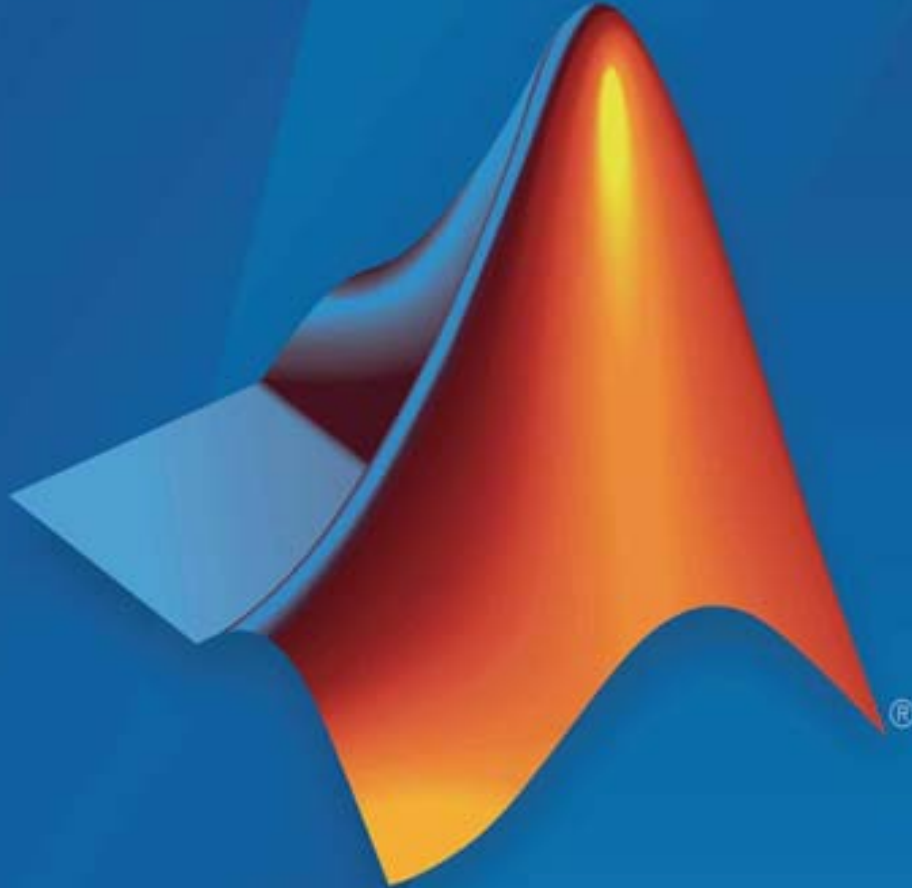


الجامعة المستنصرية
كلية الهندسة
قسم هندسة الموارد المائية



Lecture 1: Introduction to MATLAB

المحاضرة الاولى: مقدمة في الماتلاب

المنهاج الدراسي لمادة البرمجه والتطبيقات (ماتلاب)
الكورس الدراسي الاول / المرحلة الثانية

من اعداد د. صباح حسن لفته

1. Introduction:

What is MATLAB?

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming within an easy-to-use environment in which problems and solutions are expressed in familiar mathematical notation.

Typical uses include:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This permits you to solve many technical computing issues, especially those with matrix and vector formulations, in a fraction of the time that it would have to write an application in a scalar noninteractive language like C or Fortran. The MATLAB was originally written to give easy access to matrix software developed by the LINPACK and EISPACK projects and first version issued was in 1984, which collectively represent the innovative in applications for matrix computation. Currently, MathWorks is the company that responsible to develop and issue the program every year. <https://www.mathworks.com/>

MATLAB has been developed over a span of years with input from several users. In universities environments, it is the standard instructional tool for introductory and advanced classes in math, engineering, and science. In business, MATLAB is the tool of choice to high-productivity analysis, creation, and evaluation. MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many other applications.

2. The MATLAB System

The MATLAB system consists of five main parts:

a-The MATLAB Language.

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and short programs, and "programming in the large" to create complete large and complex application programs.

b-Handle Graphics.

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete Graphical User Interfaces on your MATLAB applications.

c-The MATLAB Mathematical Function Library.

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

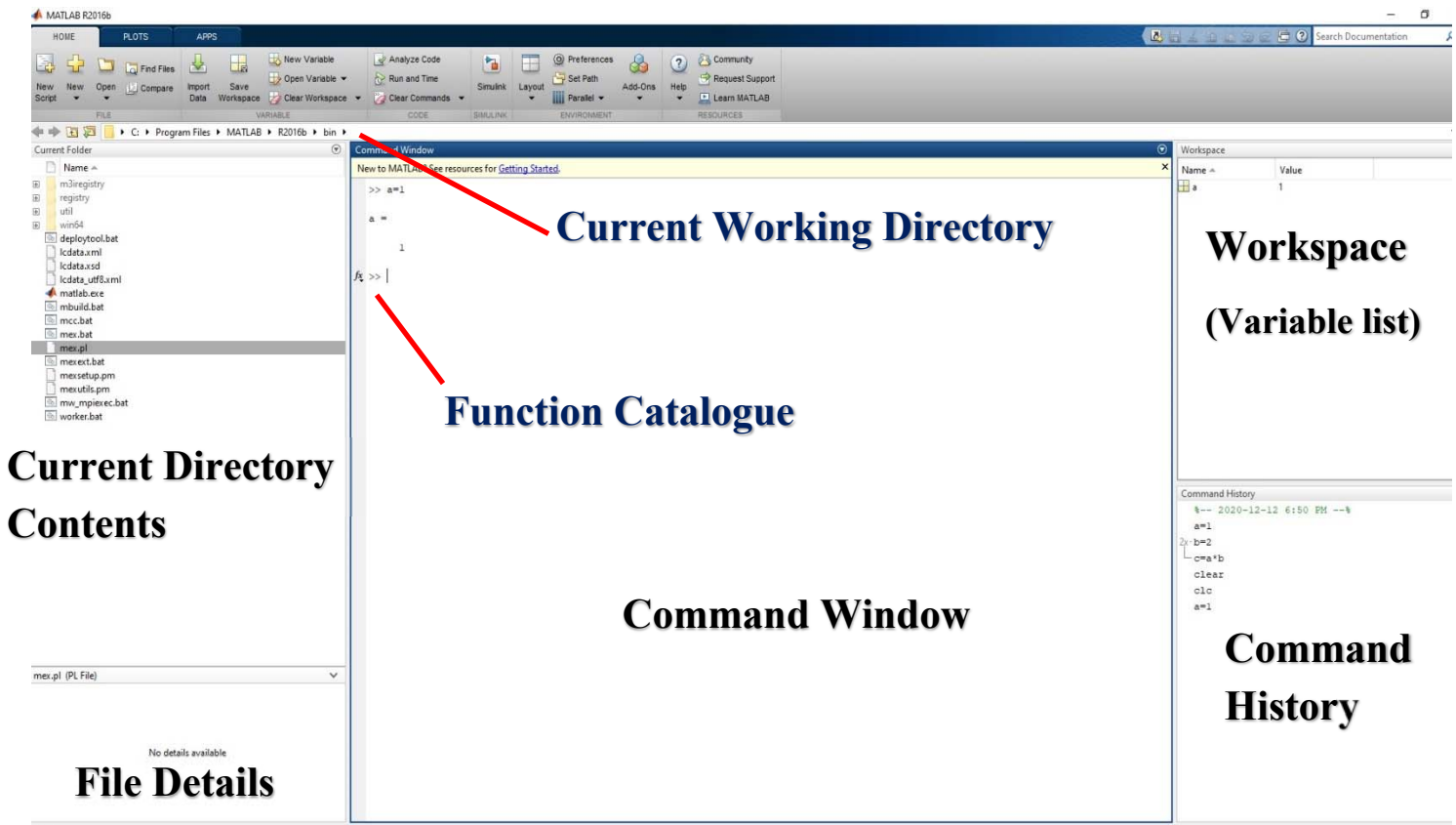
d-The MATLAB Application Program Interface (API).

This is a library that allows you to write C and Fortran programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

e-The MATLAB Working Environment.


This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, profiling M-files, and MATLAB's applications. See following picture which shows a typical work environment of MATLAB.

Typical MATLAB Work Environment



Running MATLAB Program:

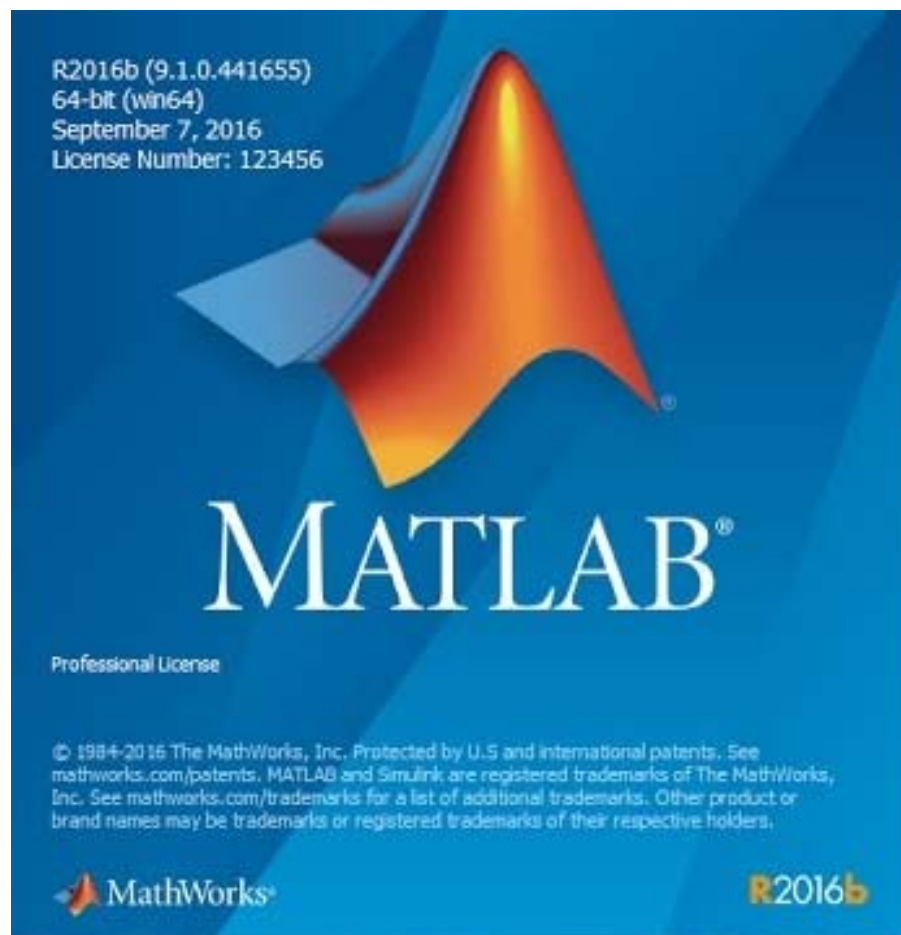
There are two different methods to run MATLAB:

1- After the installation of MATLAB on your PC you will see an icon added to desktop which has following shape  and this use to open MATLAB by double click using left mouse button

2- The second way is by open Start menu and from Programs you will see the icon of MATLAB by click it once time, the program will open.

start → Programs → MATLAB

Then a screen will appear having the name of MATLAB with version information including the issue year as shown below.



After a few seconds, the main MATLAB screen appear like the one shown above (MATLAB work environment).

MATLAB Window Components

Main MATLAB window consists of the following:

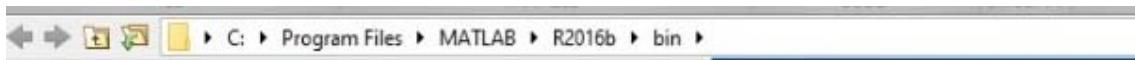
- 1- Address bar came with a unique colour in comparison with other bars and can be located on the left of the MATLAB icon



- 2- Three main taps which are Home, Plots, and Apps



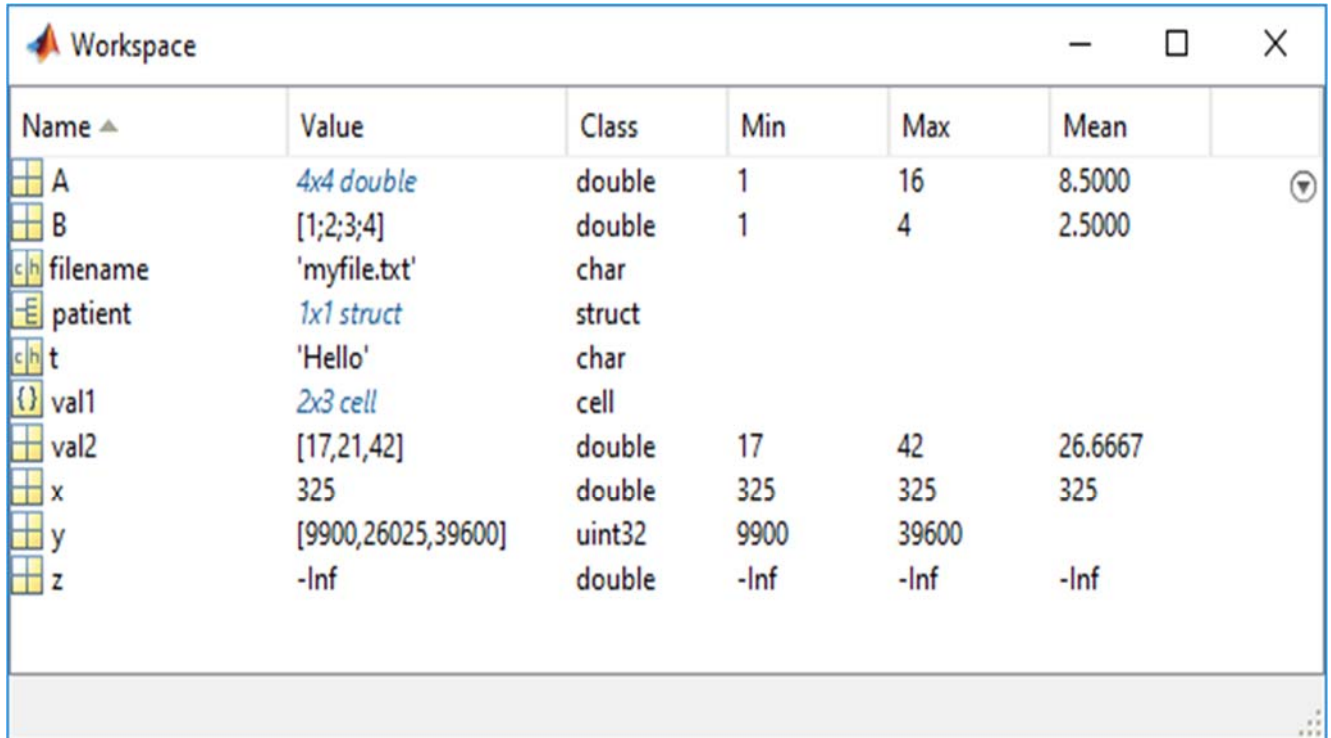
- 3- Each of the above tab includes tool bars that are designed to perform specific tasks. Under these tool bars there is an important part called current directory, this tells the user at which part of the PC the files of MATLAB is exist as shown in the below picture.



- 4- The MATLAB work environment window that appears in previous picture are parts of the main MATLAB program, each window has a unique function as follow:

- a- **Command Window:** it a very important window and uses primary to write and execute statements, also uses to display results after execution of statements which writes after the mark (`>>`).

b- **Workspace:** this is a user graphic window allows to user to load and save variables of MATLAB in which a menu appear contains the name of the variable, its size, and data volume (all MATLAB variables consider of matrices category) as shown below



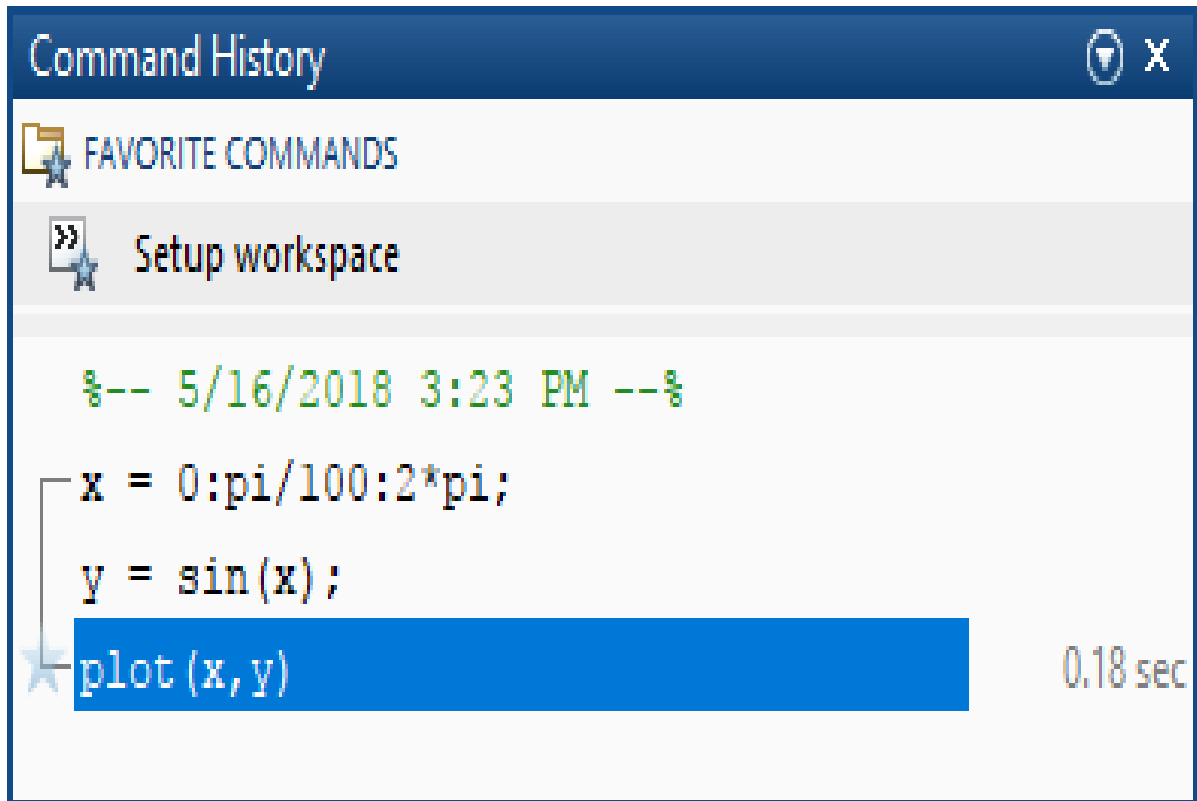
The screenshot shows the MATLAB Workspace window with a table of variables. The table has columns for Name, Value, Class, Min, Max, and Mean. The variables listed are A, B, filename, patient, t, val1, val2, x, y, and z.

Name	Value	Class	Min	Max	Mean
A	4x4 double	double	1	16	8.5000
B	[1;2;3;4]	double	1	4	2.5000
filename	'myfile.txt'	char			
patient	1x1 struct	struct			
t	'Hello'	char			
val1	2x3 cell	cell			
val2	[17,21,42]	double	17	42	26.6667
x	325	double	325	325	325
y	[9900,26025,39600]	uint32	9900	39600	
z	-Inf	double	-Inf	-Inf	-Inf

c- **Current directory window** which is also a graphic window contains the file that MATLAB deals with.

d- **Help window**, this is a graphic window allows user to search and display the documents directly.

- e- **Command History window**, this window allows user to execute previous orders which has been done in the Command Window with out need to rewrite them as shown in the below picture.



Notes:

- 1- Each variable in MATLAB is considered as a matrix in which MATLAB language is directed by matrices even the variables are scalar quantities.
- 2- The statement **Clear under Workspace** is used to erase all variables and Functions from the memory of MATLAB.
- 3- The statement **clc under Workspace** is used to clear Command Window.
- 4- The numerical results can be displayed in MATLAB in different formats:
Format short, long, short e, long e, hex, blank, +
- 5- Leaving three points (...) and space at the end of each line means the continuity of the statement to the next line.
- 6- Semi colon (;) after the statement preventing from printing the variable or the results in the Command Window and in Editor Window.
- 7- Using percentage symbol (%) at the beginning of the line means this line is a comment and not statement.
- 8- MATLAB files called M-files and its extension (.m) for example (sample.m).
- 9- Using up and down arrows of the keyboard to navigate previous executed statements in the Command Window.
- 10- The Editor window is helpful to write program in MATLAB.
- 11- To calculate the execution time of statements in MATLAB, the statements (tic) and (toc) are used before and after the statements.