Numerical Analysis 2015

A First Introduction to MATLAB

This is a bare-bones introduction to MATLAB, to familiarize students with its functionality.

MATLAB basics

The Interface:

- Command Window (enter commands here)
- Command History (double click)
- Current Directory (use this for access to course MATLAB files)
- Workspace (lists current variables and values)
- Help (F1) – extensive help menu

Beginning Commands:

- `cd` *directory* – change current directory (Eg. `cd e:\mfiles`)
- `format compact` – MATLAB output in compact format
- ↑ – step through previous commands
- help (F1) – extensive help menu
- `who`, `whos` – list workspace variables
- `help` *filename* – lists some help lines in the script (Eg. `help informative`)
- `clc` – clear command window
- [1 2 3; 4 5 6] – Enter a matrix $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$
- [1 2 3; 4 5 6]′ – Take the transpose of the last matrix to get $\begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$. (Notice the apostrophe.)
- M = [1 2 3 4; 5 6 7 8; 9 10 11 12] – Define a matrix $M = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{pmatrix}$. The semicolon indicates the end of a row.
- $M(1,3)$ – extracts the entry in the first row and third column of M, namely 3.
- $M(2, 3{:}4)$ – extracts the entries in row 2 and columns 3 through 4, namely the vector $\begin{pmatrix} 7 & 8 \end{pmatrix}$.
- $M(:, 1{:}2)$ – extracts the entries in all the rows, and columns one and two of M, namely the submatrix $\begin{pmatrix} 1 & 2 \\ 5 & 6 \\ 9 & 10 \end{pmatrix}$.

- The difference between $+$, $*$, $\wedge$, / and .+, .*, .$\wedge$, ./

  Without the period, these symbols have their usual meaning: addition, multiplication, exponentiation, and division. With the period, the operation will be performed on each element of a vector or matrix. Type `help power` for more details on .^ These commands are essential for plotting. See below.

Plotting:

Let's do an example to plot $y = x^2 + 4$ on the interval $[-4, 6]$

`x=[-4:.1:6];`	[beginning number : stepsize : end number]
`y=x.^2+4`	get the corresponding y values
`plot(x,y)`	plot the curve by connecting the dots between points with x-coordinates saved in the vector x and corresponding y-coordinates in vector y.
`y2=log(x)`	get y-values for $f(x) = \ln(x)$
`plot(x,y2,'r')`	
`hold on`	saves the current plot
`help plot`	get help information about plotting options
`plot(x,y,'go')`	
ezplot('x^2+4',[-4,6])	EaSy plot a simple function

Descriptive statistics commands:

Computing elementary quantities to summarize a data vector x.

`mean(x);`	mean of data vector x
`std(x);`	standard deviation of data vector x
`median(x);`	median of data vector x
`min(x), max(x), var(x), cov(x), mode(x)`	minimum, maximum, covariance, mode of x

File Types (m-files):

- Script files. For example, `onepop.m`. This is essentially a program file. It contains a number of MATLAB commands.
- Function m-files. Files containing MATLAB commands that take arguments and possibly return values.