

# Computer Aided Design (CAD)



## Lecture 2 Matlab Environment

Dr.Eng. Basem ElHalawany

# Course Info

## Title

Computer Aided Design (CAD)

## Lecturer:

**Dr. Basem ElHalawany**

## Lecturer Webpage:

<http://www.bu.edu.eg/staff/basem.mamdoh>

## Room/Email

306 / [basem.mamdoh@feng.bu.edu.eg](mailto:basem.mamdoh@feng.bu.edu.eg)

## Teaching Assistant (TA)

**Eng. Shimaa Sayed**

## Course Webpage

<http://www.bu.edu.eg/staff/basem.mamdoh-courses/...>

## References

**Multiple references will be used**

## Software Packages

**Matlab/Simulink - .....**

## Assessment 100/50

1. **Final Term Exam (100)**
2. **Mid Term Exam**
3. **Assignment**
4. **Project**



# Schedule (Draft)

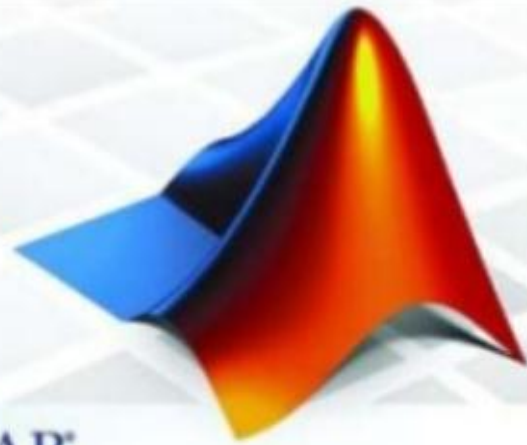
Topics	Estimated Duration (# Lectures)
Introduction	1
Introduction to Matlab Environment	1
Matlab Programing (m-files)	5
Modeling using Matlab Simulink Tool	4
Communication Systems Simulation (Applications)	3
Midterm	8 <sup>th</sup> Week
Introduction to FPGA + Review on Digital Logic/Circuits	2
VHDL Modeling Language	4
VHDL Application	2
Introduction to OPNET Network Simulator	3
Course Closeout / Feedback/ project (s) Delivery	1



introducing

**MATLAB**

MATLAB



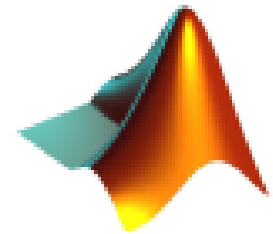
**The Lecture is based on :**

**A. Matlab by Example: Programming Basics, Munther Gdeisat**

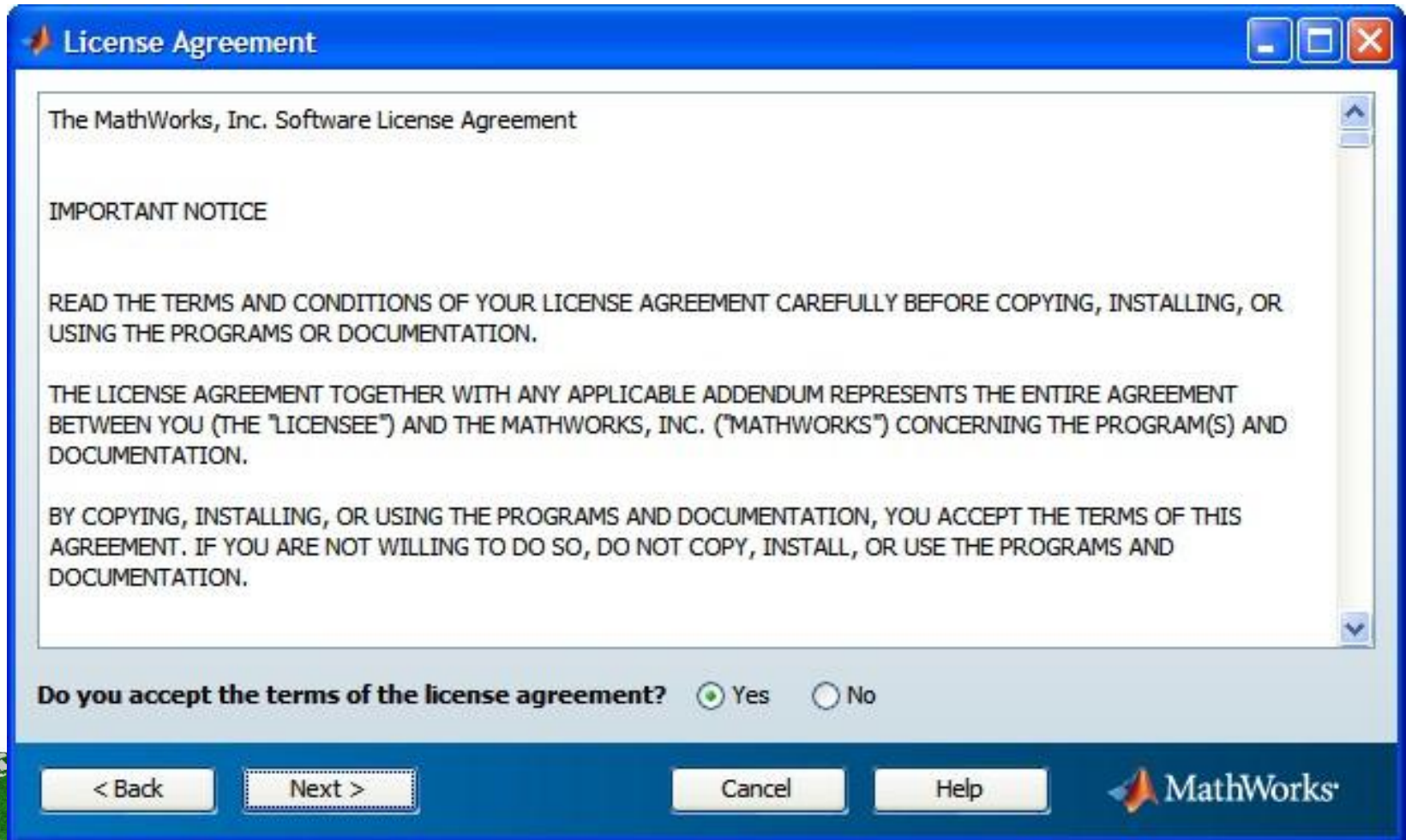
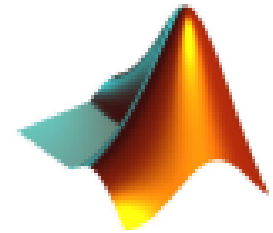




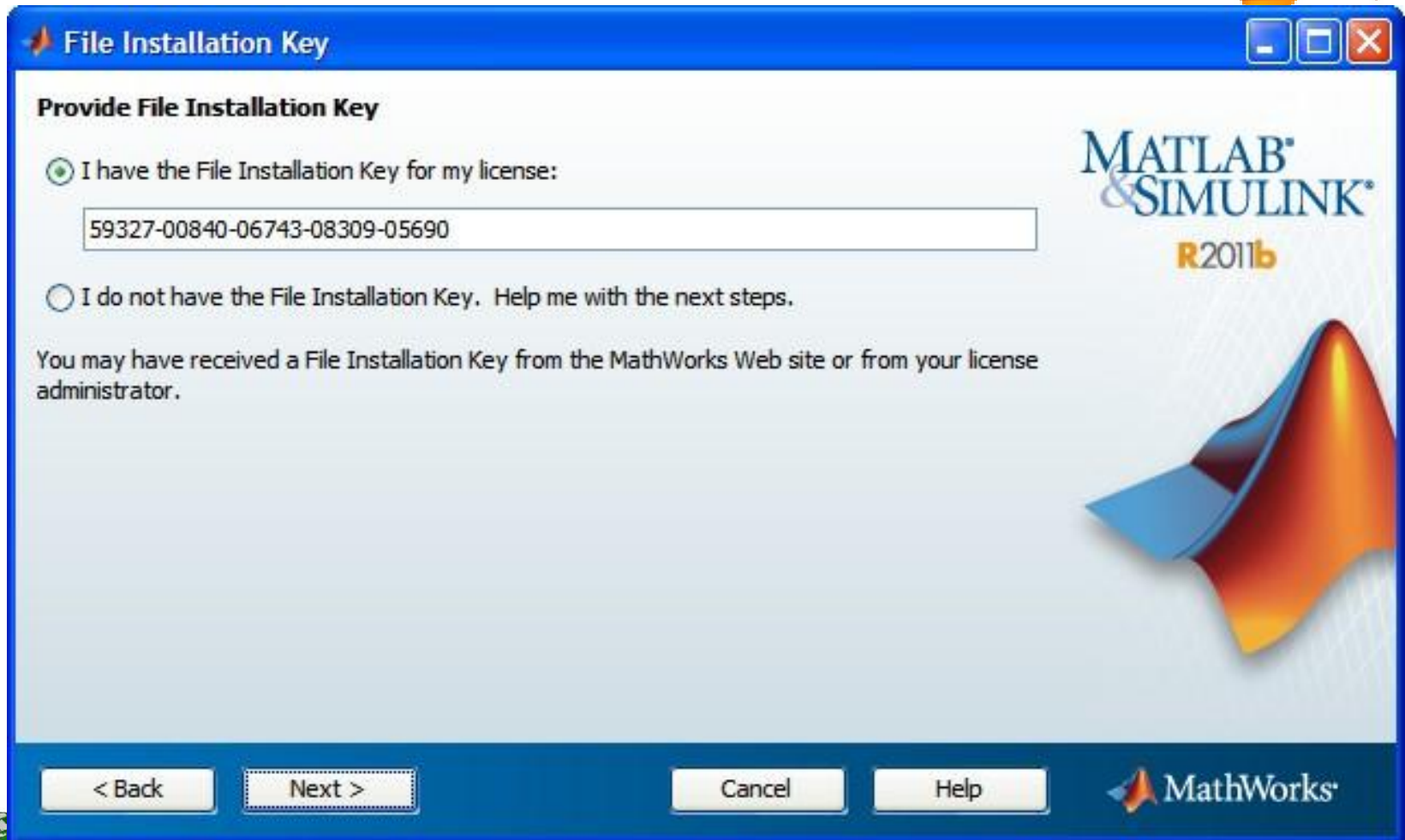
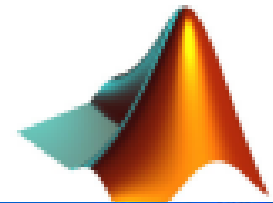
# How to Setup Matlab



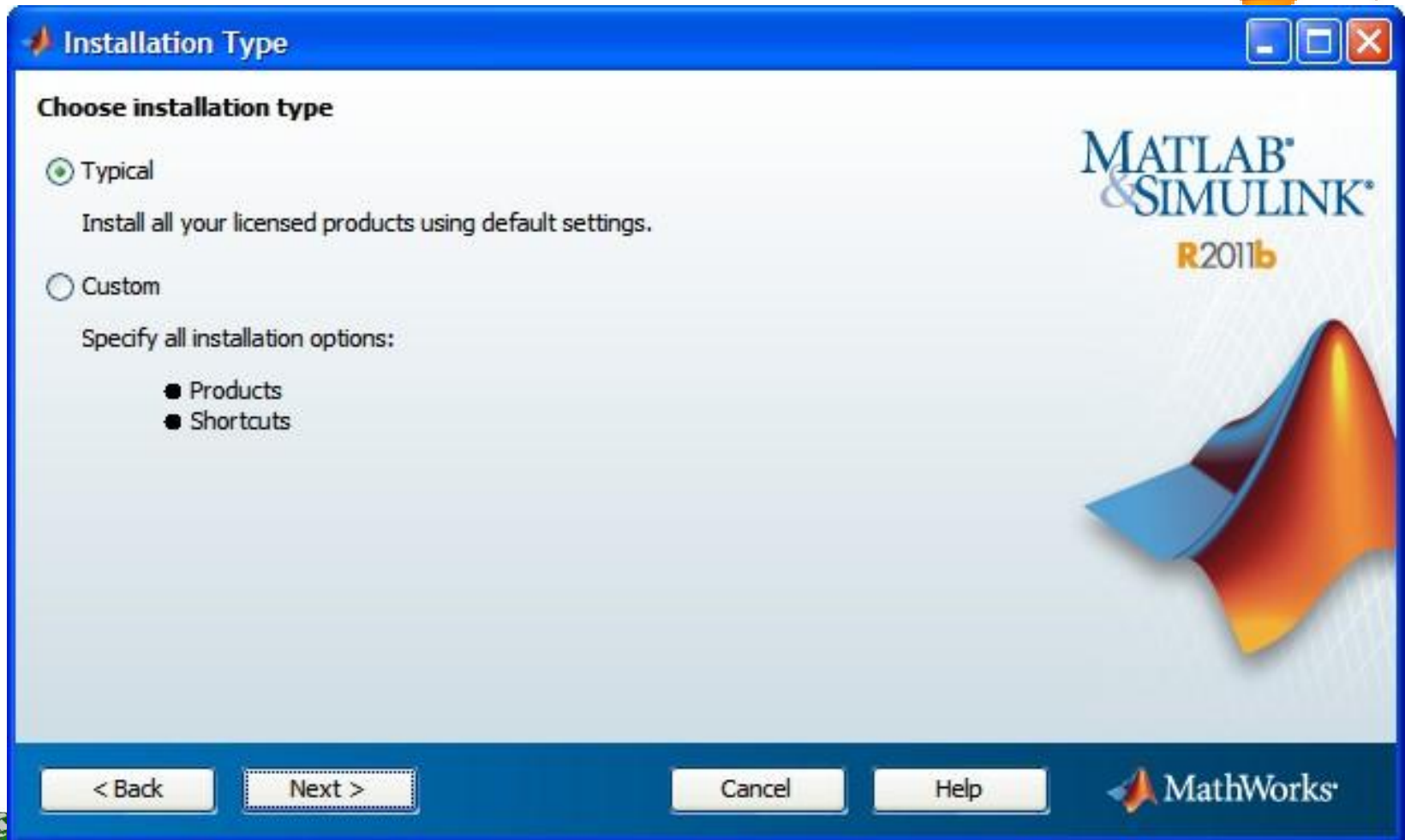
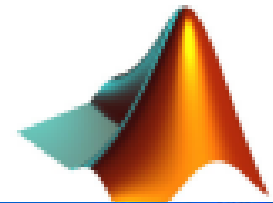
# How to Setup Matlab



# How to Setup Matlab

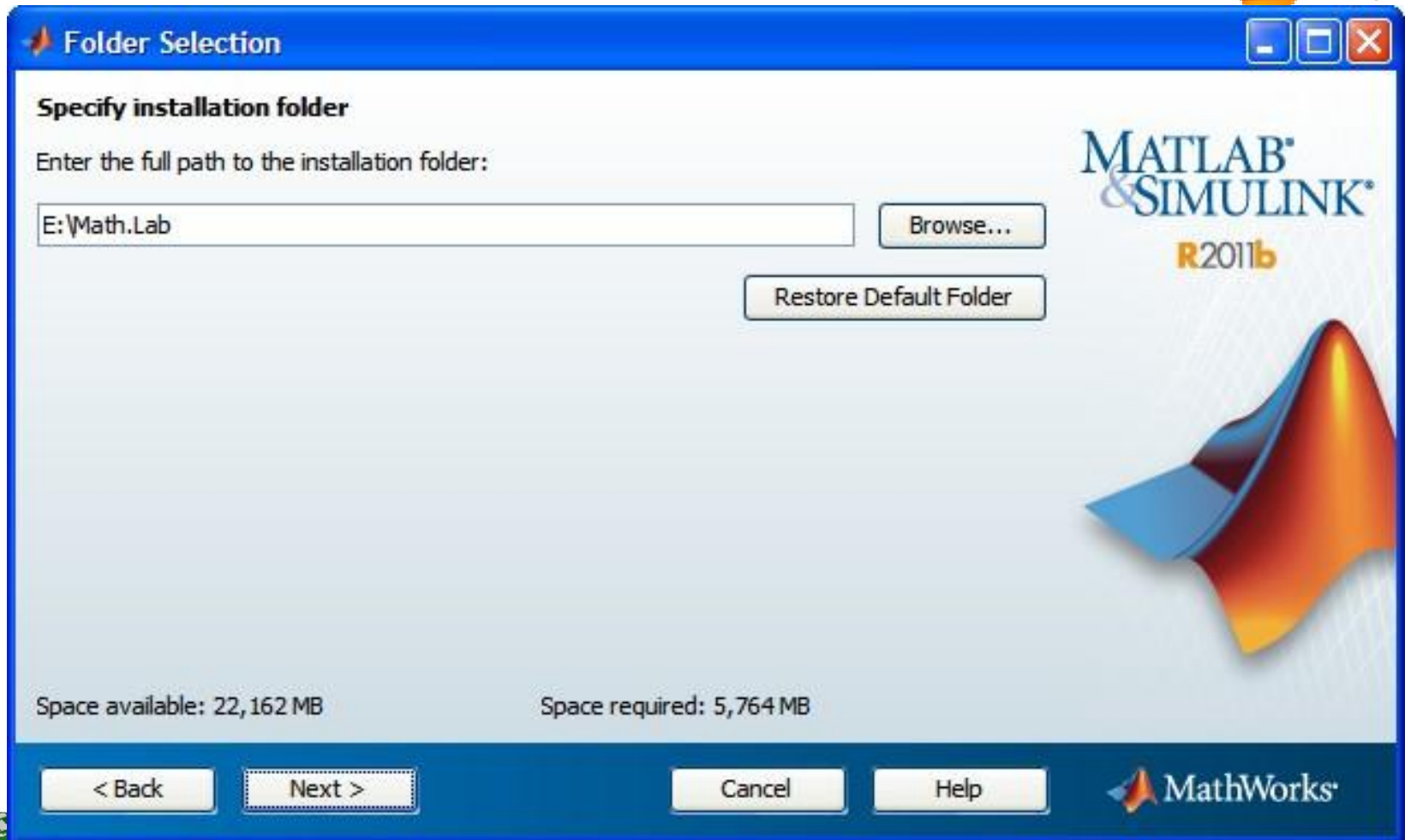
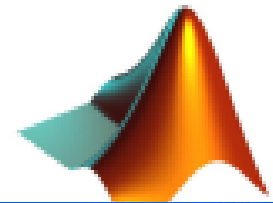


# How to Setup Matlab

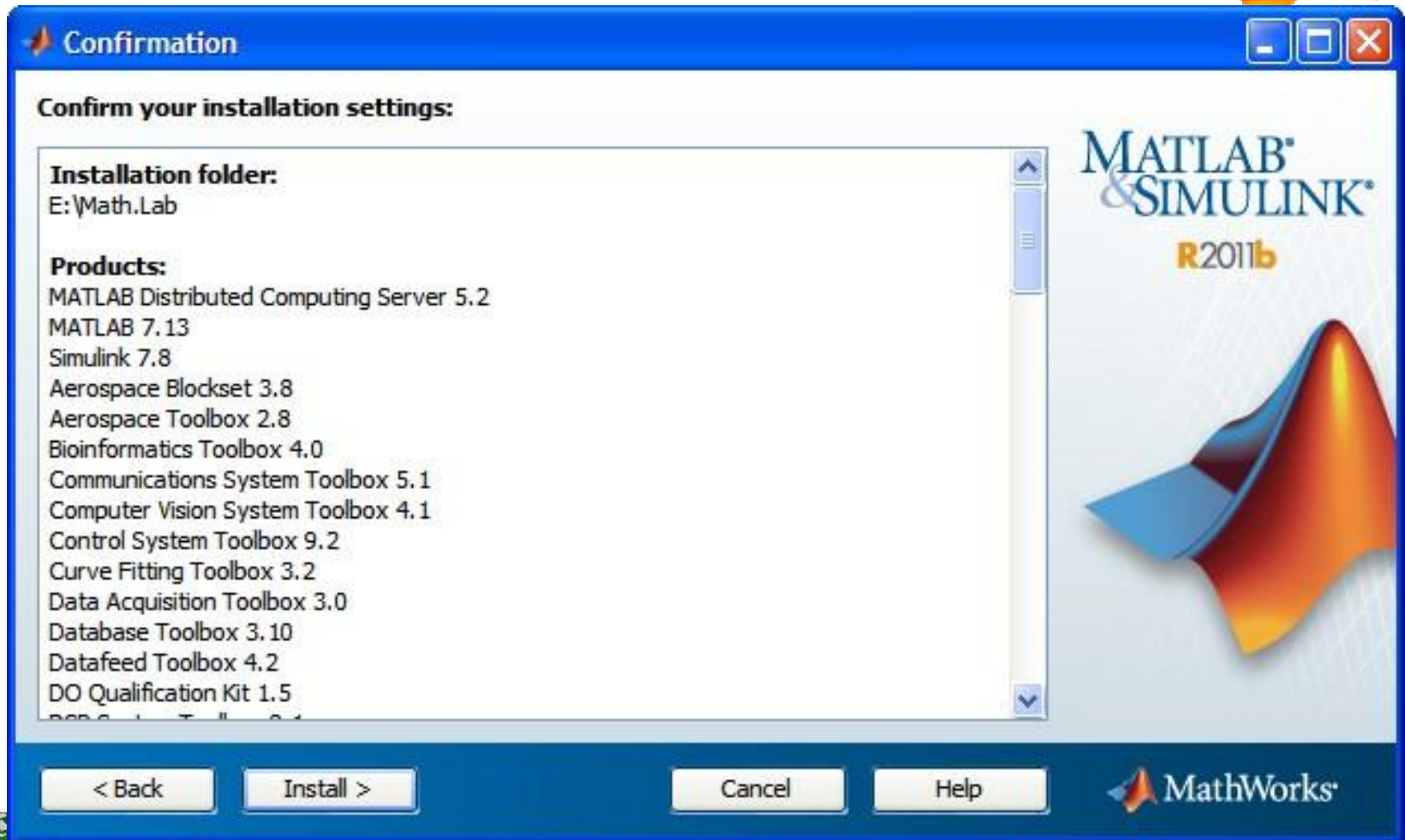
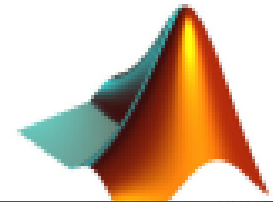




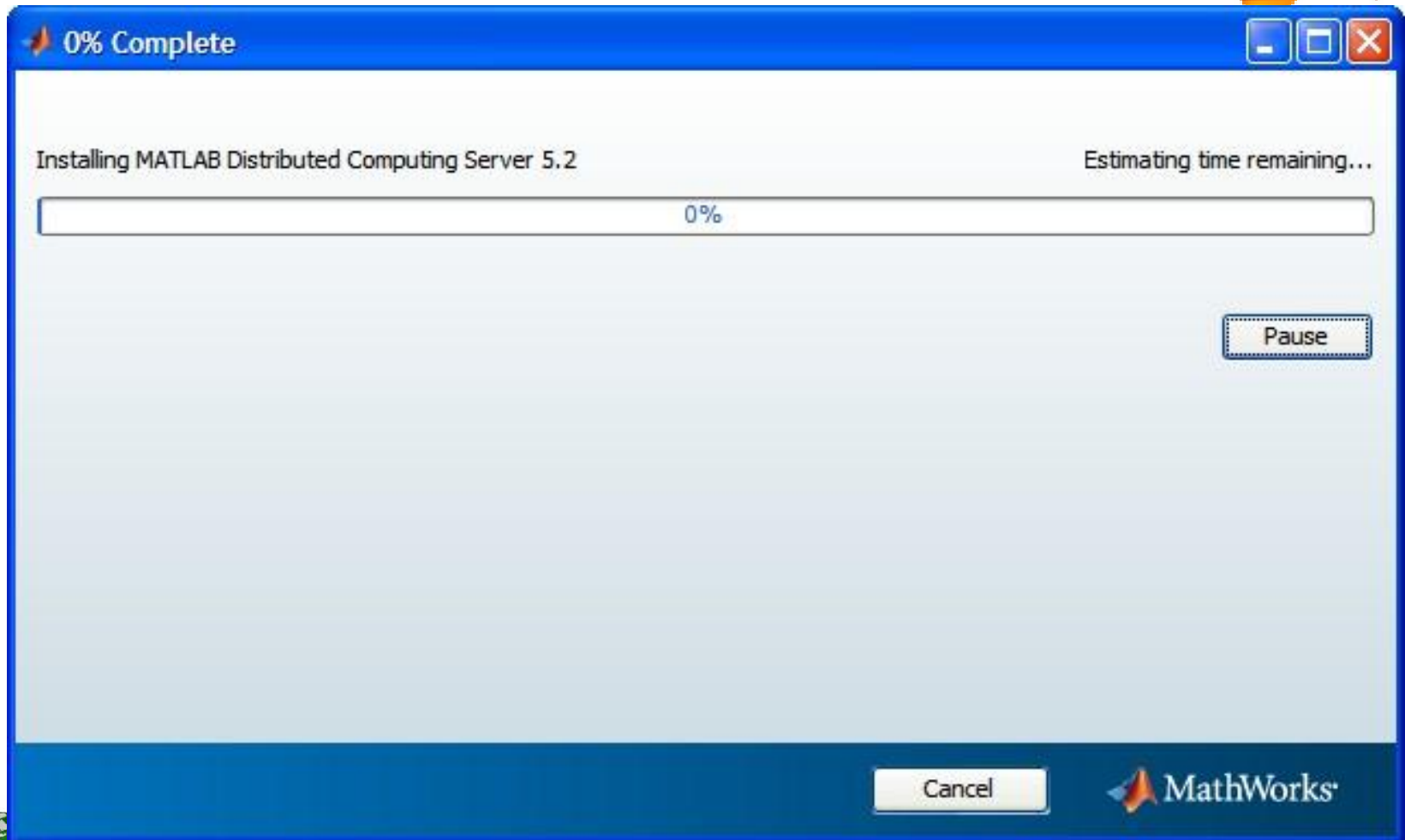
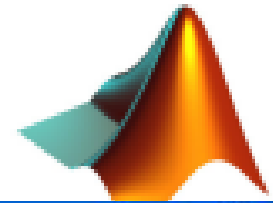
# How to Setup Matlab



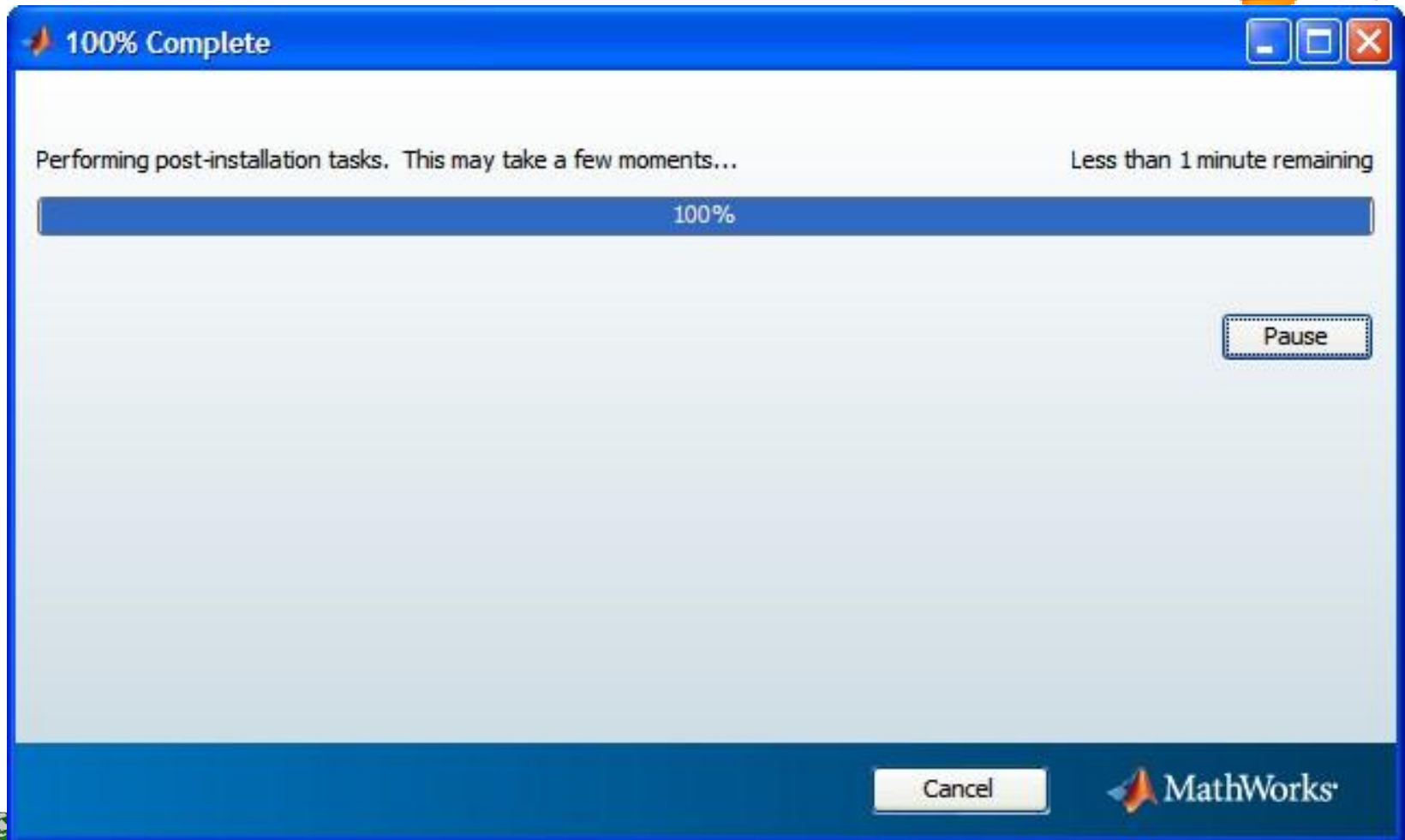
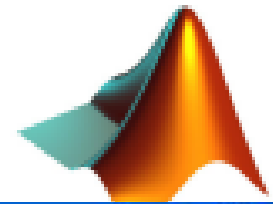
# How to Setup Matlab



# How to Setup Matlab

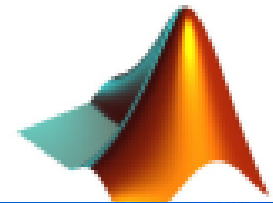


# How to Setup Matlab





# How to Setup Matlab





**Product Configuration Notes**

Your installation may require additional configuration steps.

1. To configure Real-Time Windows Target you must type `rtwintgt -setup` in a MATLAB command window.
2. After this installation is complete, you should continue with your configuration of the MATLAB Distributed Computing Server as outlined in the instructions obtained from [www.mathworks.com/distconfig](http://www.mathworks.com/distconfig).
3. Run `mbuild -setup` from MATLAB before using MATLAB Compiler or builder products.

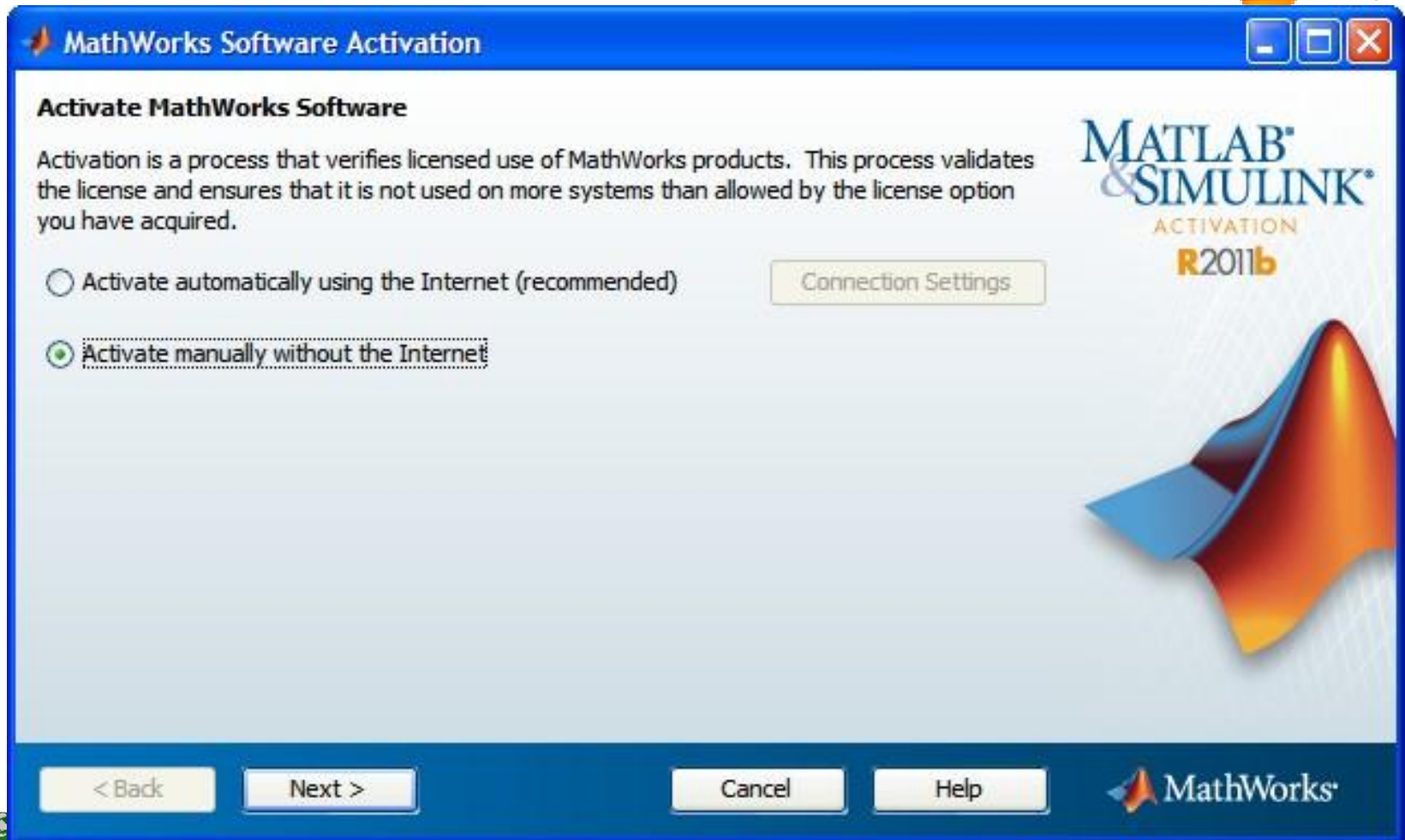
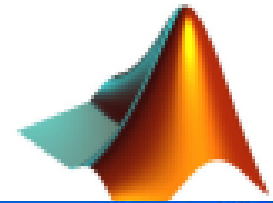
**MATLAB® & SIMULINK®**  
**R2011b**



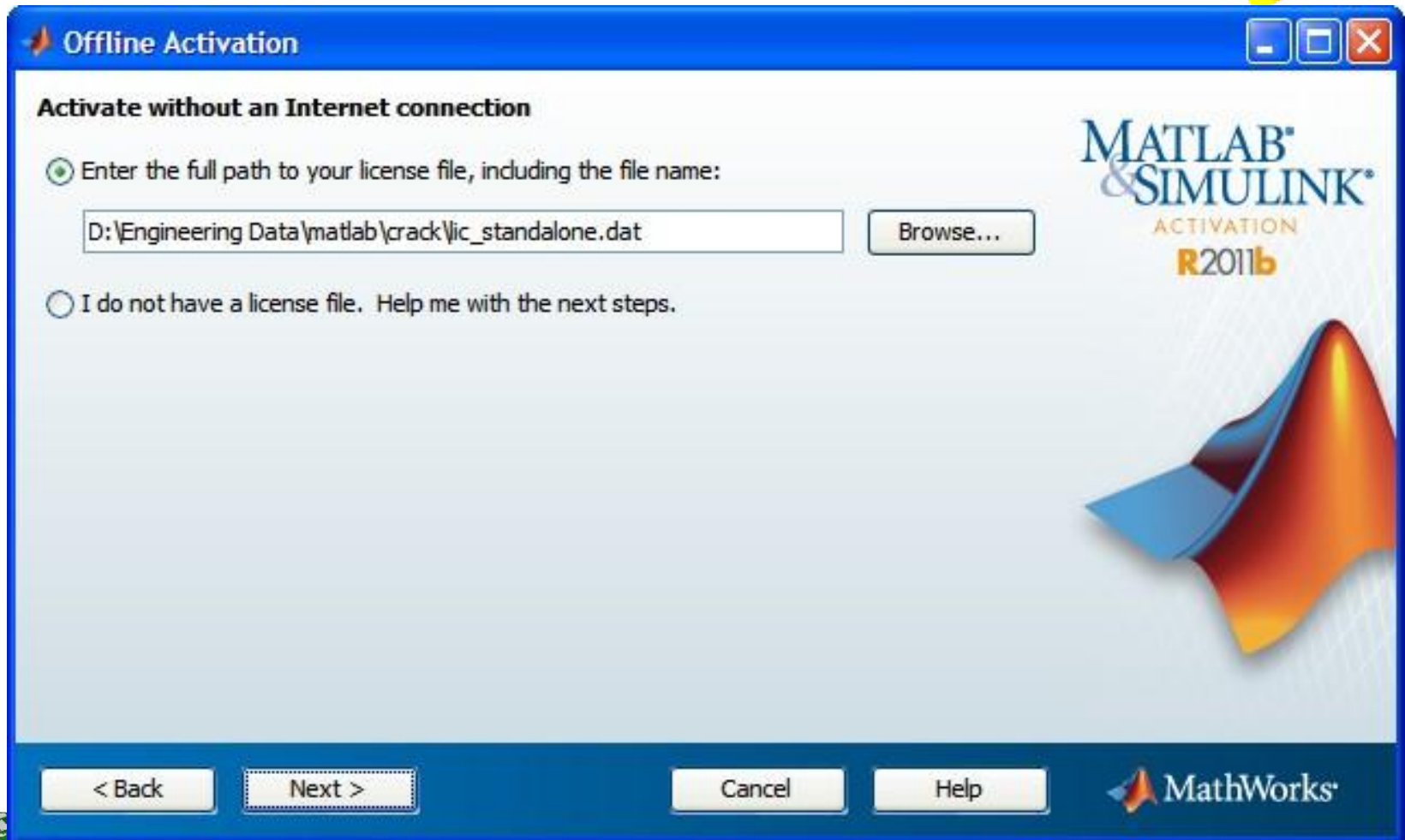
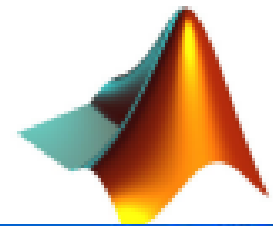
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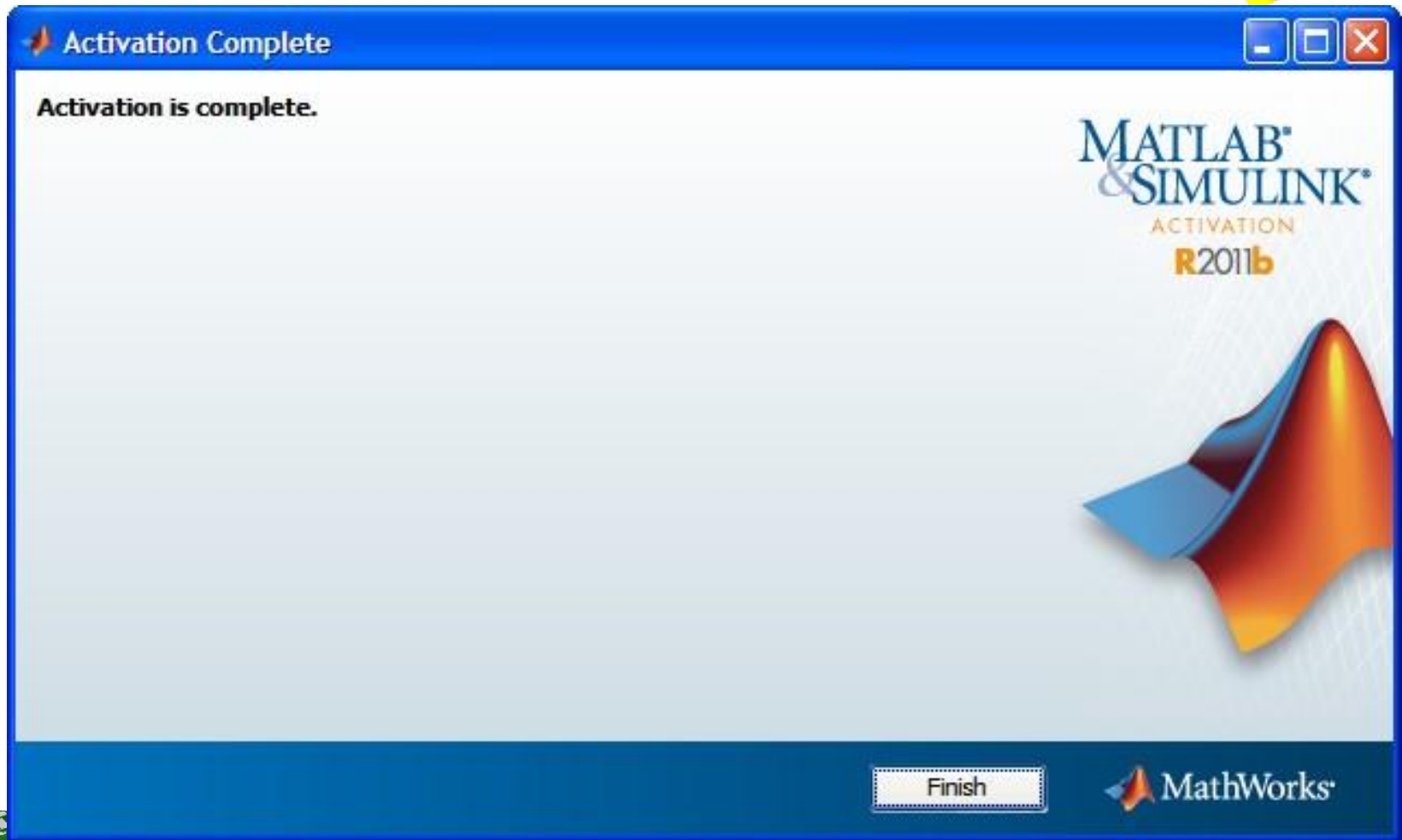
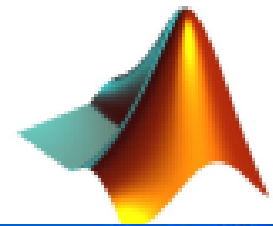
# How to Setup Matlab



# How to Setup Matlab



# How to Setup Matlab





# Why Matlab?

- **Matrix Laboratory**
- Created in late 1970's
- Intended for used in courses of matrix theory, linear algebra and numerical analysis
- Currently has grown into an interactive system and high level programming language for general scientific and technical computation



# Why Matlab?

## Common Uses for Matlab in Research

- Data Acquisition
- Multi-platform, Multi Format data importing
- Analysis Tools (Existing, Custom)
- Statistics
- Graphing
- Modeling



# Why Matlab?

## Data Acquisition

- A framework for bringing live, measured data into MATLAB using PC-compatible, plug-in data acquisition hardware



# Why Matlab?

## Statistical Analysis

- A considerable variety of statistical tests available including:
  - TTEST
  - Mann-Whitney Test
  - Rank Sum Test
  - ANOVAs
  - Linear Regressions
  - Curve Fitting

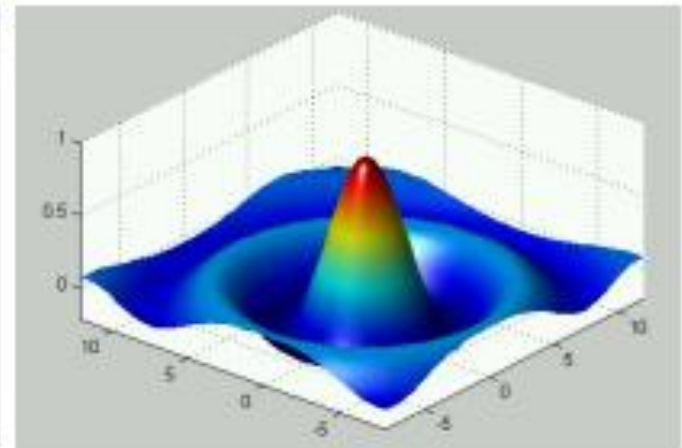
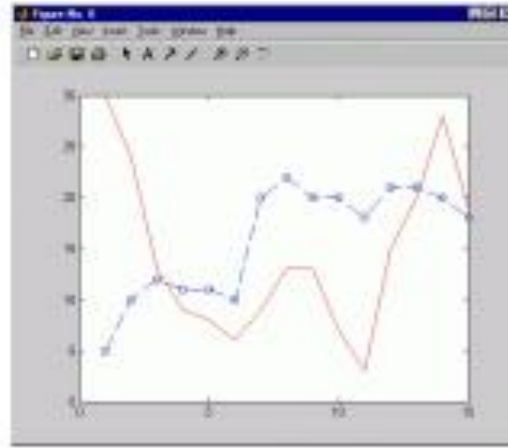
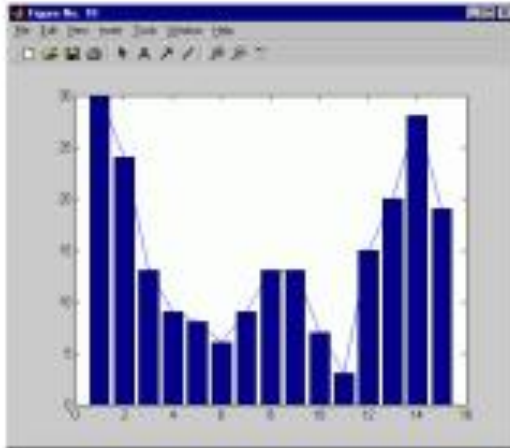




# Why Matlab?

## Graphing

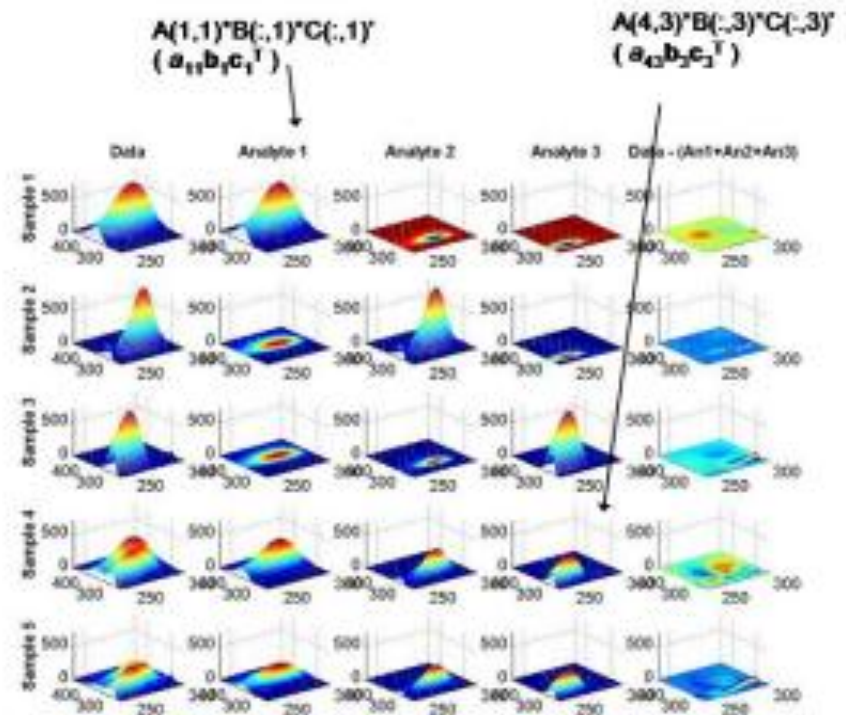
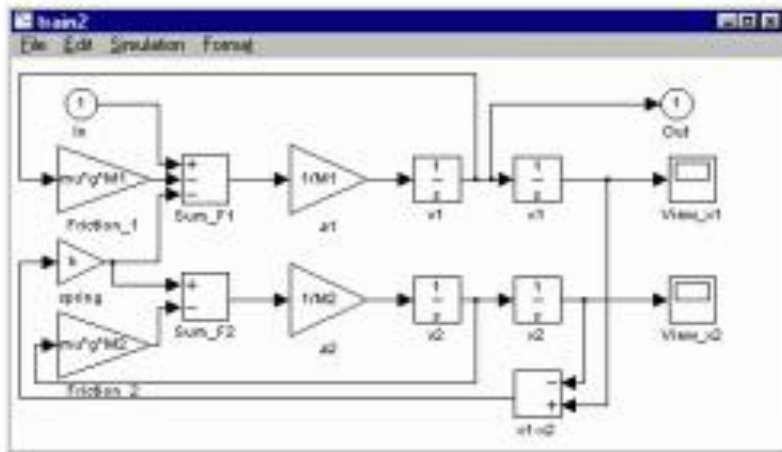
- A Comprehensive array of plotting options available from 2 to 4 dimensions
- Full control of formatting, axes, and other visual representational elements



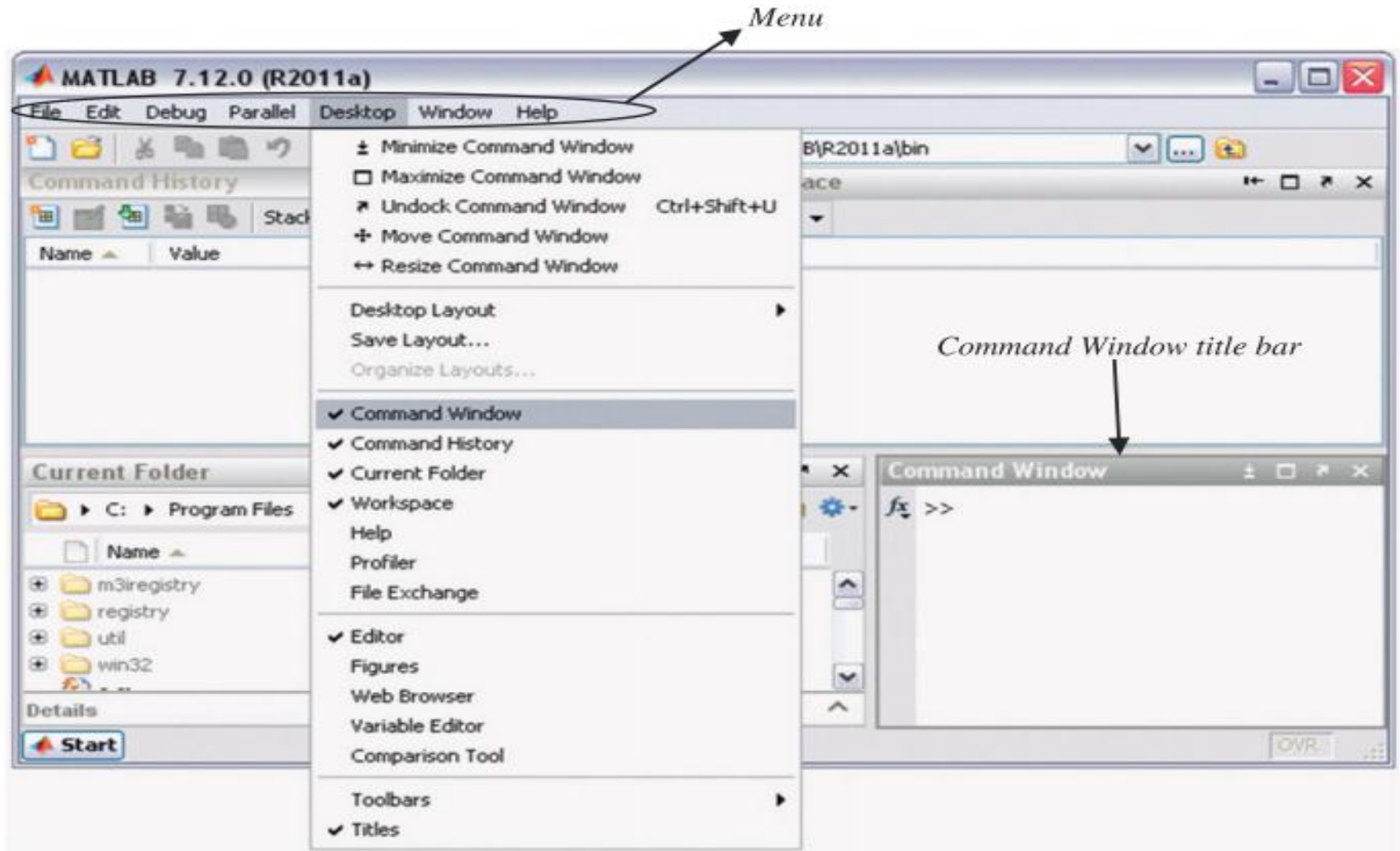
# Why Matlab?

## Modeling

- Models of complex dynamic system interactions can be designed to test experimental data

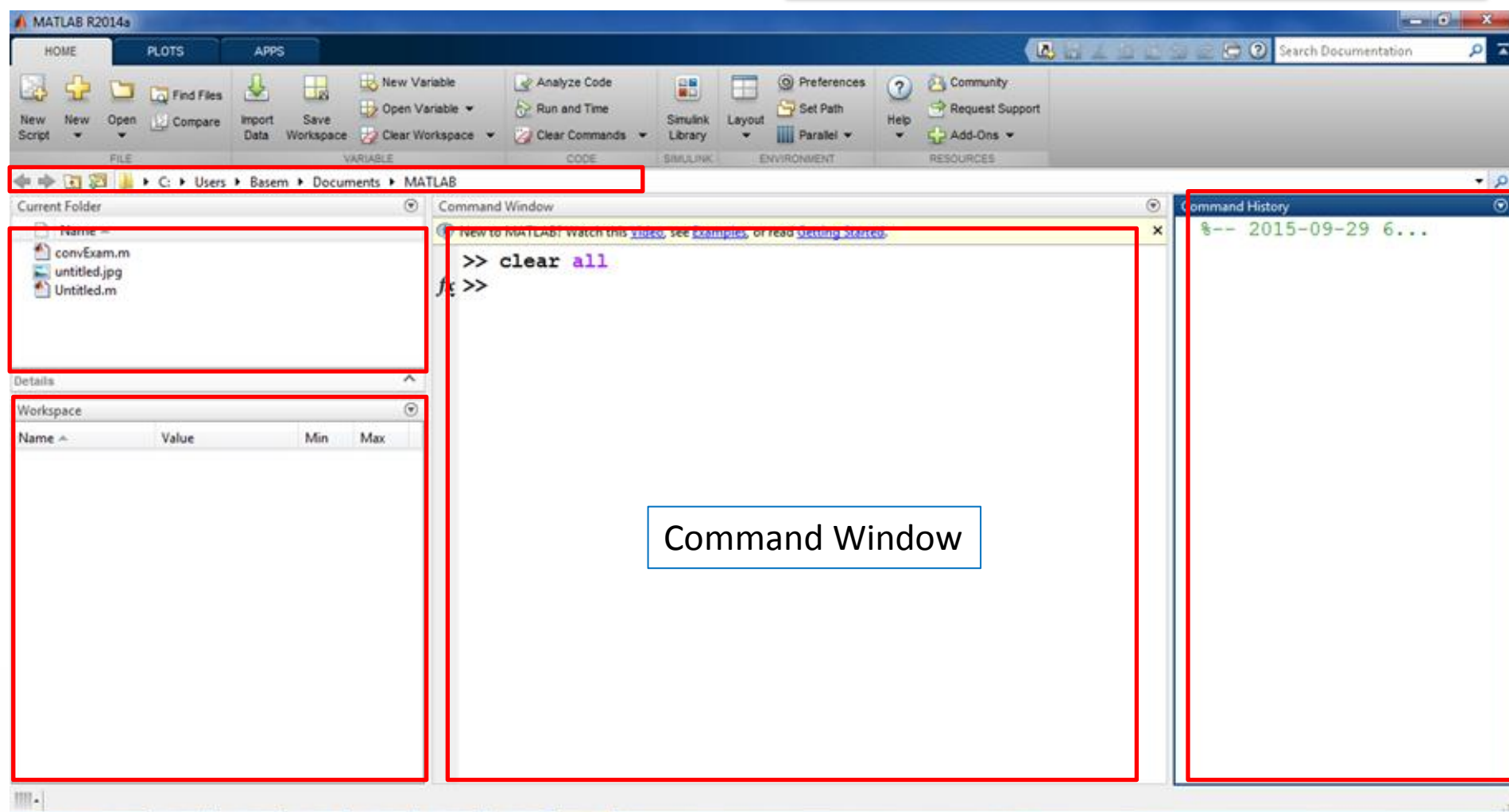


# 1 Matlab Integrated Development Environment



# 1 Matlab Integrated Development Environment

Matlab 2014



## 1.1.2 Creating Scalar Variables

- Matlab is a short name for Matrix laboratory.
- As the name indicates, Matlab is a matrix-based software package, which, in fact, considers the scalar variable to be a 1X1 matrix.
- A scalar here means a number such as “2” or “ - 100”

`>> x = 1;`

command prompt.      scalar variable  $x$       The semicolon “;”

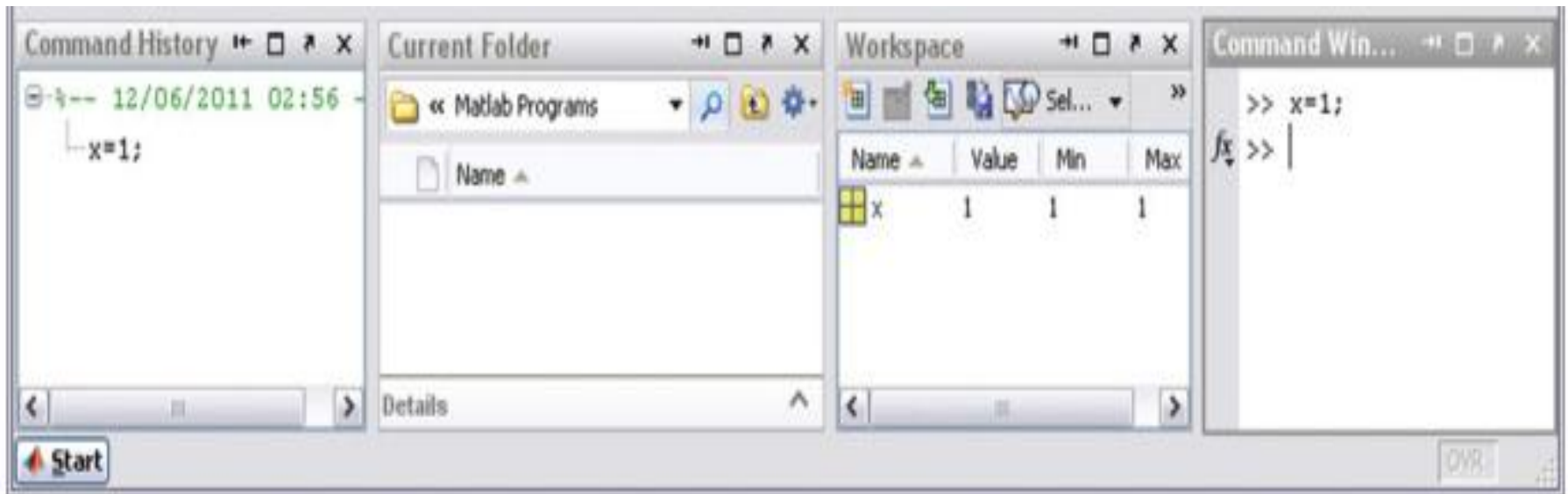
Note the changes that happened in the Command Window, the Command History, and the Workspace windows.

is used to direct Matlab not to display the value of the variable  $x$  in the Command Window.



## 1.1.2 Creating Scalar Variables

Note the changes that happened in the Command Window, the Command History, and the Workspace windows.



The screenshot displays the MATLAB interface with four windows open:

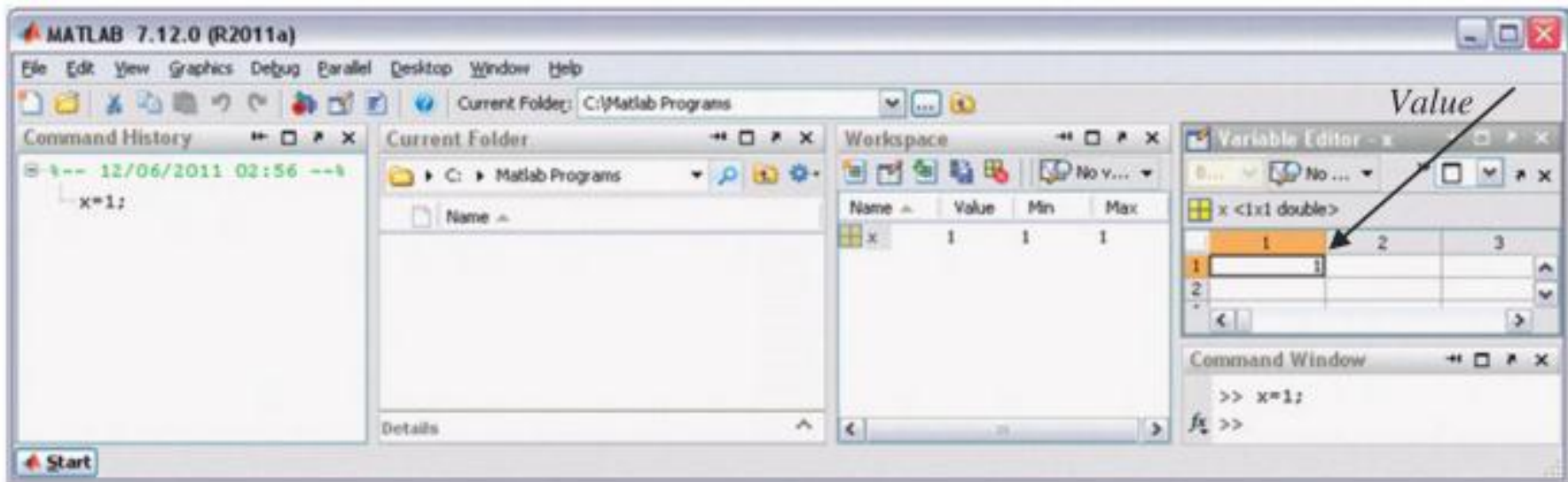
- Command History:** Shows the command `x=1;` entered at 12/06/2011 02:56.
- Current Folder:** Shows the current directory as `Matlab Programs`.
- Workspace:** Shows a table with the following data:

Name	Value	Min	Max
x	1	1	1
- Command Win...:** Shows the command `>> x=1;` entered in the Command Window.



## The Variable Editor

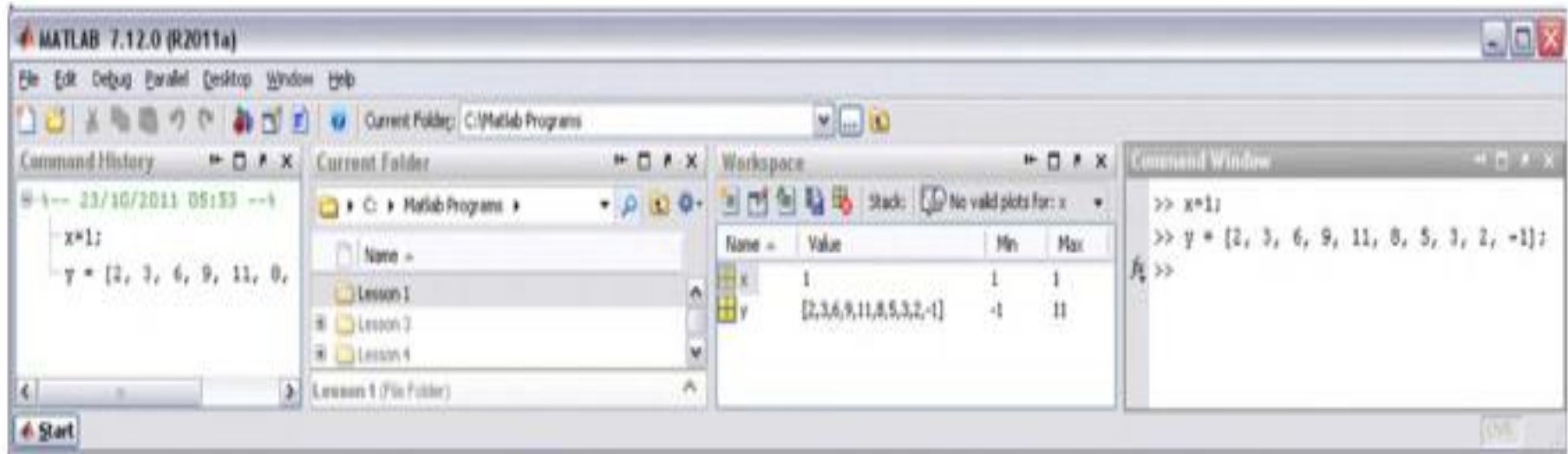
- Double-click the variable `x` in the Workspace.
- The Variable Editor pops up and shows the value of the variable.



# 1.1.3 Creating Vector Variables

To create a vector variable, type the Matlab command

```
>> y = [2,3,6,9,11,8,5,3,2,-1];
```



In order to draw the vector variable `y`,

- Right Click on the `y` variable in the workspace and plot(`y`).
- Or Left Click, then use “Plot” Tab to select



## 1.1.4 Creating Array Variables

To create an array variable, type the following Matlab command

```
>> Z = [1,2;3,4];
```

This command creates an array variable with the following values:

```
Z = [1 2  
     3 4]
```

➤ Right Click on the z variable in the and mesh(z)... Check the results



# 1.2 Matlab Script Files

## 1.2.1 Creating a Script File

- An M-file is a text file that contains a collection of commands that Matlab executes in a sequential order.
- A script file has the following properties:
  - It has no arguments (input data) and it does not return any values (outputs).
  - The commands executed in the script file have the same effect as if these commands were executed in the **Command Window**.
  - The variables created by the script file are displayed in the **Workspace** window.

- Suppose that we would like to create a script file that contains the following Matlab commands:

```
x = 1 ;  
y = 2 ;
```

create the script file





# 1.2 Matlab Script Files

## 1.2.2 Naming a Script File

Stupid Error Source ☹️

➤ The following restrictions must be taken into consideration when a script file is named:

- The file name must **not** contain spaces or hyphens (-).
- The file name **must** start with an alphabetical character (a–z or A–Z).
- The file name **must** contain only alphabetical characters (a–z or A–Z), numbers (1–9) or underscores ( \_ ).
- Punctuation characters such as commas ( , ) or apostrophes ( ' ) are not allowed, because many of them have special meanings in Matlab.
- The file name must be neither a **Matlab variable** nor an existing **Matlab function**.

Remember: It can be very helpful to use meaningful and descriptive file names.



# 1.2 Matlab Script Files

## 1.2.2 Naming a Script File

- The use of a **Matlab reserved word** as a file name is not allowed.
- A list of Matlab reserved words are given below:

'name'	'across_variable'
'node'	'build'
'output'	'description'
'parameter'	'descriptor'
'setup'	'element'
'signal'	'input'
'source'	'interface_input'
'terminal'	'interface_node'
'through_variable'	'interface_output'
'variable'	'item_type'
	'local_variable'

- The use of a **Matlab keyword** as a file name is not allowed.
- A list of Matlab keywords are given below.

'break'	'global'
'case'	'if'
'catch'	'otherwise'
'classdef'	'parfor'
'continue'	'persistent'
'else'	'return'
'elseif'	'spmd'
'end'	'switch'
'for'	'try'
'function'	'while'



# 1.2 Matlab Script Files

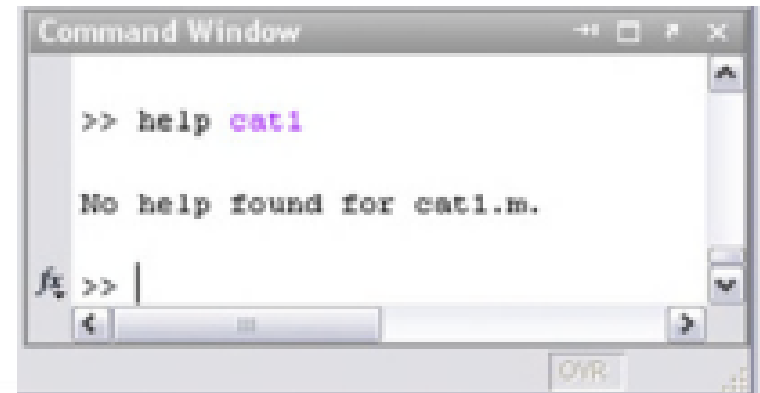
## 1.2.2 Naming a Script File

- To check that the file name you have chosen is not a Matlab keyword or a Matlab function, you can use Matlab help

```
>> help cat
```

Matlab responds and informs you that there is already a function called cat that concatenates arrays.

```
>> help cat1
```



# 1.2 Matlab Script Files

## 1.2.4 Executing a Script File

➤ There are two methods available for executing the script file

Method 1



2. The second method is to type the name of the M-file at the Command Prompt without the file extension.

```
>> cat1
```



# 1.2 Matlab Script Files

## 1.2.5 Matlab Code Readability

- It is good programming/engineering practice to produce Matlab programs that are tidy and well commented.
- This makes the code easier to understand, both for you and for others.

```
x = 6;  
y = 8;  
z = 25;  
a = 3;  
b = 2;  
c = 4;  
r = x * a + y * b + z * c
```

```
price_of_ruler = 6;  
price_of_rubber = 8;  
price_of_book = 25;  
No_of_rulers = 3;  
No_of_rubbers = 2;  
No_of_books = 4;  
Total_price_paid_by_Chris = ...  
    price_of_ruler * No_of_rulers + ...  
    price_of_rubber * No_of_rubbers + ...  
    price_of_book * No_of_books
```

Which version of the code do you think is easier to understand?

The continuation characters “...” at the end of the line makes the code continue onto the next line.



# 1.2 Matlab Script Files

## 1.2.6 Commenting Matlab Code

- You can add a comment to Matlab code by inserting a percentage sign “%” at the beginning of the line. For example:

```
% Chris bought three rulers, two rubbers, and four books.  
% The price of a ruler is d6. The price of a rubber is d8.  
% The price for a book is d25.  
% This Matlab program calculates the total price paid by  
% Chris.
```

- A more elaborate method for commenting code is performed by using **block commenting**.
- In this method, add the textual characters “%{” before the first line of the comments and add the characters “%}” after the last line of the comments.

```
%{  
Chris bought three rulers, two rubbers, and four books.  
The price of a ruler is £6. The price of a rubber is £8.  
The price for a book is £25. This Matlab program calculates the total  
price paid by Chris.  
%}
```