

# Computer Applications for Engineers

## ET 601

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**MATLAB Fundamentals: Academic Tutorial**



**Office Hours: (BKD 3601-7)**

**Wednesday 9:30-11:30**

**Wednesday 16:00-17:00**

**Thursday 14:40-16:00**

# MATLAB Fundamentals: Academic Tutorial

The screenshot displays the MATLAB Fundamentals Academic Tutorial interface within a Mozilla Firefox browser window. The browser's address bar shows the URL: [https://www.mathworks.com/academia/student\\_center/tutorials/player/player/content/CoursePlayer.html](https://www.mathworks.com/academia/student_center/tutorials/player/player/content/CoursePlayer.html). The page header includes the MathWorks logo and "Training Services" on the left, and "MATLAB® Fundamentals Academic Tutorial" in the center. On the right, there are navigation buttons for "Home" (www.mathworks.com), "Resources", and "Help".

The main content area is titled "MATLAB R2012b" and features a navigation bar with "HOME", "PLOTS", "APPS", and "SHORTCUTS". Below this is a search bar for "Search Documentation". The interface is divided into several panels:

- Left Sidebar:** Contains a table of contents for "Working with the MATLAB® User Interface". The items are: Introduction (checked), The MATLAB Desktop (expanded), The MATLAB Desktop (selected), Quiz, Importing Data into MATLAB, Exploring Data in MATLAB, Saving and Loading Variables, Visualizing Data, Formatting Plots, Data Analysis Tools, and Export to Another Application.
- Current Folder:** Shows a file explorer view of the "C:\class\work" directory, listing files: gasprices.mat, gasprices.csv, and gasprices.xls.
- Command Window:** Displays the MATLAB command prompt with the following text:

```
>> x = 5  
  
x =  
  
5  
  
f1 >>
```
- Workspace:** A table showing the current workspace variables:

Name	Value
x	5
- Command History:** Shows the execution history, including the timestamp "11/11/13 2:48 PM" and the command "x = 5".

The bottom of the browser window shows the Windows taskbar with the Zotero application icon and system tray icons.

# MATLAB Fundamentals: Academic Tutorial

MathWorks | Training Services

MATLAB® Fundamentals Academic Tutorial

Home www.mathworks.com  
Resources Help

**01 Introduction**  
10 minutes - Not started

02 Working with the MATLAB® User Interface  
55 minutes - Not started

03 Variables and Expressions  
60 minutes - Not started

04 Analysis and Visualization with Vectors  
60 minutes - Not started

05 Analysis and Visualization with Matrices  
45 minutes - Not started

06 Automating Commands with Scripts  
50 minutes - Not started

07 Working with Data Files

### Introduction

This chapter provides the course learning objectives and describes the e-learning environment you will use.

**Objectives:**

- Navigate the e-learning environment

Start Chapter from Beginning or Continue by Individual lesson

Lesson	Duration	Completed
Course introduction	5 mins	<input type="checkbox"/>
Course software and examples	5 mins	<input type="checkbox"/>

#### Academic Tutorial Information

The Academic Tutorial teaches the basic skills required to become a successful MATLAB user in an academic setting. The Academic Tutorial is composed of a subset of a larger and more comprehensive [MATLAB Fundamentals course](#).

The lessons that appear dimmed are offered in the full MATLAB Fundamentals course, which is available to students, researchers, and professors for \$200 and builds on the skills taught throughout the Academic Tutorial. The lessons available in the Academic Tutorial are intended to be taken sequentially.

# MATLAB Fundamentals: Academic Tutorial

## ET601: Computer Applications for Engineers

### Synopsis

This course introduces engineers to the practical aspects of constructing computerized simulation studies to analyze and interpret real phenomena. This course explains how a computer can be used to generate random numbers, and how to use these random numbers to generate the behavior of a stochastic model over time. It presents the statistics needed to analyze simulated data as well as that needed for validating the simulation model.

### Announcements

- Welcome to ET601! Feel free to look around this site.

### General Information

- **Instructor:** Asst. Prof. Dr.Prapun Suksompong ( [prapun@siit.tu.ac.th](mailto:prapun@siit.tu.ac.th) )
  - Office: BKD3601-7
  - Office Hour:
    - TBA
- **Course Syllabus** [To be posted in the second week]
- **Textbook:** [Ross] [Simulation, 5th edition](#) by S. M. Ross. Academic Press, 2012
- **References**
  - [Simulation, 4th edition](#) by S. M. Ross. Elsevier, 2006: Call No. QA273 R82 2006
  - [MFAT] [MATLAB Fundamentals: Academic Tutorial](#) (Interactive MATLAB Tutorials)
  - [MATLAB Primer, 8th edition](#) by T. A. Davis. CRC Press, 2010.
    - Seventh Edition by T. A. Davis and K. Sigmon: Call No. QA297 D38 2005
    - [Third Edition](#) by K. Sigmon (Free)
    - [Second Edition](#) by K. Sigmon (Free)
  - [Introduction to Probability](#) by Charles M. Grinstead and J. Laurie Snell (Free)

The screenshot shows the MathWorks website interface. At the top, the MathWorks logo is followed by the tagline "Accelerating the pace of engineering and science". Below this is a navigation bar with links for "Products & Services", "Solutions", "Academia", "Support", "User Community", "Events", and "Co". The main content area is titled "Tutorials" and features a section for "MATLAB Tutorials" with the sub-heading "Get started learning MATLAB". Underneath, there are two columns of video thumbnails. The first column includes "Getting Started with MATLAB 5:06" and "Writing a MATLAB Program 4:57". Below the videos is a "Code Examples" section with the text "Start with existing MATLAB code to perform specific tasks" and a list of examples: "Manipulating Multidimensional Arrays in MATLAB", "Signal Generation and Visualization", and "Detect and Measure Circular Objects in an Image". To the right, there is a "Webinars" section with a list of topics: "Introduction to MATLAB", "MATLAB for C/C++ P", "MATLAB for Excel Users", and "Mathematical Modelin". At the bottom of the page, there is a "MATLAB Tutorial, Designed for Students (3 hours)" section with the text "Learn the basic skills for your next class assignment or project." and a "Launch tutorial" button. A green arrow points to the "Launch tutorial" button.

# 2 Working with the MATLAB user Interface (1/2)

- The MATLAB Desktop
  - Command Window, Workspace, Command History
  - Selecting layout, Default layout
- Importing Data into MATLAB
  - Current Folder
  - Open as Text, Open outside MATLAB,
  - Import DATA..., Import Tool, csv files
    - Blue cell vs. yellow cell (un-importable cells, replacement rule, NaN)
    - Column vectors, Matrix
    - Partial selection to import subset of data

# 2 Working with the MATLAB user Interface (2/2)

- Exploring Data in MATLAB
  - Variables in Workspace, Showing more attributes
  - Class (Type): Double
  - Variable Editor, Tiles, New from Selection
- Saving and Loading Variables: Save / Clear / Load Workspace, .mat file
- Visualizing Data: **Plotting** Data, Plotting one variable against another, CTRL-Click, Plot as multiple line series
- **Formatting Plots**
  - Plot Tools, Property Editor
  - Multiple Plots, Data Source, (Insert) Label, Legend, Title
- Data Analysis Tools: Basic Fitting, Linear Fit, Show equations,

# 3 Variables and Expressions (1/3)

- MATLAB commands
  - Command Execution
  - **Command History, Up & Down Keys, pi**
  - Saving and Loading .mat files, save, load
  - Lifetime of variables, **clear**
- Assignment
  - Double: 64-bit precision (8-byte)
  - Assignment operator (=)
  - Variable names
    - are case sensitive
    - can only contain letters, numbers, underscore (\_)
    - can only start with a letter

# 3 Variables and Expressions (2/3)

- Vectors and Matrices
  - Vector: one-dimensional array
    - Square brackets [] concatenate values
    - **Comma** (or space) separated values create row vector
    - **Semicolon** separated values create column vector
    - Equally-spaced vectors: **colon operator** ( $a : dx : b$ ), **linspace** ( $a, b, n$ ), transpose operator (single quote mark)
    - Use semicolon at the end to suppress the output in the Command Window
  - Creating Matrices
    - Square brackets [] concatenate values
    - Commas (,) or spaces ( ) separate columns
    - Semicolons (;) separate rows
    - Consistent dimensions
  - Matrix Creation Functions
    - **rand, randn, zeros**



# 3 Variables and Expressions (3/3)

- Help and Documentation: `doc`, function browser, help browser
- Row, Column Indexing, `end`, Multiple Indices, colon operator
- Concatenation, Matrix completion with `NaN`
- Characters and Strings
  - Single quotation marks, char class
  - `save` command with function syntax

# 4 Analysis and Visualization with Vectors

- Statistical Functions: `min`, `max`, `mean`, `sort`
  - The use of square brackets to obtain multiple output arguments
- Array Operations
  - Element-by-element operations: addition
  - Scalar Expansion: multiplication, addition, division by a scalar
    - Deviation from the mean
- Mathematical Operations
  - Element-wise operator: `sin`, `round`
  - Rounding number to a nearest tenth: `round(10*x)/10`
- Plotting
  - Plotting Vectors, Plot Options
  - Annotating Plots: `title`, `xlabel`, `ylabel`, `legend`

# 5 Analysis and Visualization with Matrices

- Matrix Multiplication:
  - Elementwise (`.` `*`) vs. (mathematical) matrix multiplication
  - Elementwise operation: `+`, `-`, `.` `*`, `.` `/`, `.` `^`
  - Weighted average
- Function Behavior
  - Functions that treat a matrix as a single mathematical entity and apply to each element individually: `round`, `sin`, `floor`
  - Functions (e.g., many statistical functions) that treat a matrix as a collection of vectors and apply to each column individually: `mean`, `max`, `min`, `std`, `sum`
- Plotting Matrices
  - `plot` function also treats matrix as a collection of vectors.
  - `legend`

# 6 Automating Commands with Scripts

- clear, close all, clc
- soundsc
- MATLAB Scripts: `edit`
  - Selecting commands from the command history window
  - `.m` extension
- Comments: `%`
- Cells: `%%`
  - Create section, can execute individual section separately