차세대 반도체 디지털 혁신공유대학 사업단

POLARIS

MATLAB

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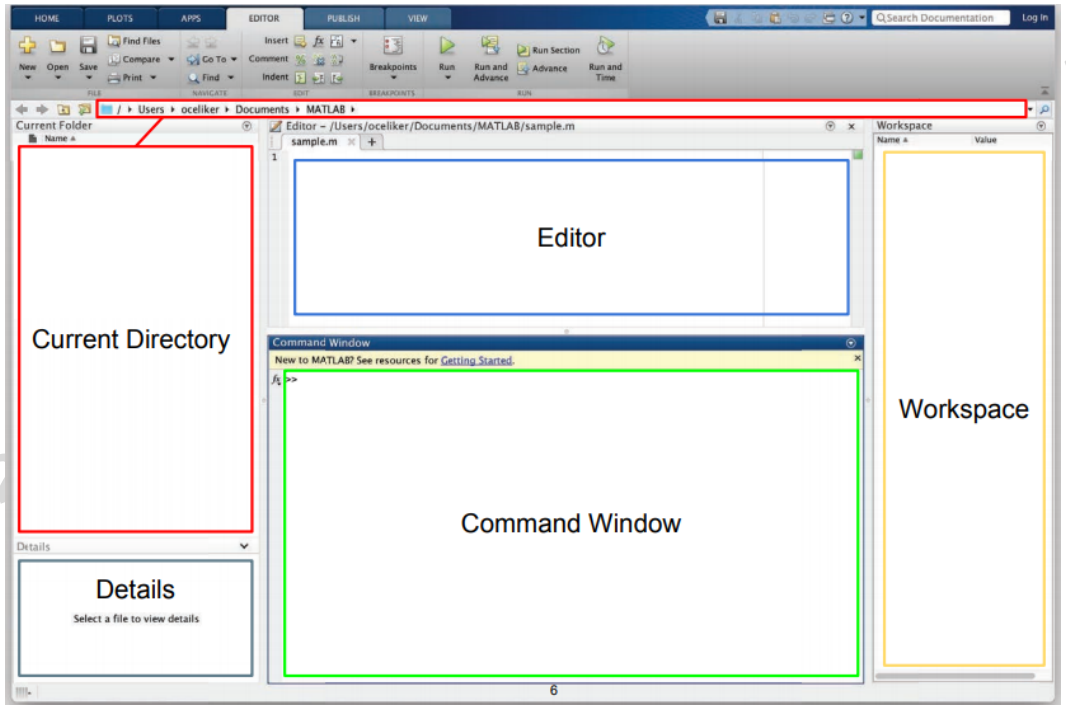
Matlab

- MATLAB can be thought of as a super-powerful graphing calculator
  - With many built-in functions
- In addition, it is a programming language
  - MATLAB is an interpreted language, like Python
  - Commands are executed line-by-line

Introduction to Matlab by MIT open courseware[1], https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-057-introduction-to-matlab-january-iap-2019

Matlab

- Matlab working environment:
  - Editor, Command window
  - Workspace, Current directory, and Details



Scripts

- Scripts are
  - Collection of commands executed in sequence
  - Written in the MATLAB editor
  - Saves as m-files (.m extension)
- To create an m-file from the command line
  - edit MyFileName.m
  - Or click the "New Script" button on the top left
- Comment!
  - Anything following a % sign is interpreted as a comment
  - Comment thoroughly to avoid wasting time later
  - Mark beginning of a code block by using %%
- Note that scripts are somewhat static, with no explicit input
- All variables created or modified in a script retain their value after script execution

Exercise: Script

- Make a script with the name helloMatlab.m
- When run, the script should show the following text
  - Hello MATLAB!
  - I am going to learn MATLAB!

- Hint:
  - Use disp(…) to display a string. Strings are written between single quotes, e.g., 'Hardware System Design for AI'
  - Use "doc cmd" to find the definition of a command "cmd"

Variable types

- MATLAB is a "weakly typed" language
  - No need to initialize variables!
- MATLAB supports various types
  - 3.84: 64-bit double (default)
  - 'A': 16-bit char
- Most variables are vectors, matrices, doubles or chars.
- It supports other types: complex, symbolic, 16-bit and 8-bit integers.

Naming variables

- To create a variable, simply assign a value to a name
  - myStringVariable = 'Hardware Design for AI'
  - myLayerVariable = 16
- Rules
  - First character must be a LETTER followed by any combination of numbers, letters and _
  - Names are CASE-SENSITIVE (e.g. var1, is different from Var1).

- Build-in variables (don't use these names for anything else!)
  - i, j: can be used to indicate complex numbers (ii, jj, kk, … for loop)
  - pi: has the value 3.1415…
  - ans: stores the results of the last unsigned value
  - Inf, -Inf: infinities
  - NaN: "Not a Number"

Scalars

- A variable can be given a value explicit
  - x=10
  - Shows up in workspace
- Or as a function of explicit values and existing variables
  - Y=1.3*4.5-7.8
- To suppress output, end of the line with a semicolon
  - hisname = 'John';

Arrays

- Like other programming languages, arrays are an important part of MATLAB
- Two types of arrays
  - Matrix of numbers (either double or complex)
  - Cell array of objects (more advanced data structure)

⇒ MATLAB makes vectors easy! That's its power

Row vectors

- Row vector: comma- or space-separated values between square brackets
  - Row = [1 2 3 4 5 6];
  - Row = [1, 2, 3, 4, 5, 6];

- Command windows

```
K>> row = [1 2 3 4 5 6]

row =

     1     2     3     4     5     6
```

- Workspace

Name	Value
row	[1,2,3,4,5,6]

Column vectors

- Column vector: semicolon-separated values between square brackets
  - Col = [1; 2; 3; 4;];

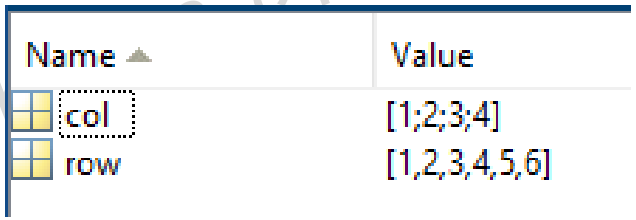
- Command window

```
K>> col = [1;2;3;4]

col =

     1
     2
     3
     4
```

- Workspace



Size and Length

- We can see the difference between a row and a column by
  - Looking in the workspace
  - Display the variable in the command window
  - Using the size function

```
K>> size(row)

ans =

     1     6

K>> length(row)

ans =

     6
```

```
K>> size(col)

ans =

     4     1

K>> length(col)

ans =

     4
```

Matrices

- Make matrices like vectors
  - Element by element
    - A = [1 2; 3 4];

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

- Strings are character vectors

save/clear/load

- Use “save” to save variables to a file
  - save myFile a b
  - Saves variables a and b to the file myFile.mat in the current directory
  - Default working directory is MATLAB unless you navigate to another folder/

- Use clear to clear the variables in workspace
  - clear a b
  - Look at workspace: variables a and b are gone

- Use “load” to load variables into the workspace
  - load myFile
  - Look at workspace: a and b are back

Functions

- MATLAB has an enormous library of built-in functions
- Call using parentheses, passing parameters to function
  - sqrt(2), log(2), log10(0.23), cos(pi), atan(pi/2), exp(2+4*1i), round(1.1).

- Functions for vectors and matrixes
  - Transpose: turn a column vector into a row vector and vice versa
  - Addition and subtraction:
    - Element-wise operations
    - Use the transpose to make sizes compatible
    - Can sum up or multiply elements of vectors
  - To do element-wise functions, use the dot (.*, ./, or .*)