BE.011 MATLAB Tutorial

March 17, 2003

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for BE.420

How to Start and Run MATLAB

- On a Mac or PC, run as you would any other program..just point and click

- All 12 PC's in the building 26 computer lab have MATLAB 6.5 (and Solver!!) now installed

Running MATLAB on MIT server…

- At the MIT server prompt, type:
  - MITserver% add matlab;
  - MITserver% matlab
- First time, make a subdirectory:
  - MITserver% mkdir ~/matlab
- In MATLAB, you can access additional MIT server options by typing:
  - help MIT server
  - On some workstations, you can access newer version of MATLAB by typing:
    - matlab-desktop at the matlab prompt

MATLAB Helpdesk

- At the MATLAB prompt, type:
  - helpdesk

➢ This will gives you a searchable command help index which is toolbox specific and more similar to the help resources that you will see in the PC version 6.xx

MATLAB Basics

Functions:

- – Matrix formulation: fast calculation
- – Strong in numerical, but weak in analytical
- – General purpose math solvers: nonlinear equations, ODEs, PDEs, optimization

Basic mode of usage:

- – Interactive mode
- – Permanent MATLAB files (M-files)
  - • M-script
  - • Functions

➢ M-script and Functions must be written in separate files

- – Note: M-files are saved in "Work" folder in the MATLAB program files subdirectory

Basic Syntax

- Case sensitive variable name
- Library of Reserved Words
  - These will appear in blue if you are writing your code as an M-file
- End statements with a ";"
- Vector: Vec(i)
- Matrix: Mat(i,j,…)
- Element by element matrix operations:
  - ".*, ./, .^2"
- General matrix operations:
  - Cross product (*)

Syntax for Variable Assignment

- Simple Variable
  - Type A = 4;

- Vector
  - Type A = [1 2 3 4];

- Matrix
  - Type A = [1 2 3 4; 5 6 7 8];

Variable Assignment Continued

- Assignment of one value in a matrix
  - Type b = A(2,1); (same as b=5 here)

- Incremental Vectors
  - Typing:
    - Z = (1:5) gives increments of 1
      - i.e. Z = [1 2 3 4 5]
    - Z = (1:3:7) gives increments of 3 between 1 and 7
      - i.e. Z = [1 4 7]

Two Important Points

- If you do not put a semi-colon at the end of the line, the result of the operation for that line will be displayed when your program is run => BE CAREFUL!!

- Assignment vs. Equals: Important in Loops!
  - Assignment: a = b
  - Equals: a == b

Looping in MATLAB

- For Loop

for I = 1:N

for J = 1:N

A(I,J) = 1/(I+J-1)

end

end

•All Boolean expressions work

➢Less than: <, Greater than: >, Equal to: ==, Not equal to: ~=, Less than or equal to: <=, Greater than or equal to: >=.

Looping Continued…

- ## If Statement

if I == J

A(I,J) = 2;

elseif abs(I-J) == 1

A(I,J) = -1;

else

A(I,J) = 0;

end

•As in C++, While loops can also be executed in MATLAB

Basic MATLAB Commands

Matlab commands	Functions and descriptions
help *functionname*	Matlab on-line help for functions
lookfor *searchphrase*	To find matlab function with descriptions containing the search phrase
who	To list all variables currently used
size(*matrix*)	To identify the dimensionality of the *matrix* (use length(*vector*) for a vector)
ones(*m,n*)	To create a unit matrix of size m x n
print –depsc *filename.ps*	To print an active plot (later use lpr to print in MIT server)

Comments

- You can write comments between and after lines of code by typing "%" in front of your message

- You shold write your name and assignment info on top of each program

- Lastly, use comments throughout the code to show me that you know what you're doing

Plotting Your Data

- After you have called your function (and assigned a variable name to the sol'n)
  - Type: figure (don't need a semicolon here)
  - Type: plot(t,X)
    - t is your time vector and X is the sol'n vector that you named in your function call or part of your sol'n matrix (i.e. X(:,1), first column of matrix)
  - Note: You can type semilogx(t,X) or semilogy(t,X) to get a semilog plot of your choosing

Plotting Your Data Continued..

- Typing "hold on" after introducing a second figure will allow you to plot multiple curves on the same set of axes

- Using the "subplot(x,y,z), plot(t,X)" sequence will allow you to plot a matrix of graphs of size (x,y) on the same page, with z being the location of the graph in the matrix

- Typing "plot(t,X,'*letter*')" will allow you to control the color of the line for that plot, type 'help plot" in prompt to see the color key

Labelling Axes, Making Legends

- For the plot title, type:
  - title('*title*')
- For the x and y axes, type:
  - xlabel('*axis name*')
  - ylabel*('axis name')*
- To make a legend, type:
  - legend*('name of curve 1,'name of curve 2', etc.*)
- Type all of these commands after each figure and plot command so that I know what you are presenting in each graph!!

Saving Your Work

- In the MATLAB prompt, type:
    - save *filename*
- In Windows, just use the save icon or the save option in the drop down menu under file
- Make sure that your file is saved in the proper directory so that it can run from the MATLAB prompt
    - In MIT server this is the directory you named the first time you ran MATLAB
    - In Windows, it is normally the "Work" folder

Running Your Saved Work

- Type the name of the M-file in the Matlab prompt and hit enter

  - Also make sure that any functions that your program uses are in the same directory as this main M-file

- If there are any errors in your code, they will show up as messages in red text in the prompt window

Some advice on getting help…

- USE THE HELP SEARCH TOOL
  - In MATLAB 6.xx, type:
    - help *functionname*
  - In the MIT server clusters, version 5.xx, use the helpdesk option
- Debug carefully
  - Write your code a little at a time
  - Use flags to see where errors are
- If debugging is going nowhere, ask a friend to check things out

MIT Help

- Go to:

http://web.mit.edu/answers/www/matlab/

- The Copy Tech also has printouts of basic MATLAB commands and operations, you can pick up a copy for free there

If you have a Pentium 4 and you have MATLAB Version 6.0……

- Go to:

  http://www.mathworks.com/

- Search for Pentium 4, Matlab version 6.0, and you'll be directed to a link that gives you instructions to fix everything.