

APSC 1001 Introduction to Matlab

Based on "Getting Your Hands Dirty With MATLAB by Dr. Kartik Bulusu

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1 WHAT IS MATLAB?

The name MATLAB stands for MATrix LABoratory. It is a software package for numerical computation and visualization with many built-in functions for technical computation, graphics and animation. Most of these functions are state-of-the art algorithms which provide excellent tools for linear algebra computations, data analysis, signal processing, numerical solution to ODEs etc.

The basic building block of MATLAB is the matrix. The fundamental data-type is the array. Special cases of this basic data-type are vectors, scalars, real and complex matrices. In MATLAB, you almost never have to declare the dimensions of a matrix. A novice MATLAB programmer has to have a grasp over the basics of matrix algebra, because MATLAB quite simply and precisely works with matrix operations.

2 BASICS OF MATLAB

In this section we look at the general structure of MATLAB the environment. MATLAB works through three basic windows:

2.1 TYPES OF WINDOWS

Command Window: When you launch the MATLAB program, it pulls up this window. It is characterized by the MATLAB command prompt " » ". All commands, including user-written programs, can be executed from this prompt.

Graphics Window: The output of all graphics commands and plotting functions are shown in the graphics window or *Figure* window.

Edit Window: MATLAB provides a built-in editor where you can write, edit, create, and save your programs in files called "*m-files*". Consequently, you can use any text editor to carry out these tasks. All MATLAB programs should have a ".m" extension. For example, a sample file name is "*my_program.m*".

There are two other important sections of the screen to be aware of:

Workspace: The workspace is where all current variables are shown, along information about the size and type of each variable.

Current Folder: Any files that you save will be located here. If you are running an .m file, it must be located in the current folder (or in the system path in MATLAB's settings).

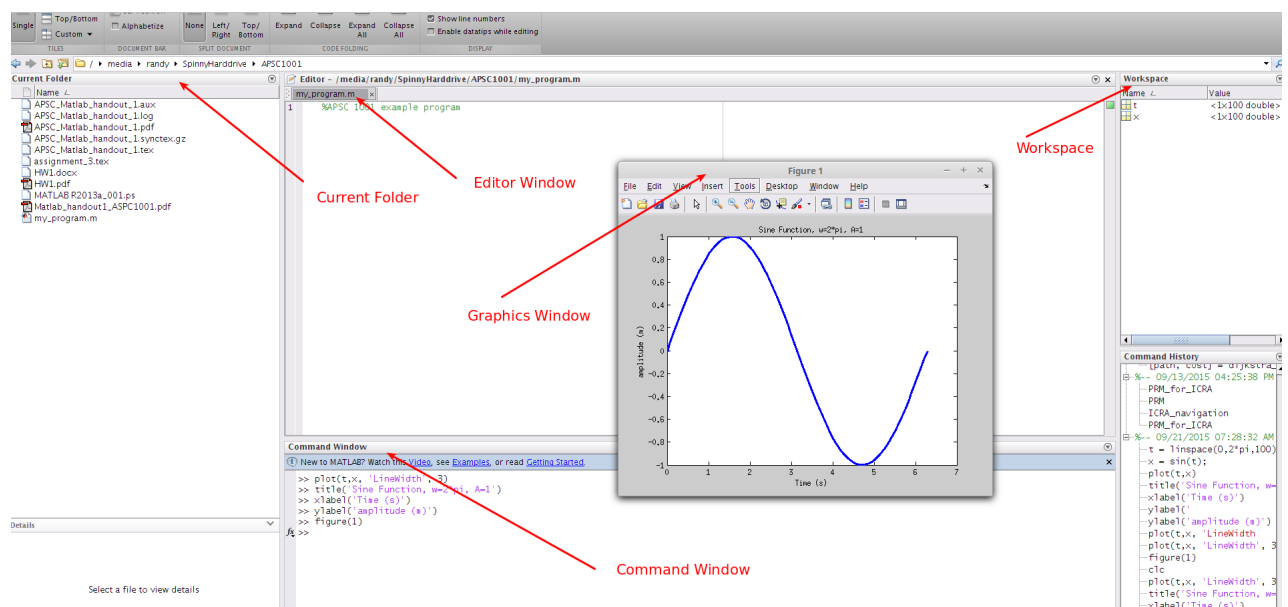


Figure 2.1: Default setup of Matlab Windows. Windows can be rearranged, minimized, or broken out if desired.

3 LESSON 1: CREATING AND WORKING WITH ARRAYS OF NUMBERS

An *array* is a list of numbers or expressions arranged in horizontal rows and vertical columns. When an array has one row or column, it is called a *vector*. An array with m

rows and n columns is called a *matrix* of size $m \times n$. (Pratap, 1999)

There are many mathematical concepts associated with vectors and matrices that we won't cover in this course. Some of them you will cover in later courses, when you will appreciate that MATLAB can handle common operations such as determinant, inverse, rank, and various matrix decompositions.

In this lesson we deal only with one-dimensional arrays, or vectors. In later exercises, we will introduce two-dimensional arrays, or matrices. Follow the instructions below and type them in the command window after you have read through the exercises.

Note that any text following % symbol is a comment. While creating m-files or simply typing the script on the command window any text following the % is taken in MATLAB as comment and will not be executed in the program. It is a good practice to comment lines in your program so that when you revisit your code it will still make sense. From experience, this will save many long and painfully frustrating hours in the future.

Now it's time to practice programming:

row and column vectors

$$\begin{bmatrix} 2 & 4 & 5 \end{bmatrix} \gg x = \begin{bmatrix} 2 & 4 & 5 \end{bmatrix} \text{ is a row vector with 3 elements } x = 245 \quad (3.1)$$