Chapter 1: Getting started with MATLAB

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1.1– Introduction

MATLAB is an abbreviation of Matrix LABoratory. Originally written in Fortran by C. Moler, MATLAB was intended to facilitate access to the matrix software developed in the LINPACK and EISPACK projects. The current version, written in C by MathWorks Inc., exists in a professional version and a student version. Its availability is ensured on several platforms: Sun, Bull, HP, IBM, PC compatible (DOS, Unix or Windows), Macintoch, iMac and several parallel machines [1-3]. There are two operating modes [4]:

- Interactive mode: MATLAB executes instructions as they are given by the user.
- Executive mode: MATLAB executes a ".m" file (program in MATLAB language) line by line.

Generally speaking, Matlab is used to do computational experiments very quickly.

In this chapter we present the Matlab environment, then the following syntax elements:

- Starting MATLAB
- Presentation and general information

1.2 - MATLAB environment

MATLAB is a complete, open and extensible environment for calculation and visualization. As in Figure 1.1, the main interface is broken down into the following elements:

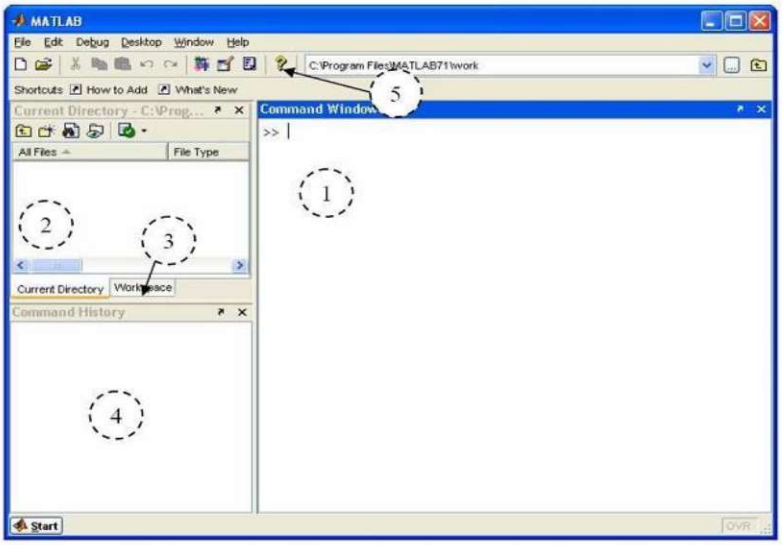

Figure 1.1 *MATLAB environment*

A. Command window: Allows you to execute commands outside of the program and displays the results.

Example: Tap 1+3

B. Current Directory: Content of the current directory where your programs should be located.

C. Workspace: Displays all the variables used.

D. History command: Allows you to view the last commands executed. It is possible to drag these commands to the command window. You can also access it by pressing the up arrow or for older commands by typing the first letter of the expression then up arrow.

E. Choice of current directory: This is the folder where your programs should be located (*.m files). You can put your programs in another folder but in this case you must include it in File >> Set Path

1.3 - Start, exit

To start running MATLAB:

- ✓ under Windows, you must click on Startup, then Program, then MATLAB,
- ✓ under other systems, refer to the installation manual.

The MATLAB '>>' prompt should then appear in the command window, following which the commands will be entered.

The "quit" function allows you to exit MATLAB:

>>quit

1.4 - Help, online documentation

Online help can be obtained directly in the session by typing help command or function name. The "help" command allows you to provide help on a given problem.

Example:

>> help cos

COS Cosine.

COS(X) is the cosine of the elements of X.

-List of help commands:

help ⟶ gives help on a function or toolkit (help)
helpdesk ⟶ hypertext documentation (requires Netscape or other)
helpwin ⟶ online help in a separate window.
lookfor ⟶ search for a keyword (slow).
which ⟶ locates functions and files.
what ⟶ list of Matlab files in the current directory.
exist ⟶ check if a function or variable exists in the workspace.
who, whos ⟶ list of variables in the workspace.

```
>> who          % provides the list of functions defined in the workspace
>> whos         % gives more information than who
```

1.5 - Presentation and generalities

MATLAB allows interactive work either in command mode or in programming mode; while still having the possibility of making graphical visualizations. Considered one of the best programming languages, it has the following particularities compared to these languages:

- Easy programming,
- Continuity among whole, real and complex values,
- The extended range of numbers and their precisions,
- The very comprehensive mathematical library,
- The graphical tool which includes graphical interface functions and utilities,
- The possibility of linking with other classic programming languages.

1.5.1- Calculations in Command mode

Let's start with the most common operators: +, -, *, /, ^. The last one means “power”. Parentheses are used in the classic way. We have everything to make a first calculation:

Type any mathematical expression and press <Enter>. For example:

>> (3*2)/(5+3)

ans =
0.7500
The result is automatically put into a variable called ans (answer). This can be used for the following calculation, for example:

>> ans*2

ans =
1.5000

Then you will notice that the result is displayed with 5 significant figures, which does not mean that the calculations are made with such low precision. If you want to display numbers more precisely, type the long format command. To return to the initial behavior: short format.

1.5.2- Command history

All the commands you have taped in MATLAB can be found and edited using the arrow keys. Press ↑ to go back through previous commands, ↓ to go back down, and use → and ← to edit a command. To restart a command, there is no need to return the cursor to the end, you press the <Enter> key directly. Even stronger: you can find all the commands starting with a group of letters. For example, to find all commands starting with <plot>, type plot, then press ↑ several times.

1.5.3- Functions on scalars

abs: Absolute value or complex module

conj: Complex conjugate

imag: Imaginary part

real: Real part

prod: Product of all elements of a vector argument

sum: Sum of all elements of a vector argument

round: Rounds all elements to the nearest integers.

1.5.4- Batch files (scripts)

Batch scripting consists of a series of commands to be executed by the command-line interpreter, stored in a plain text file (batch file). Batch files can have any name, but must end with the extension ".m".

To create a command file, tap MATLAB commands inside the integrated editor, save for example under the name " toyou.m", then under MATLAB, tap:

>> toyou

All commands in the file will be executed in bulk.

1.5.5- Comments and self-documentation

White lines are considered comments. Anything after the "%" symbol will also be considered a comment. It is also possible to document your order files. So, define a series of uninterrupted comment lines at the beginning of your toyou.m file. When you type:

>> help toyou

These comment lines will appear on the screen. This is how MATLAB online help works.

It's so simple that it would be a shame to miss out on it.

1.5.6- Removing the display

So far, we have seen that all commands typed in MATLAB displayed the result. For certain commands (creation of large tables), this can be tedious. We can therefore place the character ";" at the end of a command line to tell MATLAB that it should not display the result.

1.6- Exercises

A. First program in Matlab

Write the following example, save it under the name 'firstprog' and run it from the command window.

```
% first program under Matlab
disp('This is my first program')
disp(' It displays the first 10 integers on the screen')
for i=1:10
i
end
% end of program
```

Edit the program by adding a '**;**' After the '**i**'. What does its execution give now?

B. Input and format

Write a script that prompts the user to enter a number, displays it in short simple format then short with power of 10. Indices: input, format. Is the precision in a calculation with each of these numbers affected?

C. Addpath (adds a path)

Write a simple program and save it in a directory that is not the current directory. Try to run it by calling it from the command window. Use the addpath command to make the call effective.