

## INTRODUCTION:

Matlab = Matrix Laboratory. It is designed to be great at handling matrices.

Matlab is a “high-level” language and interactive environment. You write simple ASCII text that is translated into a lower-level language the computer can understand in order to perform calculations.

No computer language is best for every application. Here are examples of “high-level” languages:

- Matlab is great at manipulating matrices and is very user friendly. It is used in many different academic fields.
- Fortran, C are great at pure number crunching, not as user friendly. Both are used extensively in engineering.
- Maple and Mathematica are great at symbolic math and are very user friendly.

Matlab will be a good first language, especially for engineers. The techniques you will learn in this course will apply to a lot of other languages. Once you learn one language, it is much easier to learn other languages.

Here is a brief history of Matlab:

[http://74.125.155.132/search?q=cache:OmoXn7Jew\\_4J:www.cpe.ku.ac.th/~anan/courses/204111-MATLAB/document-2004/2004-01-2-History-Matlab-Jim.ppt+matlab+history&cd=4&hl=en&ct=clnk&gl=us&client=firefox-a](http://74.125.155.132/search?q=cache:OmoXn7Jew_4J:www.cpe.ku.ac.th/~anan/courses/204111-MATLAB/document-2004/2004-01-2-History-Matlab-Jim.ppt+matlab+history&cd=4&hl=en&ct=clnk&gl=us&client=firefox-a)

(Quick summary: Matlab was developed to do everything other high-level languages can do, but be much more user friendly.)

## TOOLS OF THE COURSE – MATLAB/OCTAVE:

In class and discussion, we will be using a free open-source program called Octave, which is very similar to Matlab. Whatever you learn using Octave will apply to Matlab... for the purposes of this class, the two languages are interchangeable. I will be using Octave in my lectures and discussion sections.

You can buy the student version of Matlab for ~\$100 at the bookstore, or use it for free in some engineering labs.

You can download Octave for FREE for Windows, UNIX, and Macs here:

<http://www.gnu.org/software/octave/download.html>

Here is the shortcut to the Windows version:

[http://sourceforge.net/projects/octave/files/Octave\\_Windows%20-%20MinGW/Octave%203.2.3%20for%20Windows%20MinGW32%20Installer/Octave-3.2.3-2\\_i686-pc-mingw32\\_gcc-4.4.0\\_setup.exe/download](http://sourceforge.net/projects/octave/files/Octave_Windows%20-%20MinGW/Octave%203.2.3%20for%20Windows%20MinGW32%20Installer/Octave-3.2.3-2_i686-pc-mingw32_gcc-4.4.0_setup.exe/download)

From now on, I will assume that you are using Octave from a Windows machine. But these lecture notes will be similar if you are using a UNIX machine or a Mac.

## Starting Octave:

### (1) Using the Quick Launch icon:

Once you have installed Octave, an icon should appear in your Quick Launch toolbar, on your Desktop, and/or under Start > Programs > GNU Octave 3.2.4 > Octave. Clicking this icon will start Octave.

### (2) Using Octave:

After clicking the Octave icon, you will see a black window pop up with some text:

```
GNU Octave, version 3.2.4
Copyright (C) 2009 John W. Eaton and others.
This is free software; see the source code for copying conditions.
(stuff)
octave-3.2.3.exe:1:C:\Octave\3.2.4_gcc-4.4.0\bin
> (blinking cursor)
```

All commands are issued from a command line, symbolized by the greater than sign (>).

**ls** or **dir** – see contents of current directory

**cd** – change directories

**delete** – remove file

**copyfile** – copy file

**movefile** – renames or moves files

**mkdir** – make directory

**rmdir** – remove directory

**clc** – clear screen

**exit** – closes terminal

**edit** – opens text editor

**pwd** – lists the pathway to the current directory

**..** – double dots indicate one directory higher

Keep in mind these commands are case sensitive.

Let's try some commands out. First, where are we?

```
> pwd
ans = C:\Octave\3.2.4_gcc-4.4.0\bin
```

We are in the folder **bin**, which is in the folder **3.2.4\_gcc-4.4.0**, which is in the folder **Octave**, which is in the hard drive (**C:**). Let's look at the contents of this folder.

```
> ls
Volume in drive C is TI100712V0E
Volume Serial Number is B82B-4BED
Directory of C:\Octave\3.2.4_gcc-4.4.0\bin
[.]          history.dll
[.]          iconv.dll
amd.dll      intl.dll
arpack.dll   jpeg-7.dll
(files and folders)
hdf5.dll     zlib1.dll
          101 File(s)  82,491,596 bytes
          2 Dir(s)  197,501,927,424 bytes free
```

These are the files that run Octave and we don't want to mess around with them. Let's try moving around our computer using commands at the command line. First, move out of the current directory into the home directory. Type **cd** at the command line.

```
> cd
> pwd
ans = C:\Users\Paul
```

We are now in the home directory... that is, we are in the folder **Paul** which is in a folder **Users** which is in the **C:** drive (the hard drive). You can get to the same folder using the graphical user interface (GUI). Go to My Computer > C: > Users > Paul. Note that the name **Paul** likely will be replaced by your username. Let's see what is in this directory.

```
> ls
Volume in drive C is TI100712V0E
Volume Serial Number is B82B-4BED
Directory of C:\Users\Paul
[.]          [Documents]      sample.txt
[.]          [Downloads]    [Saved Games]
(more files and folders)
          18 File(s)  537,890 bytes
          13 Dir(s)  197,522,796,544 bytes free
```

We can access what is on the **Desktop** by moving to the **Desktop** folder.

```
> cd Desktop
> pwd
ans = C:\Users\Paul\Desktop
```

You are now in the **Desktop** folder and can see what is on your **Desktop**.

```
> ls
Volume in drive C is TI100712V0E
Volume Serial Number is B82B-4BED
Directory of C:\Users\Paul\Desktop
(files and folders)
    24 File(s)  545,995,563 bytes
    19 Dir(s)  197,522,755,584 bytes free
```

This is the list of items on your **Desktop**. Let's create a folder on your **Desktop** called **HW\_Assignments**

```
> mkdir HW_Assignments
> ls
```

You should be able to see the folder **HW\_Assignments** on your Desktop. What is in it?

```
> cd HW_Assignments
> pwd
ans = C:\Users\Paul\Desktop\HW_Assignments
```

You are in the correct folder.

```
> ls
```

You should see nothing because there are no files or folders in this directory. Let's make a simple text file.

```
> edit firstfile.txt
```

A simple text editor should open up. Type anything you want, save the file, then close the text editor if you wish.

```
> ls
Volume in drive C is TI100712V0E
Volume Serial Number is B82B-4BED
Directory of C:\Users\Paul\Desktop\HW_Assignments
[.]      [..]      firstfile.txt
    1 File(s)      21 bytes
    2 Dir(s)  187,437,633,536 bytes free
```

Ta da! You have created a text file. Note that you can open this file from your normal graphical user interface. Next, we will move the file into a sub-folder

```
> mkdir HW1
> ls                (see the new directory 'HW1' and the old file 'firstfile.txt'?)
> movefile firstfile.txt HW1
> ls                ('firstfile.txt' has been moved into the folder 'HW1')
> cd HW1
> ls                (this is the new location of 'firstfile.txt')
```

If you want to move the file up one directory (out of 'HW1' and back into 'HW\_Assignments') you can type the following command,

```
> movefile firstfile.txt ..    (the double dots mean one level up)
> ls                            ('firstfile.txt' has been moved out of 'HW1')
> cd ..
> ls                            (there it is)
```

You can make a copy of a file with the **copyfile** command.

```
> copyfile firstfile.txt backup_firstfile.txt
> ls                (you have made an identical copy with a different name)
```

There are a couple of time-saving tricks you can use.

- Cycle through old commands with the up arrow
- Use TAB to auto-complete commands, file names, and folder names.

### (3) Starting Matlab:

In Windows, you can start Matlab by clicking on Start > Programs > Matlab > Matlab. You are now at a command line.

Notice the Matlab uses both a graphical user interface and a command line interface. It is more user friendly (and more expensive) than Octave.

## BASIC OPERATIONS:

+ - \* / ^  
(we will be learning more)

In Octave, you can do mathematical operations from the command line.

```
> 2 * 5
```

ans = 10  
> 2/5  
ans = 0.40000  
> 2+5  
ans = 7  
> 2-5  
ans = -3  
> 2^5  
ans = 32

You can do math with very large numbers too. Here I use scientific notation.

> 2.4e4 + 1.2e4  
ans = 3.6000e+004  
> 2.4e4 + 1.2e3  
ans = 2.5200e+004

2.4e4 is the same as  $2.4 \times 10^4$ , or 24000.

## **ORDER OF OPERATIONS:**

Please Excuse My Dear Aunt Sally  
Parentheses, Exponent, Multiplication and Division, Addition and Subtraction

The expression is evaluated left to right.

Examples:

> 2 + 5 \* 3 ^ 2 - 2/2  
ans = 46  
> (2 + 5) \* 3 ^ (2 - 2/2)  
ans = 21