Computer Applications for Engineers
ET 601

Asst. Prof. Dr. Prapun Suksompong

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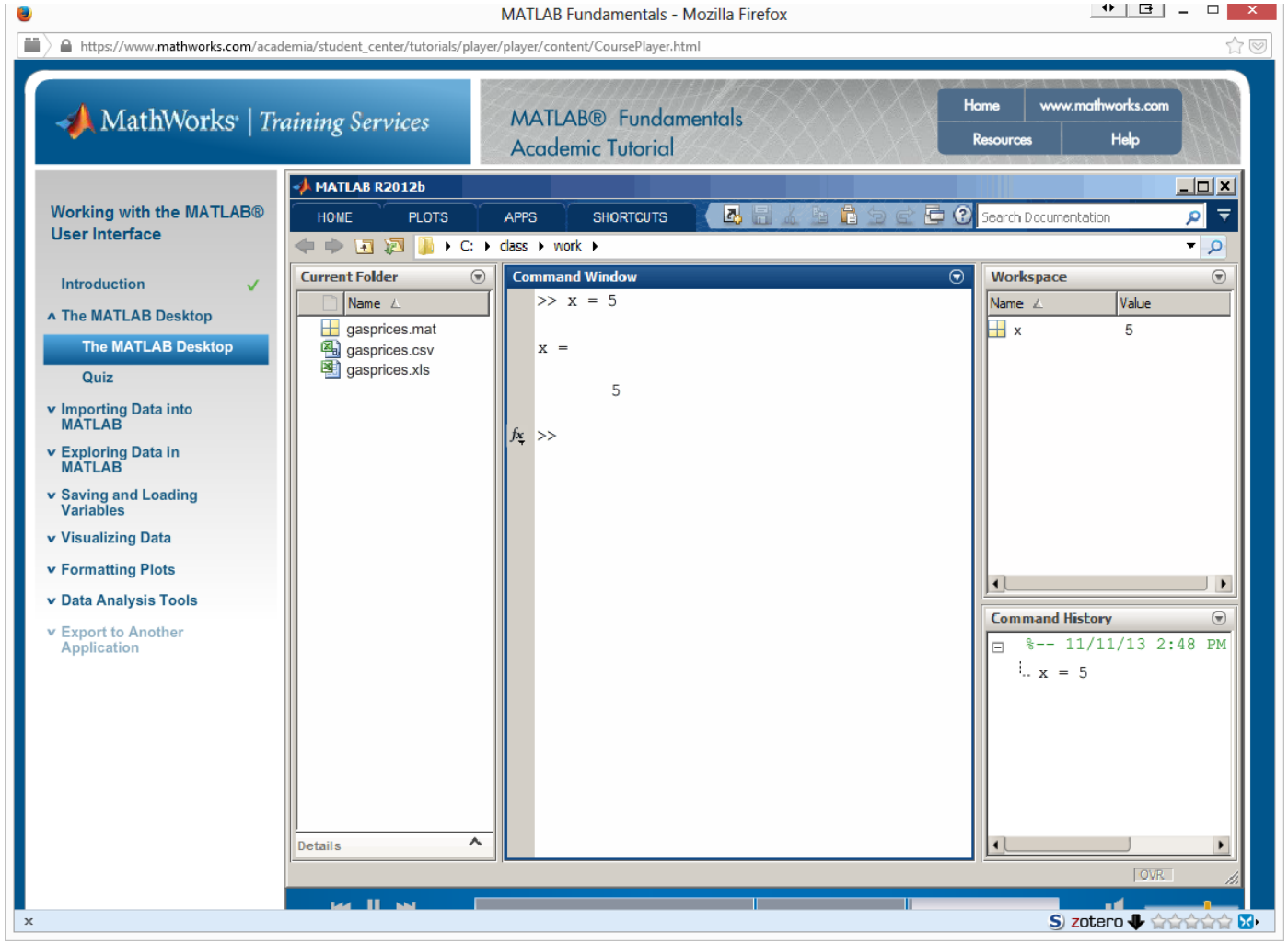
MATLAB Fundamentals: Academic Tutorial

Office Hours: (BKD 3601-7)
Wednesday 9:30-11:30
Wednesday 16:00-17:00
Thursday 14:40-16:00

MATLAB Fundamentals: Academic Tutorial



MATLAB Fundamentals: Academic Tutorial

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ET601: Computer Applications for Engineers

Synopsis

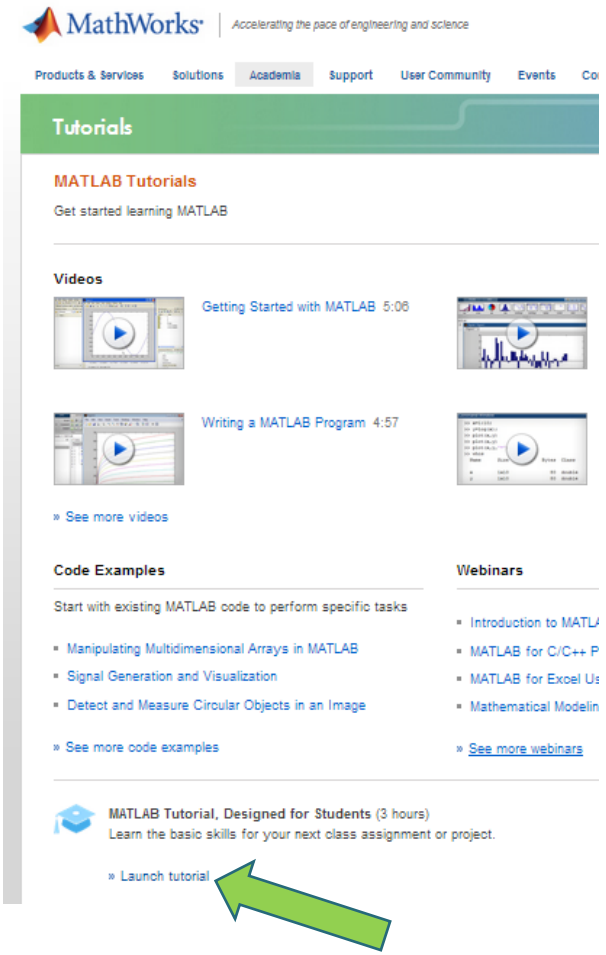
This course introduces engineers to the practical aspects of constructing computerized simulation studies to analyze and interpret real phenomena. This course explains how a computer can be used to generate random numbers, and how to use these random numbers to generate the behavior of a stochastic model 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)
  - 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)



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 quations,

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