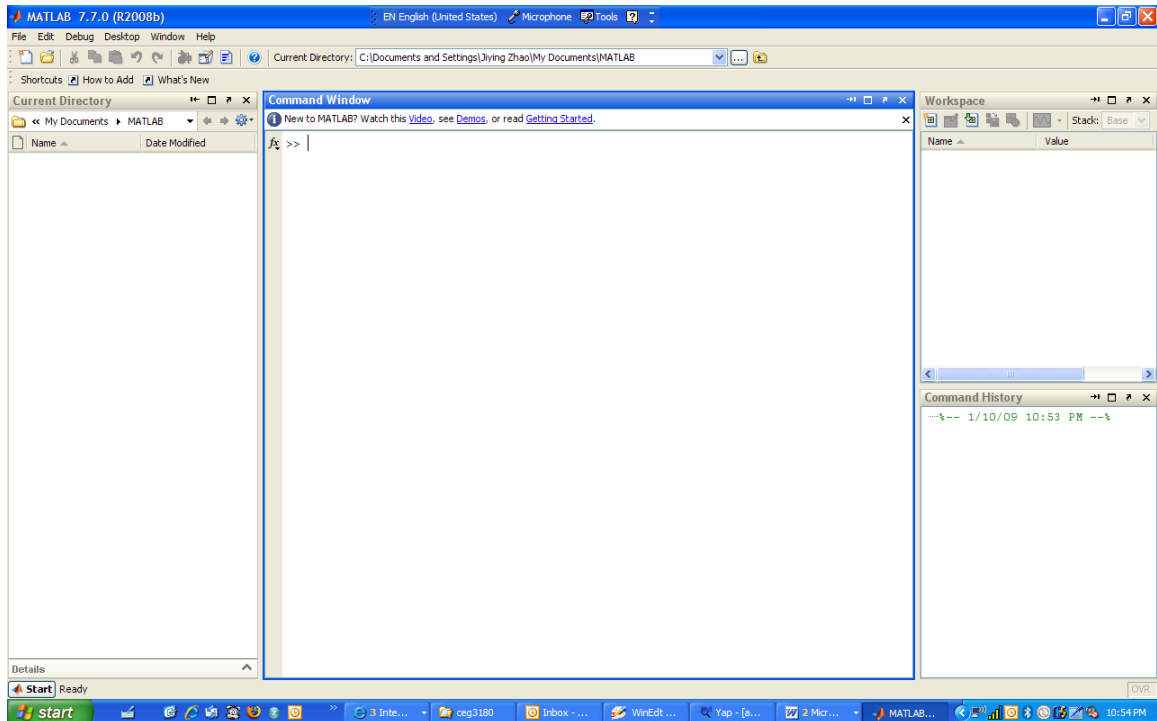


# Introduction to MATLAB

## SEG 3155/CEG3185 Winter 2012



1. After Matlab is started, a command window is displayed where commands can be entered.
  - Matlab is an interpreter: a command is executed immediately after it is entered.
  - You can enter commands one by one in the command window.
  - You can also prepare MATLAB commands as a batch. Use a text editor to prepare commands and save them as a .m file. Enter the name of the file in the command window to run. You can use notepad or the editor provided by Matlab: File->New->M-File to prepare for the plain text file.
2. Current directory
  - default place where you can load and save programs, data files, etc.
  - most common value = "C:\MATLAB7\work"
  - current directory can be changed using one of the following:
    - i. current directory box listed in the toolbar menu
    - ii. using command `cd('...\...\')`
3. If you want to load data files from another location, or save them to another locations, specify full path in you command. eg:
  - `wavread('...\...\tarzan.wav');`
  - `wavwrite('...\...\tarzan2.wav');`
4. MATLAB commands and variables are case-sensitive
5. Vector
  - `y = v1:d:v2`

- i. produces the vector ( $v_1, v_1+d, v_1+2*d, \dots, v_2-d, v_2$ )
    - ii. useful in creating a vector with fixed incremental values, e.g. specifying the x-axis values for a plot.
  - $y = \text{linspace}(a,b,n)$ 
    - i. generates a row vector  $y$  of  $n$  points linearly spaced between and including  $a$  and  $b$
6. the operator  $+, -, *, ./$  allows two vectors (or arrays) of the same size to be operated component by component
- e.g.  $B$  and  $C$  are both vectors of size  $N$
  - $B.*C$  will produce the vector  $(B(1)*C(1), B(2)*C(2), \dots, B(N)*C(N))$
7.  $ZC = \text{conj}(Z)$
- returns the complex conjugate of the elements of  $Z$ .
8.  $\text{figure}(h)$
- does one of two things, depending on whether or not a figure with handle  $h$  exists. If  $h$  is the handle to an existing figure,  $\text{figure}(h)$  makes the figure identified by  $h$  the current figure, makes it visible, and raises it above all other figures on the screen. The current figure is the target for graphics output. If  $h$  is not the handle to an existing figure, but is an integer,  $\text{figure}(h)$  creates a figure and assigns it the handle  $h$ .  $\text{figure}(h)$  where  $h$  is not the handle to a figure, and is not an integer, is an error.

$\text{plot}(X_1, Y_1, \dots)$

plots all lines defined by  $X_n$  versus  $Y_n$  pairs. If only  $X_n$  or  $Y_n$  is a matrix, the vector is plotted versus the rows or columns of the matrix, depending on whether the vector's row or column dimension matches the matrix. If  $X_n$  is a scalar and  $Y_n$  is a vector, disconnected line objects are created and plotted as discrete points vertically at  $X_n$ .

$\text{title}(\text{'string'})$

outputs the string at the top and in the center of the current axes.

$\text{axis}([x_{\min} \ x_{\max} \ y_{\min} \ y_{\max}])$

sets the limits for the x- and y-axis of the current axes.

$\text{xlabel}(\text{'string'})$

labels the x-axis of the current axes

9. If you want the figures to appear in different windows, use  $\text{figure}(i)$  to separate them, eg
- ```
figure(1);
plot(...);
figure(2);
plot(...);
```
10.  $\text{wavplay}(y, F_s)$
- plays the audio signal stored in the vector  $y$  on a PC-based audio output device. You specify the audio signal sampling rate with the integer  $F_s$  in samples per second. The default value for  $F_s$  is 11025 Hz (samples per second).

11. to transfer the results of a figure to MSWord, do either one of the following:
  - copy (Ctrl-c) it from your plot window and paste (Ctrl-v) it to your Word document,
  - save the figure (eg, as a bitmap file) using File→Save in the plot window menu. Then insert the figure into your Word document.
  
12. .wav file is a file format for storing the signal amplitude of a sound wave. It can be loaded into MATLAB, displayed, processed, played, and written back to a disk file.
  
13. for loop allows you to repeat some operations where n will change from n1 to n2  
 for n=n1:n2  
 ...  
 ...  
 end
  
14. [y, Fs, bits] = wavread('tarzan.wav');
  - y is a vector containing the signal amplitude in 'tarzan.wav'
  - Fs is a scalar representing the sampling frequency
  - bits is a scalar representing the sampling depth (eg, 8 bits used to represent one sample)
  
15. wavwrite(y,Fs,N,filename)
  - writes the data stored in the variable y to a WAVE file called filename. The data has a sample rate of Fs Hz and is N-bit.
  
16. Y=fft(y,N)
  - DFT (discrete Fourier transform)
    - i. one of the specific forms of Fourier analysis
    - ii. requires an input function that is *discrete* and whose non-zero values have a limited (*finite*) duration
  - FFT (fast Fourier transform)
    - i. an efficient algorithm to compute the discrete Fourier transform (DFT) and its inverse
    - ii. computing a DFT of  $N$  points in the obvious way, using the definition, takes  $O(N^2)$  arithmetical operations, while an FFT can compute the same result in only  $O(N \log N)$  operations
  - Produce a N point FFT
    - N should be larger than the size of input vector y. To find out the size of y, use size(y)
  - High frequency corresponds to middle part of Y, around mid point  $N/2$ .
  - Low frequency corresponds to both sides of Y, around 0 and N
  
17. y = ifft(X)
  - returns the inverse discrete Fourier transform (DFT) of vector X, computed with a fast Fourier transform (FFT) algorithm. If X is a matrix, ifft returns the inverse DFT of each column of the matrix.
  
18. Use semicolon at the end of a command if you do not want the results to be displayed.

19. MATLAB Help contains an index where you can find the syntax and usage of a MATLAB command. You can also do a search on a specific topic.