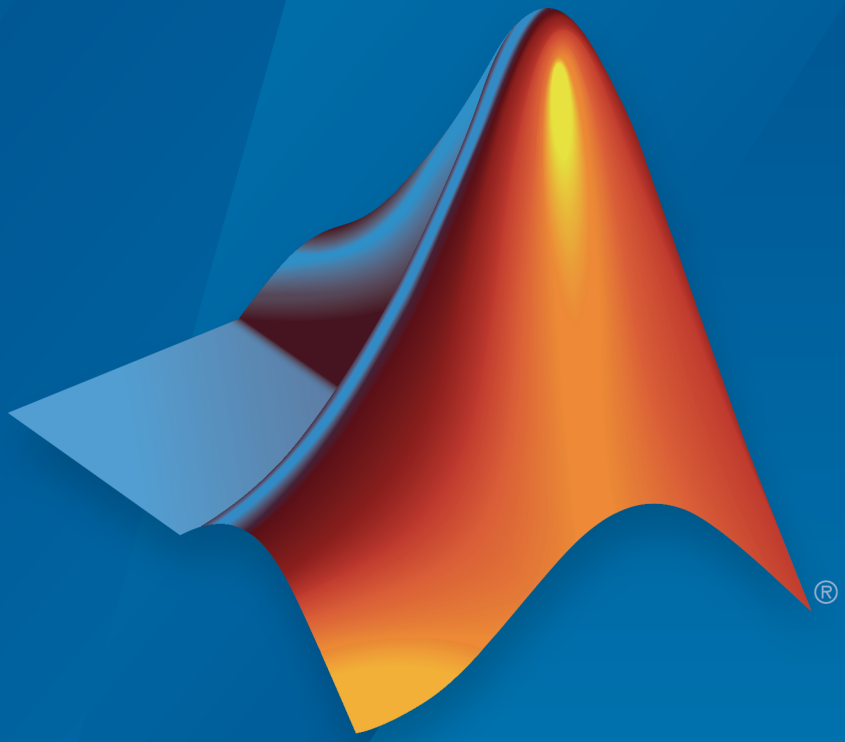
Spreadsheet Link™

User's Guide



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Spreadsheet Link™ User's Guide

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3 Error Messages and Troubleshooting

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Getting Started

Spreadsheet Link Product Description

Use MATLAB from Microsoft Excel

Spreadsheet Link connects Excel® spreadsheet software with the MATLAB® workspace, enabling you to access the MATLAB environment from an Excel spreadsheet. With Spreadsheet Link software, you can exchange data between MATLAB and Excel, taking advantage of the familiar Excel interface while accessing the computational speed and visualization capabilities of MATLAB.

Key Features

- Data preprocessing, editing, and viewing in the familiar Excel environment
- Sophisticated analysis of Excel data using MATLAB and application toolboxes
- Delivery of Excel based applications, using MATLAB as a computational and graphics engine and Excel as an interface
- Interactive selection of available functions using the MATLAB Function Wizard
- Visual interface for customization of all Spreadsheet Link preferences

Microsoft Excel and MATLAB Interaction

Spreadsheet Link Add-In integrates the Microsoft Excel and MATLAB products in a computing environment running Microsoft Windows®. It connects the Excel interface to the MATLAB workspace, enabling you to use Excel worksheet and macro programming tools to leverage the numerical, computational, and graphical power of MATLAB.

You can use Spreadsheet Link functions in an Excel worksheet or macro to exchange and synchronize data between Excel and MATLAB, without leaving the Excel environment. With a small number of functions to manage the link and manipulate data, the Spreadsheet Link software is powerful in its simplicity.

The Spreadsheet Link software supports MATLAB two-dimensional numeric arrays, one-dimensional character arrays (strings), and two-dimensional cell arrays. It does not work with MATLAB multidimensional arrays and structures.

Related Examples

- “Work with MATLAB Functions in Microsoft Excel” on page 1-16

Installation

In this section...

Product Installation

Install the Microsoft Excel product *before* you install the MATLAB and Spreadsheet Link software. To install the Spreadsheet Link Add-In, follow the instructions in the MATLAB installation documentation. Select the **Spreadsheet Link** check box when choosing components to install.

Notes: If you have several versions of MATLAB installed on your computer, Spreadsheet Link uses the version that you registered last.

To install the Spreadsheet Link Add-In, you need administrator system privileges on the computer. Contact your system administrator to enable these privileges.

Files and Folders Created by the Installation

Note: The MATLAB root folder, *`matlabroot`*, is where MATLAB is installed on your system.

The Spreadsheet Link installation program creates a subfolder under *`matlabroot`*`\toolbox\`. The `exlink` folder contains these files:

- `excllink.xlam`: The Spreadsheet Link Add-In for Microsoft Excel
- `ExliSamp.xls`: Spreadsheet Link example files described in this documentation

After You Upgrade the Spreadsheet Link Software

If MATLAB and Spreadsheet Link are installed on your computer, to upgrade to a newer version:

1. Install the new version of MATLAB and Spreadsheet Link.
2. Start MATLAB and a Microsoft Excel session.
3. Configure the Spreadsheet Link software. For details, see “Add-In Setup” on page 1-6.
4. If you have existing workbooks with macros that use Spreadsheet Link, update references to Spreadsheet Link in each workbook.

To update the references in an existing workbook in Microsoft Excel:

1. In a Microsoft Excel session, open the Visual Basic® Editor window by clicking **Visual Basic** on the **Developer** tab. (If you do not find the **Developer** tab, see the Excel Help.)
2. In the left pane, select a module for which you want to update a reference.
3. From the main menu, select **Tools** > **References**.
4. In the References dialog box, select the **SpreadsheetLink2007_2010** check box.
5. Click **OK**.

More About

- “Add-In Setup” on page 1-6

Add-In Setup

In this section...

Configure Microsoft Excel

To enable the Spreadsheet Link Add-In, start a Microsoft Excel session and follow these steps.

If you use Microsoft Excel 2007:

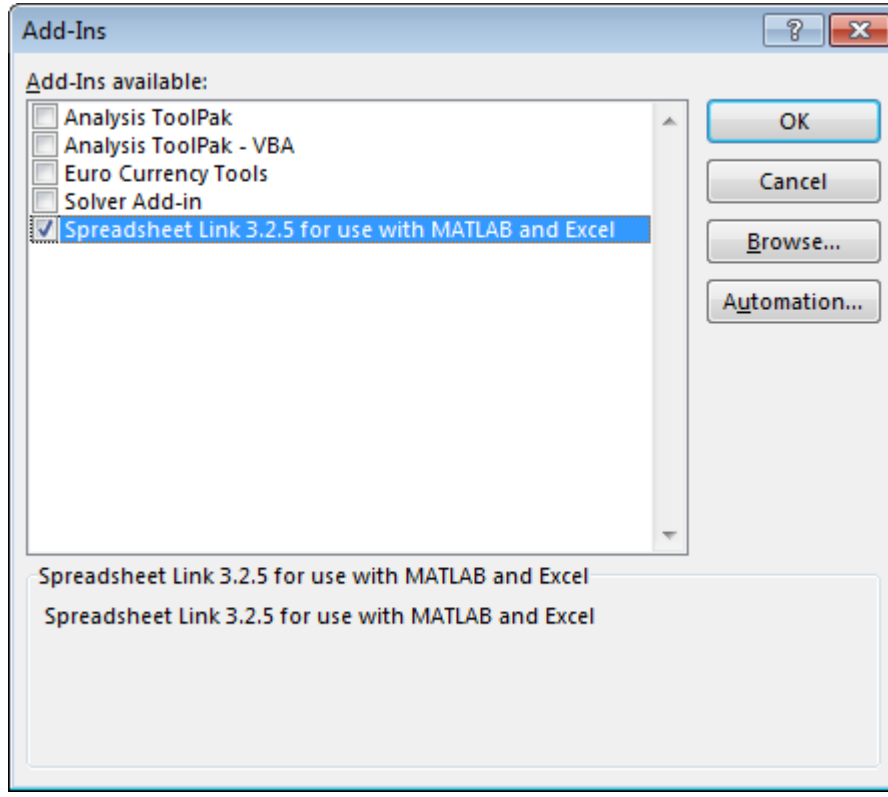
1. Click  , the Microsoft Office button.
2. Click **Excel Options**. The Excel Options dialog box opens.

If you use Microsoft Excel 2010 and later versions:

1. Select **File** from the main menu.
2. Click **Options**. The Excel Options dialog box opens.

The next steps are the same for both versions:

1. Click **Add-Ins**.
2. From the **Manage** selection list, choose **Excel Add-Ins**.
3. Click **Go**. The Add-Ins dialog box opens.
4. Click **Browse**.
5. Select *`matlabroot`*`\toolbox\exlink\excllink.xlam`.
6. Click **Open**. In the Add-Ins dialog box, the **Spreadsheet Link for use with MATLAB and Excel** check box is selected.



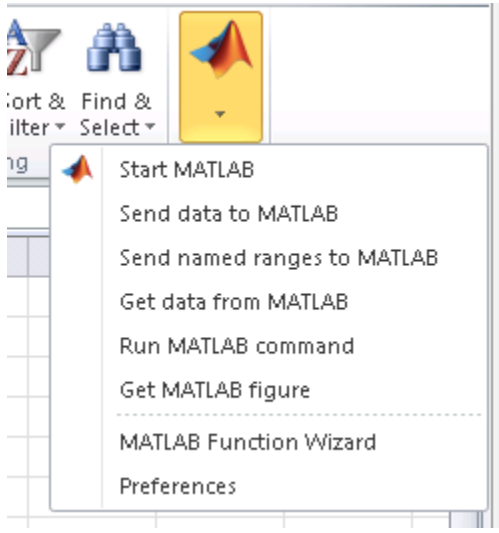
7 Click **OK** to close the Add-Ins dialog box.

8 Click **OK** to close the Excel Options dialog box.

The Spreadsheet Link Add-In loads now and with each subsequent Excel session.

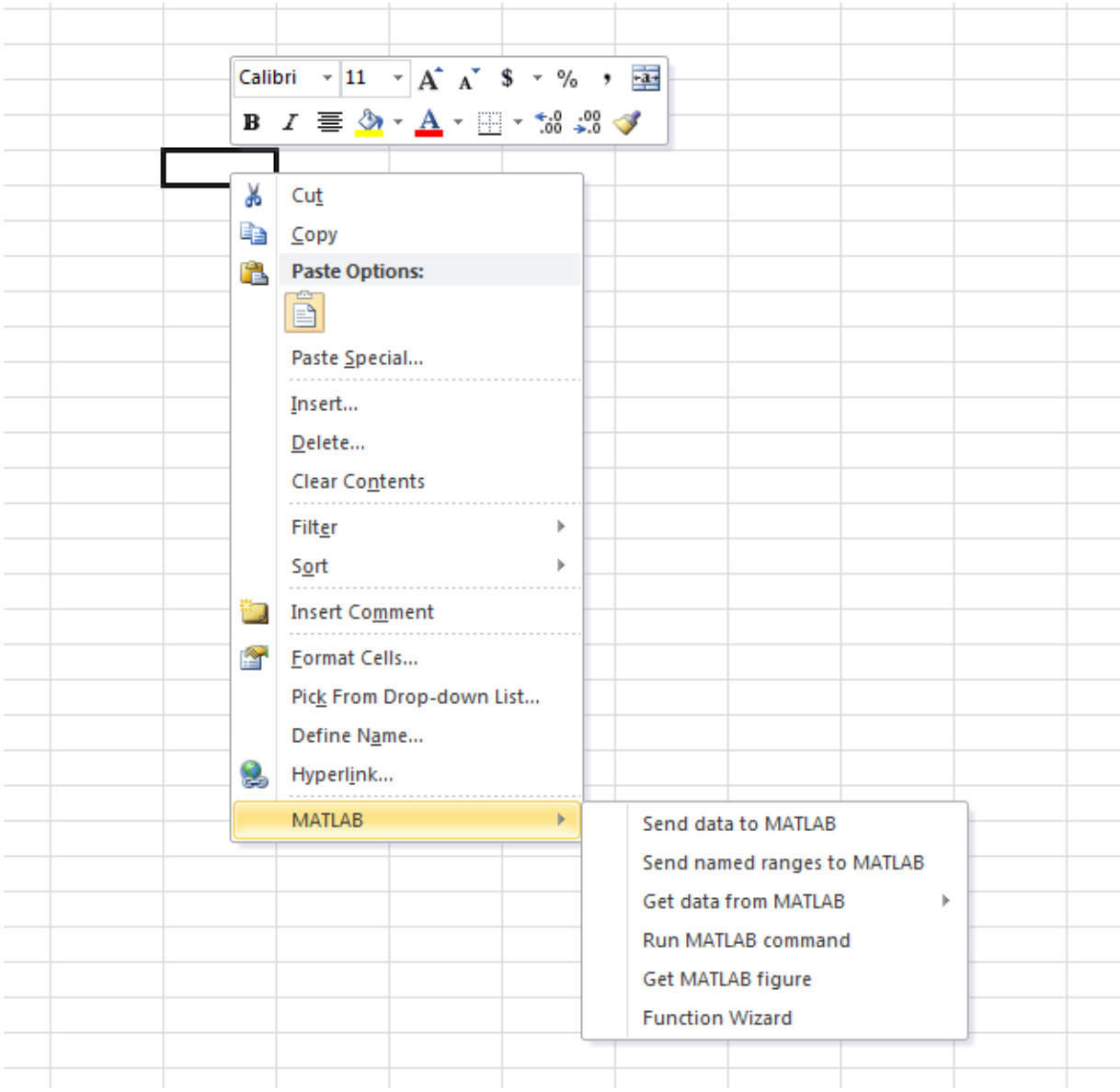
The **MATLAB Command Window** button appears on the Microsoft Windows taskbar.

The MATLAB group appears on the top right of the **Home** tab in your Excel worksheet.



Spreadsheet Link is ready for use.

Right-click a cell to list the MATLAB options.


Calibri
11
Cut
Copy
Paste Options:
Paste Special...
Insert...
Delete...
Clear Contents
Filter
Sort
Insert Comment
Format Cells...
Pick From Drop-down List...
Define Name...
Hyperlink...
MATLAB
Send data to MATLAB
Send named ranges to MATLAB
Get data from MATLAB
Run MATLAB command
Get MATLAB figure
Function Wizard

Work with the Microsoft Visual Basic Editor

To enable Spreadsheet Link as a Reference in the Microsoft Visual Basic Editor:

1. Open a Visual Basic session. Click the **Visual Basic** button on the **Developer** tab, or press **Alt+F11**.

   Note: For instructions about displaying the **Developer** tab, see Excel Help.

2. In the Visual Basic toolbar, select **Tools > References**.
3. In the References — VBA Project dialog box, select the **SpreadsheetLink** or **SpreadsheetLink2007_2010** check box.
4. Click **OK**.

See Also

`matlabroot`

More About

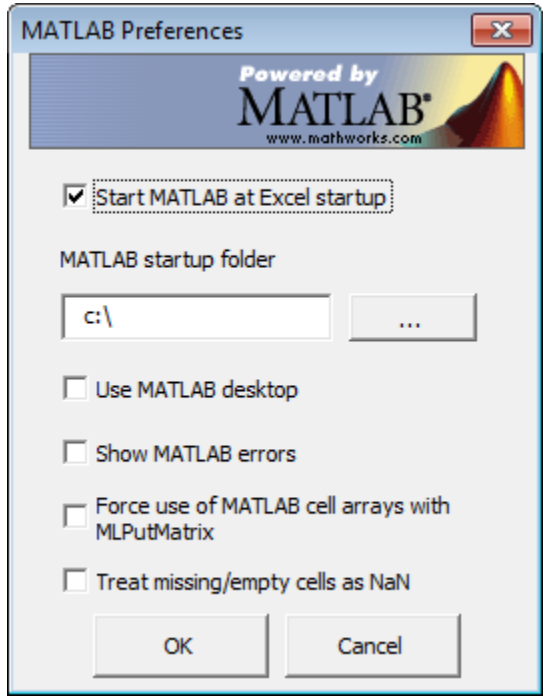
- "Installation" on page 1-4

Set Spreadsheet Link Preferences and MATLAB Version

In this section...

Set Spreadsheet Link Preferences

Use the Preferences dialog box to set Spreadsheet Link preferences. Click the **preferences** button in the Excel toolbar or MATLAB group to open this dialog box.



Preferences include:

- **Start MATLAB at Excel startup** starts a MATLAB session automatically when an Excel session starts. By default, this option is enabled.

- **MATLAB startup folder** lets you specify the startup folder for your MATLAB session.
- **Use MATLAB desktop** starts the MATLAB desktop, including the current folder, workspace, command history, and Command Window panes, when an Excel session starts.
- **Show MATLAB errors** displays MATLAB error messages in Excel worksheet cells. Without this option, worksheet cells display Excel error messages. See "Worksheet Cell Errors" on page 3-2.
- **Force use of MATLAB cell arrays with MLPutMatrix** enables the `MLPutMatrix` function to use cell arrays for data transfer between Excel and the MATLAB workspace.
- **Treat missing/empty cells as NaN** sets data in missing or empty cells to `NaN` or zero.

Set the MATLAB Version

If there are several versions on MATLAB installed on your computer, the Spreadsheet Link software uses the last registered version. Typically, the last registered version is the latest version you have installed. To change the last registered version of MATLAB:

1. Shut down all MATLAB and Excel sessions.
2. Open a Command Prompt window, and using `cd`, change to the `bin\win64` subfolder of the MATLAB installation folder.
3. Enter the command:

```
.\matlab /regserver
```

Start and Stop Spreadsheet Link and MATLAB

In this section...

Start Spreadsheet Link and MATLAB Automatically

When installed and configured according to the instructions in "Add-In Setup" on page 1-6, the Spreadsheet Link and MATLAB software automatically start when you start a Microsoft Excel session.

Start Spreadsheet Link and MATLAB Manually

1. Select **Tools** > **Macro**.
   - In Excel 2007, click the **View** or **Developer** tab, and then click the **Macros** button.
   - In Excel 2010, click the **View** menu and select **Macros** on the Excel toolstrip, and then click **View Macros**.
2. Enter `matlabinit` into the **Macro Name/Reference** field.
3. Click **Run**. The **MATLAB Command Window** button appears on the Microsoft Windows taskbar.

Connect to an Already Running MATLAB Session

By default, Spreadsheet Link starts a new MATLAB session. Alternatively, it can connect to an already running MATLAB session.

Note: If several versions of MATLAB are installed on your computer, Spreadsheet Link always uses the last registered version. If you try to connect to an already running MATLAB session that is not the last registered version, Spreadsheet Link starts a new

MATLAB session. Spreadsheet Link does not connect to the existing one. To change the last registered version, see “Set the MATLAB Version” on page 1-12.

To connect a new Excel session to an already running MATLAB session:

1. In MATLAB, enter the following command:

   ```
   enableservice('AutomationServer',true)
   ```

   This command converts a running MATLAB session into an Automation server.
2. Start a new Excel session. It automatically connects to the running MATLAB session.

Alternatively, you can start MATLAB as an automation server from the beginning. To start MATLAB as an automation server, use the `automation` command-line option:

```
matlab -automation
```

This command does not start MATLAB in a full desktop mode. To do so, use the `-desktop` option:

```
matlab -automation -desktop
```

If you always use MATLAB as an automation server, modify the shortcut that you use to start MATLAB:

1. Right-click your MATLAB shortcut icon. (You can use the icon on your desktop or in the Windows **Start** menu.)
2. Select **Properties**.
3. Click the **Shortcut** tab.
4. Add the string `-automation` in the **Target** field. Remember to leave a space between `matlab.exe` and `/automation`.
5. Click **OK**.

Specify the MATLAB Startup Folder

MATLAB starts in the MATLAB root folder and completes the initialization. After starting, MATLAB changes to the Spreadsheet Link MATLAB startup folder. For details about specifying the startup folder, see `MLStartDir`.

Stop Spreadsheet Link and MATLAB

If you started the Spreadsheet Link and MATLAB software from the Excel interface:

- To stop both the Spreadsheet Link and MATLAB software, close the Excel session as you normally would.
- To stop the Spreadsheet Link and MATLAB software and leave the Excel session running, enter the `=MLClose()` command into an Excel worksheet cell. You can use the `MLOpen` or `matlabinit` function to restart the Spreadsheet Link and MATLAB sessions manually.

If you connected an Excel session to an existing MATLAB session, close Excel and MATLAB sessions separately. Closing one session does not automatically close the other.

Work with MATLAB Functions in Microsoft Excel

In this section...

Differences Between Spreadsheet Link and Microsoft Excel Functions

- Spreadsheet Link functions *perform an action*, while Microsoft Excel functions *return a value*.
- Spreadsheet Link function names *are not* case-sensitive; that is, `MLPutMatrix` and `mlputmatrix` are the same.
- MATLAB function names and variable names *are* case-sensitive; that is, `BONDS`, `Bonds`, and `bonds` are three different MATLAB variables.

Note: Excel operations and function keys might behave differently with Spreadsheet Link functions.

Spreadsheet Link Function Types

Spreadsheet Link functions manage the connection and data exchange between the Excel software and the MATLAB workspace, without your ever needing to leave the Excel environment. You can run functions as worksheet cell formulas or in macros. The Spreadsheet Link software enables Excel to act as an easy-to-use data-storage and application-development front end for the MATLAB software, which is a powerful computational and graphical processor.

There are two types of Spreadsheet Link functions: link management functions and data management functions.

Link management functions initialize, start, and stop the Spreadsheet Link and MATLAB software. You can run any link management function other than `matlabinit`

as a worksheet cell formula or in macros. Run the `matlabinit` function from the Excel **Tools** > **Macro** menu, or in macro subroutines.

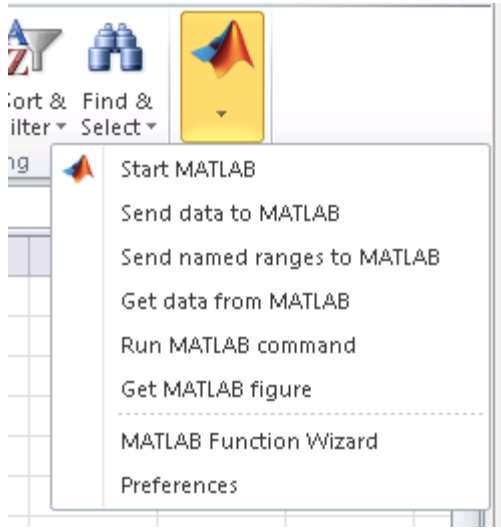
Data management functions copy data between the Excel software and the MATLAB workspace, and execute MATLAB commands in the Excel interface. You can run any data management function other than `MLPutVar` and `MLGetVar` as a worksheet cell formula or in macros. The `MLPutVar` and `MLGetVar` functions can run only in macros.

Use Spreadsheet Link Functions with Microsoft Excel

Execute a Function from the Microsoft Excel Ribbon

This example shows how to use the function `mlputranges` from the Microsoft Excel Ribbon.

1. Start Microsoft Excel and start MATLAB.
2. Name and select a range in the worksheet.
3. Select **Send named ranges to MATLAB** using the MATLAB group that appears on the top right of the **Home** tab in your Excel worksheet. When you select this option, MATLAB executes `mlputranges`.

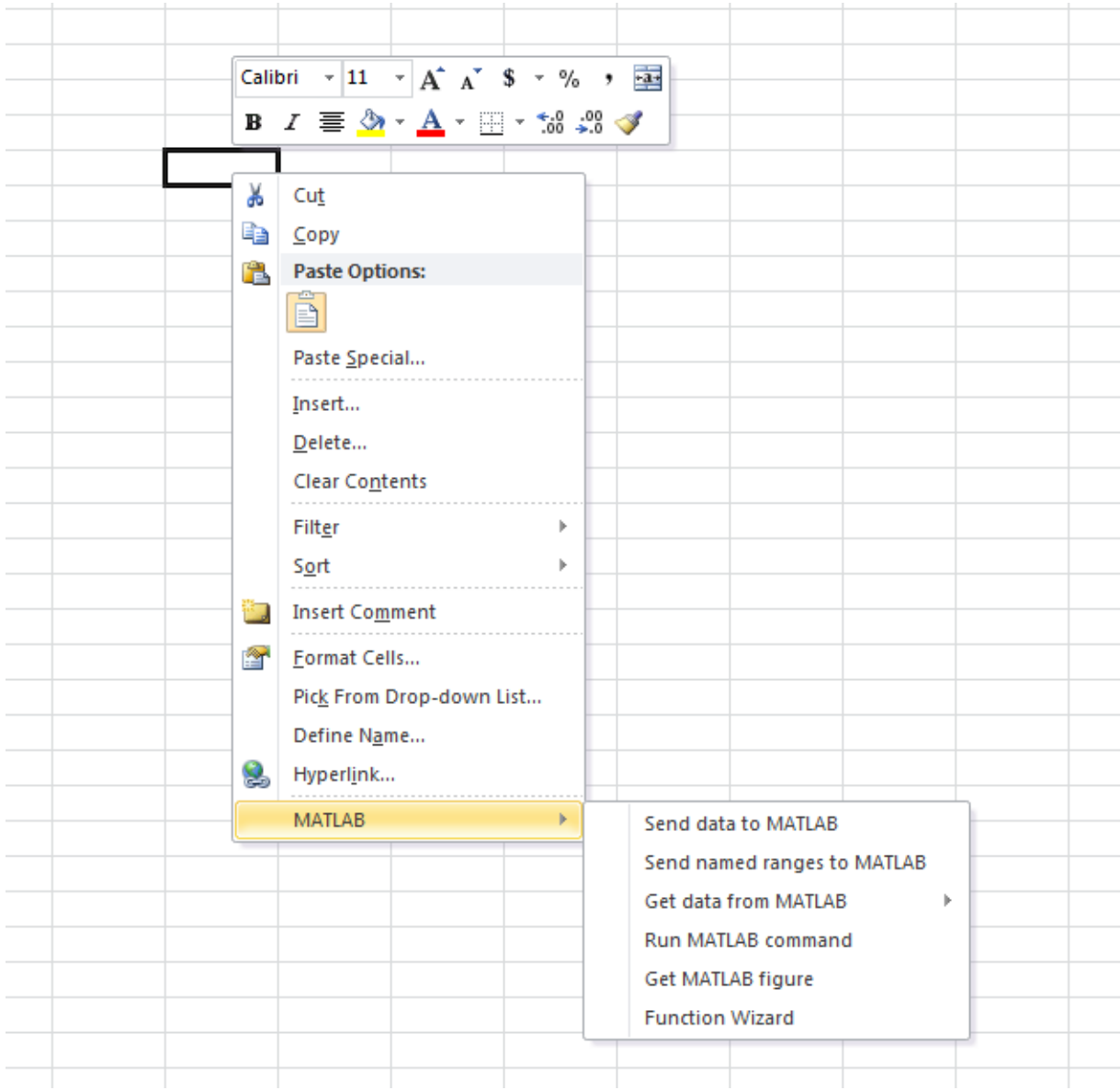


Microsoft Excel exports the named range into a MATLAB variable.

Execute a Function from a Microsoft Excel Cell

This example shows how to use the function `mlputranges` from a cell in the worksheet.

1. Start Microsoft Excel and start MATLAB.
2. Name and select a range in the worksheet.
3. Right-click a cell to list the MATLAB options.


Calibri
11
Cut
Copy
Paste Options:
Paste Special...
Insert...
Delete...
Clear Contents
Filter
Sort
Insert Comment
Format Cells...
Pick From Drop-down List...
Define Name...
Hyperlink...
MATLAB
Send data to MATLAB
Send named ranges to MATLAB
Get data from MATLAB
Run MATLAB command
Get MATLAB figure
Function Wizard

4 Select **MATLAB > Send named ranges to MATLAB**. When you select this option, MATLAB executes `mlputranges`.

Microsoft Excel exports the named range into a MATLAB variable.

Use Worksheets

Enter Functions into Worksheet Cells

Spreadsheet Link functions expect A1-style worksheet cell references, that is, columns designated with letters and rows with numbers (the default reference style). If your worksheet shows columns designated with numbers instead of letters:

1 Select **Tools** > **Options**.
2 Click the **General** tab.
3 Under **Settings**, clear the **R1C1 reference style** check box.

Enter Spreadsheet Link functions directly into worksheet cells as worksheet formulas. Begin worksheet formulas with + or = and enclose function arguments in parentheses. The following example uses `MLPutMatrix` to put the data in cell `C10` into matrix `A`:

```
=MLPutMatrix("A", C10)
```

For more information on specifying arguments in Spreadsheet Link functions, see "Work with Arguments" on page 1-21.

Caution: Do not use the Excel Function Wizard. It can generate unpredictable results.

After a Spreadsheet Link function successfully executes as a worksheet formula, the cell contains the value `0`. While the function executes, the cell might continue to show the formula that you entered.

To change the active cell when an operation completes, select **Excel Tools Options** > **Edit** > **Move Selection after Enter**. This action provides a useful confirmation for lengthy operations.

Automatic Calculation Mode vs. Manual Calculation Mode

Spreadsheet Link functions are most effective in automatic calculation mode. To *automate* the recalculation of a Spreadsheet Link function, add to it a cell whose value

changes. In the following example, the `MLPutMatrix` function executes again when the value in cell `C1` changes:

```
=MLPutMatrix("bonds", D1:G26) + C1
```

Caution: Be careful to avoid creating endless recalculation loops.

To use `MLGetMatrix` in manual calculation mode:

1. Enter the function into a cell.
2. Press **F2**.
3. Press **Enter**. The function executes.

Spreadsheet Link functions do not automatically adjust cell addresses. If you use explicit cell addresses in a function, edit the function arguments to reference a new cell address when you are:

- Inserting or deleting rows or columns.
- Moving or copying the function to another cell.

Note: Pressing **F9** to recalculate a worksheet affects only Excel functions. This key does not operate on Spreadsheet Link functions.

Work with Arguments

This section describes tips for managing variable-name arguments and data-location arguments in Spreadsheet Link functions.

Variable-Name Arguments

- You can *directly* or *indirectly* specify a variable-name argument in most Spreadsheet Link functions:
  - To specify a variable name directly, enclose it in double quotation marks; for example, `MLDeleteMatrix("Bonds")`.
  - To specify a variable name as an indirect reference, enter it without quotation marks. The function evaluates the contents of the argument to get the variable

name. The argument must be a worksheet cell address or range name, for example, `MLDeleteMatrix(C1)`.

Note: Spreadsheet Link functions do not support global variables. When exchanging data between Excel and MATLAB, the base workspace is used. Variables in the base workspace exist until you clear them or end your MATLAB session.

Data-Location Arguments

- A data-location argument must be a worksheet cell address or range name.
- Do not enclose a data-location argument in quotation marks (except in `MLGetMatrix`, which has unique argument conventions).
- A data-location argument can include a worksheet number; for example, `Sheet3!B1:C7` or `Sheet2!OUTPUT`.

Tip: You can reference special characters as part of a worksheet name in `MLGetMatrix` or `MLPutMatrix` by embedding the worksheet name within single quotation marks (`' '`).

Use Spreadsheet Link Functions in Macros

About the Examples

These examples show how to manipulate MATLAB data using Spreadsheet Link.

- For an example of how to exchange data between the MATLAB and Excel workspaces, see “Import and Export Data Between Microsoft Excel and the MATLAB Workspace” on page 1-24.
- For an example of how to export data from the MATLAB workspace and display it in an Excel worksheet, see “Send MATLAB Data to an Excel Worksheet” on page 1-22.

Send MATLAB Data to an Excel Worksheet

This example shows how to run MATLAB commands using VBA, send MATLAB data to the Excel software, and display the results in an Excel dialog box.

1 Start an Excel session.

2. Initialize the MATLAB session by clicking the **startmatlab** button in the Spreadsheet Link toolbar or by running the `matlabinit` function.
3. Enable the Spreadsheet Link Add-In. For details, see "Configure Microsoft Excel" on page 1-6.
4. Enable the Spreadsheet Link software as a Reference in the Microsoft Visual Basic Editor. For instructions, see "Work with the Microsoft Visual Basic Editor" on page 1-10.
5. In the Visual Basic Editor, create a module.
   a. Right-click the **Microsoft Excel Objects** folder in the **Project — VBAProject** browser.
   b. Select **Insert** > **Module**.
6. Enter the following code into the module window:

```
Option Base 1
Sub Method1()

    MLShowMatlabErrors "yes"

    '''To MATLAB:
    Dim Vone(2, 2) As Double    'Input
    Vone(1, 1) = 1
    Vone(1, 2) = 2
    Vone(2, 1) = 3
    Vone(2, 2) = 4

    MLPutMatrix "a", Range("A1:B2")
    MLPutVar "b", Vone
    MLEvalString ("c = a*b")
    MLEvalString ("d = eig(c)")

    '''From MATLAB:
    Dim Vtwo As Variant         'Output
    MLGetVar "c", Vtwo
    MsgBox "c is " & Vtwo(1, 1)

    MLGetMatrix "b", Range("A7:B8").Address
    MatlabRequest
    MLGetMatrix "c", "Sheet1!A4:B5"
    MatlabRequest

    Sheets("Sheet1").Select
```

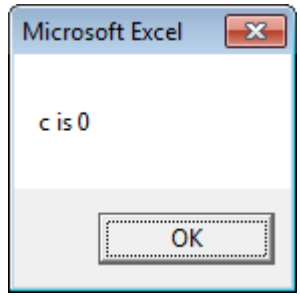
```
    Range("A10").Select
    MLGetMatrix "d", ActiveCell.Address
    MatlabRequest

End Sub
```

Tip: Copy and paste this code into the Visual Basic Editor from the HTML version of the documentation.

7 Run the code. Press **F5** or select **Run** > **Run Sub/UserForm**.

The following dialog box appears.



8 Click **OK** to close the dialog box.

Note: Do not include `MatlabRequest` in a macro function unless the macro function is called from a subroutine.

Tip: In macros, leave a space between the function name and the first argument. Do not use parentheses.

Import and Export Data Between Microsoft Excel and the MATLAB Workspace

- This example uses `MLGetMatrix` in a macro subroutine to export data from the MATLAB matrix `A` into the Excel worksheet `Sheet1`.

```
Sub Test1()
   MLGetMatrix "A", "Sheet1!A5"
   MatlabRequest
```

```
End Sub
```

Note: The `MatlabRequest` function initializes internal Spreadsheet Link variables and enables `MLGetMatrix` to function in the subroutine.

- This example uses `MLPutMatrix` in a macro subroutine to import data into the MATLAB matrix `A`, from a specified cell range in the Excel worksheet `Sheet1`.

```
Sub Test2()
  Set myRange = Range("A1:C3")
  MLPutMatrix "A", myRange
End Sub
```

See Also

`matlabfcn` | `matlabinit` | `matlabsub` | `MLGetMatrix` | `MLGetVar` | `MLPutMatrix` | `MLPutRanges` | `MLPutVar` | `pathtool`

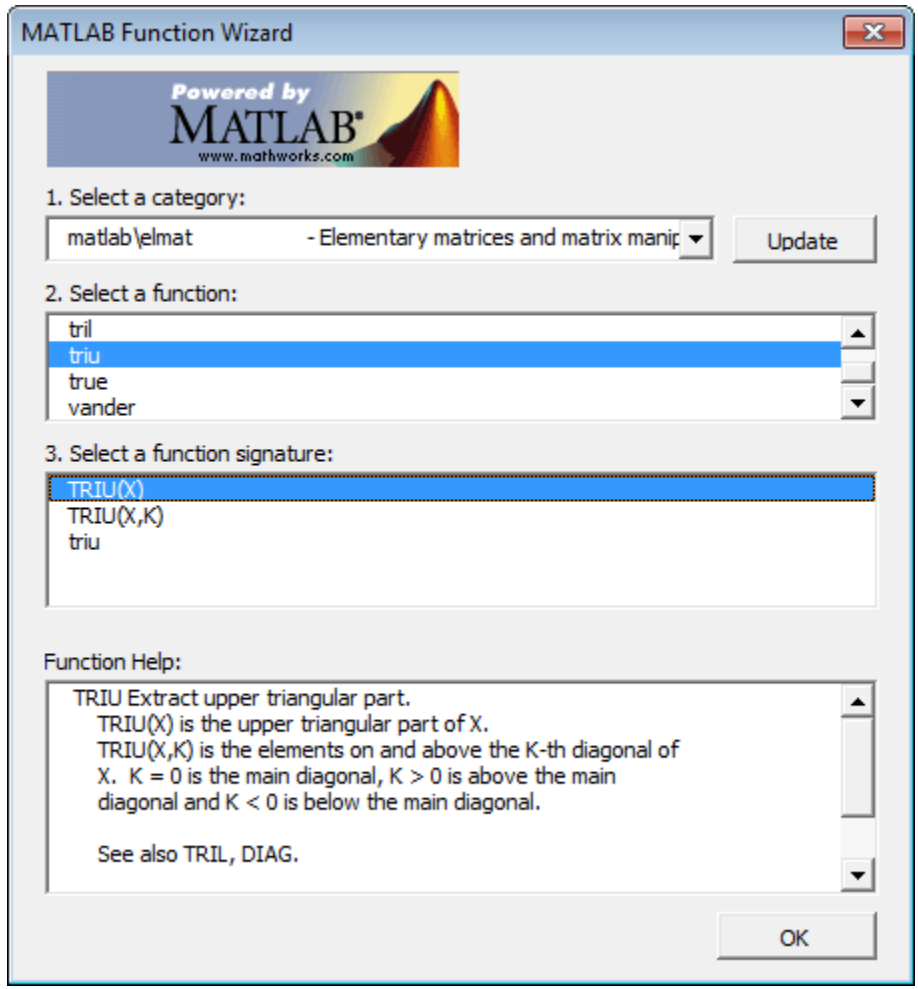
Related Examples

- “Configure Microsoft Excel” on page 1-6
- “Work with the Microsoft Visual Basic Editor” on page 1-10
- “Work with Dates” on page 1-35

Work with the MATLAB Function Wizard

In this section...

The MATLAB Function Wizard for the Spreadsheet Link software lets you browse MATLAB folders and run functions from the Excel interface.



Work with MATLAB Functions

1 List all MATLAB working folders and function categories.

   All folders or categories in the current `MATLABPATH` appear in the **Select a category** field. Click an entry in the list to select it. Each entry in the list appears as a folder path and a description read from the `Contents.m` file in that folder. If no `Contents.m` file is found, the folder or category display notifies you as follows:

```
finance\finsupport -(No table of contents file)
```

   To refresh the folder/category list, click **Update**.

2 Select a particular folder or category, and list functions available for that folder or category.

   After you select a folder or category, the **Select a function** field displays available functions for that folder or category. Click a function name to select it.

   Tip: The Function Wizard prohibits access to MATLAB constructors and methods. You can write a wrapper function for a method or a constructor and access that wrapper.

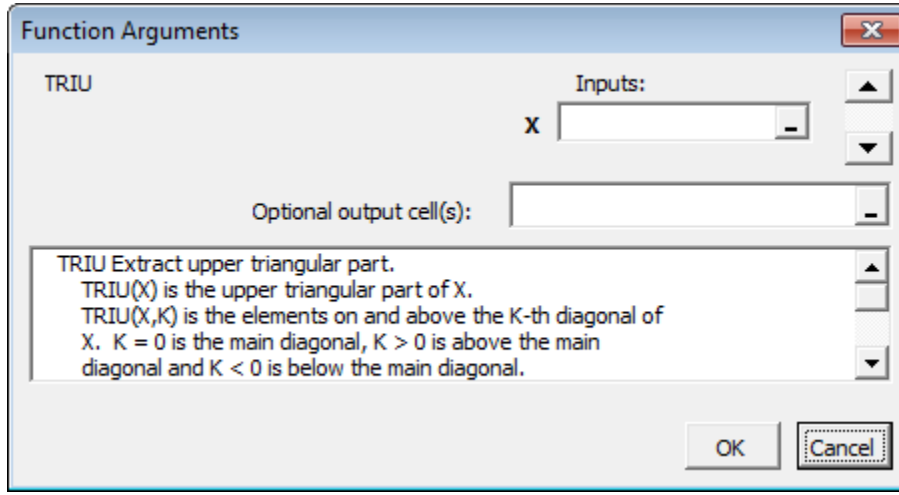
3 Select a function signature and enter a formula into the current worksheet cell.

   After you select a function, the **Select a function signature** field displays available signatures for that function. Click a function signature to select it.

4 View help information for the selected function.

   The **Function Help** field displays help for the selected function.

When you click a function signature, the Function Arguments dialog box appears.



This dialog box lets you specify the cells that contain input arguments and the cells where to display outputs. By default, the output of the selected function appears in the current worksheet cell using the Spreadsheet Link function `matlabfcn`. In the following example, the output appears in the current worksheet cell and generates a MATLAB figure:

```
=matlabfcn("plot",Sheet1!$B$2:$D$4)
```

Specifying a target range of cells using the **Optional output cell(s)** field causes the selected function to appear in the current worksheet cell as an argument of `matlabsub`. In addition, `matlabsub` includes an argument that indicates where to write the output. In the following example, the data from `A2` is input to the `rand` function, whose target cell is `B2`:

```
=matlabsub("rand","Sheet1!$B$2",Sheet1!$A$2)
```

Tip Although the Function Wizard lets you specify multiple output cells, it does not return multiple outputs. If you specify a range of output cells, the wizard returns the first output argument starting in the first output cell.

For example, if a function returns two separate elements `a` and `b`, and you specify `A1:A2` as output cells, the Function Wizard displays element `a` in cell `A1`. It discards element

b. If an output is a matrix, the Function Wizard displays all elements of that matrix starting in the first output cell.

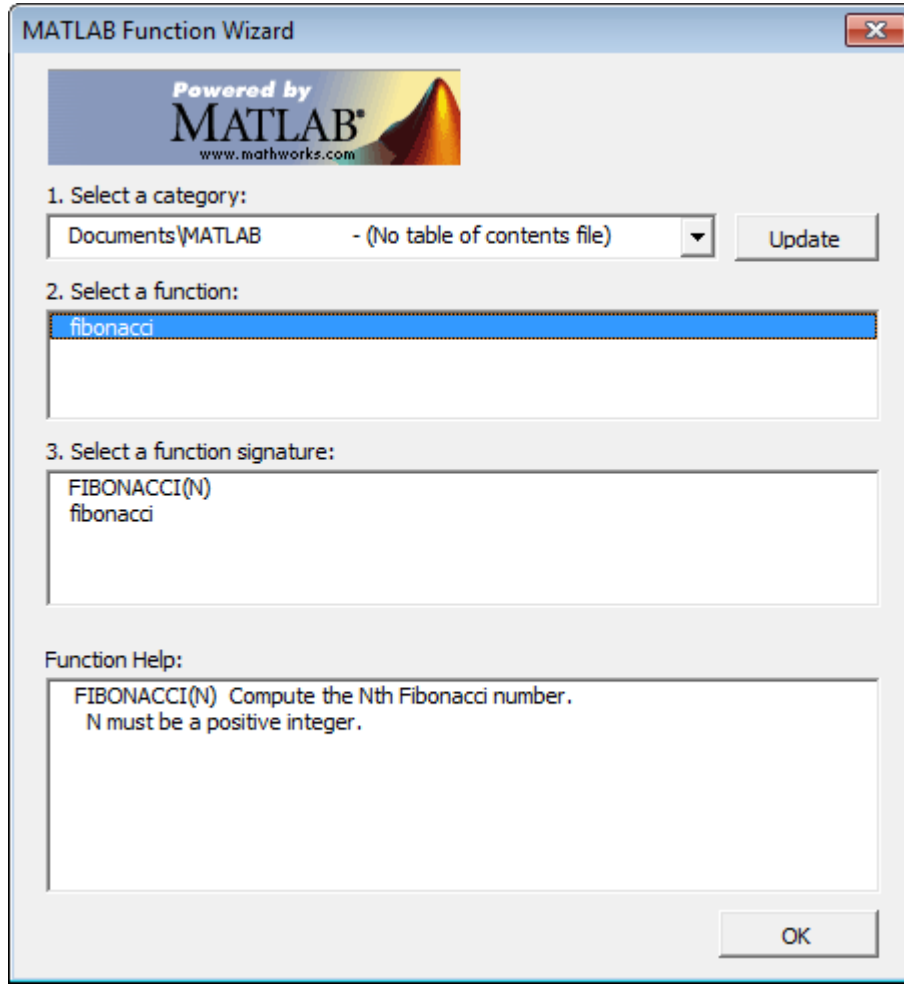
Work with Custom MATLAB Functions

1. In MATLAB, create and save your function. Create a help header in your function that contains supported function signatures to use with the MATLAB Function Wizard. For example, write the function that computes the Fibonacci numbers and save it in the folder `Documents\MATLAB`:

   ```
   function f = fibonacci(n)
   %FIBONACCI(N)  Compute the Nth Fibonacci number.
   % N must be a positive integer.
   if n < 0
       error('Invalid number.')
   elseif n == 0
       f = 0;
   elseif n == 1
       f = 1;
   else
       f = fibonacci(n - 1) + fibonacci(n - 2);
   end;
   end
   ```

2. Add the folder where you saved the function to the MATLAB search path. To add the folder to the search path, use the `pathtool` function or select **Set Path** in the MATLAB Toolstrip.

3. In Excel, open the MATLAB Function Wizard and select the folder where you saved your function.



The Function Wizard does not let you access MATLAB constructors and methods. To access a method or a constructor from the Function Wizard, write a wrapper function for that method or constructor. For example, to access the `timeseries(DATA)` constructor from the Function Wizard, write the following wrapper function:

```
function TS = timeseries_wrapper(DATA)
% timeseries_wrapper(DATA) is a wrapper function
% for TIMESERIES(DATA)
```

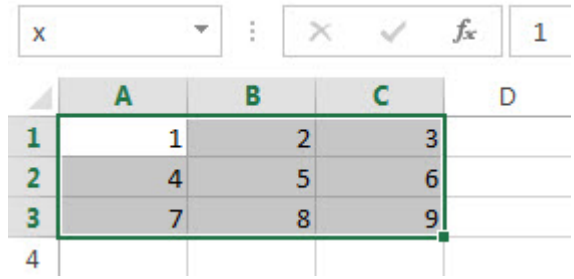
```
%   TS = TIMESERIES(DATA) creates a time series object TS using
%   data DATA. By default, the time vector ranges from 0 to N-1,
%   where N is the number of samples, and has an interval of 1
%   second. The default name of the TS object is 'unnamed'.
T = timeseries(DATA);
TS = T.data;
end
```

Run a MATLAB Function with Multiple Output Arguments

This example shows how to execute a MATLAB function that returns multiple output arguments in Microsoft Excel using a Microsoft Visual Basic macro. The macro writes multiple output arguments from the MATLAB workspace to Microsoft Excel cells.

This example calculates the singular value decomposition of a matrix using `svd`.

1. In the Microsoft Excel cells from A1 through C3, create a range of data. Enter numbers from 1 through 3 in cells A1 to A3. Enter numbers from 4 through 6 in cells B1 to B3. Enter numbers from 7 through 9 in cells C1 to C3.



2. Create a Microsoft Visual Basic macro named `applysvd`. For details about creating macros, see Excel Help.

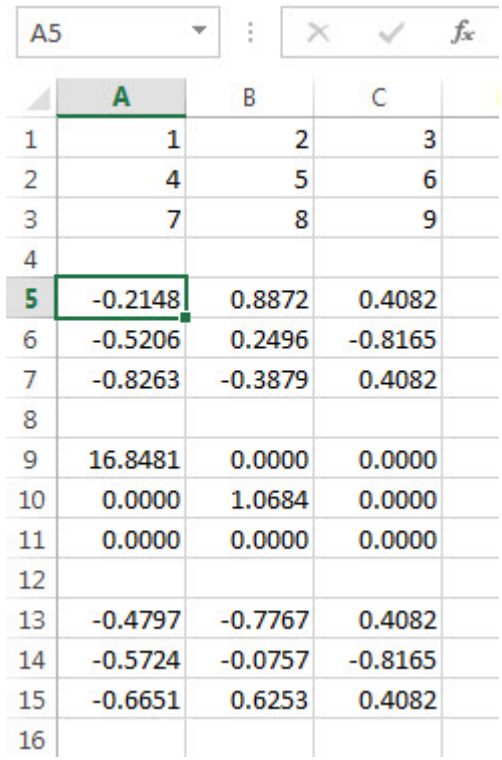
```
Public Sub applysvd()
MLOpen
MLPutMatrix "x", Range("A1:C3")
MLEvalString ("[u,s,v] = svd(x)")
MLGetMatrix "u", "A5"
MLGetMatrix "s", "A9"
MLGetMatrix "v", "A13"
MatlabRequest
MLClose
End Sub
```

The macro performs these tasks:

- Starts MATLAB.
- Sends the data in the A1 through C3 cell range to the MATLAB workspace and assigns it to the MATLAB variable `x`.
- Runs `svd` with the input argument `x` and output arguments `u`, `s`, and `v`.

- Individually retrieves data for one output argument into a specific Microsoft Excel cell while accounting for the size of each output data matrix to avoid overwriting data. For the first output argument, retrieves the data for the output argument `u` into cell A5.
- Closes MATLAB.

3 Run `applysvd`. MATLAB runs `svd` and populates the specified cells with data from the three output arguments.



For details about running macros, see Excel Help.

See Also

`MLClose` | `MLEvalString` | `MLGetMatrix` | `MLOpen` | `MLPutMatrix` | `svd`

Related Examples

- “Work with MATLAB Functions in Microsoft Excel” on page 1-16

Work with Dates

Default Microsoft Excel date numbers represent the number of days that have passed since January 1, 1900. For example, January 1, 1950 is represented as 18264 in the Excel software.

However, MATLAB date numbers represent the number of days that have passed since January 1, 0000, so January 1, 1950 is represented as 712224 in the MATLAB software. Therefore, the difference in dates between the Excel software and the MATLAB software is a constant, 693960 (712224 minus 18264).

To use date numbers in MATLAB calculations, apply the 693960 constant as follows:

- Add it to Excel date numbers that are read into the MATLAB software.
- Subtract it from MATLAB date numbers that are read into the Excel software.

Note: If you use the optional Excel 1904 date system, the constant is 695422.

Dates are stored internally in the Excel software as numbers and are unaffected by locale.

Related Examples

- “Work with MATLAB Functions in Microsoft Excel” on page 1-16

Localization Information

This document uses Microsoft Excel with an `English (United States)` Microsoft Windows regional setting for illustrative purposes. If you use Spreadsheet Link with a non-`English (United States)` Windows desktop environment, certain syntactical elements might not work as illustrated. For example, you might have to replace the comma delimiter within Spreadsheet Link commands with a semicolon or other operator.

Please consult your Windows documentation to determine which regional setting differences exist among non-U.S. versions.

Related Examples

- “Set Spreadsheet Link Preferences and MATLAB Version” on page 1-11

Solving Problems with the Spreadsheet Link Software

Model Data Using Regression and Curve Fitting

In this section...

Regression techniques and curve fitting attempt to find functions that describe the relationship among variables. In effect, they attempt to build mathematical models of a data set. MATLAB matrix operators and functions simplify this task.

This example shows both data regression and curve fitting. It also executes the same example in a worksheet version and a macro version. The example uses Microsoft Excel worksheets to organize and display the data. Spreadsheet Link functions copy the data to the MATLAB workspace, and then executes MATLAB computational and graphic functions. The macro version also returns output data to an Excel worksheet.

This example is included in the Spreadsheet Link product. To run it:

1. Start Excel, Spreadsheet Link, and MATLAB sessions.
2. Navigate to the folder *`matlabroot`*`\toolbox\exlink\`.
3. Open the file `ExliSamp.xls`
4. Execute the example as needed.

Using Worksheets

1. Click the **Sheet1** tab on the `ExliSamp.xls` window. The worksheet for this example appears.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Regression and Curve Fitting**												
2													
3		**DATA**			**Spreadsheet Link Functions**								
4	35	207	1325		1. Transfer the data to MATLAB.								
5	17	90	533		#MATLAB' <== MLPutMatrix("data",DATA)								
6	43	180	1013										
7	41	187	1163		2. Set up data for regression.								
8	177	552	5326		#MATLAB' <== MLEvalString("y = data(:,3)")								
9	57	354	2043		#MATLAB' <== MLEvalString("e = ones(length(data),1)")								
10	20	101	602		#MATLAB' <== MLEvalString("A = [e data(:,1:2)]")								
11	18	91	532										
12	17	86	543		3. Compute regression coefficients.								
13	35	180	1134		#MATLAB' <== MLEvalString("beta = A\y")								
14	25	136	766										
15	17	84	495		4. Calculate regressed result.								
16	23	102	635		#MATLAB' <== MLEvalString("fit = A*beta")								
17	24	148	913										
18	40	292	1591		5. Compare original data with regression results.								
19	25	126	671		#MATLAB' <== MLEvalString("[y,k] = sort(y)")								
20	17	88	521		#MATLAB' <== MLEvalString("fit = fit(k)")								
21	46	235	1319		#MATLAB' <== MLEvalString("n = size(data,1)")								
22	37	204	1038										
23	15	68	458		6. Use MATLAB's polynomial solving functions for another curve fit.								
24	85	363	2904		#MATLAB' <== MLEvalString("[p,S] = polyfit(1:n,y',5)")								
25	66	300	2006		#MATLAB' <== MLEvalString("newfit = polyval(p,1:n,S)")								
26	39	161	938										
27	111	459	3282		7. Plot curves and add legend								
28	16	80	476		#MATLAB' <== MLEvalString("plot(1:n,y,'bo',1:n,fit,'r:',1:n,newfit,'g'); legend('data','fit','newfit')")								

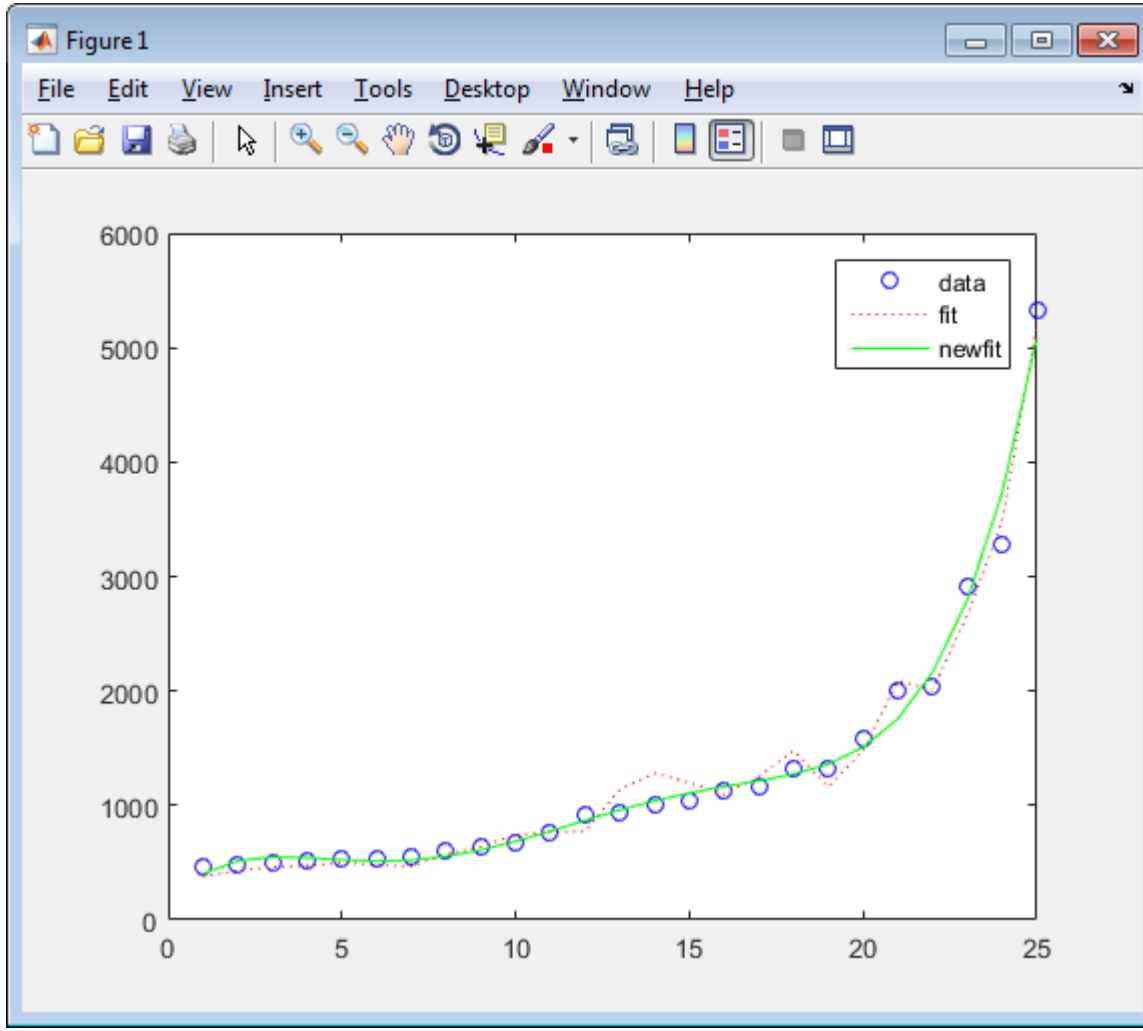
The worksheet contains one named range: `A4:C28` is named `DATA` and contains the data set for this example.

2 Make `E5` the active cell. Press **F2**; then press **Enter** to execute the Spreadsheet Link function that copies the sample data set to the MATLAB workspace. The data set contains 25 observations of three variables. There is a strong linear dependence among the observations; in fact, they are close to being scalar multiples of each other.

3 Move to cell `E8` and press **F2**; then press **Enter**. Repeat with cells `E9` and `E10`. These Spreadsheet Link functions regress the third column of data on the other two columns, and create the following:

- A single vector `y` containing the third-column data.
- A three-column matrix `A`, that consists of a column of ones followed by the rest of the data.

4. Execute the function in cell `E13`. This function computes the regression coefficients by using the MATLAB back slash `(\)` operation to solve the (overdetermined) system of linear equations, `A*beta = y`.
5. Execute the function in cell `E16`. MATLAB matrix-vector multiplication produces the regressed result (`fit`).
6. Execute the functions in cells `E19`, `E20`, and `E21`. These functions do the following:
   a. Compare the original data with `fit`.
   b. Sort the data in increasing order and apply the same permutation to `fit`.
   c. Create a scalar for the number of observations.
7. Execute the functions in cells `E24` and `E25`. Often it is useful to fit a polynomial equation to data. To do so, you would ordinarily have to set up a system of simultaneous linear equations and solve for the coefficients. The MATLAB `polyfit` function automates this procedure, in this case for a fifth-degree polynomial. The `polyval` function then evaluates the resulting polynomial at each data point to check the goodness of fit (`newfit`).
8. Execute the function in cell `E28`. The MATLAB `plot` function graphs the original data (blue circles), the regressed result `fit` (dashed red line), and the polynomial result (solid green line). It also adds a legend.

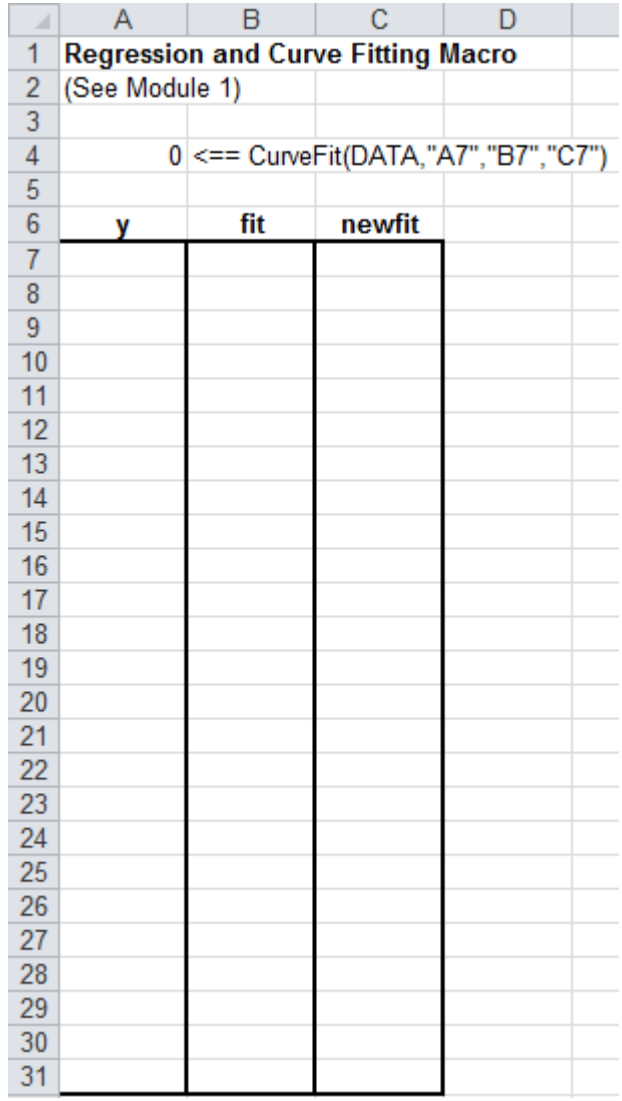


Since the data is closely correlated but not exactly linearly dependent, the `fit` curve (dashed line) shows a close, but not an exact, fit. The fifth-degree polynomial curve, `newfit`, is a more accurate mathematical model for the data.

When you finish this version of the example, close the figure window.

Using Macros

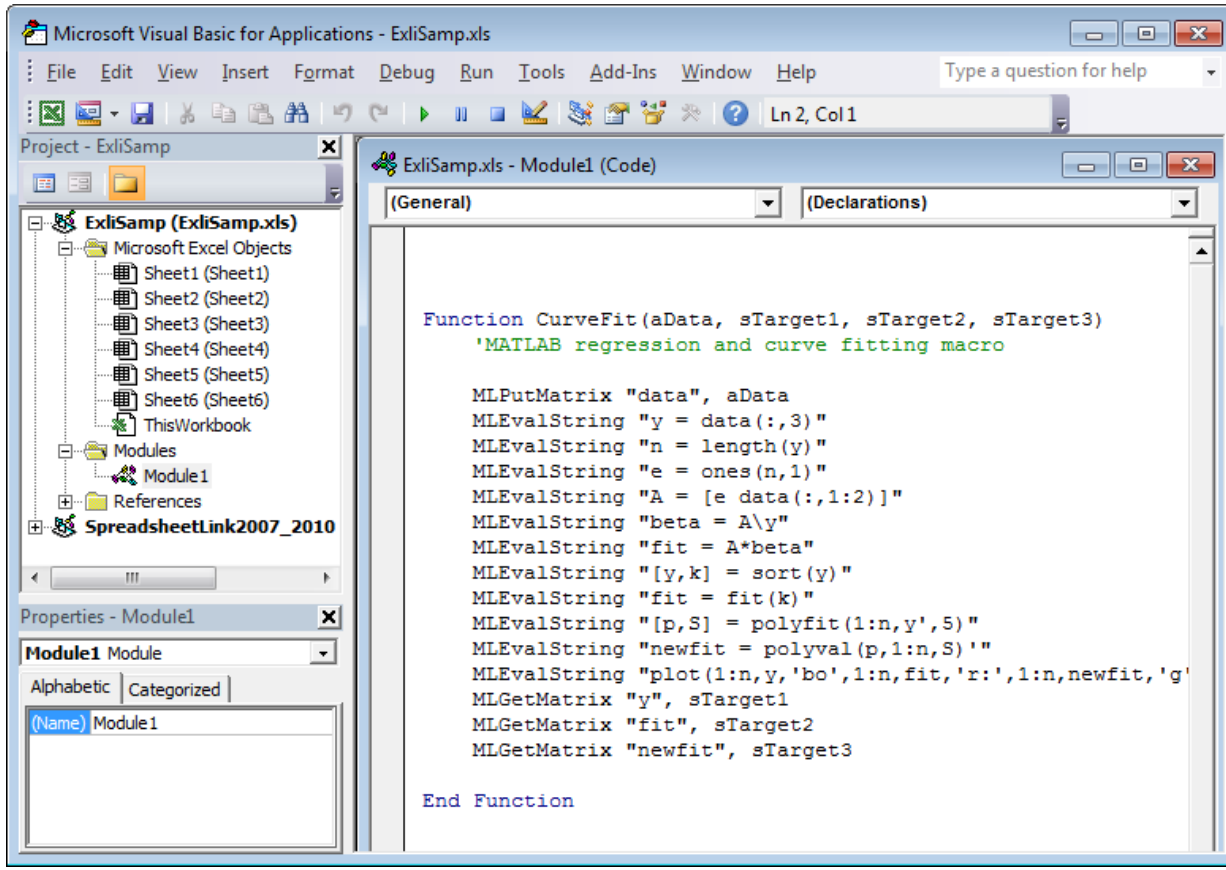
1 Click the **Sheet2** tab on `ExliSamp.xls`. The worksheet for this example appears.



	A	B	C	D
1	**Regression and Curve Fitting Macro**			
2	(See Module 1)			
3				
4	0	<== CurveFit(DATA,"A7","B7","C7")		
5				
6	**y**	**fit**	**newfit**	
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				

2 Make cell A4 the active cell, but do not execute it yet.

Cell A4 calls the macro `CurveFit`, which you can examine in the Microsoft Visual Basic environment.



3 While this module is open, make sure that the Spreadsheet Link Add-In is enabled. To enable it, see “Add-In Setup” on page 1-6.

4 In cell A4 of **Sheet2**, press **F2**; then press **Enter** to execute the `CurveFit` macro. The macro does the following:

   a Runs the same functions as the worksheet example (in a slightly different order), including plotting the graph.

b Calls the `MLGetMatrix` function in the `CurveFit` macro. This macro copies to the worksheet the original data `y` (sorted), the corresponding regressed data `fit`, and the polynomial data `newfit`.

	A	B	C	D
1	**Regression and Curve Fitting Macro**			
2	(See Module 1)			
3				
4	0	<== CurveFit(DATA,"A7","B7","C7")		
5				
6	**y**	**fit**	**newfit**	
7	1325	379.0475	402.008	
8	533	430.3099	515.8528	
9	1013	462.4722	549.7114	
10	1163	472.0222	543.0184	
11	5326	501.7971	524.5499	
12	2043	476.7973	513.775	
13	602	467.2472	522.2081	
14	532	570.8968	554.761	
15	543	641.1212	611.0947	
16	1134	743.6461	686.9715	
17	766	767.5211	775.6072	
18	495	773.5589	869.023	
19	635	1143.781	959.3974	
20	913	1279.593	1040.419	
21	1591	1201.219	1108.636	
22	671	1098.695	1164.812	
23	521	1251.081	1215.276	
24	1319	1478.743	1273.275	
25	1038	1163.157	1360.322	
26	458	1479.157	1507.557	
27	2904	2086.177	1757.09	
28	2006	2011.592	2163.358	
29	938	2666.224	2794.475	
30	3282	3483.345	3733.586	
31	476	5197.796	5080.215	

Interpolate Data

Interpolation is a process for estimating values that lie between known data points. It is important for applications such as signal and image processing and data visualization. MATLAB interpolation functions let you balance the smoothness of data fit with execution speed and efficient memory use.

This example is included in the Spreadsheet Link product. To run it:

1. Start Excel, Spreadsheet Link, and MATLAB sessions.
2. Navigate to the folder *`matlabroot`*`\toolbox\exlink\`.
3. Open the file `ExliSamp.xls`
4. Execute the example as needed.

This example uses a two-dimensional data-gridding interpolation function on thermodynamic data, where volume has been measured for time and temperature values. It finds the volume values underlying the two-dimensional, time-temperature function for a new set of time and temperature coordinates.

The example uses a Microsoft Excel worksheet to organize and display the original data and the interpolated output data. You use Spreadsheet Link functions to copy the data to and from the MATLAB workspace, and then execute the MATLAB interpolation function. Finally, you invoke MATLAB graphics to display the interpolated data in a three-dimensional color surface.

1. Click the **Sheet3** tab on `ExliSamp.xls`. The worksheet for this example appears.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	**Data Interpolation**																			
2																				
3	**Original Data**					**Interpolated Values**														
4	**Time**	**Temp**	**Volume**																	
5	0.025	68.00	2504.08			**Temp**														
6	0.050	68.05	2535.07		**Time**	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5	72.0	72.5	73.0	73.5	74.0	74.5	75.0
7	0.075	68.07	2562.91		0.025															
8	0.100	68.09	2575.74		0.05															
9	0.125	68.20	2606.16		0.075															
10	0.150	68.50	2628.58		0.1															
11	0.175	68.85	2681.38		0.125															
12	0.200	69.22	2712.06		0.15															
13	0.225	70.08	2767.52		0.175															
14	0.250	70.33	2815.54		0.2															
15	0.275	70.59	2824.37		0.225															
16	0.300	70.85	2873.65		0.25															
17	0.325	71.11	2882.20		0.275															
18	0.350	71.44	2896.49		0.3															
19	0.375	71.82	2902.07		0.325															
20	0.400	72.33	2920.04		0.35															
21	0.425	72.65	2929.35		0.375															
22	0.450	73.46	2934.23		0.4															
23	0.475	73.85	2938.55		0.425															
24	0.500	74.22	3012.93		0.45															
25	0.525	74.37	3099.12		0.475															
26	0.550	74.55	3130.01		0.5															
27	0.575	74.67	3179.24		0.525															
28	0.600	74.72	3180.71		0.55															
29	0.625	75.00	3184.15		0.575															
30					0.6															
31	**Spreadsheet Link Functions**																			
32	1. Transfer original data to MATLAB.																			
33	#MATLAB <== MLPutMatrix("Labels", A4:C4)																			
34	#MATLAB <== MLPutMatrix("X",A5:A29)																			
35	#MATLAB <== MLPutMatrix("T",B5:B29)																			
36	#MATLAB <== MLPutMatrix("V",C5:C29)																			
37																				
38	2. Transfer interpolation data points to MATLAB.																			
39	#MATLAB <== MLPutMatrix("Xa",E7:E30)																			
40	#MATLAB <== MLPutMatrix("Ta",F6:T6)																			
41																				
42	3. Execute MATLAB data interpolation function.																			
43	#MATLAB <== MLEvalString("[Xl, Tl, Vl] = griddata(X,T,V,Xa,Ta, 'nearest')")																			
44																				
45	4. Transpose output data matrix and transfer data to Excel.																			
46	#MATLAB <== MLEvalString("lV = Vl';")																			
47	#MATLAB <== MLGetMatrix("lV","sheet3!F7")																			
48																				
49	5. Plot interpolated data and label the figure.																			
50	#MATLAB <== MLEvalString("surf(Xl, Tl, Vl);title('Interpolated Data');xlabel(Labels{1});ylabel(Labels{2});zlabel(Labels{3});grid on")																			

The worksheet contains the measured thermodynamic data in cells `A5:A29`, `B5:B29`, and `C5:C29`. The time and temperature values for interpolation are in cells `E7:E30` and `F6:T6`, respectively.

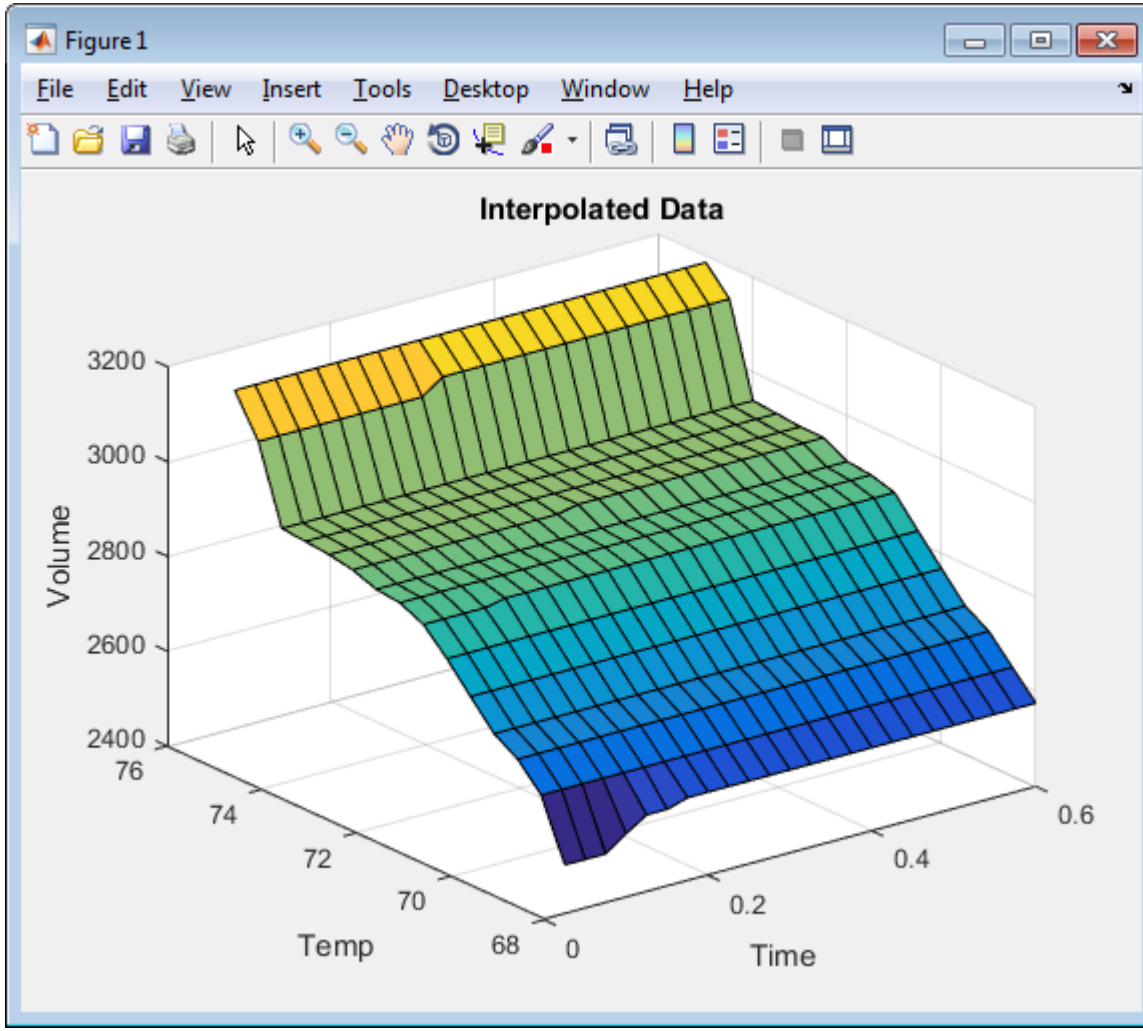
2. Make `A33` the active cell. Press **F2**; then press **Enter** to execute the Spreadsheet Link function that passes the `Time`, `Temp`, and `Volume` labels to the MATLAB workspace.

3. Make `A34` the active cell. Press **F2**; then press **Enter** to execute the Spreadsheet Link function that copies the original time data to the MATLAB workspace. Move to cell `A35` and execute the function to copy the original temperature data. Execute the function in cell `A36` to copy the original volume data.

4. Move to cell A39 and press **F2**; then press **Enter** to copy the interpolation time values to the MATLAB workspace. Execute the function in cell A40 to copy the interpolation temperature values.
5. Execute the function in cell A43. `griddata` is the MATLAB two-dimensional interpolation function that generates the interpolated volume data using the inverse distance method.
6. Execute the functions in cells A46 and A47 to transpose the interpolated volume data and copy it to the Excel worksheet. The data fills cells F7:T30, which are enclosed in a border.

	Interpolated Values														
	Temp														
Time	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5	72.0	72.5	73.0	73.5	74.0	74.5	75.0
0.025	2504.08	2638.15	2707.32	2750.09	2784.91	2851.19	2911.62	2940.67	2961.40	2983.17	3000.06	3006.32	3041.01	3125.78	3026.85
0.05	2507.26	2635.76	2704.79	2746.66	2779.96	2846.35	2907.00	2934.98	2955.07	2976.69	2993.64	2999.35	3034.49	3126.43	3036.68
0.075	2510.83	2633.45	2702.58	2743.62	2775.40	2841.84	2902.75	2929.64	2949.08	2970.51	2987.50	2992.60	3027.98	3126.97	3046.32
0.1	2513.93	2631.34	2700.70	2740.99	2771.27	2837.66	2898.88	2924.66	2943.43	2964.66	2981.67	2986.08	3021.49	3127.39	3055.77
0.125	2515.14	2629.60	2699.17	2738.77	2767.61	2833.83	2895.40	2920.07	2938.14	2959.14	2976.16	2979.83	3015.06	3127.71	3065.02
0.15	2514.31	2628.58	2698.02	2736.99	2764.49	2830.38	2892.31	2915.87	2933.23	2953.97	2970.99	2973.86	3008.70	3127.95	3074.08
0.175	2511.84	2628.88	2697.25	2735.66	2762.00	2827.31	2889.59	2912.08	2928.72	2949.17	2966.17	2968.21	3002.47	3128.11	3082.93
0.2	2508.10	2629.91	2696.87	2734.79	2760.22	2824.68	2887.26	2908.72	2924.62	2944.75	2961.71	2962.89	2996.39	3128.21	3091.57
0.225	2503.37	2631.32	2696.88	2734.37	2759.24	2822.57	2885.29	2905.80	2920.96	2940.73	2957.65	2957.93	2990.50	3128.25	3099.99
0.25	2497.84	2632.93	2697.28	2734.42	2759.10	2821.05	2883.68	2903.34	2917.76	2937.13	2953.97	2953.36	2984.86	3128.24	3108.19
0.275	2491.66	2634.64	2698.05	2734.91	2759.76	2820.23	2882.43	2901.33	2915.02	2933.97	2950.71	2949.20	2979.52	3128.18	3116.14
0.3	2484.92	2636.35	2699.18	2735.85	2761.12	2820.16	2881.55	2899.79	2912.78	2931.26	2947.88	2945.48	2974.53	3128.07	3123.83
0.325	2477.71	2638.00	2700.64	2737.22	2763.09	2820.81	2881.06	2898.72	2911.04	2929.03	2945.47	2942.21	2969.96	3127.90	3131.26
0.35	2470.07	2639.54	2702.41	2739.01	2765.59	2822.11	2880.97	2898.13	2909.82	2927.29	2943.52	2939.43	2965.89	3127.66	3138.38
0.375	2462.06	2640.93	2704.45	2741.19	2768.54	2823.98	2881.29	2898.00	2909.13	2926.05	2942.01	2937.16	2962.39	3127.30	3145.19
0.4	2453.70	2642.15	2706.75	2743.75	2771.89	2826.33	2882.03	2898.34	2908.97	2925.33	2940.96	2935.42	2959.55	3126.79	3151.66
0.425	2445.03	2643.15	2709.26	2746.67	2775.62	2829.13	2883.20	2899.16	2909.34	2925.14	2940.37	2934.25	2957.45	3126.07	3157.75
0.45	2436.07	2643.94	2711.97	2749.92	2779.68	2832.32	2884.78	2900.44	2910.23	2925.48	2940.24	2933.67	2956.16	3125.09	3163.42
0.475	2426.82	2644.48	2714.84	2753.48	2784.06	2835.88	2886.78	2902.19	2911.63	2926.34	2940.57	2933.71	2955.74	3123.85	3168.63
0.5	2417.31	2644.77	2717.84	2757.32	2788.73	2839.78	2889.19	2904.40	2913.52	2927.71	2941.36	2934.34	2956.22	3122.46	3173.31
0.525	2407.54	2644.80	2720.95	2761.44	2793.67	2844.01	2891.99	2907.04	2915.89	2929.57	2942.61	2935.55	2957.60	3121.27	3177.39
0.55	2397.51	2644.56	2724.14	2765.79	2798.87	2848.55	2895.19	2910.11	2918.72	2931.90	2944.30	2937.30	2959.85	3120.88	3180.74
0.575	2387.24	2644.05	2727.39	2770.37	2804.31	2853.38	2898.77	2913.60	2921.99	2934.68	2946.43	2939.57	2962.89	3121.69	3183.21
0.6	2376.71	2643.25	2730.67	2775.14	2809.97	2858.49	2902.71	2917.48	2925.67	2937.89	2948.99	2942.35	2966.66	3123.41	3184.53

7. Execute the function in cell A50. The MATLAB software plots and labels the interpolated data on a three-dimensional color surface, with the color proportional to the interpolated volume data.



When you finish the example, close the figure window.

Price Stock Options Using the Binomial Model

The Financial Toolbox product provides functions that compute prices, sensitivities, and profits for portfolios of options or other equity derivatives. This example uses the binomial model to price an option. The binomial model assumes that the probability of each possible price over time follows a binomial distribution. That is, prices can move to only two values, one up or one down, over any short time period. Plotting these two values over time is known as building a *binomial tree*.

This example organizes and displays input and output data using a Microsoft Excel worksheet. Spreadsheet Link functions copy data to a MATLAB matrix, calculate the prices, and return data to the worksheet.

This example is included in the Spreadsheet Link product. To run it:

1. Start Excel, Spreadsheet Link, and MATLAB sessions.
2. Navigate to the folder *`matlabroot`*`\toolbox\exlink\`.
3. Open the file `ExliSamp.xls`
4. Execute the example as needed.

Note This example requires Financial Toolbox, Statistics and Machine Learning Toolbox™, and Optimization Toolbox™.

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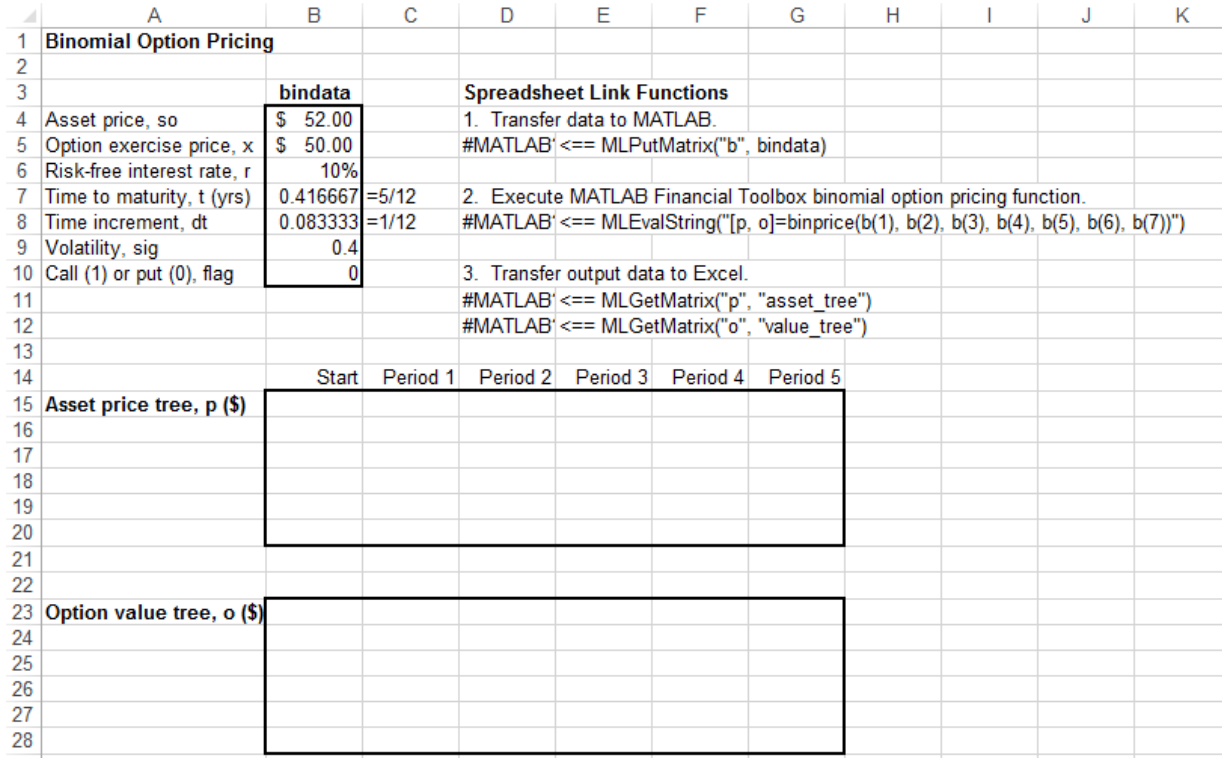
1. Click the **Sheet4** tab on `ExliSamp.xls` to open the worksheet for this example.



	A	B	C	D	E	F	G	H	I	J	K
1	**Binomial Option Pricing**										
2											
3		**bindata**		**Spreadsheet Link Functions**							
4	Asset price, so	$ 52.00		1. Transfer data to MATLAB.							
5	Option exercise price, x	$ 50.00		#MATLAB' <== MLPutMatrix("b", bindata)							
6	Risk-free interest rate, r	10%									
7	Time to maturity, t (yrs)	0.416667	=5/12	2. Execute MATLAB Financial Toolbox binomial option pricing function.							
8	Time increment, dt	0.083333	=1/12	#MATLAB' <== MLEvalString("[p, o]=binprice(b(1), b(2), b(3), b(4), b(5), b(6), b(7))")							
9	Volatility, sig	0.4									
10	Call (1) or put (0), flag	0		3. Transfer output data to Excel.							
11				#MATLAB' <== MLGetMatrix("p", "asset_tree")							
12				#MATLAB' <== MLGetMatrix("o", "value_tree")							
13											
14		Start	Period 1	Period 2	Period 3	Period 4	Period 5				
15	**Asset price tree, p ($)**										
16											
17											
18											
19											
20											
21											
22											
23	**Option value tree, o ($)**										
24											
25											
26											
27											
28											

The worksheet contains three named ranges:

- `B4:B10` named `bindata`. Two cells in `bindata` contain formulas:
  - `B7` contains `=5/12`
  - `B8` contains `=1/12`
- `B15` named `asset_tree`.
- `B23` named `value_tree`.

2. Make `D5` the active cell. Press **F2**; then press **Enter** to execute the Spreadsheet Link function that copies the asset data to the MATLAB workspace.
3. Move to `D8` and execute the function that computes the binomial prices.
4. Execute the functions in `D11` and `D12` to copy the price data to the Excel worksheet.

The worksheet looks as follows.

	A	B	C	D	E	F	G	H	I	J	K
1	**Binomial Option Pricing**										
2											
3		**bindata**		**Spreadsheet Link Functions**							
4	Asset price, so	$ 52.00		1. Transfer data to MATLAB.							
5	Option exercise price, x	$ 50.00		0 <== MLPutMatrix("b", bindata)							
6	Risk-free interest rate, r	10%									
7	Time to maturity, t (yrs)	0.416667	=5/12	2. Execute MATLAB Financial Toolbox binomial option pricing function.							
8	Time increment, dt	0.083333	=1/12	0 <== MLEvalString("[p, o]=binprice(b(1), b(2), b(3), b(4), b(5), b(6), b(7))")							
9	Volatility, sig	0.4									
10	Call (1) or put (0), flag	0		3. Transfer output data to Excel.							
11				0 <== MLGetMatrix("p", "asset_tree")							
12				0 <== MLGetMatrix("o", "value_tree")							
13											
14		Start	Period 1	Period 2	Period 3	Period 4	Period 5				
15	**Asset price tree, p ($)**	52.000	58.365	65.509	73.527	82.527	92.628				
16		0	46.329	52.000	58.365	65.509	73.527				
17		0	0	41.277	46.329	52.000	58.365				
18		0	0	0	36.776	41.277	46.329				
19		0	0	0	0	32.765	36.776				
20		0	0	0	0	0	29.192				
21											
22											
23	**Option value tree, o ($)**	3.728	1.664	0.428	0	0	0				
24		0	5.918	2.964	0.876	0	0				
25		0	0	9.060	5.164	1.793	0				
26		0	0	0	13.224	8.723	3.671				
27		0	0	0	0	17.235	13.224				
28		0	0	0	0	0	20.808				

Read the asset price tree as follows:

- Period 1 shows the up and down prices.
- Period 2 shows the up-up, up-down, and down-down prices.
- Period 3 shows the up-up-up, up-up, down-down, and down-down-down prices.
- And so on.

Ignore the zeros. The option value tree gives the associated option value for each node in the price tree. The option value is zero for prices significantly above the exercise price. Ignore the zeros that correspond to a zero in the price tree.

5 Try changing the data in `B4:B10`, and then executing the Spreadsheet Link functions again.

Note: If you increase the time to maturity (`B7`) or change the time increment (`B8`), you may need to enlarge the output tree areas.

---

6 When you finish the example, close the figure window.

Compute Efficient Frontier of Financial Portfolios

MATLAB and Financial Toolbox functions compute and plot risks, variances, rates of return, and the efficient frontier of portfolios. Efficient portfolios have the lowest aggregate variance, or risk, for a given return. Microsoft Excel and the Spreadsheet Link software let you set up data, execute financial functions and MATLAB graphics, and display numeric results.

This example analyzes three portfolios, using rates of return for six time periods. In actual practice, these functions can analyze many portfolios over many time periods, limited only by the amount of computer memory available.

This example is included in the Spreadsheet Link product. To run it:

1. Start Excel, Spreadsheet Link, and MATLAB sessions.
2. Navigate to the folder *`matlabroot`*`\toolbox\exlink\`.
3. Open the file `ExliSamp.xls`
4. Execute the example as needed.

Note This example requires Financial Toolbox, Statistics and Machine Learning Toolbox, and Optimization Toolbox.

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1. Click the **Sheet5** tab on `ExliSamp.xls`. The worksheet for this example appears.

	A	B	C	D	E	F	G	H	I	J
1	**Portfolio Efficient Frontier**									
2								**Global**	**Corp. Bnd**	**Small Cap**
3	**Rates of return**	Global	Corp. Bnd	Small Cap		**Risk**	**ROR**	**Weights**		
4	Nov-91	7.125%	4.125%	8.375%						
5	Nov-92	5.125%	5.125%	3.875%						
6	Nov-93	-1.375%	5.750%	10.500%						
7	Nov-94	7.750%	6.000%	14.750%						
8	Nov-95	8.250%	6.375%	-3.625%						
9	Nov-96	12.625%	6.125%	9.125%						
10										
11										
12										
13	**Spreadsheet Link Functions**									
14	1. Transfer data to MATLAB.									
15	#MATLAB?	<== MLPutMatrix("Labels", F3:G3)								
16	#MATLAB?	<== MLPutMatrix("retseries", B4:D9)								
17										
18	2. Execute MATLAB Financial Toolbox functions.									
19	#MATLAB?	<== MLEvalString("[ret, cov] = ewstats(retseries)")								
20	#MATLAB?	<== MLEvalString("[risk, ror, weights] = portopt(ret, cov, 20)")								
21										
22	3. Transfer output data to Excel.									
23	#MATLAB?	<== MLGetMatrix("risk", "sheet5!F4")								
24	#MATLAB?	<== MLGetMatrix("ror", "sheet5!G4")								
25	#MATLAB?	<== MLGetMatrix("weights", "sheet5!H4")								
26										
27	4. Plot efficient frontier data and label the figure.									
28	#MATLAB?	<== MLEvalString("portopt(ret, cov, 20); grid on; xlabel(Labels{1}); ylabel(Labels{2})")								

2. Make A15 the active cell. Press **F2**; then press **Enter**. The Spreadsheet Link function transfers the labels that describe the output that the MATLAB software computes.
3. Make A16 the active cell to copy the portfolio return data to the MATLAB workspace.
4. Execute the functions in A19 and A20 to compute the Financial Toolbox efficient frontier function for 20 points along the frontier.
5. Execute the Spreadsheet Link functions in A23, A24, and A25 to copy the output data to the Excel worksheet.

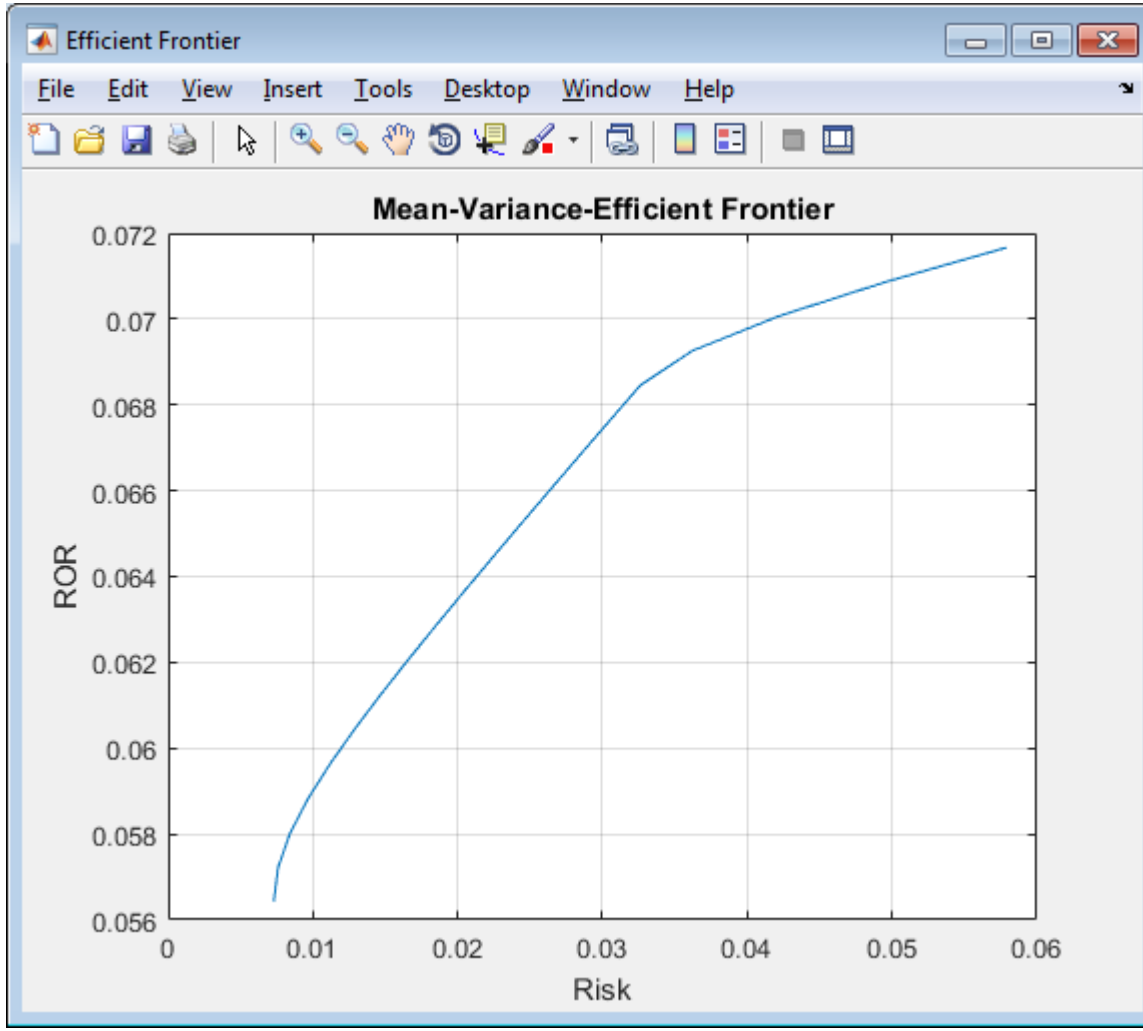
The worksheet looks as follows.

	A	B	C	D	E	F	G	H	I	J
1	**Portfolio Efficient Frontier**									
2								**Global**	**Corp. Bnd**	**Small Cap**
3	**Rates of return**	Global	Corp. Bnd	Small Cap		**Risk**	**ROR**	**Weights**		
4	Nov-91	7.125%	4.125%	8.375%		0.730%	5.643%	0.3%	96.1%	3.5%
5	Nov-92	5.125%	5.125%	3.875%		0.760%	5.723%	4.0%	89.7%	6.3%
6	Nov-93	-1.375%	5.750%	10.500%		0.844%	5.803%	7.7%	83.3%	9.0%
7	Nov-94	7.750%	6.000%	14.750%		0.968%	5.883%	11.3%	76.9%	11.8%
8	Nov-95	8.250%	6.375%	-3.625%		1.118%	5.964%	15.0%	70.5%	14.5%
9	Nov-96	12.625%	6.125%	9.125%		1.287%	6.044%	18.7%	64.0%	17.3%
10						1.466%	6.124%	22.3%	57.6%	20.0%
11						1.653%	6.204%	26.0%	51.2%	22.8%
12						1.846%	6.284%	29.7%	44.8%	25.5%
13	**Spreadsheet Link Functions**					2.042%	6.365%	33.3%	38.4%	28.3%
14	1. Transfer data to MATLAB.					2.241%	6.445%	37.0%	32.0%	31.1%
15	0	<== MLPutMatrix("Labels", F3:G3)				2.443%	6.525%	40.6%	25.6%	33.8%
16	0	<== MLPutMatrix("retseries", B4:D9)				2.646%	6.605%	44.3%	19.1%	36.6%
17						2.850%	6.685%	48.0%	12.7%	39.3%
18	2. Execute MATLAB Financial Toolbox functions.					3.055%	6.766%	51.6%	6.3%	42.1%
19	0	<== MLEvalString("[ret, cov] = ewstats(retseries)")				3.262%	6.846%	55.0%	0.0%	45.0%
20	0	<== MLEvalString("[risk, ror, weights] = portopt(ret, cov, 20)")				3.620%	6.926%	41.3%	0.0%	58.7%
21						4.213%	7.006%	27.5%	0.0%	72.5%
22	3. Transfer output data to Excel.					4.955%	7.086%	13.8%	0.0%	86.2%
23	0	<== MLGetMatrix("risk", "sheet5!F4")				5.791%	7.167%	0.0%	0.0%	100.0%
24	0	<== MLGetMatrix("ror", "sheet5!G4")								
25	0	<== MLGetMatrix("weights", "sheet5!H4")								
26										
27	4. Plot efficient frontier data and label the figure.									
28	#MATLAB?	<== MLEvalString("portopt(ret, cov, 20); grid on; xlabel(Labels{1}); ylabel(Labels{2})")								

The data describes the efficient frontier for these three portfolios: that set of points representing the highest rate of return (`ROR`) for a given risk. For each of the 20 points along the frontier, the weighted investment in each portfolio (`Weights`) would achieve that rate of return.

6 Now move to A28 and press **F2**; then press **Enter** to execute the Financial Toolbox function that plots the efficient frontier for the same portfolio data.

The following figure appears.



The light blue line shows the efficient frontier. Note the change in slope above a 6.8% return because the Corporate Bond portfolio no longer contributes to the efficient frontier.

7 To try running this example using different data, close the figure window and change the data in cells `B4:D9`. Then execute all the Spreadsheet Link functions again. The

worksheet then shows the new frontier data, and the MATLAB software displays a new efficient frontier graph.

When you finish this example, close the figure window.

Map Time and Bond Cash Flows

This example shows how to use the Financial Toolbox and Spreadsheet Link software to compute a set of cash flow amounts and dates, given a portfolio of five bonds with known maturity dates and coupon rates. It is included in the Spreadsheet Link product. To run it:

1. Start Excel, Spreadsheet Link, and MATLAB sessions.
2. Navigate to the folder *`matlabroot`*`\toolbox\exlink\`.
3. Open the file `ExliSamp.xls`
4. Execute the example as needed.

Note This example requires Financial Toolbox, Statistics and Machine Learning Toolbox, and Optimization Toolbox.

---

1. Click the **Sheet6** tab on `ExliSamp.xls`. The worksheet for this example appears.

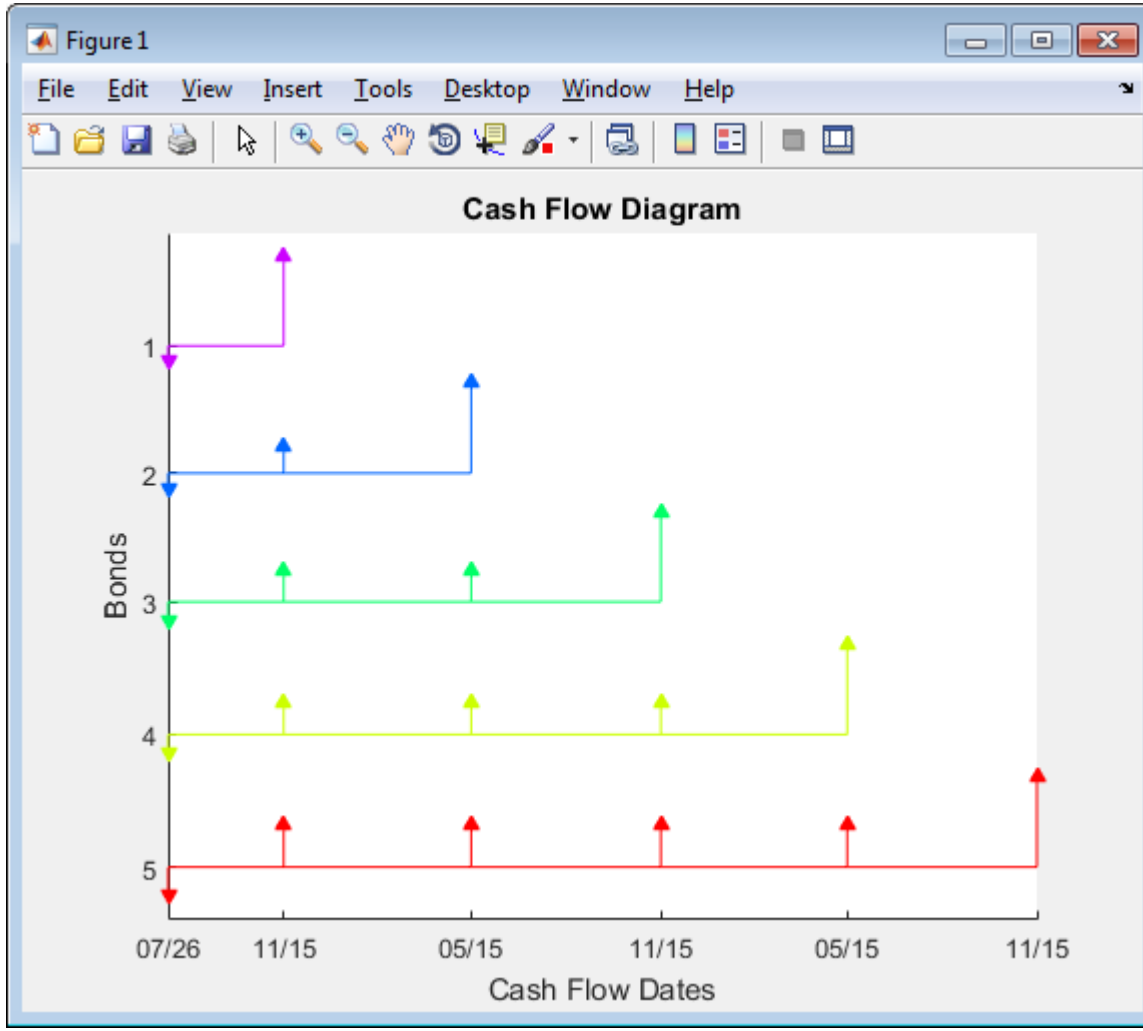
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Cash Flow and Time Mapping for a Portfolio of Bonds**													
2											**Cash Flow Dates**			
3	Settlement Date		26-Jul-99					**Bond1**						
4								**Bond2**						
5			**Bond Data**					**Bond3**						
6								**Bond4**						
7		**Maturity**	**Coupon Rate**					**Bond5**						
8	**Bond1**	15-Nov-99	0.05875											
9	**Bond2**	15-May-00	0.06375											
10	**Bond3**	15-Nov-00	0.08500											
11	**Bond4**	15-May-01	0.08000											
12	**Bond5**	15-Nov-01	0.15750								**Cash Flow Amounts**			
13														
14								**Bond1**						
15								**Bond2**						
16	**Spreadsheet Link Functions**							**Bond3**						
17	1. Transfer data to MATLAB.							**Bond4**						
18	#MATLAB' <== MLPutMatrix("maturity",'Maturity')							**Bond5**						
19	#MATLAB' <== MLPutMatrix("cpnrate","CpnRate")													
20	#MATLAB' <== MLPutMatrix("sd",C3)													
21														
22	2. Execute MATLAB Financial Toolbox Cash flow and Time mapping function.													
23	#MATLAB' <== MLEvalString("md = x2mdate(maturity,0); sdm = x2mdate(sd,0)")													
24	#MATLAB' <== MLEvalString("[cfa, cfd] = cfamounts(cpnrate, sdm, md, 2)")													
25														
26	3. Transform date numbers to string cell array.													
27	#MATLAB' <== MLEvalString("i = find(isnan(cfd)); zcfd = cfd; zcfd(i) = 0; scfd=datestr(zcfd,2);")													
28	#MATLAB' <== MLEvalstring("ccfd = num2cell(scfd,2); ccfd(i) = {'N/A'}; ccfd = reshape(ccfd, size(cfd));")													
29	#MATLAB' <== MLEvalString("ccfa = cfa; ccfa(i) = 0; alldates = ccfd(end, :);")													
30														
31	4. Transfer output data to Excel.													
32	#MATLAB' <== MLGetMatrix("ccfd", "sheet6!i3")													
33	#MATLAB' <== MLGetMatrix("alldates", "sheet6!i13")													
34	#MATLAB' <== MLGetMatrix("ccfa", "sheet6!i14")													
35														
36	5. Plot the cash flow diagram.													
37	#MATLAB' <== MLEvalString("cfplot(cfd, cfa); dtaxis('x',6,sdm,50);title('Cash Flow Diagram');xlabel('Cash Flow Dates');ylabel('Bonds');")													

2. Make A18 the active cell. Press **F2**, then **Enter** to execute the Spreadsheet Link function that transfers the column vector `Maturity` to the MATLAB workspace.
3. Make A19 the active cell to transfer the column vector `Coupon Rate` to the MATLAB workspace.
4. Make A20 the active cell to transfer the settlement date to the MATLAB workspace.
5. Execute the functions in cells A23 and A24 to enable the Financial Toolbox software to compute cash flow amounts and dates.
6. Now execute the functions in cells A27 through A29 to transform the dates into string form contained in a cell array.

7 Execute the functions in cells A32 through A34 to transfer the data to the Excel worksheet.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Cash Flow and Time Mapping for a Portfolio of Bonds**													
2														
3	Settlement Date		26-Jul-99								**Cash Flow Dates**			
4								**Bond1**	7/26/1999	11/15/1999	N/A	N/A	N/A	N/A
5			**Bond Data**					**Bond2**	7/26/1999	11/15/1999	5/15/2000	N/A	N/A	N/A
6								**Bond3**	7/26/1999	11/15/1999	5/15/2000	11/15/2000	N/A	N/A
7		**Maturity**	**Coupon Rate**					**Bond4**	7/26/1999	11/15/1999	5/15/2000	11/15/2000	5/15/2001	N/A
8	**Bond1**	15-Nov-99	0.05875					**Bond5**	7/26/1999	11/15/1999	5/15/2000	11/15/2000	5/15/2001	11/15/2001
9	**Bond2**	15-May-00	0.06375											
10	**Bond3**	15-Nov-00	0.08500											
11	**Bond4**	15-May-01	0.08000								**Cash Flow Amounts**			
12	**Bond5**	15-Nov-01	0.15750											
13									7/26/1999	11/15/1999	5/15/2000	11/15/2000	5/15/2001	11/15/2001
14								**Bond1**	-1.1495	102.9375	0	0	0	0
15								**Bond2**	-1.2473	3.1875	103.1875	0	0	0
16	**Spreadsheet Link Functions**							**Bond3**	-1.6630	4.2500	4.2500	104.2500	0	0
17	1. Transfer data to MATLAB.							**Bond4**	-1.5652	4.0000	4.0000	4.0000	104.0000	0
18	0 <== MLPutMatrix("maturity",'Maturity')							**Bond5**	-3.0815	7.8750	7.8750	7.8750	7.8750	107.8750
19	0 <== MLPutMatrix("cpnrate","CpnRate")													
20	0 <== MLPutMatrix("sd",C3)													
21														
22	2. Execute MATLAB Financial Toolbox Cash flow and Time mapping function.													
23	0 <== MLEvalString("md = x2mdate(maturity,0); sdm = x2mdate(sd,0)")													
24	0 <== MLEvalString("[cfa, cfd] = cfamounts(cpnrate, sdm, md, 2)")													
25														
26	3. Transform date numbers to string cell array.													
27	0 <== MLEvalString("i = find(isnan(cfd)); zcfd = cfd; zcfd(i) = 0; scfd=datestr(zcfd,2);")													
28	0 <== MLEvalstring("ccfd = num2cell(scfd,2); ccfd(i) = {'N/A'}; ccfd = reshape(ccfd, size(cfd));")													
29	0 <== MLEvalString("ccfa = cfa; ccfa(i) = 0; alldates = ccfd(end, :);")													
30														
31	4. Transfer output data to Excel.													
32	0 <== MLGetMatrix("ccfd", "sheet6!i3")													
33	0 <== MLGetMatrix("alldates", "sheet6!i13")													
34	0 <== MLGetMatrix("ccfa", "sheet6!i14")													
35														
36	5. Plot the cash flow diagram.													
37	#MATLAB' <== MLEvalString("cfplot(cfd, cfa); dtaxis('x',6,sdm,50);title('Cash Flow Diagram');xlabel('Cash Flow Dates');ylabel('Bonds');")													

8 Finally, execute the function in cell A37 to display a plot of the cash flows for each portfolio item.



9 When you finish the example, close the figure window.

3

Error Messages and Troubleshooting

Worksheet Cell Errors

You might see these error messages displayed in a worksheet cell.

The first column contains worksheet cell error messages. The error messages begin with the number sign (#). Most end with an exclamation point (!) or with a question mark (?).

Worksheet Cell Error Messages

Error Message	Meaning	Solution
#COLS>#MAXCOLS!	Your MATLAB variable exceeds the Microsoft Excel limit of #MAXCOLS! columns.	This is a limitation in the Excel product. Try the computation with a variable containing fewer columns.
#COMMAND!	The MATLAB software does not recognize the command in an MLEvalString function. The command might be misspelled.	Verify the spelling of the MATLAB command. Correct typing errors.
#DIMENSION!	You used MLAppendMatrix and the dimensions of the appended data do not match the dimensions of the matrix you want to append.	Verify the matrix dimensions and the appended data dimensions, and correct the argument. For more information, see the MLAppendMatrix reference page.
#INVALIDNAME!	You entered an illegal variable name.	Make sure to use legal MATLAB variable names. MATLAB variable names must start with a letter followed by up to 30 letters, digits, or underscores.
#INVALIDTYPE!	You specified an illegal MATLAB data type with MLGetVar or MLGetMatrix.	Make sure to use the supported MATLAB data types.
#MATLAB?	You used a Spreadsheet Link function and no MATLAB software session is running.	Start the Spreadsheet Link and MATLAB software. See "Start and Stop Spreadsheet Link and MATLAB" on page 1-13.
#NAME?	The function name is unrecognized. The excllink.xla add-in is not	Be sure the excllink.xla add-in is loaded. See "Add-In Setup" on page 1-6. Check the spelling of

Error Message	Meaning	Solution
	loaded, or the function name might be misspelled.	the function name. Correct typing errors.
#NONEXIST!	You referenced a nonexistent matrix in an `MLGetMatrix` or `MLDeleteMatrix` function. The matrix name might be misspelled. Also, you receive the `#NONEXIST!` error when you attempt to use `matlabfcn` to obtain an output.	Verify the spelling of the MATLAB matrix. Use the MATLAB `whos` command to display existing matrices. Correct typing errors.
#ROWS>#MAXROWS!	Your MATLAB variable exceeds the Excel limit of `#MAXROWS!` rows.	This is a limitation in the Excel product. Try the computation with a variable containing fewer rows.
#SYNTAX?	You entered a Spreadsheet Link function with incorrect syntax. For example, you did not specify double quotation marks `(")`, or you specified single quotation marks (') instead of double quotation marks.	Verify and correct the function syntax.
#VALUE!	An argument is missing from a function, or a function argument is the wrong type.	Supply the correct number of function arguments, of the correct type.
#VALUE!	A macro subroutine uses `MLGetMatrix` followed by `MatlabRequest`, which is correct standard usage. A macro function calls that subroutine, and you execute that function from a worksheet cell. The function works correctly, but this message appears in the cell.	Since the function works correctly, ignore the message. Or, in this special case, remove `MatlabRequest` from the subroutine.
#INVALIDRANGE!	The named range is defined incorrectly, or the named range spans multiple worksheets.	Select a range of data on only one worksheet and create an appropriate name for the range of data. For instructions about defining names, see Excel Help.

Note: When you open an Excel worksheet that contains Spreadsheet Link functions, the Excel software tries to execute the functions from the bottom up and right to left. Excel might generate cell error messages such as `#COMMAND!` or `#NONEXIST!`. This is expected behavior, so ignore the messages and do the following:

1. Close the MATLAB figure windows.

2. Execute the cell functions again one at a time in the correct order by pressing **F2**, and then **Enter**.

Microsoft Excel Errors

The Excel software can display these error messages.

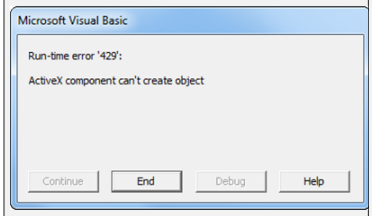
Error Message	Cause of Error	Solution
`Error in formula`	You entered a formula incorrectly. Common errors include a space between the function name and the left parenthesis; or missing, extra, or mismatched parentheses. **Note:** If you use the Spreadsheet Link software with a non-English (`United States`) Windows desktop environment, certain syntactical elements might not work. For details, see "Localization Information" on page 1-36.	Review the entry and correct typing errors.

`Can't find project or library`
 	
or
 	
`Compile error: Sub or Function not defined`
	You executed a macro and the location of `excllink.xla` is incorrect or not specified.	Click **OK**. The References window opens. Remove the check mark from `MISSING: excllink.xla`. Find `excllink.xla` in its correct location, select its check box in the References window, and click **OK**. Or, select **Tools** > **References** to open the References window. Select the box named `SpreadsheetLink2007_2010`. Click **OK**.

`Run-time error '1004': Cells method`	You used `MLGetMatrix` and the matrix is larger	Click **OK**. Reset worksheet calculation mode to

Error Message	Cause of Error	Solution
`of Application class failed`	than the space available in the worksheet. This error destabilizes the Spreadsheet Link software session and changes worksheet calculation mode to manual.	`automatic`, and save your worksheet as needed. Restart the Excel, Spreadsheet Link, and MATLAB software sessions.
`MATLAB failed to check out a license of Spreadsheet Link or does not have a valid installation of Spreadsheet Link`	You entered an invalid license passcode or did not install Spreadsheet Link properly.	Ensure that you entered the license passcode properly. Reinstall the Spreadsheet Link add-on. (See “Installation” on page 1-4.) If you followed the installation guidelines, used a proper passcode, and you are still unable to start the Spreadsheet Link software, contact your MathWorks® representative.
`Datasource: Excel; prompt for user name and password`	This message appears when an attempt to connect to the Excel software from the Database Toolbox™ software fails.	Ensure that the Excel worksheet referenced by the data source exists, then retry the connection.
`Could not load some objects because they are not available on this machine`	This message appears when Excel 2013 is not configured properly.	From the Windows **Control Panel**, remove Microsoft Office 2010 in the programs list.

Error Message	Cause of Error	Solution

	This error appears when you start the automation server from the Excel interface, and multiple versions of the MATLAB software are installed on your desktop.	To correct this error, perform the following:
		1 Shut down all MATLAB and Excel instances.
		2 Open a command prompt, and using `cd`, change to the `bin\win64` subfolder of the MATLAB installation folder.
		3 Type the command:
		`.\matlab /regserver`
		4 When the MATLAB session starts, close it. Using `/regserver` fixes the registry entries.
		5 Start an Excel session. The Spreadsheet Link add-in now loads properly.
		6 Verify that the Spreadsheet Link software is working by entering the following command from the Command Window:
		`a = 3.14159`
		7 Enter the following formula in cell `A1` of the open Excel worksheet:
		`=mlgetmatrix("a","a1")`
		8 The value `3.14159` appears in cell `A1`.

Data Errors

In this section...

Matrix Data Errors

Data in the MATLAB or Microsoft Excel workspaces may produce the following errors.

Data Errors

Data Error	Cause	Solution
MATLAB matrix cells contain zeros (0).	Corresponding Excel worksheet cells are empty.	Excel worksheet cells must contain only numeric or string data.
MATLAB matrix is a 1-by-1 zero matrix.	You used quotation marks around the data-location argument in `MLPutMatrix` or `MLAppendMatrix`.	Correct the syntax to remove quotation marks.
MATLAB matrix is empty ([ ]).	You referenced a nonexistent VBA variable in `MLPutVar`.	Correct the macro; you may have typed the variable name incorrectly.
VBA matrix is empty.	You referenced a nonexistent MATLAB variable in `MLGetVar`.	Correct the macro; you may have typed the variable name incorrectly.

Errors When Opening Saved Worksheets

This section describes errors that you may encounter when opening saved worksheets.

- When you open an Excel worksheet that contains Spreadsheet Link functions, the Excel software tries to execute the functions from the bottom up and right to left. Excel may generate cell error messages such as `#COMMAND!` or `#NONEXIST!`. This is expected behavior. Do the following:

  1 Ignore the messages.

2. Close MATLAB figure windows.
3. Execute the cell functions again one at a time in the correct order by pressing **F2**, and then **Enter**.

- If you save an Excel worksheet containing Spreadsheet Link functions, and then reopen it in an environment where the `excllink.xla` add-in is in a different location, you may see the message: `This document contains links: Re-establish links?`

  To address this issue, do the following:

  1. Click **No**.
  2. Select **Edit** > **Links**.
  3. In the Links dialog box, click **Change Source**.
  4. In the Change Links dialog box, select *`matlabroot`*`\toolbox\exlink\excllink.xla`.
  5. Click **OK**.

     The Excel software executes each function as it changes its link. You may see MATLAB figure windows and hear error beeps as the links change and functions execute; ignore them.
  6. In the Links dialog box, click **OK**.

     The worksheet now connects to the Spreadsheet Link add-in.

  Or, instead of using the **Links** menu, you can manually edit the link location in each affected worksheet cell to show the correct location of `excllink.xla`.

License Errors

If you are running an automation server of MATLAB that does not have a Spreadsheet Link license associated with it, you will receive an license error message. To correct this issue, from the MATLAB installation that includes Spreadsheet Link, run the command:

```
matlab /regserver
```

Startup Errors

If you have enabled `MLAutoStart`, double-clicking an `xls` file in the MATLAB Current Folder browser and choosing **Open Outside MATLAB** causes a Microsoft Excel error to appear. To open the file successfully, click **End** in the error window.

To avoid this issue, disable `MLAutoStart`. Start MATLAB sessions from the Excel interface by clicking the **startmatlab** button in the Excel menu bar.

Audible Error Signals

You may hear audible errors while passing data to the MATLAB workspace using `MLPutMatrix` or `MLAppendMatrix`. These errors usually indicate that you have insufficient computer memory to carry out the operation. Close other applications or clear unnecessary variables from the MATLAB workspace and try again. If the error signal reoccurs, you probably have insufficient physical memory in your computer for this operation.

Functions — Alphabetical List

matlabfcn

Evaluate MATLAB command given Microsoft Excel data

Syntax

```
matlabfcn(command,inputs)
```

Description

`matlabfcn(command,inputs)` passes the command to the MATLAB workspace for evaluation, given the function input data. The function returns a single value or string depending upon the MATLAB output. The result is returned to the calling worksheet cell. *This function is intended for use as an Excel worksheet function.*

Input Arguments

`command`

MATLAB command to evaluate.

Embed the command in double quotes, for example, `"command"`.

`inputs`

Variable length input argument list passed to a MATLAB command.

The argument list may contain a range of worksheet cells that contain input data.

Examples

Compute the Sum of Excel Data and Return the Result to an Active Cell

Add the data in worksheet cells `B1` through `B10` returning the sum to the active worksheet cell:

```
matlabfcn("sum", B1:B10)
```

Plot Excel Data Using the MATLAB Plotting Function

Plot the data in worksheet cells `B1` through `B10`, using `x` as the marker type:

```
matlabfcn("plot", B1:B10, "x")
```

- "Work with MATLAB Functions in Microsoft Excel" on page 1-16

More About

Tips

- If `matlabfcn` fails, then by default you get a standard Spreadsheet Link error, such as `#COMMAND`. To return MATLAB error strings, use `MLShowMatlabErrors`.

See Also

`matlabsub` | `MLShowMatlabErrors`

Introduced before R2006a

matlabinit

Initialize Spreadsheet Link and start MATLAB

Syntax

```
matlabinit
```

Description

`matlabinit` Initializes the Spreadsheet Link software and starts MATLAB process. If the Spreadsheet Link software has been initialized and the MATLAB software is running, subsequent invocations do nothing. Use `matlabinit` to start Spreadsheet Link and MATLAB sessions manually when you have set `MLAutoStart` to `no`. If you set `MLAutoStart` to `yes`, `matlabinit` executes automatically.

More About

Tips

- To run `matlabinit` from the Microsoft Excel toolbar, click **Tools** > **Macro**. In the **Macro Name/Reference** box, enter `matlabinit` and click **Run**. Alternatively, you can include this function in a macro subroutine. You cannot run `matlabinit` as a worksheet cell formula or in a macro function.

See Also

`MLAutoStart` | `MLOpen`

Related Examples

- “Work with MATLAB Functions in Microsoft Excel” on page 1-16

Introduced before R2006a

matlabsub

Evaluate MATLAB command given Microsoft Excel data and designate output location

Syntax

```
matlabsub(command,edat,inputs)
```

Description

`matlabsub(command,edat,inputs)` passes the specified command to the MATLAB workspace for evaluation, given the function input data. The function returns a single value or string depending upon the MATLAB output. *This function is intended for use as an Excel worksheet function.*

Input Arguments

`command`

MATLAB command to evaluate.

Enter the MATLAB command in double quotes, for example, `"command"`.

`edat`

Worksheet location where the function writes the returned data.

`edat` in quotes directly specifies the location.`edat` without quotes specifies a worksheet cell address (or range name) that contains a reference to the location. In both cases, `edat` must be a cell address or a range name.

Although you can specify a range of output cells, `matlabsub` does not support multiple outputs. Instead of returning multiple outputs, `matlabsub` returns the first output starting in the first cell from the specified range, and discards all other outputs.

`inputs`

Variable length input argument list passed to MATLAB command.

This argument list can contain a range of worksheet cells that contain input data.

Examples

Compute the Sum of Data and Return Result to the Specified Cell

Sum the data in worksheet cells `B1` through `B10` returning the output to cell `A1`:

```
matlabsub("sum", "A1", B1:B10)
```

• "Work with MATLAB Functions in Microsoft Excel" on page 1-16

More About

Tips

- To return an array of data to the Microsoft Excel Visual Basic for Applications (VBA) workspace, see `MLEvalString` and `MLGetVar`.
- `edat` must not include the cell that contains the `matlabsub` function. In other words, be careful not to overwrite the function itself.
- Ensure that there is enough room in the worksheet to write the matrix contents. If there is insufficient room, the function generates a fatal error.
- If `matlabsub` fails, then by default you get a standard Spreadsheet Link error, such as `#COMMAND`. To return MATLAB error strings, use `MLShowMatlabErrors`.

See Also

`matlabfcn` | `MLShowMatlabErrors`

Introduced before R2006a

MLAppendMatrix

Create or append MATLAB matrix with data from Microsoft Excel worksheet

Syntax

```
MLAppendMatrix(var_name,mdat)
MLAppendMatrix var_name,mdat
out = MLAppendMatrix(var_name,mdat)
```

Description

`MLAppendMatrix(var_name,mdat)` appends data in `mdat` to MATLAB matrix `var_name` or creates `var_name` if it does not exist. *Use this syntax when working directly in a worksheet.*

`MLAppendMatrix var_name,mdat` appends data in `mdat` to MATLAB matrix `var_name` or creates `var_name` if it does not exist. *Use this syntax in a VBA macro.*

`out = MLAppendMatrix(var_name,mdat)` lets you catch errors when executing `MLAppendMatrix` in a VBA macro. If `MLAppendMatrix` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`var_name`

Name of MATLAB matrix to which to append data.

`var_name` in quotes directly specifies the matrix name. `var_name` without quotes specifies a worksheet cell address (or range name) that contains the matrix name. Do not use the MATLAB variable `ans` as `var_name`.

`mdat`

Location of data to append to `var_name`.

`mdat` must be a worksheet cell address or range name. Do not enclose it in quotes.

`mdat` must contain either numeric data or string data. Data types cannot be combined within the range specified in `mdat`. Empty `mdat` cells become MATLAB matrix elements containing zero if the data is numeric, and empty strings if the data is a string.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Append Data from a Worksheet Cell Range to a MATLAB Matrix

In this example, `B` is a 2-by-2 MATLAB matrix. Append the data in worksheet cell range `A1:A2` to `B`:

```
MLAppendMatrix("B", A1:A2)
```

		A1
		A2

`B` is now a 2-by-3 matrix with the data from `A1:A2` in the third column.

Append Data from a Named Worksheet Cell Range to a MATLAB Matrix

`B` is a 2-by-2 MATLAB matrix. Cell `C1` contains the label (string) `B`, and `new_data` is the name of the cell range `A1:B2`. Append the data in cell range `A1:B2` to `B`:

```
MLAppendMatrix(C1, new_data)
```

A1	B1
A2	B2

B is now a 4-by-2 matrix with the data from A1:B2 in the last two rows.

More About

Tips

- MLAppendMatrix checks the dimensions of var_name and mdat to determine how to append mdat to var_name. If the dimensions allow appending mdat as either new rows or new columns, it appends mdat to var_name as new rows. If the dimensions do not match, the function returns an error.
- If mdat is not initially an Excel Range data type and you call the function from a worksheet, MLAppendMatrix performs the necessary type coercion.
- If mdat is not an Excel Range data type and you call the function from within a Microsoft Visual Basic macro, the call fails. The error message ByRef Argument Type Mismatch appears.

See Also

MLPutMatrix

Introduced before R2006a

MLAutoStart

Automatically start MATLAB

Syntax

```
MLAutoStart(flag)
MLAutoStart flag
out = MLAutoStart(flag)
```

Description

`MLAutoStart(flag)` sets automatic startup of the Spreadsheet Link and MATLAB software. A change of state takes effect the next time an Excel session starts. *Use this syntax when working directly in a worksheet.*

`MLAutoStart flag` sets automatic startup of the Spreadsheet Link and MATLAB software. A change of state takes effect the next time an Excel session starts. *Use this syntax in a VBA macro.*

`out = MLAutoStart(flag)` lets you catch errors when executing `MLAutoStart` in a VBA macro. If `MLAutoStart` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`flag`

Either `"yes"` or `"no"`.

Specify `"yes"` to automatically start the Spreadsheet Link and MATLAB software every time a Microsoft Excel session starts. Specify `"no"` to cancel automatic startup of the Spreadsheet Link and MATLAB software.

Default: `"yes"`

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Cancel Automatic Startup of Spreadsheet Link and MATLAB

Enter this command in a worksheet:

```
MLAutoStart("no")
```

Spreadsheet Link and MATLAB do not start on subsequent Excel session invocations.

More About

Tips

- If Spreadsheet Link and MATLAB are running, then `MLAutoStart("no")` does not stop them.
- "Start Spreadsheet Link and MATLAB Automatically" on page 1-13

See Also

`matlabinit` | `MLClose` | `MLOpen`

Introduced before R2006a

MLClose

Stop MATLAB

Syntax

```
MLClose()
MLClose
out = MLClose()
```

Description

`MLClose()` ends the MATLAB process, deletes all variables from the MATLAB workspace, and tells the Microsoft Excel software that the MATLAB software is no longer running. *Use this syntax when working directly in a worksheet.*

`MLClose` ends the MATLAB process, deletes all variables from the MATLAB workspace, and tells the Microsoft Excel software that the MATLAB software is no longer running. *Use this syntax in a VBA macro.*

`out = MLClose()` lets you catch errors when executing `MLClose` in a VBA macro. If `MLClose` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

End the MATLAB Session

End the MATLAB session from a worksheet:

```
MLClose()
```

More About

Tips

- If you use `MLClose` when no MATLAB process is running, nothing happens.
- "Stop Spreadsheet Link and MATLAB" on page 1-15

See Also

`MLAutoStart` | `MLOpen`

Introduced before R2006a

MLDeleteMatrix

Delete MATLAB matrix

Syntax

```
MLDeleteMatrix(var_name)
MLDeleteMatrix var_name
out = MLDeleteMatrix(var_name)
```

Description

`MLDeleteMatrix(var_name)` deletes the named matrix from the MATLAB workspace. *Use this syntax when working directly in a worksheet.*

`MLDeleteMatrix var_name` deletes the named matrix from the MATLAB workspace. *Use this syntax in a VBA macro.*

`out = MLDeleteMatrix(var_name)` lets you catch errors when executing `MLDeleteMatrix` in a VBA macro. If `MLDeleteMatrix` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`var_name`

Name of MATLAB matrix to delete.

`var_name` in quotes directly specifies the matrix name. `var_name` without quotes specifies a worksheet cell address (or range name) that contains the matrix name.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Delete a Matrix from the MATLAB Workspace

Delete matrix A from the MATLAB workspace:

```
MLDeleteMatrix("A")
```

See Also

MLAppendMatrix | MLGetMatrix | MLPutMatrix

Introduced before R2006a

MLEvalString

Evaluate command in MATLAB

Syntax

```
MLEvalString(command)
MLEvalString command
out = MLEvalString(command)
```

Description

`MLEvalString(command)` passes a command string to the MATLAB software for evaluation. *Use this syntax when working directly in a worksheet.*

`MLEvalString command` passes a command string to the MATLAB software for evaluation. *Use this syntax in a VBA macro.*

`out = MLEvalString(command)` lets you catch errors when executing `MLEvalString` in a VBA macro. If `MLEvalString` fails, then `out` is a string containing error code or error message. Otherwise, `out` is `0`.

Input Arguments

`command`

MATLAB command to evaluate.

`command` in quotes directly specifies the command. `command` without quotes specifies a worksheet cell address (or range name) that contains the command.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code or error message. To return MATLAB error messages instead of error code, use `MLShowMatlabErrors`.

Examples

Evaluate a MATLAB Command from an Excel Worksheet

Divide the MATLAB variable `b` by 2, and then plot it:

```
MLEvalString("b = b/2;plot(b)")
```

This command only modifies the MATLAB variable `b`. To update data in the Excel worksheet, use `MLGetMatrix`.

More About

Tips

- The specified action alters only the MATLAB workspace. It has no effect on the Microsoft Excel workspace.
- If `MLEvalString` fails, then by default you get a standard Spreadsheet Link error, such as `#COMMAND`. To return MATLAB error strings, use `MLShowMatlabErrors`.

See Also

`MLGetMatrix` | `MLShowMatlabErrors`

Introduced before R2006a

MLGetFigure

Import current MATLAB figure into Microsoft Excel worksheet

Syntax

```
MLGetFigure(width,height)
MLGetFigure width, height
out = MLGetFigure(width,height)
```

Description

`MLGetFigure(width,height)` import the current MATLAB figure into an Excel worksheet, where the top-left corner of the figure is the current worksheet cell. *Use this syntax when working directly in a worksheet.*

`MLGetFigure width, height` import the current MATLAB figure into an Excel worksheet, where the top-left corner of the figure is the current worksheet cell. *Use this syntax in a VBA macro.*

`out = MLGetFigure(width,height)` lets you catch errors when executing `MLGetFigure` in a VBA macro. If `MLGetFigure` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`width`

Width (in normalized units) of the MATLAB figure when imported into an Excel worksheet.

`height`

Height (in normalized units) of the MATLAB figure when imported into an Excel worksheet.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Import a MATLAB Figure into an Excel Worksheet

Import the current MATLAB figure into an Excel worksheet. Specify the width and the height of the figure to be half those of the original figure:

```
MLGetFigure(.5,.5)
```

Note that if you use Microsoft Excel 2007 or 2010, the width and the height of the imported figure will be a quarter of those of the original figure.

More About

Tips

- If you use Microsoft Excel 2007 or 2010, `MLGetFigure` scales the imported figure by the product of `width` and `height` along both dimensions.
- If worksheet calculation mode is automatic, `MLGetFigure` executes when you enter the formula in a cell. If worksheet calculation mode is manual, enter the `MLGetFigure` function in a cell, then press `F9` to execute it. Remember that pressing `F9` in this situation can also execute other worksheet functions again and generate unpredictable results.
- If you use `MLGetFigure` in a macro subroutine, enter `MatlabRequest` on the line after the `MLGetFigure`. `MatlabRequest` initializes internal Spreadsheet Link variables and enables `MLGetFigure` to function in a subroutine. Do not include `MatlabRequest` in a macro function unless the function is called from a subroutine.

See Also

`MLGetMatrix` | `MLGetVar`

Introduced in R2006b

MLGetMatrix

Write contents of MATLAB matrix to Microsoft Excel worksheet

Syntax

```
MLGetMatrix(var_name,edat)
MLGetMatrix var_name, edat
out = MLGetMatrix(var_name,edat)
```

Description

`MLGetMatrix(var_name,edat)` writes the contents of MATLAB matrix `var_name` in the Excel worksheet, beginning in the upper-left cell specified by `edat`. *Use this syntax when working directly in a worksheet.*

`MLGetMatrix var_name, edat` writes the contents of MATLAB matrix `var_name` in the Excel worksheet, beginning in the upper-left cell specified by `edat`. *Use this syntax in a VBA macro.*

`out = MLGetMatrix(var_name,edat)` lets you catch errors when executing `MLGetMatrix` in a VBA macro. If `MLGetMatrix` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`var_name`

Name of MATLAB matrix to access.

`var_name` in quotes directly specifies the matrix name. `var_name` without quotes specifies a worksheet cell address (or range name) that contains the matrix name. Do not use the MATLAB variable `ans` as `var_name`.

`edat`

Worksheet location where the function writes the contents of `var_name`.

`edat` in quotes directly specifies the location. `edat` without quotes specifies a worksheet cell address (or range name) that contains a reference to the location. In both cases, `edat` must be a cell address or a range name.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Specify the Matrix Name and Location Directly

Write the contents of the MATLAB matrix `bonds` starting in cell `C10` of `Sheet2`. If `bonds` is a 4-by-3 matrix, fill cells `C10..E13` with data:

```
MLGetMatrix("bonds", "Sheet2!C10")
```

Specify the Matrix Name and Location Indirectly

Access the MATLAB matrix named by the string in worksheet cell `B12`. Write the contents of the matrix to the worksheet starting at the location named by the string in worksheet cell `B13`:

```
MLGetMatrix(B12, B13)
```

Use `MLGetMatrix` in a VBA Macro

Write the contents of MATLAB matrix `A` to the worksheet, starting at the cell named by `RangeA`:

```
Sub Get_RangeA()
MLGetMatrix "A", "RangeA"
MatlabRequest
End Sub
```

Use the `Address` Property of the Range Object to Specify Location

In a macro, use the `Address` property of the range object returned by the VBA `Cells` function to specify where to write the data:

```
Sub Get_Variable()
MLGetMatrix "X", Cells(3, 2).Address
MatlabRequest
End Sub
```

Catch Errors in a VBA Macro

Use this function to get the variable A from MATLAB and to test if the command succeeded:

```
Sub myfun()
    Dim out As Variant

    out = MLGetMatrix("A", "A1")

    If out <> 0 Then
        MsgBox out
    End If
    MatlabRequest
End Sub
```

If `MLGetMatrix` fails, `myfun` displays a message box with the error code.

- "Work with MATLAB Functions in Microsoft Excel" on page 1-16

More About

Tips

- If data exists in the specified worksheet cells, it is overwritten.
- If the dimensions of the MATLAB matrix are larger than that of the specified cells, the data overflows into additional rows and columns.
- `edat` must not include the cell that contains the `MLGetMatrix` function. In other words, be careful not to overwrite the function itself. Also make sure there is enough room in the worksheet to write the matrix contents. If there is insufficient room, the function generates a fatal error.
- `MLGetMatrix` function does not automatically adjust cell addresses. If `edat` is an explicit cell address, edit it to correct the address when you do either of the following:
  - Insert or delete rows or columns.
  - Move or copy the function to another cell.

- If worksheet calculation mode is automatic, `MLGetMatrix` executes when you enter the formula in a cell. If worksheet calculation mode is manual, enter the `MLGetMatrix` function in a cell, and then press **F9** to execute it. However, pressing **F9** in this situation may also execute other worksheet functions again and generate unpredictable results.
- If you use `MLGetMatrix` in a macro subroutine, enter `MatlabRequest` on the line after the `MLGetMatrix`. `MatlabRequest` initializes internal Spreadsheet Link variables and enables `MLGetMatrix` to function in a subroutine. Do not include `MatlabRequest` in a macro function unless the function is called from a subroutine.

See Also

`MLAppendMatrix` | `MLPutMatrix` | `MLPutRanges`

Introduced before R2006a

MLGetVar

Write contents of MATLAB matrix in Microsoft Excel VBA variable

Syntax

```
MLGetVar ML_var_name, VBA_var_name
```

Description

`MLGetVar ML_var_name, VBA_var_name` writes the contents of MATLAB matrix `ML_var_name` in the Excel Visual Basic for Applications (VBA) variable `VBA_var_name`. Creates `VBA_var_name` if it does not exist. Replaces existing data in `VBA_var_name`.

Input Arguments

`ML_var_name`

Name of MATLAB matrix to access.

`ML_var_name` in quotes directly specifies the matrix name. `ML_var_name` without quotes specifies a VBA variable that contains the matrix name as a string. Do not use the MATLAB variable `ans` as `ML_var_name`. If defined, `ML_var_name` must be of type `VARIANT`. Any other type will give a `"TYPE MISMATCH"` error.

`VBA_var_name`

Name of VBA variable where the function writes the contents of `ML_var_name`.

Use `VBA_var_name` without quotes.

Examples

Write the Contents of a MATLAB Matrix into a VBA Variable

Write the contents of the MATLAB matrix `J` into the VBA variable `DataJ`:

```
Sub Fetch()
MLGetVar "J", DataJ
End Sub
```

- “Work with MATLAB Functions in Microsoft Excel” on page 1-16

See Also

`MLPutVar`

Introduced before R2006a

MLMissingDataAsNaN

Set empty cells to `NaN` or `0`

Syntax

```
MLMissingDataAsNaN(flag)
MLMissingDataAsNaN flag
out = MLMissingDataAsNaN(flag)
```

Description

`MLMissingDataAsNaN(flag)` sets empty cells to `NaN` or `0`. When the Spreadsheet Link software is installed, the default is `"no"`, so empty cells are handled as `0`s. If you change the value of `MLUseCellArray` to `"yes"`, the change remains in effect the next time a Microsoft Excel session starts. *Use this syntax when working directly in a worksheet.*

`MLMissingDataAsNaN flag` sets empty cells to `NaN` or `0`. *Use this syntax in a VBA macro.*

`out = MLMissingDataAsNaN(flag)` lets you catch errors when executing `MLMissingDataAsNaN` in a VBA macro. If `MLMissingDataAsNaN` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`flag`

Either `"yes"` or `"no"`.

Specify `"yes"` to set empty cells to use `NaN`s. Specify `"no"` to set empty cells to use `0`s.

Default: `"no"`

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Set Empty Cells to Use 0s

Cancel the use of the value `NaN` for empty cells:

```
MLMissingDataAsNaN("no")
```

More About

Tips

- A string in an Excel range always forces cell array output and empty cells as `NaN`s.

See Also

`MLPutMatrix`

Introduced in R2007a

MLOpen

Start MATLAB

Syntax

```
MLOpen()
MLOpen
out = MLOpen()
```

Description

`MLOpen()` starts MATLAB process. Use `MLOpen` to restart the MATLAB session after you have stopped it with `MLClose` in a given Microsoft Excel session. *Use this syntax when working directly in a worksheet.*

`MLOpen` starts MATLAB process. Use `MLOpen` to restart the MATLAB session after you have stopped it with `MLClose` in a given Microsoft Excel session. *Use this syntax in a VBA macro.*

`out = MLOpen()` lets you catch errors when executing `MLOpen` in a VBA macro. If `MLOpen` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Start a MATLAB Session

Start a MATLAB session from a worksheet:

```
MLOpen()
```

More About

Tips

- If a MATLAB process has already started, subsequent calls to `MLOpen` do nothing.
- To start a MATLAB session and initialize the Spreadsheet Link software, use `matlabinit` rather than `MLOpen`.

See Also

`matlabinit` | `MLClose`

Introduced before R2006a

MLPutMatrix

Create or overwrite MATLAB matrix with data from Microsoft Excel worksheet

Syntax

```
MLPutMatrix(var_name, mdat)
MLPutMatrix var_name, mdat
out = MLPutMatrix(var_name,mdat)
```

Description

`MLPutMatrix(var_name, mdat)` creates or overwrites matrix `var_name` in MATLAB workspace with specified data in `mdat`. Creates `var_name` if it does not exist. *Use this syntax when working directly in a worksheet.*

`MLPutMatrix var_name, mdat` creates or overwrites matrix `var_name` in MATLAB workspace with specified data in `mdat`. *Use this syntax in a VBA macro.*

`out = MLPutMatrix(var_name,mdat)` lets you catch errors when executing `MLPutMatrix` in a VBA macro. If `MLPutMatrix` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`var_name`

Name of MATLAB matrix to create or overwrite.

`var_name` in quotes directly specifies the matrix name. `var_name` without quotes specifies a worksheet cell address (or range name) that contains the matrix name.

`mdat`

Location of data to copy into `var_name`.

`mdat` must be a worksheet cell address or range name. Do not enclose it in quotes.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

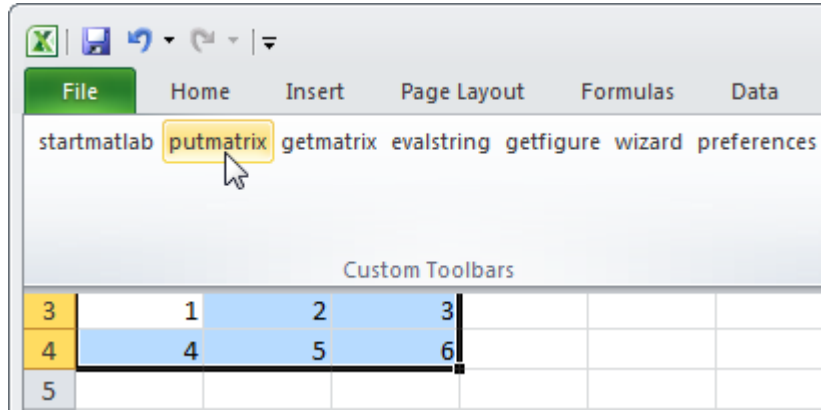
Create or Overwrite a Matrix in the MATLAB Workspace

Create or overwrite matrix `A` in the MATLAB workspace with the data in the worksheet range `A1:C3`:

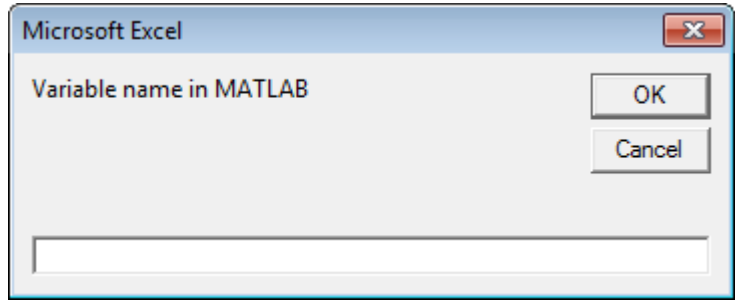
```
MLPutMatrix "A", Range("A1:C3")
```

Import Data from a Microsoft Excel Worksheet to the MATLAB Workspace Using the putmatrix Toolbar Button

1. In the Excel worksheet, select the columns and/or rows you want to export to the MATLAB workspace.



2. Click the **putmatrix** button on the Spreadsheet Link toolbar. A window appears that prompts you to specify the name of the MATLAB variable in which you want to store your data.



3 Enter `newmatrix` for the MATLAB variable name.

4 Click **OK**.

Now you can manipulate `newmatrix` in the Command Window.

```
newmatrix
newmatrix =

     1     2     3
     4     5     6
```

- "Work with MATLAB Functions in Microsoft Excel" on page 1-16

More About

Tips

- If `var_name` exists, this function replaces the contents with `mdat`.
- Empty numeric data cells within the range of `mdat` become numeric zeros within the MATLAB matrix identified by `var_name`.
- If any element of `mdat` contains string data, `mdat` is exported as a MATLAB cell array. Empty string elements within the range of `mdatmdat` become `NaN`s within the MATLAB cell array.
- When using `MLPutMatrix` in a subroutine, indicate the source of the worksheet data using the Microsoft Excel macro `Range`. For example:

```
Sub test()
  MLPutMatrix "a", Range("A1:A3")
End Sub
```

If you have a named range in your worksheet, you can specify the name instead of the range; for example:

```
Sub test()
  MLPutMatrix "a", Range("temp")
End Sub
```

where `temp` is a named range in your worksheet.

See Also

`MLAppendMatrix` | `MLGetMatrix` | `MLPutRanges`

Introduced before R2006a

MLPutRanges

Send data in Microsoft Excel named ranges to MATLAB

Syntax

```
= MLPutRanges()

MLPutRanges
out = MLPutRanges()
```

Description

`= MLPutRanges()` writes the named cell ranges in a Microsoft Excel worksheet into MATLAB variables. The variables are named with the same name specified by the cell range name in Microsoft Excel. To use this syntax, right-click in any Microsoft Excel cell and enter this syntax and press **Enter**.

`MLPutRanges` writes the named cell ranges in a Microsoft Excel worksheet into MATLAB variables. The variables are named with the same name specified by the cell range name in Microsoft Excel. Use this syntax when working directly in a Microsoft Visual Basic macro.

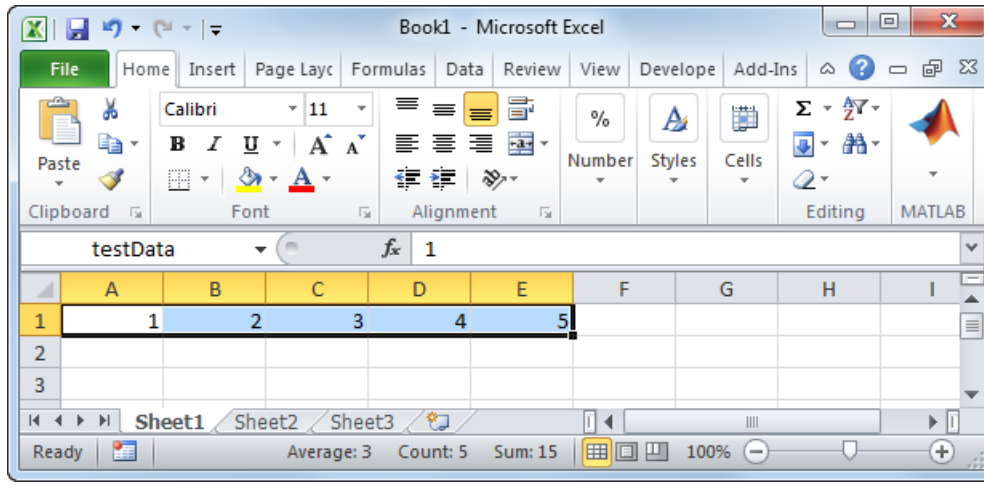
`out = MLPutRanges()` returns the named cell ranges in a Microsoft Excel worksheet into MATLAB variables. The variables are named with the same name specified by the cell range name in Microsoft Excel. In this case, `out` specifies whether the `MLPutRanges` function executed successfully. Use this syntax when working directly in a Microsoft Visual Basic macro.

Examples

Send Microsoft Excel Named Ranges to MATLAB in a Microsoft Excel Cell

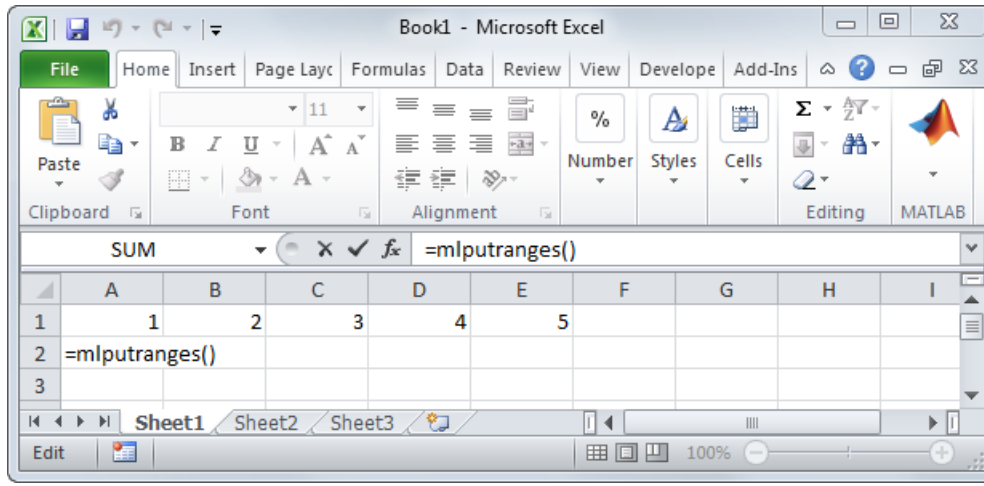
Define a name for a range of cells. For instructions about defining names, see **Excel Help** and enter the search term: define and use names in formulas.

The name of the range of cells appears in the **Name Box**. In this example, the range selected from cell `A1` to cell `E1` is named `testData`.

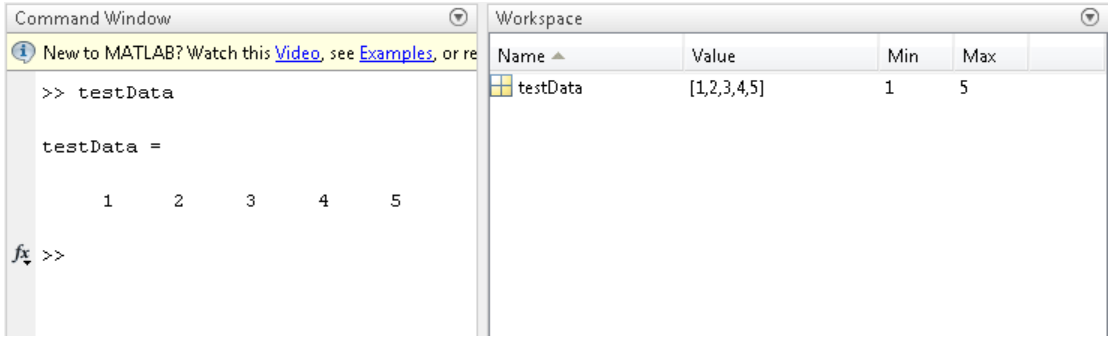


Call the function inside a worksheet cell to send data in the named ranges in the current worksheet to MATLAB.

```
= MLPutRanges()
```



After pressing **Enter**, the range named `testData` is sent from Microsoft Excel to a variable named `testData` in MATLAB.



Send Microsoft Excel Named Ranges to MATLAB in Microsoft Visual Basic Macro Without Output

Call the function to send data in the named ranges in the current worksheet to MATLAB.

```
MLPutRanges
```

Send Microsoft Excel Named Ranges to MATLAB in Microsoft Visual Basic Macro with Output

Call the function to send data in the named ranges in the current worksheet to MATLAB.

```
out = MLPutRanges()
```

`out` returns 0 if the function succeeded or a string with the corresponding error code if the function failed.

- "Work with MATLAB Functions in Microsoft Excel" on page 1-16

Output Arguments

`out` — Status

0 | string

Status for execution of `MLPutRanges`, returned as 0 if the function succeeded, or a string containing an error code.

See Also

`MLGetMatrix` | `MLPutMatrix`

Introduced in R2013b

MLPutVar

Create or overwrite MATLAB matrix with data from Microsoft Excel VBA variable

Syntax

```
MLPutVar ML_var_name, VBA_var_name
out = MLPutVar ML_var_name, VBA_var_name
```

Description

`MLPutVar ML_var_name, VBA_var_name` creates or overwrites matrix `ML_var_name` in MATLAB workspace with data in `VBA_var_name`. Creates `ML_var_name` if it does not exist. If `ML_var_name` exists, this function replaces the contents with data from `VBA_var_name`.

`out = MLPutVar ML_var_name, VBA_var_name` lets you catch errors when executing `MLPutVar`. If `MLPutVar` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`ML_var_name`

Name of MATLAB matrix to create or overwrite.

`ML_var_name` in quotes directly specifies the matrix name. `ML_var_name` without quotes specifies a VBA variable that contains the matrix name as a string.

`VBA_var_name`

Name of VBA variable whose contents are written to `ML_var_name`.

Use `VBA_var_name` without quotes.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Create a MATLAB Matrix Using Data Stored in a VBA Variable

Create (or overwrite) the MATLAB matrix `K` with the data in the VBA variable `DataK`:

```
Sub Put()
MLPutVar "K", DataK
End Sub
```

- "Work with MATLAB Functions in Microsoft Excel" on page 1-16

More About

Tips

- Use `MLPutVar` only in a macro subroutine, not in a macro function or in a subroutine called by a function.
- Empty numeric data cells within `VBA_var_name` become numeric zeros within the MATLAB matrix identified by `ML_var_name`.
- If any element of `VBA_var_name` contains string data, `VBA_var_name` is exported as a MATLAB cell array. Empty string elements within `VBA_var_name` become `NaN`s within the MATLAB cell array.

See Also

`MLGetVar`

Introduced before R2006a

MLShowMatlabErrors

Return standard Spreadsheet Link errors or full MATLAB errors using `MLEvalString`

Syntax

```
MLShowMatlabErrors(flag)
MLShowMatlabErrors flag
out = MLShowMatlabErrors(flag)
```

Description

`MLShowMatlabErrors(flag)` sets the Spreadsheet Link error display mode when executing MATLAB commands using `MLEvalString`. *Use this syntax when working directly in a worksheet.*

`MLShowMatlabErrors flag` sets the Spreadsheet Link error display mode when executing MATLAB commands using `MLEvalString`. *Use this syntax in a VBA macro.*

`out = MLShowMatlabErrors(flag)` lets you catch errors when executing `MLShowMatlabErrors` in a VBA macro. If `MLShowMatlabErrors` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`flag`

Either `"yes"` or `"no"`.

Specify `"yes"` to display the full MATLAB error string upon `MLEvalString` failure. Specify `"no"` to display the standard Spreadsheet Link errors upon `MLEvalString` failure.

Default: `"no"`

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Switch to Displaying Spreadsheet Link Errors

Switch to displaying standard Spreadsheet Link errors, such as `#COMMAND`, on `MLEvalString` failures:

```
MLShowMatlabErrors("no")
```

Switch to Displaying MATLAB Errors

Switch to displaying MATLAB error strings, such as `??? Undefined function or variable 'foo'`, on `MLEvalString` failures:

```
MLShowMatlabErrors("yes")
```

See Also

`MLEvalString`

Introduced in R2006b

MLStartDir

Specify MATLAB current working folder after startup

Syntax

```
MLStartDir(path)
MLStartDir path
out = MLStartDir(path)
```

Description

`MLStartDir(path)` sets the MATLAB working folder after startup. *Use this syntax when working directly in a worksheet.*

`MLStartDir path` sets the MATLAB working folder after startup. *Use this syntax in a VBA macro.*

`out = MLStartDir(path)` lets you catch errors when executing `MLStartDir` in a VBA macro. If `MLStartDir` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`path`

Path to the new MATLAB working folder after startup.

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Specify MATLAB Working Folder

Set the MATLAB working folder to `d:\work` after startup:

```
MLStartDir (“d:\work”)
```

Specify MATLAB Working Folder That Includes Spaces

If your folder path includes a space, embed the path in single quotation marks within double quotation marks.

Set the MATLAB working folder to `d:\my work`:

```
MLStartDir (“'d:\my work'”)
```

More About

Tips

- This function does not work like the standard Microsoft Windows **Start In** setting, because it does not automatically run `startup.m` or `matlabrc.m` in the specified folder.
- The working folder changes only if you run MATLAB *after* you run this function. Running this function while MATLAB is running does not change the working folder for the current session. In this case, MATLAB uses the specified folder as the working folder when it is restarted.

See Also

`MLAutoStart`

Introduced in R2006b

MLUseCellArray

Toggle `MLPutMatrix` to use MATLAB cell arrays

Syntax

```
MLUseCellArray(flag)
MLUseCellArray flag
out = MLUseCellArray(flag)
```

Description

`MLUseCellArray(flag)` specifies whether `MLPutMatrix` must use cell arrays for transfer of data (for example, dates). When the Spreadsheet Link software is installed, the default is `"no"`. If you change the value of `MLUseCellArray` to `"yes"`, the change remains in effect the next time a Microsoft Excel session starts. *Use this syntax when working directly in a worksheet.*

`MLUseCellArray flag` specifies whether `MLPutMatrix` must use cell arrays for transfer of data. *Use this syntax in a VBA macro.*

`out = MLUseCellArray(flag)` lets you catch errors when executing `MLUseCellArray` in a VBA macro. If `MLUseCellArray` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

`flag`

Either `"yes"` or `"no"`.

Specify `"yes"` to automatically uses cell arrays for transfer of data structures. Specify `"no"` to stop using cell arrays for transfer of data structures.

Default: `"no"`

Output Arguments

`out`

0 if the command succeeded. Otherwise, a string containing error code.

Examples

Stop Using Cell Arrays When Transferring Data Structures

Cancel automatic use of cell arrays for easy transfer of data:

```
MLUseCellArray("no")
```

See Also

`MLPutMatrix`

Introduced in R2007a

MLUseFullDesktop

Specify whether to use full MATLAB desktop or Command Window

Syntax

```
MLUseFullDesktop(flag)
MLUseFullDesktop flag
out = MLUseFullDesktop(flag)
```

Description

`MLUseFullDesktop(flag)` sets the MATLAB session to start with the full desktop or Command Window only. *Use this syntax when working directly in a worksheet.*

`MLUseFullDesktop flag` sets the MATLAB session to start with the full desktop or Command Window only. *Use this syntax in a VBA macro.*

`out = MLUseFullDesktop(flag)` lets you catch errors when executing `MLUseFullDesktop` in a VBA macro. If `MLUseFullDesktop` fails, then `out` is a string containing error code. Otherwise, `out` is `0`.

Input Arguments

Default:

`flag`

Either `"yes"` or `"no"`.

Specify `"yes"` to start full MATLAB desktop. Specify `"no"` to start the Command Window only.

Default: `"yes"`

Output Arguments

`out`

`0` if the command succeeded. Otherwise, a string containing error code.

Examples

Start Only the Command Window

Set the MATLAB session to start with the command window only:

```
MLUseFullDesktop("no")
```

See Also

`matlabinit` | `MLClose` | `MLOpen`

Introduced in R2006b