

# ME 3001 Lecture, Roots of Non-Linear Equations

## A Brief Refresher in MATLAB

- **What is it?**

- High Level programming language
  - \* language written in C++
  - \* Interactive Development Environment written in JAVA
  - \* Windows, Mac, and Linux compatible
- *MATrix LABoratory*
- *Technical Computing Language* - Mathworks

- **Why use it?**

- A powerful tool for engineers, scientists, and students
  - \* optimized for floating point arithmetic and linear algebra
  - \* extensive library of mathematical functions and operations
  - \* specialized functions and operations
    - Aerospace
    - Robotics
    - Communications
    - Image/Signal Processing
    - Embedded Systems and Controls
  - \* ability to use *symbolic programming*
- Ease of Access and Community
  - \* *Plug and Play*, it works out of the box
  - \* requires little or no programming experience to begin
  - \* online community for sharing code, *MATLAB Central*

- **Why Not?**

- **Review of some basic MATLAB**

- **Useful Commands( type in Command Window)**

```
>> clear variables
```

```
>> clc
```

```
>> close all
```

```
>>
```

- **Built-In MATLAB functions**

- \* **Typical Mathematics Functions**

- `sqrt()`

- `exp()`

- `log()`

- `log2()`

- `log10()`

**\* Other Useful Functions**

- `round()`
- `floor()`
- `int8()`
- `sign()`
- `mod()`
- `rem()`
- `fzero()`

**\* The Built in Help**

- `>> help fzero()`
- use the help to get information about the built in functions
- the full documentation is also available online

## – Constants

Several useful constants are built into MATLAB.

- \* `pi`

- \* `i`

- \* `j`

- \* `inf`

- \* `NaN`

## – Random Numbers

Sometime it is useful generate random data in MATLAB.

- \* `rand()`

- \* `randi()`

## – User Defined Functions

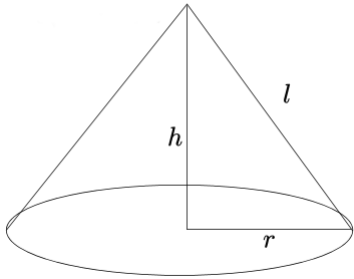
- \* We often write our own functions in MATLAB. To do this we must define the function in the function file.

- \* When we use a function we *call* the function.

- \* we can refer to a function with *handle operator*

## • A Mechanical Design Problem

As an engineer you are asked to design a structure. The geometry of this structures is simple but certain properties are critical. Also you want to spend as little as possible on materials.



surface area,  $s = \pi r l = \pi r \sqrt{h^2 + r^2}$

volume,  $v = \pi r^2 \frac{h}{3}$

The first structure you are required to design is a cone with a surface area of exactly  $25m^2$  to a tolerance of  $0.1 m^2$  and a height of exactly  $1m$ . Your goal is to find the radius in meters.

Write a program the uses the *Newton -Raphson* method to solve the problem. Verify and compare your answer with the *fzero* function.

- **REMINDER - Homework 1 is due Friday**
- **REMINDER - MATLAB script from today's lecture will be posted on ilearn.**