an MWStruct object. This class is not creatable and contains four properties/methods:

Property Name As String

The name of the field (read only).

Property Value As Variant

Stores the field's value (read/write). The Value property is the default property of the MWField class. The value of a field can be any type that is coercible to a Variant, as well as object types.

Property MWFlags As MWFlags

Stores a reference to an MWFlags object. This property sets or gets the array formatting and data conversion flags for a particular field. Each field in a structure has its own MWFlags property. This property overrides the value of any flags set on the object whose methods are called.

Sub Clone(ppField As MWField)

Creates a copy of an MWField object.

Parameters

Argument	Type	Description
ppField	MWField	Reference to an uninitialized MWField object to receive the copy

Return Value

None.

Remarks

Clone allocates a new MWField object and creates a deep copy of the object's contents. Call this function when a separate object is required instead of a shared copy of an existing object reference.

Class MWComplex

The MWComplex class passes or receives a complex numeric array into or from a compiled class method. This class contains four properties/methods:

Property Real As Variant

Stores the real part of a complex array (read/write). The Real property is the default property of the MWComplex class. The value of this property can be any type coercible to a Variant, as well as object types, with the restriction that the underlying array must resolve to a numeric matrix (no cell data allowed). Valid Visual Basic numeric types for complex arrays include Byte, Integer, Long, Single, Double, Currency, and Variant/vbDecimal.

Property Imag As Variant

Stores the imaginary part of a complex array (read/write). The Imag property is optional and can be Empty for a pure real array. If the Imag property is not empty and the size and type of the underlying array do not match the size and type of the Real property's array, an error results when the object is used in a method call.

Example

The following Visual Basic code creates a complex array with the following entries:

```

    x = [ 1+i 1+2i
          2+i 2+2i ]
Sub foo()
    Dim x As MWComplex
    Dim rval(1 To 2, 1 To 2) As Double
    Dim ival(1 To 2, 1 To 2) As Double

    On Error Goto Handle_Error
    For I = 1 To 2
        For J = 1 To 2
            rval(I,J) = I
            ival(I,J) = J
        Next
    Next
    Set x = new MWComplex
    x.Real = rval
    x.Imag = ival
    .
    .
    .
    Exit Sub
Handle_Error:
    MsgBox(Err.Description)
End Sub

```

Property MWFlags As MWFlags

Stores a reference to an MWFlags object. This property sets or gets the array formatting and data conversion flags for a particular complex array. Each MWComplex object has its own MWFlags property. This property overrides the value of any flags set on the object whose methods are called.

Sub Clone(ppComplex As MWComplex)

Creates a copy of an MWComplex object.

Parameters

Argument	Type	Description
ppComplex	MWComplex	Reference to an uninitialized MWComplex object to receive the copy

Return Value

None

Remarks

Clone allocates a new MWComplex object and creates a deep copy of the object's contents. Call this function when a separate object is required instead of a shared copy of an existing object reference.

Class MWSparse

The MWSparse class passes or receives a two-dimensional sparse numeric array into or from a compiled class method. This class has seven properties/methods:

Property NumRows As Long

Stores the row dimension for the array. The value of NumRows must be nonnegative. If the value is zero, the row index is taken from the maximum of the values in the RowIndex array.

Property NumColumns As Long

Stores the column dimension for the array. The value of NumColumns must be nonnegative. If the value is zero, the row index is taken from the maximum of the values in the ColumnIndex array.

Property RowIndex As Variant

Stores the array of row indices of the nonzero elements of the array. The value of this property can be any type coercible to a Variant, as well as object types, with the restriction that the underlying array must resolve to or be coercible to a numeric matrix of type Long. If the value of NumRows is nonzero and any row index is greater than NumRows, a bad-index error occurs. An error also results if the number of elements in the RowIndex array does not match the number of elements in the Array property's underlying array.

Property ColumnIndex As Variant

Stores the array of column indices of the nonzero elements of the array. The value of this property can be any type coercible to a Variant, as well as object types, with the restriction that the underlying array must resolve to or be coercible to a numeric matrix of type Long. If the value of NumColumns is nonzero and any column index is greater than NumColumns, a bad-index error occurs. An error also results if the number of elements in the ColumnIndex array does not match the number of elements in the Array property's underlying array.

Property Array As Variant

Stores the nonzero array values of the sparse array. The value of this property can be any type coercible to a Variant, as well as object types, with the restriction that the underlying array must resolve to or be coercible to a numeric matrix of type Double or Boolean.

Property MWFlags As MWFlags

Stores a reference to an MWFlags object. This property sets or gets the array formatting and data conversion flags for a particular sparse array. Each MWSparse object has its own MWFlags property. This property overrides the value of any flags set on the object whose methods are called.

Sub Clone(ppSparse As MWSparse)

Creates a copy of an MWSparse object.

Parameters

Argument	Type	Description
ppSparse	MWSparse	Reference to an uninitialized MWSparse object to receive the copy

Return Value

None.

Remarks

Clone allocates a new MWSparse object and creates a deep copy of the object's contents. Call this function when a separate object is required instead of a shared copy of an existing object reference.

Example

The following Visual Basic sample creates a 5-by-5 tridiagonal sparse array.

```
X = [ 2 -1 0 0 0
      -1 2 -1 0 0
        0 -1 2 -1 0
         0 0 -1 2 -1
          0 0 0 -1 2 ]
```

```
Sub foo()
    Dim x As MWSparse
    Dim rows(1 To 13) As Long
    Dim cols(1 To 13) As Long
    Dim vals(1 To 13) As Double
    Dim I As Long, K As Long

    On Error GoTo Handle_Error
    K = 1
    For I = 1 To 4
        rows(K) = I
        cols(K) = I + 1
        vals(K) = -1
        K = K + 1
        rows(K) = I
        cols(K) = I
        vals(K) = 2
        K = K + 1
        rows(K) = I + 1
        cols(K) = I
        vals(K) = -1
        K = K + 1
    Next
    rows(K) = 5
    cols(K) = 5
    vals(K) = 2
    Set x = New MWSparse
    x.NumRows = 5
    x.NumColumns = 5
    x.RowIndex = rows
End Sub
```



```
x.ColumnIndex = cols
x.Array = vals
.
.
.
Exit Sub
Handle_Error:
MsgBox (Err.Description)
End Sub
```

Class MWArg

The MWArg class passes a generic argument into a compiled class method. This class passes an argument for which the data conversion flags are changed for that one argument. This class has three properties/methods:

Property Value As Variant

The Value property stores the actual argument to pass. Any type that can be passed to a compiled method is valid for this property.

Property MWFlags As MWFlags

Stores a reference to an MWFlags object. This property sets or gets the array formatting and data conversion flags for a particular argument. Each MWArg object has its own MWFlags property. This property overrides the value of any flags set on the object whose methods are called.

Sub Clone(ppArg As MWArg)

Creates a copy of an MWArg object.

Parameters

Argument	Type	Description
ppArg	MWArg	Reference to an uninitialized MWArg object to receive the copy

Return Value

None.

Remarks

Clone allocates a new MWArg object and creates a deep copy of the object's contents. Call this function when a separate object is required instead of a shared copy of an existing object reference.

Enum mxArrayFormat

The mxArrayFormat enumeration is a set of constants that denote an array formatting rule for data conversion.

mxArrayFormat Values

Constant	Numeric Value	Description
mxArrayFormatAsIs	0	Do not reformat the array.
mxArrayFormatMatrix	1	Format the array as a matrix.
mxArrayFormatCell	2	Format the array as a cell array.

Enum `mwDataType`

The `mwDataType` enumeration is a set of constants that denote a MATLAB numeric type.

`mwDataType` Values

Constant	Numeric Value	MATLAB Type
<code>mwTypeDefault</code>	0	Not applicable
<code>mwTypeLogical</code>	3	logical
<code>mwTypeChar</code>	4	char
<code>mwTypeDouble</code>	6	double
<code>mwTypeSingle</code>	7	single
<code>mwTypeInt8</code>	8	int8
<code>mwTypeUInt8</code>	9	uint8
<code>mwTypeInt16</code>	10	int16
<code>mwTypeUInt16</code>	11	uint16
<code>mwTypeInt32</code>	12	int32
<code>mwTypeUInt32</code>	13	uint32

Enum mwDateFormat

The mwDateFormat enumeration is a set of constants that denote a formatting rule for dates.

mwDateFormat Values

Constant	Numeric Value	Description
mwDateFormatNumeric	0	Format dates as numeric values
mwDateFormatString	1	Format dates as strings

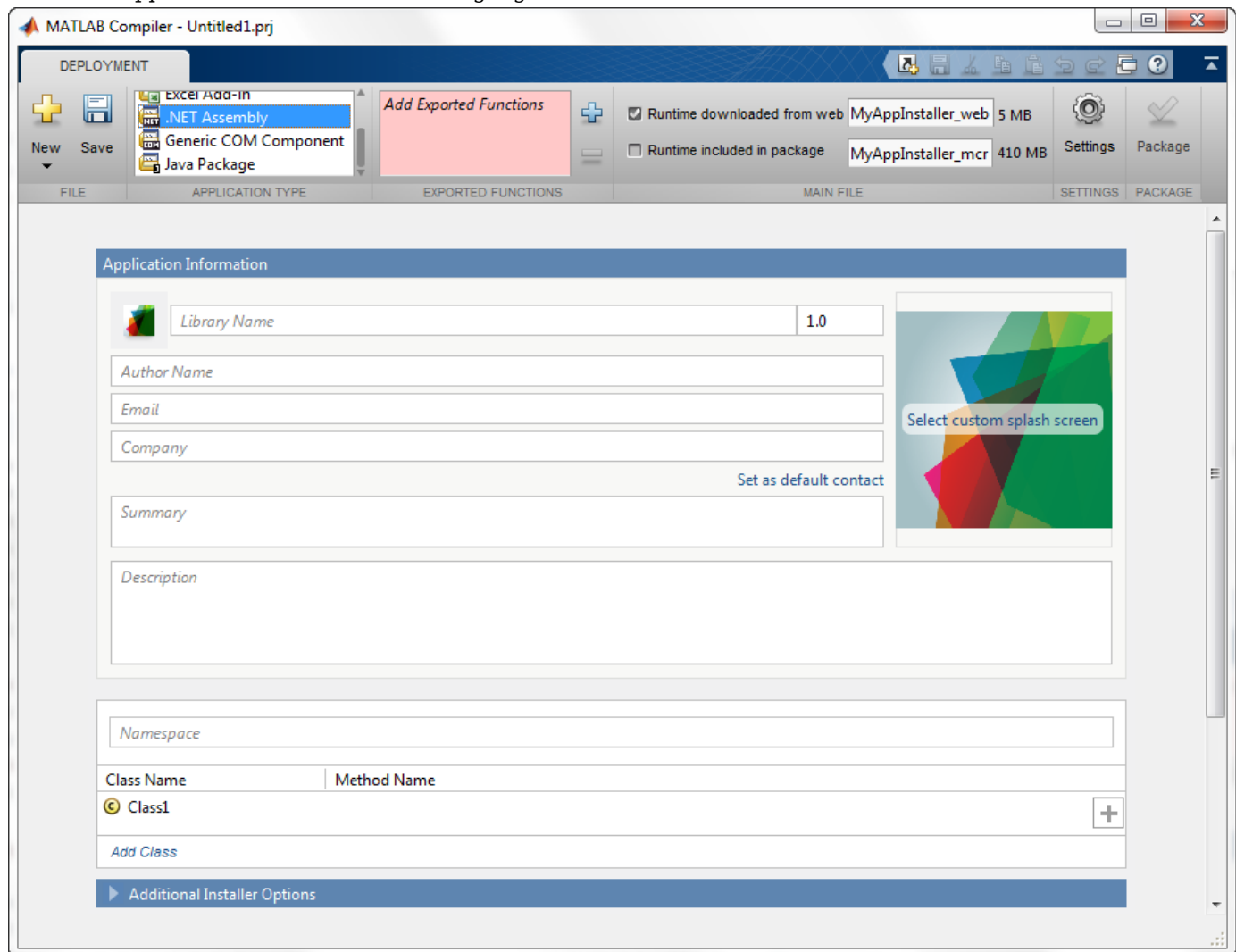
Apps

Library Compiler

Package MATLAB programs for deployment as shared libraries and components

Description

The **Library Compiler** app packages MATLAB functions to include MATLAB functionality in applications written in other languages.



Open the Library Compiler App

- MATLAB Toolstrip: On the **Apps** tab, under **Application Deployment**, click the app icon.
- MATLAB command prompt: Enter `libraryCompiler`.

Examples

- “Create Excel Add-In from MATLAB” on page 2-6
- “Create a C Shared Library with MATLAB Code” (MATLAB Compiler SDK)
- “Generate a C++ mxArray API Shared Library and Build a C++ Application” (MATLAB Compiler SDK)
- “Generate a C++ MATLAB Data API Shared Library and Build a C++ Application” (MATLAB Compiler SDK)
- “Generate .NET Assembly and Build .NET Application” (MATLAB Compiler SDK)
- “Create a Generic COM Component with MATLAB Code” (MATLAB Compiler SDK)
- “Generate Java Package and Build Java Application” (MATLAB Compiler SDK)
- “Generate a Python Package and Build a Python Application” (MATLAB Compiler SDK)

Parameters

type — type of library generated

C Shared Library | C++ Shared Library | Excel Add-in | Generic COM Component | Java Package
| .NET Assembly | Python Package

Type of library to generate.

exported functions — functions to package

list of character vectors

Functions to package as a list of character vectors.

packaging options — method for installing the MATLAB Runtime with the compiled library

MATLAB Runtime downloaded from web (default) | MATLAB Runtime included in package

You can decide whether or not to include the MATLAB Runtime fallback for MATLAB Runtime installer in the generated application by selecting one of the two options in the **Packaging Options** section. Including the MATLAB Runtime installer in the package significantly increases the size of the package.

Runtime downloaded from web — Generates an installer that downloads the MATLAB Runtime and installs it along with the deployed MATLAB application.

Runtime included in package — Generates an installer that includes the MATLAB Runtime installer.

The first time you select this option, you are prompted to download the MATLAB Runtime installer or obtain a CD if you do not have internet access.

files required for your library to run — files that must be included with library

list of files

Files that must be included with library as a list of files.

files installed for your end user — optional files installed with library

list of files

Optional files installed with library as a list of files.

Settings

Additional parameters passed to MCC — flags controlling the behavior of the compiler
character vector

Flags controlling the behavior of the compiler as a character vector.

testing files — folder where files for testing are stored
character vector

Folder where files for testing are stored as a character vector.

end user files — folder where files for building a custom installer are stored
character vector

Folder where files for building a custom installer are stored are stored as a character vector.

packaged installers — folder where generated installers are stored
character vector

Folder where generated installers are stored as a character vector.

Library Information

library name — name of the installed library
character vector

Name of the installed library as a character vector.

The default value is the name of the first function listed in the **Exported Functions** field of the app.

version — version of the generated library
character vector

Version of the generated library as a character vector.

splash screen — image displayed on installer
image

Image displayed on installer as an image.

author name — name of the library author
character vector

Name of the library author as a character vector.

e-mail — e-mail address used to contact library support
character vector

E-mail address used to contact library support as a character vector.

summary — brief description of library
character vector

Brief description of library as a character vector.

description — detailed description of library

character vector

Detailed description of library as a character vector.

Additional Installer Options**default installation folder — folder where artifacts are installed**

character vector

Folder where artifacts are installed as a character vector.

installation notes — notes about additional requirements for using artifacts

character vector

Notes about additional requirements for using artifacts as a character vector.

Programmatic Use

libraryCompiler

See Also**Topics**

“Create Excel Add-In from MATLAB” on page 2-6

“Create a C Shared Library with MATLAB Code” (MATLAB Compiler SDK)

“Generate a C++ mxArray API Shared Library and Build a C++ Application” (MATLAB Compiler SDK)

“Generate a C++ MATLAB Data API Shared Library and Build a C++ Application” (MATLAB Compiler SDK)

“Generate .NET Assembly and Build .NET Application” (MATLAB Compiler SDK)

“Create a Generic COM Component with MATLAB Code” (MATLAB Compiler SDK)

“Generate Java Package and Build Java Application” (MATLAB Compiler SDK)

“Generate a Python Package and Build a Python Application” (MATLAB Compiler SDK)

Introduced in R2013b

Data Conversion

Data Conversion Rules

This topic describes the data conversion rules for the MATLAB Compiler components. These components are dual interface Microsoft COM objects that support data types compatible with Automation.

Note Automation (formerly called OLE Automation) is a technology that allows software packages to expose their unique features to scripting tools and other applications. Automation uses the Component Object Model (COM), but may be implemented independently from other OLE features, such as in-place activation.

When a method is invoked on a MATLAB Compiler component, the input parameters are converted to the MATLAB internal array format and passed to the compiled MATLAB function. When the function exits, the output parameters are converted from the MATLAB internal array format to COM Automation types.

The COM client passes all input and output arguments in the compiled MATLAB functions as type **VARIANT**. The COM **VARIANT** type is a union of several simple data types. A type **VARIANT** variable can store a variable of any of the simple types, as well as arrays of any of these values.

The Win32 application program interface (API) provides many functions for creating and manipulating **VARIANT**s in C/C++, and Visual Basic provides native language support for this type.

Note This discussion of data refers to both **VARIANT** and **Variant** data types. **VARIANT** is the C++ name and **Variant** is the corresponding data type in Visual Basic.

See the Visual Studio® documentation for definitions and API support for COM **VARIANT**s. **VARIANT** variables are self describing and store their type code as an internal field of the structure.

The following table lists the **VARIANT** type codes supported by MATLAB Compiler components.

VARIANT Type Codes Supported

VARIANT Type Code (C/C++)	C/C++ Type	Variant Type Code (Visual Basic)	Visual BasicType	Definition
VT_EMPTY	–	vbEmpty	–	Uninitialized VARIANT
VT_I1	char	–	–	Signed one-byte character
VT_UI1	unsigned char	vbByte	Byte	Unsigned one-byte character
VT_I2	short	vbInteger	Integer	Signed two-byte integer
VT_UI2	unsigned short	–	–	Unsigned two-byte integer
VT_I4	long	vbLong	Long	Signed four-byte integer
VT_UI4	unsigned long	–	–	Unsigned four-byte integer
VT_R4	float	vbSingle	Single	IEEE® four-byte floating-point value
VT_R8	double	vbDouble	Double	IEEE eight-byte floating-point value
VT_CY	CY ⁺	vbCurrency	Currency	Currency value (64-bit integer, scaled by 10,000)
VT_BSTR	BSTR ⁺	vbString	String	String value
VT_ERROR	SCODE ⁺	vbError	–	An HRESULT (signed four-byte integer representing a COM error code)
VT_DATE	DATE ⁺	vbDate	Date	Eight-byte floating point value representing date and time
VT_INT	int	–	–	Signed integer; equivalent to type int
VT_UINT	unsigned int	–	–	Unsigned integer; equivalent to type unsigned int
VT_DECIMAL	DECIMAL ⁺	vbDecimal	–	96-bit (12-byte) unsigned integer, scaled by a variable power of 10
VT_BOOL	VARIANT_BOOL ⁺	vbBoolean	Boolean	Two-byte Boolean value (0xFFFF = True; 0x0000 = False)
VT_DISPATCH	IDispatch [*]	vbObject	Object	IDispatch [*] pointer to an object

VARIANT Type Code (C/C++)	C/C++ Type	Variant Type Code (Visual Basic)	Visual BasicType	Definition
VT_VARIANT	VARIANT ⁺	vbVariant	Variant	VARIANT (can only be specified if combined with VT_BYREF or VT_ARRAY)
<anything> VT_ARRAY	—	—	—	Bitwise combine VT_ARRAY with any basic type to declare as an array
<anything> VT_BYREF	—	—	—	Bitwise combine VT_BYREF with any basic type to declare as a reference to a value
⁺ Denotes Windows-specific type. Not part of standard C/C++.				

The following table lists the rules for converting from MATLAB to COM.

MATLAB to COM VARIANT Conversion Rules

MATLAB Data Type	VARIANT Type for Scalar Data	VARIANT Type for Array Data	Comments
cell	A 1-by-1 cell array converts to a single VARIANT with a type conforming to the conversion rule for the MATLAB data type of the cell contents.	A multidimensional cell array converts to a VARIANT of type VT_VARIANT VT_ARRAY with the type of each array member conforming to the conversion rule for the MATLAB data type of the corresponding cell.	
structure	VT_DISPATCH	VT_DISPATCH	A MATLAB struct array is converted to an MWStruct object. (See “Class MWStruct” (MATLAB Compiler SDK)) This object is passed as a VT_DISPATCH type.
char	A 1-by-1 char matrix converts to a VARIANT of type VT_BSTR with string length = 1.	A 1-by-L char matrix is assumed to represent a character vector of length L in MATLAB. This case converts to a VARIANT of type VT_BSTR with a string length = L. char matrices of more than one row, or of a higher dimensionality convert to a VARIANT of type VT_BSTR VT_ARRAY. Each string in the converted array is of length 1 and corresponds to each character in the original matrix.	Arrays of character vectors are not supported as char matrices. To pass an array of character vectors, use a cell array of 1-by-L char matrices.
sparse	VT_DISPATCH	VT_DISPATCH	A MATLAB sparse array is converted to an MWSparse object. (See “Class MWSparse” (MATLAB Compiler SDK)) This object is passed as a VT_DISPATCH type.

MATLAB Data Type	VARIANT Type for Scalar Data	VARIANT Type for Array Data	Comments
double	A real 1-by-1 double matrix converts to a VARIANT of type VT_R8. A complex 1-by-1 double matrix converts to a VARIANT of type VT_DISPATCH.	A real multidimensional double matrix converts to a VARIANT of type VT_R8 VT_ARRAY. A complex multidimensional double matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See “Class MWComplex” on page 10-21)
single	A real 1-by-1 single matrix converts to a VARIANT of type VT_R4. A complex 1-by-1 single matrix converts to a VARIANT of type VT_DISPATCH.	A real multidimensional single matrix converts to a VARIANT of type VT_R4 VT_ARRAY. A complex multidimensional single matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See “Class MWComplex” on page 10-21)
int8	A real 1-by-1 int8 matrix converts to a VARIANT of type VT_I1. A complex 1-by-1 int8 matrix converts to a VARIANT of type VT_DISPATCH.	A real multidimensional int8 matrix converts to a VARIANT of type VT_I1 VT_ARRAY. A complex multidimensional int8 matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See “Class MWComplex” on page 10-21)
uint8	A real 1-by-1 uint8 matrix converts to a VARIANT of type VT_UI1. A complex 1-by-1 uint8 matrix converts to a VARIANT of type VT_DISPATCH.	A real multidimensional uint8 matrix converts to a VARIANT of type VT_UI1 VT_ARRAY. A complex multidimensional uint8 matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See “Class MWComplex” on page 10-21)
int16	A real 1-by-1 int16 matrix converts to a VARIANT of type VT_I2. A complex 1-by-1 int16 matrix converts to a VARIANT of type VT_DISPATCH.	A real multidimensional int16 matrix converts to a VARIANT of type VT_I2 VT_ARRAY. A complex multidimensional int16 matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See “Class MWComplex” on page 10-21)

MATLAB Data Type	VARIANT Type for Scalar Data	VARIANT Type for Array Data	Comments
uint16	A real 1-by-1 uint16 matrix converts to a VARIANT of type VT_UI2. A complex 1-by-1 uint16 matrix converts to a VARIANT of type VT_DISPATCH.	A real multidimensional uint16 matrix converts to a VARIANT of type VT_UI2 VT_ARRAY. A complex multidimensional uint16 matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See "Class MWComplex" on page 10-21)
int32	A 1-by-1 int32 matrix converts to a VARIANT of type VT_I4. A complex 1-by-1 int32 matrix converts to a VARIANT of type VT_DISPATCH.	A multidimensional int32 matrix converts to a VARIANT of type VT_I4 VT_ARRAY. A complex multidimensional int32 matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See "Class MWComplex" on page 10-21)
uint32	A 1-by-1 uint32 matrix converts to a VARIANT of type VT_UI4. A complex 1-by-1 uint32 matrix converts to a VARIANT of type VT_DISPATCH.	A multidimensional uint32 matrix converts to a VARIANT of type VT_UI4 VT_ARRAY. A complex multidimensional uint32 matrix converts to a VARIANT of type VT_DISPATCH.	Complex arrays are passed to and from compiled MATLAB functions using the MWComplex class. (See "Class MWComplex" on page 10-21)
Function handle	VT_EMPTY	VT_EMPTY	Not supported
Java class	VT_EMPTY	VT_EMPTY	Not supported
User class	VT_EMPTY	VT_EMPTY	Not supported
logical	VT_Bool	VT_Bool VT_ARRAY	

The following table lists the rules for conversion from COM to MATLAB.

COM VARIANT to MATLAB Conversion Rules

VARIANT Type	MATLAB Data Type (scalar or array data)	Comments
VT_EMPTY	Not applicable	Empty array created.
VT_I1	int8	
VT_UI1	uint8	
VT_I2	int16	
VT_UI2	uint16	
VT_I4	int32	
VT_UI4	uint32	
VT_R4	single	
VT_R8	double	
VT_CY	double	
VT_BSTR	char	A VARIANT of type VT_BSTR converts to a 1-by-L MATLAB char array, where L = the length of the character vector to be converted. A VARIANT of type VT_BSTR VT_ARRAY converts to a MATLAB cell array of 1-by-L char arrays.
VT_ERROR	int32	
VT_DATE	double	<p>1. VARIANT dates are stored as doubles starting at midnight Dec. 31, 1899. The MATLAB dates are stored as doubles starting at 0/0/00 00:00:00. Therefore, a VARIANT date of 0.0 maps to a MATLAB numeric date of 693960.0. VARIANT dates are converted to MATLAB double types and incremented by 693960.0.</p> <p>2. VARIANT dates can be optionally converted to character vectors. See “Data Conversion Flags” on page A-12 for more information on type coercion.</p>
VT_INT	int32	
VT_UINT	uint32	
VT_DECIMAL	double	
VT_BOOL	logical	

VARIANT Type	MATLAB Data Type (scalar or array data)	Comments
VT_DISPATCH	<i>(varies)</i>	<p>IDispatch* pointers are treated within the context of what they point to. Objects must be supported types with known data extraction and conversion rules, or expose a generic <code>Value</code> property that points to a single VARIANT type. Data extracted from an object is converted based upon the rules for the particular VARIANT obtained.</p> <p>Currently, support exists for Excel Range objects as well as the MATLAB Compiler types <code>MWStruct</code>, <code>MWComplex</code>, <code>MWSparse</code>, and <code>MWArg</code>.</p>
<anything> VT_BYREF	<i>(varies)</i>	Pointers to any of the basic types are processed according to the rules for what they point to. The resulting MATLAB array contains a deep copy of the values.
<anything> VT_ARRAY	<i>(varies)</i>	Multidimensional VARIANT arrays convert to multidimensional MATLAB arrays, each element converted according to the rules for the basic types. Multidimensional VARIANT arrays of type <code>VT_VARIANT VT_ARRAY</code> convert to multidimensional cell arrays, each cell converted according to the rules for that specific type.

Array Formatting Flags

The MATLAB Compiler components have flags that control how array data is formatted in both directions. Generally, you should develop client code that matches the intended inputs and outputs of the MATLAB functions with the corresponding methods on the compiled COM objects, in accordance with the rules listed in MATLAB to COM VARIANT Conversion Rules and COM VARIANT to MATLAB Conversion Rules. In some cases this is not possible, for example, when existing MATLAB code is used in conjunction with a third-party product like Excel.

The following table shows the array formatting flags.

Array Formatting Flags

Flag	Description
InputArrayFormat	<p>Defines the array formatting rule used on input arrays. An input array is a VARIANT array, created by the client, sent as an input parameter to a method call on a compiled COM object. Valid values for this flag are <code>mwArrayFormatAsIs</code>, <code>mwArrayFormatMatrix</code>, and <code>mwArrayFormatCell</code>.</p> <p><code>mwArrayFormatAsIs</code> passes the array unchanged.</p> <p><code>mwArrayFormatMatrix</code> (default) formats all arrays as matrices. When the input VARIANT is of type <code>VT_ARRAY type</code>, where <code>type</code> is any numeric type, this flag has no effect. When the input VARIANT is of type <code>VT_VARIANT VT_ARRAY</code>, VARIANTS in the array are examined. If they are single-valued and homogeneous in type, a MATLAB matrix of the appropriate type is produced instead of a cell array.</p> <p><code>mwArrayFormatCell</code> interprets all arrays as MATLAB cell arrays.</p>
InputArrayIndFlag	<p>Sets the input array indirection level used with the <code>InputArrayFormat</code> flag (applicable only to nested arrays, i.e., VARIANT arrays of VARIANTS, which themselves are arrays). The default value for this flag is zero, which applies the <code>InputArrayFormat</code> flag to the outermost array. When this flag is greater than zero, e.g., equal to N, the formatting rule attempts to apply itself to the Nth level of nesting.</p>
OutputArrayFormat	<p>Defines the array formatting rule used on output arrays. An output array is a MATLAB array, created by the compiled COM object, sent as an output parameter from a method call to the client. The values for this flag, <code>mwArrayFormatAsIs</code>, <code>mwArrayFormatMatrix</code>, and <code>mwArrayFormatCell</code>, cause the same behavior as the corresponding <code>InputArrayFormat</code> flag values.</p>
OutputArrayIndFlag	<p>(Applies to nested cell arrays only.) Output array indirection level used with the <code>OutputArrayFormat</code> flag. This flag works exactly like <code>InputArrayIndFlag</code>.</p>
AutoSizeOutput	<p>(Applies to Excel ranges only.) When the target output from a method call is a range of cells in an Excel worksheet and the output array size and shape is not known at the time of the call, set this flag to <code>True</code> to resize each Excel range to fit the output array.</p>
TransposeOutput	<p>Set this flag to <code>True</code> to transpose the output arguments. Useful when calling a MATLAB Compiler component from Excel where the MATLAB function returns outputs as row vectors, and you want the data in columns.</p>

Data Conversion Flags

In this section...
“CoerceNumericToType” on page A-12
“InputDateFormat” on page A-13
“OutputAsDate As Boolean” on page A-13
“DateBias As Long” on page A-13

CoerceNumericToType

This flag tells the data converter to convert all numeric **VARIANT** data to one specific MATLAB type.

VARIANT type codes affected by this flag are

VT_I1

VT_UI1

VT_I2

VT_UI2

VT_I4

VT_UI4

VT_R4

VT_R8

VT_CY

VT_DECIMAL

VT_INT

VT_UINT

VT_ERROR

VT_BOOL

VT_DATE

Valid values for this flag are

`mwTypeDefault`

`mwTypeChar`

`mwTypeDouble`

`mwTypeSingle`

`mwTypeLogical`

`mwTypeInt8`

`mwTypeUInt8`

`mwTypeInt16`

`mwTypeUInt16`

`mwTypeInt32`

`mwTypeUInt32`

The default for this flag, `mwTypeDefault`, converts numeric data according to the rules listed in “Data Conversion Rules” on page A-2.

InputDateFormat

This flag tells the data converter how to convert `VARIANT` dates to the MATLAB dates. Valid values for this flag are `mwDateFormatNumeric` (default) and `mwDateFormatString`. The default converts `VARIANT` dates according to the rule listed in `VARIANT Type Codes Supported`. The `mwDateFormatString` flag converts a `VARIANT` date to its character vector representation. This flag only affects `VARIANT` type code `VT_DATE`.

OutputAsDate As Boolean

This flag instructs the data converter to process an output argument as a date. By default, numeric dates that are output parameters from compiled MATLAB functions are passed as `Doubles` that need to be decremented by the COM date bias (693960) as well as coerced to COM dates. Set this flag to `True` to convert all output values of type `Double`.

DateBias As Long

This flag sets the date bias for performing COM to the MATLAB numeric date conversions. The default value of this property is 693960, which represents the difference between the COM `Date` type and the MATLAB numeric dates. This flag allows existing MATLAB code that already performs the increment of numeric dates by 693960 to be used unchanged with the MATLAB Compiler components. To process dates with such code, set this property to 0.

Troubleshooting

Errors and Solutions

In this section...
“Excel Add-Ins Errors and Suggested Solutions” on page B-3
“Required Locations to Develop and Use Components” on page B-5
“Microsoft Excel Errors and Suggested Solutions” on page B-5
“Function Wizard Problems” on page B-6

View errors you may encounter using MATLAB Compiler, probable causes for these errors, and suggested solutions.

Excel Add-Ins Errors and Suggested Solutions

Errors, Warnings, Cause and Suggested Solutions

Message	Probable Cause	Suggested Solution
MBUILD.BAT: Error: The chosen compiler does not support building COM objects.	The chosen compiler does not support building COM objects.	Rerun <code>mbuild -setup -client mbuild_com</code> and choose a supported compiler.
Error in <code>component_name.class_name</code> : Error getting data conversion flags.	Usually caused by <code>mwcomutil.dll</code> not being registered.	Open a DOS window, change folders to <code>matlabroot\bin\win64</code> (<code>matlabroot</code> represents the location of MATLAB on your system), and run the command <code>mwregsvr mwcomutil.dll</code> . See "Register Add-Ins and COM Components" on page 2-13 for full details.
Error in VBAProject: ActiveX component can't create object.	<ul style="list-style-type: none"> Project DLL is not registered. An incompatible MATLAB DLL exists somewhere on the system path. 	If the DLL is not registered, open a DOS window, change folders to <code><projectdir>\distrib</code> (<code><projectdir></code> represents the location of your project files), and run the command: <code>mwregsvr <projectdll>.dll</code> . See "Register Add-Ins and COM Components" on page 2-13 for full details.
Error in VBAProject: Automation error The specified module could not be found.	This usually occurs if MATLAB is not on the system path. This error message occurs if you have more than one version of MATLAB on your system path.	Anytime you have multiple versions of MATLAB, ensure that the newest version of MATLAB appears on your path first. You can verify that the newest version of MATLAB is on the path first by typing <code>path</code> at the DOS prompt. See the table "Required Locations to Develop and Use Components" on page B-5.
LoadLibrary (" <code>component_name.dll</code> ") failed - The specified module could not be found.	You may get this error message while registering the project DLL from the DOS prompt. This usually occurs if MATLAB is not on the system path.	See the table "Required Locations to Develop and Use Components" on page B-5.
Cannot recompile the M file <code>xxxx</code> because it is already in the library <code>libmmfile.mlib</code> .	The name you have chosen for your MATLAB file duplicates the name of a MATLAB file already in the library of precompiled MATLAB files.	Rename the MATLAB file, choosing a name that does not duplicate the name of a MATLAB file already in the library of precompiled MATLAB files.

Message	Probable Cause	Suggested Solution
Arguments may only be defaulted at the end of an argument list.	You have modified the VB script generated for MATLAB Compiler and have not provided one or more arguments used in the modified script.	Provide a value for any argument that requires an explicit value. Arguments that accept defaults appear at the end of the argument list.
Unable to use accessibility screen-readers or assistive technologies, such as JAWS®,	Required files JavaAccessBridge.dll and WindowsAccessBridge.dll no longer added automatically to your Windows path.	Add the following DLLs to your Windows path: JavaAccessBridge.dll WindowsAccessBridge.dll
Error in <i>class.method.version</i>	This is a generic message, but is sometimes seen when there are conflicts in architecture versions of MATLAB and Microsoft Excel.	See “Deployment Target Architectures and Compatibility” on page 2-4 for detailed information.
Error: Error IMWDispatchDriver "Method Load of object IMWDispatchDriver failed"	Different versions of the MATLAB Runtime and MATLAB results in the IMWDispatchDriver error.	Check for the current versions of MATLAB and the MATLAB Runtime. Verify the MATLAB version by typing the MATLAB path in DOS prompt. If the versions do not match update and install the new version of the MATLAB Runtime that matches the current MATLAB version.
Error in VBA project: Method xxx of object 'IClass1' failed	Multiple versions of MATLAB running on the system results in this error.	Register the mwcomutil.dll and mwcommgr.dll registry files. Open a DOS window, cd to <i>matlabroot</i> \bin\win64 (<i>matlabroot</i> represents the location of MATLAB on your system), and run the command mwregsvr mwcomutil.dll mwregsvr mwcommgr.dll
Warning: File not found. Excel primary interop assembly is not found.	Visual Studio does not have Visual Studio Tools	Install Visual Studio Tools while installing Visual Studio to access all the files and package deployable archive with Excel Integration target.


Required Locations to Develop and Use Components

Component and Target Machine

Component	Development Machine	Target Machine
MATLAB Runtime	Make sure that <i>matlabroot</i> \bin\win64 appears on your system path ahead of any other MATLAB installations. (<i>matlabroot</i> is your root MATLAB folder.)	Verify that <code><MATLAB_RUNTIME_INSTALL_DIR>\<ver>\runtime\<arch></code> appears on your system path. For more information, see "Set MATLAB Runtime Path for Deployment"


Microsoft Excel Errors and Suggested Solutions

Error, Cause, and Solutions

Message	Probable Cause	Suggested Solution
The macros in this project are disabled. Please refer to the online help or documentation of the host application to determine how to enable macros. Note: Wording may vary depending upon the version of Excel you are running.	The macro security for Excel is set to High.	<p>Set Excel macro security to Medium on the Security Level tab by doing the following:</p> <ul style="list-style-type: none"> • For Microsoft Office 2003: <ol style="list-style-type: none"> 1 Click Tools > Macro > Security. 2 For Security Level, select Medium. • For Microsoft Office 2007: <ol style="list-style-type: none"> 1 Click the 2007 Office button on the Microsoft Office ribbon  (). 2 Click Excel Options > Trust Center > Trust Center Settings > Macro Settings. 3 In Developer Macro Settings, select Trust access to the VBA project object model. • For Microsoft Office 2010: <ol style="list-style-type: none"> 1 Click File > Options > Trust Center > Trust Center Settings > Macro Settings. 2 In Developer Macro Settings, select Trust access to the VBA project object model.

Function Wizard Problems

Problems, Cause, and Suggested Solutions

Problem	Probable Cause	Suggested Solution
The Function Wizard Help does not appear.	The Function Wizard Help file (mlfunction.chm) is not in the same folder as the Function Wizard add-in (mlfunction.xla).	Copy the Help file (mlfunction.chm) into the same folder as the add-in.
The Function Wizard did not automatically import your .bas file, and you have to create your macro manually	The Function Wizard has malfunctioned with an unspecified error	<ol style="list-style-type: none"> 1 Open Excel 2 Do one of the following: <ul style="list-style-type: none"> • If you use Microsoft Office 2007 or 2010, click Developer > Macros. • If you use Microsoft Office 2003, click Tools > Macros > Macro. 3 From the Visual Basic Editor, select File > Import and select the created VBA file from the <project_dir>\distrib folder. <p>Tip You may need to enable the Developer menu item before performing this step.</p> <p>If you are using Office 365:</p> <ol style="list-style-type: none"> 1 Click File. 2 Click Options and select Customize Ribbon. 3 Under Customize the Ribbon, select Main Tabs and check the Developer check box. <p>If you are using Microsoft Office 2007 or 2010:</p> <ol style="list-style-type: none"> 1 Click the Office button on the Microsoft Office ribbon () or, in Office 2010, click File to display the Office Backstage View. 2 Click Excel Options. 3 In the Top Options for Working With Excel area,

Problem	Probable Cause	Suggested Solution
You get an error when trying to create a macro with the Function Wizard		select Show Developer tab in the Ribbon.
The message Failed to start MATLAB appears instead of Starting MATLAB... when MATLAB is invoked by the Function Wizard.	This message may appear if you manually terminate the MATLAB session that is invoked from the Function Wizard. As a result, you can no longer use the wizard's MATLAB related features in your current Excel session.	Save your work and restart Microsoft Excel.
When I use CTRL + arrow keys to select ranges with the Function Wizard, once I select a function and begin to select the function inputs, keyboard navigation no longer works in excel.	This behavior results from a bug in Microsoft Excel.	If you must use arrow keys to select ranges, apply the following fix from the Microsoft Web site: https://mskb.pkisolutions.com/kb/291110 .

Deployment Product Terms

A

Add-in — A Microsoft Excel add-in is an executable piece of code that can be actively integrated into a Microsoft Excel application. Add-ins are front-ends for COM components, usually written in some form of Microsoft Visual Basic.

Application program interface (API) — A set of classes, methods, and interfaces that is used to develop software applications. Typically an API is used to provide access to specific functionality. See *MWArray*.

Application — An end user-system into which a deployed functions or solution is ultimately integrated. Typically, the end goal for the deployment customer is integration of a deployed MATLAB function into a larger enterprise environment application. The deployment products prepare the MATLAB function for integration by wrapping MATLAB code with enterprise-compatible source code, such as C, C++, C# (.NET), F#, and Java code.

Assembly — An executable bundle of code, especially in .NET.

B

Binary — See *Executable*.

Boxed Types — Data types used to wrap opaque C structures.

Build — See *Compile*.

C

Class — A user-defined type used in C++, C#, and Java, among other object-oriented languages, that is a prototype for an object in an object-oriented language. It is analogous to a derived type in a procedural language. A class is a set of objects which share a common structure and behavior. Classes relate in a class hierarchy. One class is a specialization (a subclass) of another (one of its *superclasses*) or comprises other classes. Some classes use other classes in a client-server relationship. Abstract classes have no members, and concrete classes have one or more members. Differs from a MATLAB class

Compile — In MATLAB Compiler and MATLAB Compiler SDK, to compile MATLAB code involves generating a binary that wraps around MATLAB code, enabling it to execute in various computing environments. For example, when MATLAB code is compiled into a Java package, a Java wrapper provides Java code that enables the MATLAB code to execute in a Java environment.

COM component — In MATLAB Compiler, the executable back-end code behind a Microsoft Excel add-in. In MATLAB Compiler SDK, an executable component, to be integrated with Microsoft COM applications.

Console application — Any application that is executed from a system command prompt window.

D

Data Marshaling — Data conversion, usually from one type to another. Unless a MATLAB deployment customer is using type-safe interfaces, data marshaling—as from mathematical data types to MathWorks data types such as represented by the *MWArray* API—must be performed manually, often at great cost.

Deploy — The act of integrating MATLAB code into a larger-scale computing environment, usually to an enterprise application, and often to end users.

Deployable archive — The deployable archive is embedded by default in each binary generated by MATLAB Compiler or MATLAB Compiler SDK. It houses the deployable package. All MATLAB-based content in the deployable archive uses the Advanced Encryption Standard (AES) cryptosystem. See “Additional Details”.

DLL — Dynamic link library. Microsoft's implementation of the shared library concept for Windows. Using DLLs is much preferred over the previous technology of static (or non-dynamic) libraries, which had to be manually linked and updated.

E

Empties — Arrays of zero (0) dimensions.

Executable — An executable bundle of code, made up of binary bits (zeros and ones) and sometimes called a *binary*.

F

Fields — For this definition in the context of MATLAB Data Structures, see *Structs*.

Fields and Properties — In the context of .NET, *Fields* are specialized classes used to hold data. *Properties* allow users to access class variables as if they were accessing member fields directly, while actually implementing that access through a class method.

I

Integration — Combining deployed MATLAB code's functionality with functionality that currently exists in an enterprise application. For example, a customer creates a mathematical model to forecast trends in certain commodities markets. In order to use this model in a larger-scale financial application (one written with the Microsoft .NET Framework, for instance) the deployed financial model must be integrated with existing C# applications, run in the .NET enterprise environment.

Instance — For the definition of this term in context of MATLAB Production Server software, see *MATLAB Production Server Server Instance*.

J

JAR — Java archive. In computing software, a JAR file (or Java Archive) aggregates many files into one. Software developers use JARs to distribute Java applications or libraries, in the form of classes and associated metadata and resources (text, images, etc.). Computer users can create or extract JAR files using the `jar` command that comes with a Java Development Kit (JDK).

Java-MATLAB Interface — Known as the *JMI Interface*, this is the Java interface built into MATLAB software.

JDK — The Java Development Kit is a product which provides the environment required for programming in Java.

JMI Interface — see *Java-MATLAB Interface*.

JRE — Java Run-Time Environment is the part of the Java Development Kit (JDK) required to run Java programs. It comprises the Java Virtual Machine, the Java platform core classes, and supporting files.

It does not include the compiler, debugger, or other tools present in the JDK™. The JRE™ is the smallest set of executables and files that constitute the standard Java platform.

M

Magic Square — A square array of integers arranged so that their sum is the same when added vertically, horizontally, or diagonally.

MATLAB Runtime — An execution engine made up of the same shared libraries. MATLAB uses these libraries to enable the execution of MATLAB files on systems without an installed version of MATLAB.

MATLAB Runtime singleton — See *Shared MATLAB Runtime instance*.

MATLAB Runtime workers — A MATLAB Runtime session. Using MATLAB Production Server software, you have the option of specifying more than one MATLAB Runtime session, using the `--num-workers` options in the server configurations file.

MATLAB Production Server Client — In the MATLAB Production Server software, clients are applications written in a language supported by MATLAB Production Server that call deployed functions hosted on a server.

MATLAB Production Server Configuration — An instance of the MATLAB Production Server containing at least one server and one client. Each configuration of the software usually contains a unique set of values in the server configuration file, `main_config` (MATLAB Production Server).

MATLAB Production Server Server Instance — A logical server configuration created using the `mps-new` command in MATLAB Production Server software.

MATLAB Production Server Software — Product for server/client deployment of MATLAB programs within your production systems, enabling you to incorporate numerical analytics in enterprise applications. When you use this software, web, database, and enterprise applications connect to MATLAB programs running on MATLAB Production Server via a lightweight client library, isolating the MATLAB programs from your production system. MATLAB Production Server software consists of one or more servers and clients.

Marshaling — See *Data Marshaling*.

mbuild — MATLAB Compiler SDK command that compiles and links C and C++ source files into standalone applications or shared libraries. For more information, see the `mbuild` function reference page.

mcc — The MATLAB command that invokes the compiler. It is the command-line equivalent of using the compiler apps.

Method Attribute — In the context of .NET, a mechanism used to specify declarative information to a .NET class. For example, in the context of client programming with MATLAB Production Server software, you specify method attributes to define MATLAB structures for input and output processing.

mxArray interface — The MATLAB data type containing all MATLAB representations of standard mathematical data types.

MWArray interface — A proxy to `mxArray`. An application program interface (API) for exchanging data between your application and MATLAB. Using `MWArray`, you marshal data from traditional mathematical types to a form that can be processed and understood by MATLAB data type `mxArray`.

There are different implementations of the `MWArray` proxy for each application programming language.

P

Package — The act of bundling the deployed MATLAB code, along with the MATLAB Runtime and other files, into an installer that can be distributed to others. The compiler apps place the installer in the `for_redistribution` subfolder. In addition to the installer, the compiler apps generate a number of loose artifacts that can be used for testing or building a custom installer.

PID File — See *Process Identification File (PID File)*.

Pool — A pool of threads, in the context of server management using MATLAB Production Server software. Servers created with the software do not allocate a unique thread to each client connection. Rather, when data is available on a connection, the required processing is scheduled on a pool, or group, of available threads. The server configuration file option `--num-threads` sets the size of that pool (the number of available request-processing threads) in the master server process.

Process Identification File (PID File) — A file that documents informational and error messages relating to a running server instance of MATLAB Production Server software.

Program — A bundle of code that is executed to achieve a purpose. Programs usually are written to automate repetitive operations through computer processing. Enterprise system applications usually consist of hundreds or even thousands of smaller programs.

Properties — For this definition in the context of .NET, see *Fields and Properties*.

Proxy — A software design pattern typically using a class, which functions as an interface to something else. For example, `MWArray` is a proxy for programmers who need to access the underlying type `mxArray`.

S

Server Instance — See MATLAB Production Server Server Instance.

Shared Library — Groups of files that reside in one space on disk or memory for fast loading into Windows applications. Dynamic-link libraries (DLLs) are Microsoft's implementation of the shared library concept for Microsoft Windows.

Shared MATLAB Runtime instance — When using MATLAB Compiler SDK, you can create a shared MATLAB Runtime instance, also known as a singleton. When you invoke MATLAB Compiler with the `-S` option through the compiler (using either `mcc` or a compiler app), a single MATLAB Runtime instance is created for each COM component or Java package in an application. You reuse this instance by sharing it among all subsequent class instances. Such sharing results in more efficient memory usage and eliminates the MATLAB Runtime startup cost in each subsequent class instantiation. All class instances share a single MATLAB workspace and share global variables in the deployed MATLAB files. MATLAB Compiler SDK creates singletons by default for .NET assemblies. MATLAB Compiler creates singletons by default for the COM components used by the Excel add-ins.

State — The present condition of MATLAB, or the MATLAB Runtime. MATLAB functions often carry state in the form of variable values. The MATLAB workspace itself also maintains information about global variables and path settings. When deploying functions that carry state, you must often take additional steps to ensure state retention when deploying applications that use such functions.

Structs — MATLAB Structures. Structs are MATLAB arrays with elements that you access using textual field designators. Fields are data containers that store data of a specific MATLAB type.

System Compiler — A key part of Interactive Development Environments (IDEs) such as Microsoft Visual Studio.

T

Thread — A portion of a program that can run independently of and concurrently with other portions of the program. See *pool* for additional information on managing the number of processing threads available to a server instance.

Type-safe interface — An API that minimizes explicit type conversions by hiding the `MWArray` type from the calling application.

W

Web Application Archive (WAR) — In computing, a Web Application Archive is a JAR file used to distribute a collection of JavaServer pages, servlets, Java classes, XML files, tag libraries, and static web pages that together constitute a web application.

Webfigure — A MathWorks representation of a MATLAB figure, rendered on the web. Using the WebFigures feature, you display MATLAB figures on a website for graphical manipulation by end users. This enables them to use their graphical applications from anywhere on the web, without the need to download MATLAB or other tools that can consume costly resources.

Windows Communication Foundation (WCF) — The Windows Communication Foundation™ is an application programming interface in the .NET Framework for building connected, service-oriented, web-centric applications. WCF is designed in accordance with service oriented architecture principles to support distributed computing where services are consumed by client applications.