MATLAB Quick Start

Violeta Ivanova, Ph.D.
Educational Technology Consultant
MIT Academic Computing
violeta@mit.edu

http://web.mit.edu/ist/topics/math/

Getting MATLAB

- Athena
- Personal computers
  - Students
    - 300 floating licenses (free)
    - http://matlab.mit.edu
  - Faculty and staff
    - for purchase
    - https://web.mit.edu/is/products/vsls/matlab/matlab-license.html

Starting MATLAB on Athena

- Athena default version:

```
athena% add matlab
athena% matlab &
```

- Other Athena versions:

```
athena% add matlab -verX.X
athena% matlab &
```

- MATLAB prompt: `>>`
- Desktop interface

```
>> desktop
```

Starting MATLAB on Laptops

- MATLAB desktop interface is the default
- Supported operating systems by IS&T
  - Windows XP
  - Mac OS X

MATLAB Desktop

- Default desktop
  - Command Window
    - Type MATLAB commands
    - Can also use some UNIX commands
  - Current Directory Window
  - Command History Window
  - Menu Toolbar

Getting Help on MATLAB

Help in MATLAB

Help on Athena

Training

Help in MATLAB

- Command line help

  `>> help` *`command`*

  e.g. **`help`** `polyval`

  `>> lookfor` *`keyword`*

  e.g. **`lookfor`** `integrate`

  `>> helpwin` or `helpdesk` or `doc`

- Desktop menu
  - Help->Help MATLAB

MATLAB Help - Toolboxes

- Example
  + MATLAB
    + Mathematics
      + Matrices and Linear Algebra
        Functions summary
        + Matrices in MATLAB
        + Solving Linear Systems of Equations
        + Inverses and Determinants
        …

MATLAB Help @ MIT

- Mathematical Tools at MIT web site

  http://web.mit.edu/ist/topics/math

- Athena OLC stock answers

```
athena% olc
olc> answers
olc_answers> Matlab option #
```

Training

- MATLAB online tutorial (MIT only)
  - https://web.mit.edu/tm/matlab_mastery_I/setup/Start.htm
- Introduction to MATLAB (IAP series)
  - Class materials at: http://web.mit.edu/ist/services/educomp/math/intromatlab.html
- MathWorks training courses
  - http://www.mathworks.com/services/training/index.html
  - 50% discount for everybody from MIT

MATLAB Basics

Variables

Operators

Matrices

Variables

- Begin with an alphabetic character: `a`
- Case sensitive: `a, A`
- Data type detection: `a=5; a='ok'; a=1.3`
- Default output variable: `ans`
- Built-in constants: **`pi  i  j  Inf`**
- **`clear`** removes variables
- **`who`** lists variables
- Special characters

  `[]  ()  {}  ;  %  :  =  .  ...  @`

Operators

- Arithmetic operators

  `+  -  /  \  ^  .\  ./  .*  .^`

- Relational operators

  `<  >  <=  >=  ==  ~=`

- Logical operators

  `|  &  ||  &&  true  false`

- Operator precedence

  `()  {}  []` -> Arithmetic -> Relational -> Logical

- Do not use special characters, operators, or keywords in variable names.

Vectors

- Row vector

```
>> R1 = [1 6 3 8 5]
>> R2 = [1 : 5]
>> R3 = [-pi : pi/3 : pi]
```

- Column vector

```
>> C1 = [1; 2; 3; 4; 5]
>> C2 = R2'
```

Matrices

- Creating a matrix

```
>> A = [1 2.5 5 0; 1 1.3 pi 4]
>> A = [R1; R2]
```

- Accessing elements

```
>> A(1,1); A(1:2, 2:4); A(:,2)
```

Matrix Operations

- `A + 2`: element-wise addition
- `A * 2`: element-wise multiplication
- `A + A`: element-wise addition
- `A ^ 2`: matrix math is default!
- `A .^2`: element-wise exponentiation

MATLAB Example

Functions

Equations

Graphs

Functions

- Function $z = f(t) = \frac{at^2}{2} + 100$

- Compute for vector *t*

```
>> t = [-5: 0.01: 5];
>> a = -10;
>> z = (1/2) * a * t.^2 + 100
```

Equations

- Solve $f(t)=0$

$$p_1 t^2 + p_2 t + p_3 = \frac{a}{2} t^2 + 0t + 100 = 0$$

- Create polynomial

```
>> p = [a/2 0 100]
```

- Find roots

```
>> r = roots (p)
>> c = min(r), d = max(r)
```

More Computations

- Integration

```
>> P = polyint (p)
```

- Area under a curve

```
>> area = polyval (P,d)-
polyval(P,c)
...
```

Graphs

- Plot function *f(t)*

```
>> plot (t, z, 'r-')
>> legend ('z')
>> title ('Position vs. Time')
>> xlabel ('Time')
>> ylabel ('Position')
```

More Graphs

- Example: surface plot

```
>> [x,y] = meshgrid([-3 : 0.25 : 3], …
                   [-3 : 0.25 : 3]);
>> z = x .* exp(-(x.^2 + y.^2));
>> s1 = surf (x, y, z)
>> colorbar vert
>> shading interp
```

MATLAB Programming

M-files

Data files

Programs

File Editors

- Import Wizard

  `File->Import Data …`
- Figure editor

  `>> figure`
- M-File editor

  `>> edit`
- GUI editor

  `>> guide`

Creating M-Files

- Launch editor

  `>> edit filename`

- Copy or type commands
  - Define global variables
  - Define functions
  - Use `%` for comments
- Save as `filename.m`

M-Files Example

- Define function f (`f.m`)

```
% This is the function f(t)
function z = f(t)
global a
z = (1/2)*a*t.^2+100;
return
```

M-Files Example (continued)

- Write *program* (`program.m`)

```
clear all
global a
a = -10;
t=[-5:0.01:5]
z=f(t);
plot(t,z,'r—')
hold on
plot(t, -z, 'b-')
hold off
```

Data Files

- Saving data

```
>> A = [t; z];
>> save ('filename', 'A', '-ascii')
```

- Loading data

```
>> B = load ('filename')
>> t = B(1,:);
>> z=B(2,:);
```

Run MATLAB Programs

- Use filename only (no `.m` extension)

```
>> program
```

Questions?

QuickStart slides and M-files:

http://web.mit.edu/violeta/Public/matlab/quickstart/

Mathematical Tools at MIT:

http://web.mit.edu/ist/topics/math/