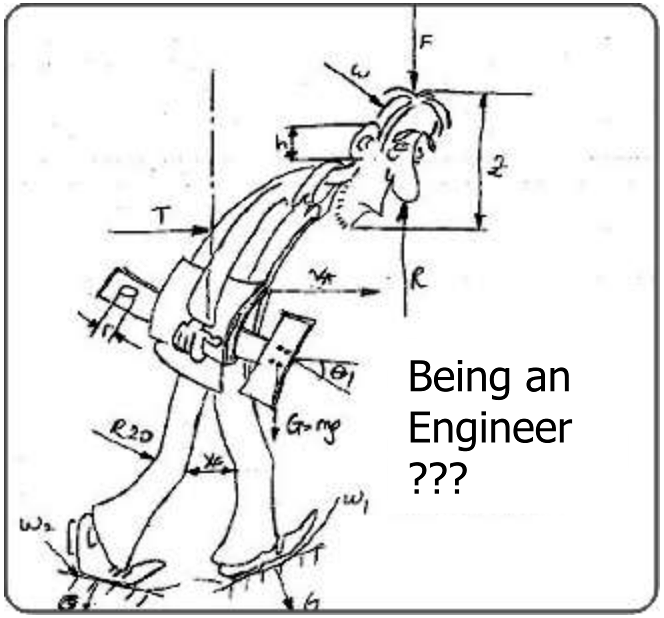

Being an Engineer ???

Introduction to MATLAB

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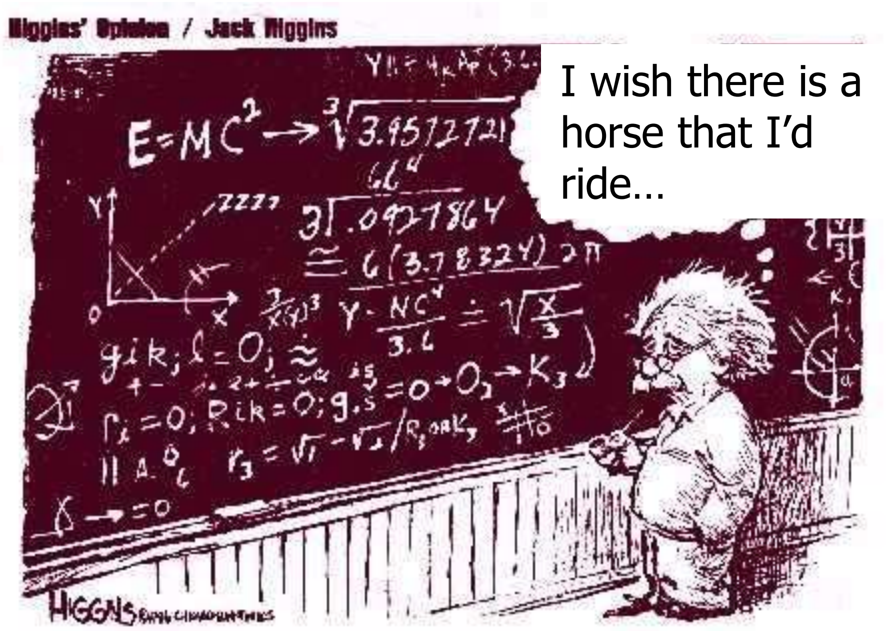
Objectives

- What is MATLAB?
- Vissualizing MATLAB
- Language of MATLAB
- Data Types used in MATLAB
- Basic Mathematical Functions and Frequently Used Functions / Commands
- Opening a document
- Saving a document

OUTLINE

- MATLAB Computing Environment
- Basic Mathematical Functions
- Frequently Used Functions
- File Management
- Saving and Restoring MATLAB Information

MATLAB Computing Environment


Higgins' Opinion / Jack Higgins
I wish there is a horse that I'd ride…
$E=MC^2$
HIGGINS

«Matlab has hundreds of built-in functions and can be used to solve problems ranging from the very simple to the sophisticated and complex. Whether you want to do some simple numerical or statistical calculations, some complex statistics, solve simultaneous equations, make a graph, or run and entire simulation program, Matlab can be an effective tool.»

MATLAB Computing Environment

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The most important thing is not to writing mess of commands, but the constructing the algorithm – logic (i.e., flowchart) - of the problem.

MATLAB Computing Environment

For example, summer is coming and you plan to start a diet…
Doctor adviced you max. kCal should not exceed 1000 kCal

"DO YOU HAVE TO USE THAT? – TONGUE DEPRESSORS MAKE ME HUNGRY."
Bila
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You have such a calory-list:

1 slice of white bread: 90
1 slice of white toasted bread: 35
Spaghetti (100 gr): 85
Rice (100 gr): 125
Yogurt (100 gr): 95
Egg: 80
Cheese (100 gr): 275
Honey (100 gr): 350
Donut (100 gr): 500

MATLAB Computing Environment

Prepare a Calorimeter

So that you can check out gained calorie. Code will be automatically calculate the kCal and warn you when you will exceed ΣkCal=1000kCal.

Which mathematical operations may be used?

MATLAB Computing Environment

Define the calory-list

@ 9:00 AM→BREAKFEST:
Homer: Enter the food you plan to eat
PC: Each food's calorie is found out and summed up by the program, ΣkCal is calculated.
Result: Since ΣkCal < 1000 →
OK, 'enjoy your meal'

@ 1:00 PM→LUNCH:
Homer: Enter the food you plan to eat
PC: ΣkCal is updated.
Result: Since ΣkCal < 1000 →
OK, 'enjoy your meal'

MATLAB Computing Environment

@5:00 PM→Homer:Donuts are attracting,hmm… Should I eat?

Homer: Enter the food you plan to eat

PC: ΣkCal is updated.

Result: Since ΣkCal > 1000 →

'No Homer, don't do THAT !!!'

MATLAB Computing Environment

Data Types in Matlab:

Numbers: are represented by two ways:

i)Fixed Point: Decimal form, with an optional decimal point.

ex: 2.6349, -381, 0.00023

ii) Floating Point: Scientific notation, representing $m \times 10e$. It is called *floating point* because the decimal point is allowed to move.

For example: 2.6349×10^5 is represented as 2.6349e5

The number has two parts:

- *mantissa m*: fixed point number (signed or unsigned), with an optional decimal point (2.6349 in the example above)
- *exponent e*: an integer exponent (signed or unsigned) (5 in the example).
- Mantissa and exponent must be separated by the letter e (or E).

MATLAB Computing Environment

Data Types in Matlab:

Integer: Integers (ex: 5, -9)
Double: Decimals (ex: 6.0345)
Character: Any character between (A(a) to Z(z), space, notation) ex: c
String: Set of characters ex: ‘civil’
fprintf: In order to display the object in the stated format.

MATLAB Computing Environment

Windows appaer in Matlab:

Command History: Lists all the operations and variables that you have previously defined in the chronological sequence.
Workspace: Lists the previously defined variables with their values.
Command Window: All commands are entered to this window after fixed prompt » and saved as mat-files→file.mat
Editor Window: Create and edit scripts of commands called M-files→file.m
Graphics (Figure) Window: Display plots and graphs
Created in response to graphic commands.

MATLAB Computing Environment

Try:

Into Editor Window:

```
Type: Var1=4 ;
      Var2=9 ;
      Var= sqrt(Var1*Var2)
```

Save it (Ctrl+S) as file1.m

Type: file1 into Command Window

What is on the Comman Window ??

What changes when you follow same procedure with ; ???

Basic Mathematical Functions

All types of simple and complex mathematical operations can be well done by Matlab.

Operation Algebraic form Matlab

Addition: a + b

Subtraction: a - b

Multiplication: a * b

Right division: a / b

Left division: a \ b

Exponentiation: a ^ b

Basic Mathematical Functions

abs(x): Absolute value |x|
sign(x): Sign, returns -1 if $x < 0$, 0 if $x = 0$, 1 if $x > 0$
exp(x): Exponential e^x
log(x): Natural logarithm $\ln x$
log10(x): Common (base 10) logarithm $\log_{10} x$
sqrt(x): Square root $\sqrt{x}$
rem(x,y): Remainder of *x/y*. Also called the **modulus** function.

ex: rem(100,21) is 16.

sind(x): Sinus function of x(degrees)
asind(x): Arcsin function of x where result in degrees

Basic Mathematical Functions

Mostly used/experienced variables:

ans: default variable name
pi: *π* = 3.1415926...
inf or Inf : infinity, e.g. 1/0
nan or NaN : not-a-number, e.g. 0/0
date: current date in a character string format, such as 13-June-2011
who: lists the names of defined variables
whos: lists the names and sizes of defined variables
clear: clears all variables so the workspace, resets default values of special variables
clear *var*: clears variable *var* → *Why do we need it?*
clc: clears the command window, homes the cursor (moves the prompt to the top line), but does not affect variables.
clf: clears the current figure and thus clears the graph window.

Frequently Used Functions

Most frequently used functions:

disp : There are two general forms of the command disp that are useful in displaying results and annotating them with units or other information:

1. disp(*variable*): Displays value of *variable* without displaying the variable name.
2. disp(‘*string*’): Displays *string* by stripping off the single quotes and echoing the characters between the quotes.

Ex:

```
>> temp=78;
>> disp(temp); disp(’degrees F’)
78
degrees F
```

Frequently Used Functions

fprintf :The general form of this command is:
fprintf(*'format string', list of variables*)

Ex:

```
>> fprintf('The temperature is %f degrees F \n', temp)
The temperature is 78.000000 degrees F
>> fprintf('The temperature is %2.1f degrees F \n', temp)
The temperature is 78.0 degrees F
```

Try :

```
        fprintf('The temperature is %e degrees F \n', temp)
        fprintf('The temperature is %d degrees F \n', temp)
```

Help: >> help *command* OR use help button
Edit: >> typing edit command explains how the command is written in the editor window

Frequently Used Functions

Prod :The product of the elements in each column is
Ex: prod(M) = 96 45 84
The product of the elements in each row can be obtained by:
prod(M,2) = 48 105 72

Cumsum : Cumulative Sum
Ex: cumsum(1:5)
ans = [1 3 6 10 15]

All :Given
Ex: A = [0.53 0.67 0.01 0.38 0.07 0.42 0.69] then
B = (A < 0.5) returns logical 1 (true) only where A is less than one half:
0 0 1 1 1 1 0

End :end terminates for, while, switch, try, if, and parfor statements also the functions.

Frequently Used Functions

Indices and Find :

EX: »X = [1 0 4 -3 0 0 0 8 6];
indices = find(X) *returns linear indices for the nonzero entries of X.*
indices = 1 3 4 8 9

»find(X > 2) *returns linear indices corresponding to the entries of X that are greater than 2.*

ans = 3 8 9

EX:» X = [3 2 0; -5 0 7; 0 0 1]; [r,c,v] = find(X) *returns a vector of*

r = 1 2 1 2 3 *a row indices of the nonzero entries of X*
c = 1 1 2 3 3 *a vector of column indices of the nonzero entries of X*
v = 3 -5 2 7 1 *and a vector containing the nonzero entries of X.*

Frequently Used Functions

Linspace : To create a vector of uniformly spaced elements, use linspace function.

Ex: A = linspace(0,36,13).`

Sort : Sorting data in ascending / descending order

Ex:

Sort horizontal vector A:

```
A = [78 23 10 100 45 5 6];
sort(A)
ans = 5 6 10 23 45 78 100
```

Frequently Used Functions

Dec2bin :Convert decimal to binary number in string

Ex: Decimal 23 converts to binary 010111:

```
dec2bin(23)
ans = 10111
```

Bin2dec (‘string’): Converts binary number in string to decimal

Now: Date + Hour is resultin.

Tic…..toc: Time elapsed

File Management

Definitions:

- File: A collection of computer data including the format of file, order, size and location of data items are stored in it.

- File Types:

i) Binary: Contains both the machine instructions and data stored in machine-readable form. → Can only be read by the program.
ii) Text: Contains keyboard characters represented by 1 byte (8bits).→Can be created and modified by text editors and printed on printers.

- File Management: The process, implemented with a set of user commands, to manage the files in a file system. This involves defining the tree structure by creating or deleting directories and managing files by creating, moving, renaming, or removing them and listing their names and attributes.

File Management

pwd: Print working directory – displays the full path of the present working directory.

cd *path*: Change to directory (folder) given by *path*, which can be either a relative or absolute path.

dir or ls: Display the names of the directories (folders) and files in the present working directory.

what: Display the names of the M-files and MAT-files in the current directory.

delete *file*: Delete *file* from current directory

type *file*: Display contents of *file* (text file only, such as an M-file).

Saving and Restoring MATLAB Information

It is good engineering practice to keep records of calculations.

These records can be used for several purposes, including:

- To revise the calculations at a later time.
- To prepare a report on the project.

Saving and Restoring MATLAB Information

Diary Command

The diary commands allows you to record all of the input and displayed output from a Matlab interactive workspace session. The commands include:

- diary '*file*.txt': Saves all text from the Matlab session, except for the prompts (>>), as text in *file*, written to the present working directory. If *file* is not specified, the information is written to the file named diary.
- diary off: Suspends diary operation.
- diary on: Turns diary operation back on.
- diary: Toggles diary state

Saving and Restoring MATLAB Information

Save
Save workspace variables to file

save(*filename*): stores all variables from the current workspace in a MATLAB formatted binary file (MAT-file) called *filename*.

save(*filename, variables*): stores only the specified variables.

load file.mat : calls back the variables predefined and saved in file.mat

Summary

- ✓ Why do we use MATLAB?
- ✓ How do we open a new document?
- ✓ What are the windows/study area typed/used in MATLAB?
- ✓ How do we organize the screen?
- ✓ What are the basic mathematical functions used in MATLAB?
- ✓ What are the main fundamental functions used in MATLAB?
- ✓ What are the data types?
- ✓ How do we save / save as / call back a document?
- ✓ What are the file extensions?

Any questions?

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