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Third stage   2018-2019   Education college
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Lecture 1

1. What is Matlab?

Matlab stands for Matrix Laboratory. It is a special programming and interpreter language that makes it possible to perform exploratory numerical calculations with a lot of built-in mathematical support (for example, matrix diagonalization, optimization, solving differential equations).

The MATLAB platform is optimized for solving engineering and scientific problems. The matrix-based MATLAB language is the world's most natural way to express computational mathematics. Built-in **graphics** make it easy to visualize and gain insights from data. A vast library of pre-built toolboxes lets you get started right away with algorithms essential to your domain. The desktop environment invites experimentation, exploration, and discovery. These MATLAB tools and capabilities are all rigorously tested and designed to work together.

MATLAB is an interpreter. This means that we can get an intermediate answer after every single step. Normally in computer languages like C or Pascal we must have a whole program ready before we can get an answer. In that sense MATLAB is working

like a good debugger which makes it possible for us to build the code in small steps and check our progress continuously as the project progresses.

As an interpreter we can do calculator-like calculations in MATLAB in the same ease as on true calculator.

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2. Key Features

• High-level language for scientific and engineering computing.

• Desktop environment tuned for iterative exploration, design, and problem-solving.

• Graphics for visualizing data and tools for creating custom plots.

• Apps for curve fitting, data classification, signal analysis, control system tuning, and many other tasks.

• Add-on toolboxes for a wide range of engineering and scientific applications.

• Tools for building applications with custom user interfaces.

• Interfaces to C/C++, Java®, .NET, Python, SQL, Hadoop, and Microsoft® Excel®.

3. Desktop Basics

When you start MATLAB, the desktop appears in its default layout.
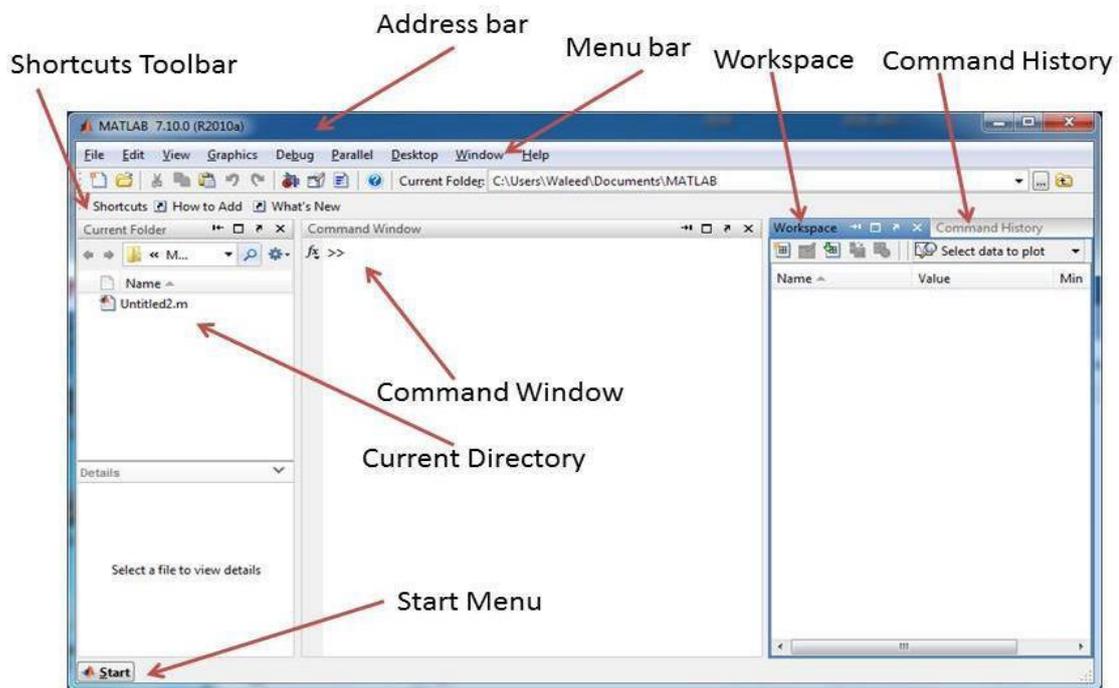
The desktop includes these panels:

• **Current Folder** — Access your files.
• **Command Window** — Enter commands at the command line, indicated by the prompt(>>).
• **Workspace** — Explore data that you create or import from files

- **Command History** - This panel shows or rerun commands that are entered at the command line.
- **Start menu**

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4. Basic Syntax

MATLAB environment behaves like a super-complex calculator. You can enter commands at the >> command prompt.
MATLAB is an interpreted environment. In other words, you give a command and MATLAB executes it right away.

Type a valid expression, **for example**,
>> 5 + 5

And press ENTER
When you click the Execute button, or type F5, MATLAB executes it immediately and the result returned is:

>> ans = 10
Let us take up few more examples:
>> 3 ^ 2   % 3 raised to the power of 2

When you click the Execute button, or type F5, MATLAB executes it immediately and the result returned is:
>> ans = 9

Another example,

>> sin(pi /2)   % sine of angle 90o
When you click the Execute button, or type F5, MATLAB executes it immediately and the result returned is:
>> ans = 1

5. Use of Semicolon (;) in MATLAB

Semicolon (;) indicates end of statement. However, if you want to suppress and hide the MATLAB output for an expression, add a semicolon after the expression.
For example,
>>x = 3;
>>y = x + 5
When you click the Execute button, or type F5, MATLAB executes it immediately and the result returned is:
>>y = 8

6. Adding Comments

The percent symbol (%) is used for indicating a comment line.

For example,

x = 9   % assign the value 9 to x

You can also write a block of comments using the block comment operators % { and % }.
The MATLAB editor includes tools and context menu items to help you add, remove, or change the format of comments.

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7. Commonly used Operators and Special Characters

MATLAB supports the following commonly used operators and special characters:

Operator	Purpose
+	Plus; addition operator.
-	Minus; subtraction operator.
*	Scalar and matrix multiplication operator.
.*	Array multiplication operator.
^	Scalar and matrix exponentiation operator.
.^	Array exponentiation operator.
\	Left-division operator.
/	Right-division operator.
.\	Array left-division operator.
./	Array right-division operator.
:	Colon; generates regularly spaced elements and represents an entire row or column.

8. Commands for Managing a Session

MATLAB provides various commands for managing a session. The following table provides all such commands:

Command	Purpose
clc	Clears command window.
clear	Removes variables from memory.
exist	Checks for existence of file or variable.
global	Declares variables to be global.
help	Searches for a help topic.
lookfor	Searches help entries for a keyword.
quit	Stops MATLAB.
who	Lists current variables.
whos	Lists current variables (long display).

9. Input and Output Commands

MATLAB provides the following input and output related commands:

Command	Purpose
disp	Displays contents of an array or string.
fscanf	Read formatted data from a file.
format	Controls screen-display format.
fprintf	Performs formatted writes to screen or file.
input	Displays prompts and waits for input.
;	Suppresses screen printing.

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The **fscanf** and **fprintf** commands behave like C scanf and printf functions. They support the following format codes:

Format Code	Purpose
%s	Format as a string.
%d	Format as an integer.
%f	Format as a floating point value.
%e	Format as a floating point value in scientific notation.
%g	Format in the most compact form: %f or %e.
\n	Insert a new line in the output string.
\t	Insert a tab in the output string.

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Language Fundamentals

Programming and Scripts

The simplest type of MATLAB program is called a script. A script is a file with a .m extension that contains multiple sequential lines of MATLAB commands and function calls. You can run a script by typing its name at the command line.
To write and run program we used three steps:

1. create a script file-new-script.
2. Save the file in the current folder.
3. You can also run scripts from the Editor by pressing the **Run** button, .

Script Locations

MATLAB looks for scripts and other files in certain places. To run a script, the file must be in the current folder or in a folder on the search path.
By default, the MATLAB folder that the MATLAB Installer creates is on the search path. If you want to store and run programs in another folder, add it to the search path. Select the folder in the Current Folder browser, right-click, and then select **Add to Path**.

Initializing MATLAB

I like to initialize MATLAB this way…

close all;   %closes all figure windows
clc;   %erases command window
clear all;   %clears all variables from memory

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1. Input statement

We can input variables to Matlab by to ways:

  a. **Direct input** : use this way when the value of variable is constant in the program.

  Example: write program in Matlab to find the average of three numbers (x,y,z) where x=2,y=3,z=4?

  Solution
```
clc
clear all
x=2,y=3,z=4;
sum =x+y+z;
average=sum/3
```

  b. **Use input function:**
  The Syntax to write this function is:

  Variable =input('message')

  We can rewrite the above example using input
```
clc
clear all
x=input('Enter the value of x:')
y=input('Enter the value of y:')
z=input('Enter the value of z')

sum =x+y+z;
average=sum/3
```

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2.**Output Function**

a. disp function:

is the abbreviation of display this function used to print the value of variable on the screen ,the **syntax** is:

disp(variable)

we can also use disp function to print string or text on the screen, the syntax is:

disp('string')

we can rewrite the example using this function to print the average.

```
 clc
 clear all
 x=input('Enter the value of x:')
 y=input('Enter the value of y:')
 z=input('Enter the value of z')

 sum =x+y+z;
 average=sum/3;
  disp('average=')
  disp(average)
```

b. fprintf function:

in this function we can print the variable and value of it in one line ,the **syntax** is:

fprintf('format',variable name)

note :the **format** describe in above table.

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we can rewrite the example using this function to print the average.

```
clc
clear all
x=input('Enter the value of x:')
y=input('Enter the value of y:')
z=input('Enter the value of z')

sum =x+y+z;
 average=sum/3;
 fprintf('the average is:%f',average)
```