ECE 101 Exploring Electrical Engineering

- ***MATLAB***
- General Features
- Videos
- User Interface
- Expressions
- Data Types

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MATLAB is a technical computing program created by *The Mathworks, Inc*. (http://www.mathworks.com)

Features:

- Includes many operators and built-in functions
- Supports both numeric and symbolic solutions
- Operates on scalars, vectors, and matrices
- Can generate 2D and 3D graphs
- Extendable by add-ons and scripting (user programs)

For introduction to MATLAB use watch the following videos available at

http://www.mathworks.com/products/matlab/videos.html

- MATLAB overview (has cc):

http://www.mathworks.com/videos/matlab-overview-61923.html

- Getting started (no cc):

http://www.mathworks.com/videos/getting-started-with-matlab-68985.html

- Working in development environment (optional, no cc)

http://www.mathworks.com/videos/working-in-the-development-environment-69021.html

- Get help (no cc):

http://www.mathworks.com/videos/top-ways-to-get-help-89848.html

For introduction to MATLAB – use tutorials from Mathworks:

http://www.mathworks.com/academia/student_center/tutorials/mltutorial_launchpad.html

In particular: MATLAB Onramp. Question: is it available to all students or just those who purchased student version? Check. One problem – no cc but there is no voice / video – just assignments using online Matlab

Section 4.2 is video with no cc – this is on import tool; I may not need this … 4.1 is OK (just save and load)

https://matlabacademy.mathworks.com/R2015b/portal.html?course=gettingstarted#chapter=4&lesson=2&section=1

It looks decent …

Could start here https://matlabacademy.mathworks.com/R2015b/

For introduction to MATLAB – use tutorials from Mathworks:

5 – indexing into and modifying arrays – not really needed …

6 – array calculations – not needed

7 – calling functions – not needed

8.1 – video on help

9 – plotting vectors; 9.3 is video; nice but a bit much for 101 – needs cc

10 – project on plotting; don't use it. It's good for 102!

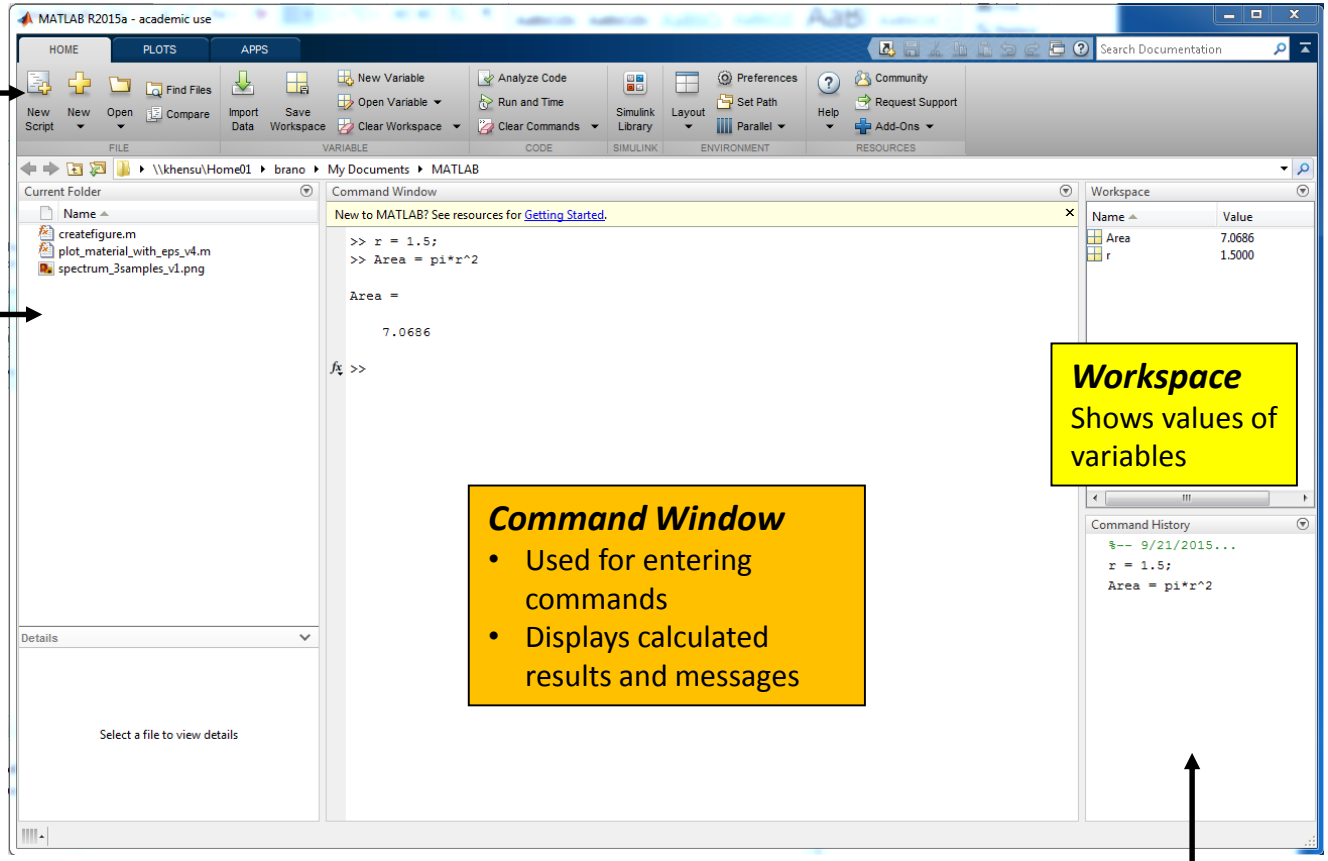
11 – Matlab editor 11.1 is video (no cc); this would be good for HW assignment …

https://matlabacademy.mathworks.com/R2015b/portal.html?course=gettingstarted#chapter=11&lesson=1&section=1

MATLAB User Interface (R2015a)

Ribbon
UI commands

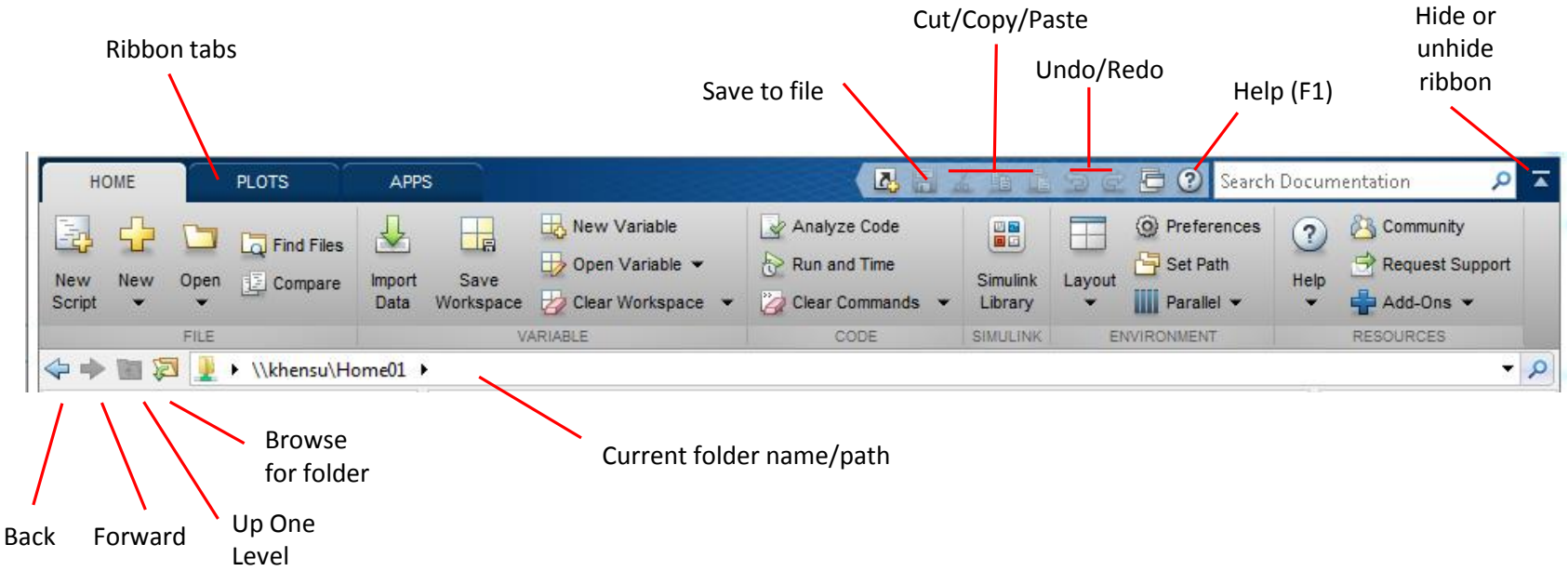
Current Folder
Shows files in the current folder (i.e., directory)

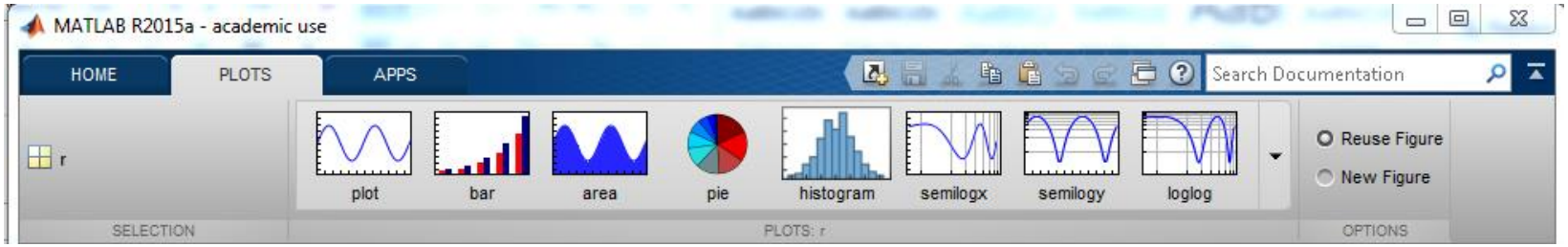


Command Window
- Used for entering commands
- Displays calculated results and messages

Workspace
Shows values of variables

Command History
Records a history of all entered commands


Ribbon tabs
Save to file
Cut/Copy/Paste
Undo/Redo
Help (F1)
Hide or unhide ribbon
HOME
PLOTS
APPS
Search Documentation
New Script
New
Open
Find Files
Compare
Import Data
Save Workspace
New Variable
Open Variable
Clear Workspace
Analyze Code
Run and Time
Clear Commands
Simulink Library
Layout
Preferences
Set Path
Parallel
Help
Community
Request Support
Add-Ons
FILE
VARIABLE
CODE
SIMULINK
ENVIRONMENT
RESOURCES
\\khensu\Home01
Browse for folder
Current folder name/path
Back
Forward
Up One Level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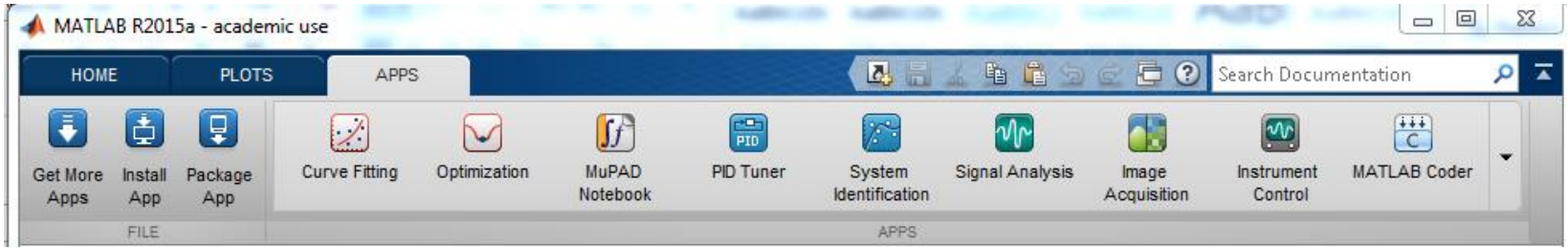
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Package App
Curve Fitting
Optimization
MuPAD Notebook
PID Tuner
System Identification
Signal Analysis
Image Acquisition
Instrument Control
MATLAB Coder
FILE
APPS

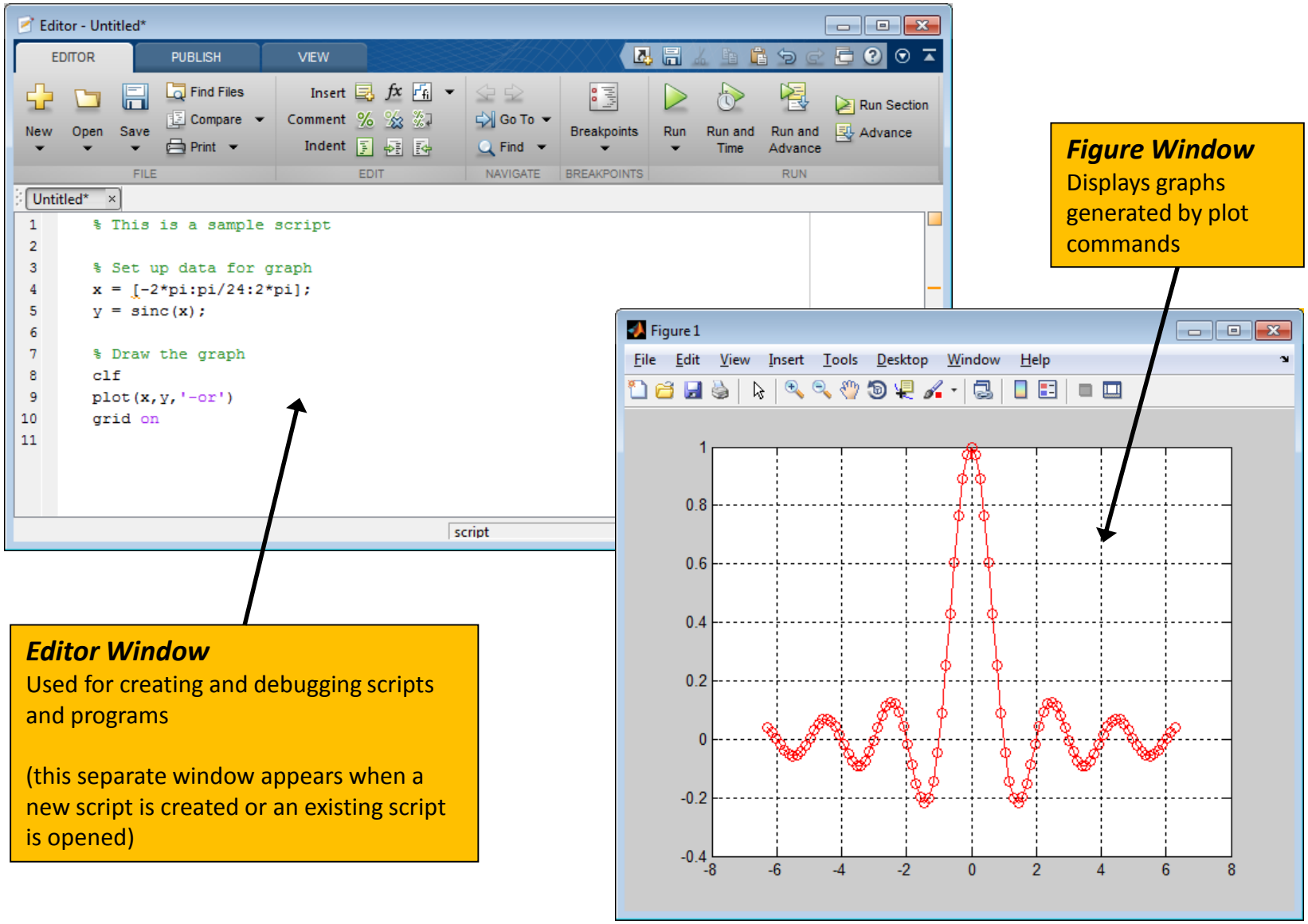

Figure Window
Displays graphs generated by plot commands

Editor Window
Used for creating and debugging scripts and programs

(this separate window appears when a new script is created or an existing script is opened)

Command Window Notes

- Definition → A "command" is:
  - an instruction that causes some action to occur
  - a mathematical expression that is evaluated
- Command prompt is: **>>**
- To interact with the Command Window:
  - Type a command at the prompt line and press the **`Enter`** key.
- Use the ↑ (up-arrow) key and the ↓ (down-arrow) key to recall previously typed commands.

- Entering a command automatically displays its associated output value (if any).

Example:

```
>> x = 2 * 1024
x =
          2048
>>
```

Command: multiply 1024 by 2 and save the result in variable **x**

Output: current value of **x**

- Appending a semicolon (;) at the end of a command will usually suppress the output.

Example:

```
>> x = 2 * 1024;
>>
```

Notice the semicolon at the end of this command

- Commonly used commands:

Command	Purpose
`clc`	Clears the command window
`help` *`name`*	Displays help information about a given command or function
`lookfor` *`key`*	Searches for and displays all commands related to a given keyword
`quit`	Shuts down and exits the MATLAB program *Alternatives:* Menu bar option: *File→Exit MATLAB* Keyboard shortcut: Ctrl+Q

Expressions

- Expressions are any valid combination of numbers, operators, functions, and variables.
- MATLAB can be used as a calculator by directly typing expressions in the command window.

- Predefined values:

Name	Description
`pi`	The number π
`inf`	Infinity
`i` or **`j`**	Defined as $\sqrt{-1}$
`NaN`	Not-A-Number

Standard Data Types

- Real numeric

  Example: `1` `5.23` `-83.5` `1.25e3`

  Use **`e`** for scientific notation (e.g., $3.1 \times 10^{-2} \rightarrow$ **`3.1e-2`**)

- Imaginary numeric

  Example: `i` `2i` `-3.5i` `5e2j`

  MATLAB accepts both **`i`** and **`j`** for imaginary

- Complex numeric

  Example: `1+i` `5.23+2i` `-83.5-3.5i`

- Character – single text letter, number, or symbol

  Example: **`'A'`** **`'z'`** **`'3'`** **`'$'`**

  - Use a pair of single quotes to define a character.

    Note: The numeric value 3 is not the same as the character value **`'3'`**.

  - Each character is associated with a unique numeric code. This is the collating sequence.

- String – collection of one or more characters

  Example: **`'x'`** **`'MATLAB'`** **`'rooms 4 rent!'`**

- Examples of commands and functions you will use in ECE 101:
- Generate a vector with angles from 0 to 90 degrees, in increments of 10 degrees:

x = [0, 10, 20, 30, 40, 50, 60, 70, 80, 90]

Find sin of series of values stored in a vector

Y = sind(x)

Note: sin() operates on angles in radians while sind() operates on angles in degrees

Other trig functions: cos, cosd, tan, tand and inverses.

- Examples of commands and functions you will use in ECE 101:
- Generate a vector with values from 0 to 10 degrees, in increments of 1:

x = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

```
Find exponent e^{x} of series of values
  stored in a vector
z = exp(x)
Find a natural log of z
Zlog = log(z)
Find a log10 (logarithm with base 10)
Zlog = log10(z)
```