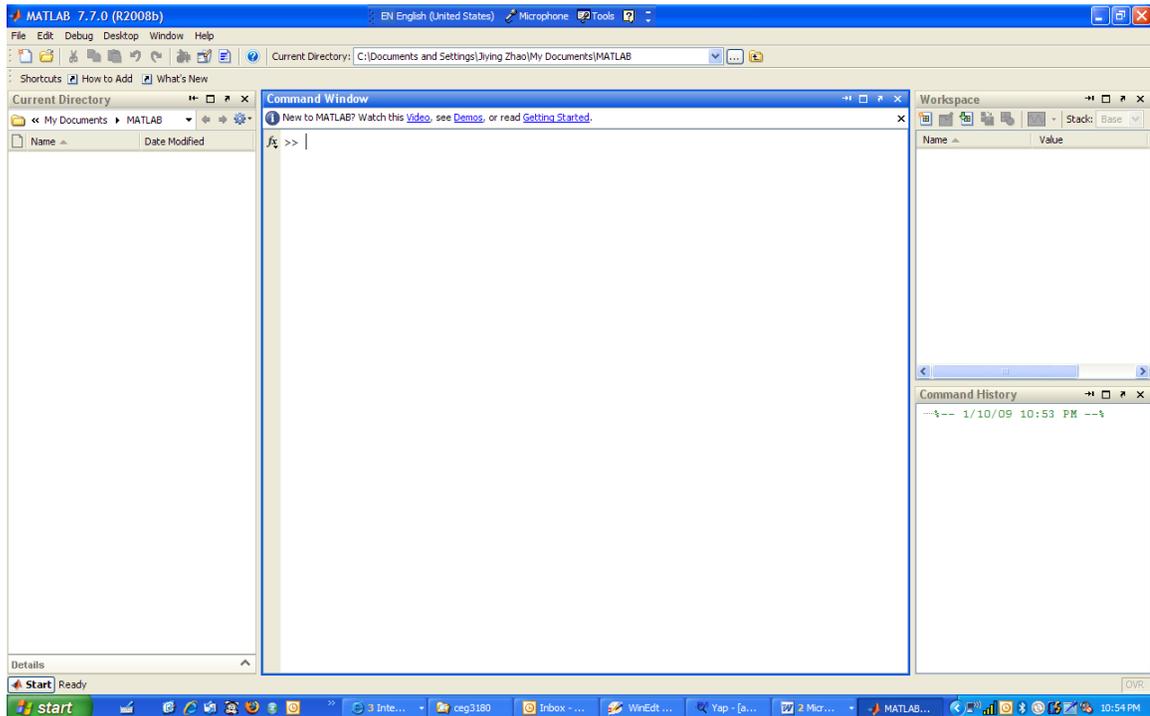


Introduction to MATLAB

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 (v1, v1+d, v1+2*d, ..., v2-d, v2)
 - ii. useful in creating a vector with fixed incremental values, e.g. specifying the x-axis values for a plot.
 - `y = 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), ..., B(N)*C(N))
7. `ZC = conj(Z)`
- returns the complex conjugate of the elements of Z.
8. `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, `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, `figure(h)` creates a figure and assigns it the handle h. `figure(h)` where h is not the handle to a figure, and is not an integer, is an error.

`plot(X1,Y1,...)`

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 .

`title('string')`

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

`axis([xmin xmax ymin ymax])`

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

`xlabel('string')`

labels the x-axis of the current axes

9. If you want the figures to appear in different windows, use `figure(i)` to separate them, eg
- ```
figure(1);
plot(...);
figure(2);
plot(...);
```
10. `wavplay(y,Fs)`
- 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 Fs in samples per second. The default value for Fs 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.