



Introduction to MATLAB

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Vibes and Waves in Action

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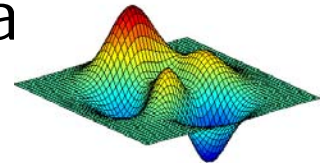


UMass-Lowell Center for Advanced Computation and Telecommunications

- Yu Liu, Electrical and Computer Eng., Ph. D. Student

What is MATLAB?

- MATLAB is a scripting language that is often used to solve scientific and mathematical problems, numerically, and to visualize results.



- Useful for
 - Solving equations
 - Simplifying functions
 - 2D-3D plotting of calculated values
 - Developing animation and simulation of physical systems.

MATLAB Desktop

Command Window: a big calculator

— Menus change, depending on the tool you are using.

Enter MATLAB statements at the prompt.

View or change the current directory.

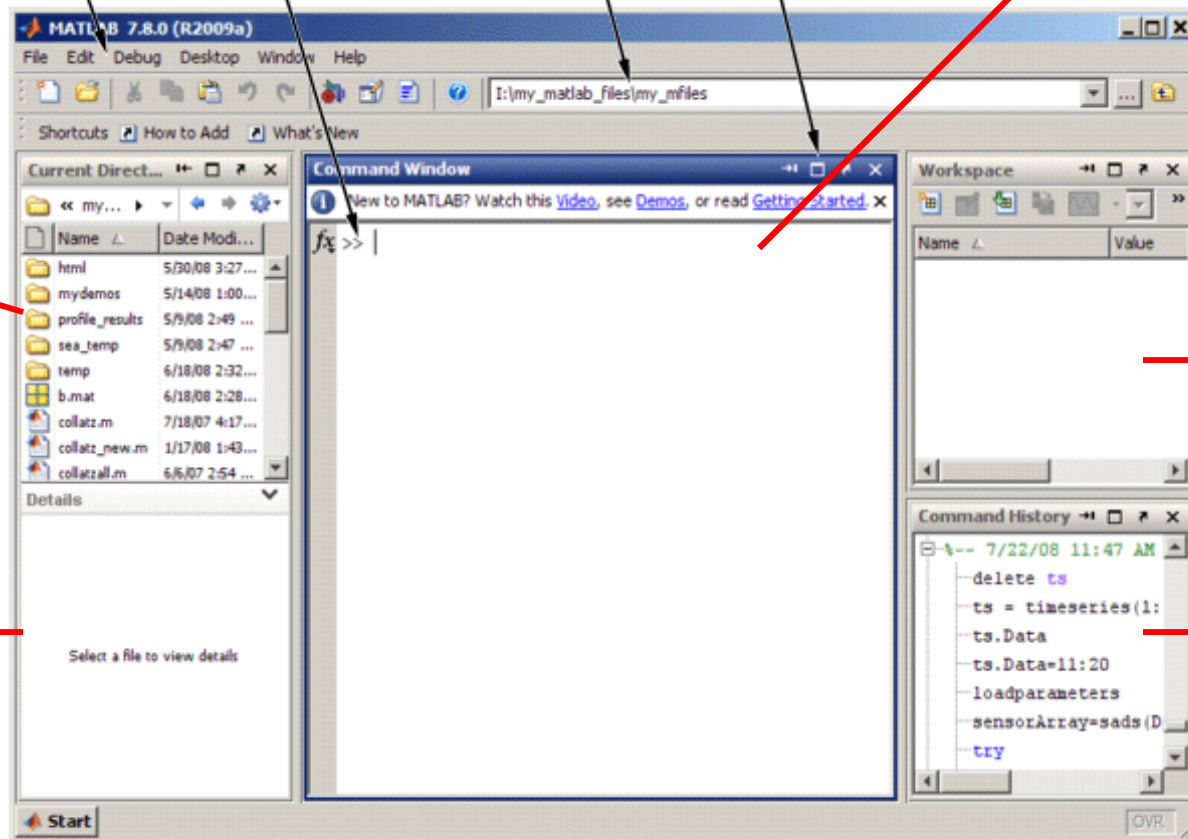
Move or resize the Command Window.

Current Directory

Details

Workspace

Command History



Matlab fundamentals

- Variables
 - Variable is a place where we store a piece of information.
(can include letters or numbers)
- Arithmetic Operations
 - Operators : + , - , * , ^ , /
- List
 - In additions to doing operations on a single number, Matlab allows us to perform operations on a list of numbers.

Variables/Numbers

- Variable is a place where we store a piece of information.

Example : Storing your friend's phone number in your cell phone.

- In Matlab variable names can include letters or numbers

Example:

nwave, T1, Kenergy, Force1, ...

Example :

```
>> a = 20
```

```
>> b = 10
```

```
>> 3*a+b notice you can't type 3a+b
```

Arithmetic Operators

○ Basic arithmetic operators: +, -, /, *

○ Try:

```
>> 5+4
```

```
>> 6-5+4*3
```

Question: Does Matlab follow the order of operations?

```
>> sqrt(100)
```

semicolon (;) stops the output display

```
>> sqrt(10);
```

will not display the result.

```
>> abs(-10)
```

|-10|

```
>> 2^2
```

```
>> 2^3
```

Question: What operation is ^ ?

Matlab and Algebra

- Creating symbolic variables

Use the commands **syms** or **sym()**

To create the symbolic variable x

```
>> syms x
```

```
>> sym('x')
```

If we wanted to create more symbolic variables at the same time

```
>> syms x y z
```


Collecting Like Terms

- Expressions in Matlab

$$3x^2 + 5x - 5 \quad = > \quad 3 * x ^ 2 + 5 * x - 5$$

The command **collect()**; combines like terms

```
>> S=2*(x+3)^2+x^2+6*x+9
```

```
>> collect(S)
```

Try it on your own, simplify the following expressions:

$$5x^2 + 7x - 2x^2 - 10x + 5$$

$$7x^3 + 3x - 2 + 5x - x^2 + x^3$$

Factoring Expressions

The command **factor()**; factors the expression or equation

```
>>p=x^2+9*x+20
```

```
>>factor(p)
```

Try it on your own, factor the following expressions

$$x^2 + 5x + 6$$

$$x^2 - 5x + 6$$

Solving Equations

- The **solve()** function; sets the equation equal to zero and solves for the roots

```
>> E1 = x - 3
```

```
>> solve(E1)
```

- **Try it on your own, solve the following equations:**

$$x - 3 = 0$$

$$5x + \frac{3}{4} - 5 = 0$$

Solving Equations

- Solving equations not equal to zero

To solve $5n - 9 = 20$

First define a new equation

```
>> eq=sym('5*n-9=20')
```

```
>> solve(eq)
```

To obtain the answer in decimal format

```
>> double(ans)
```