Week 11

EMT 101 – Engineering Programming

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Extensive Library Package

- One of the best features in MATLAB is that it has a more extensive library package compared to C++
- A MATLAB code can solve almost all types of matrix problems by connecting with LINPACK or EISPACK
- No need to re-invent the wheel!
- The next best thing in MATLAB is the library which includes various build-in plotting features

2D Plotting Commands

- use text([X],[Y],’text’) to include text
- use line([X],[Y]) to draw lines
- use quiver([X],[Y],[u],[v]) to draw vector lines

3D Plotting Commands

- use plot3([X],[Y],[Z]) to plot points in 3D
- use surf([X],[Y],[Z]) to draw surface plots
- can also use mesh([X],[Y],[Z]) (data is in “mesh”)
- use image([X],[Y],[Z]) to draw surface plots

Plot Control

- Each plot can be customized from the MATLAB script
- MATLAB uses the concept of “handle” for each element in the figure
- a handle is a identification number that points to the properties associated with a figure
- common commands to use with a “handle”:
- set,get,gco,gca,gcf

Handle Operators

- set: set the properties associated with the handle
- get: get all the properties of the figure pointed by the handle
- gco: get all the properties of an object in the figure
- gca: get all the properties of the *axis the figure*
- gcf: returns the handle value

Functions in MATLAB

- Similar to C++, a function is an external piece of code (outside main) which is called by the main program to perform certain tasks.
- A function has an input and an output
- Overall use of functions in MATLAB is very similar to C++

Function Example

- Format of a function in MATLAB:

  function [x1, x2] = functionName(y1,y2)

  <body code>

- The function file must be saved as functionName.m

- variables in [·] (LHS) are outputs of the function

- variables in (·) (RHS) are inputs of the function

Function Example

- A function to find average value of vector **x.**

```
function ave = myAverage(x)
sumx = sum(x);
n = length(x);
ave = sumx/n;
```

- This code must be saved as myAverage.m

Tutorial 1

- The task is to estimate the area under the sine function u(x) = sin 2πx for x = [0, Pi].

  Estimate the area by dividing x into many intervals. Each interval is an area of a rectangle f (xi)\Delta xi,
  where \Delta xi = xi − xi−1.

Use a function to denote square area rule and another function to represent trapezoidal rule.

Tutorial 1 Solution

```
function main
clc
clear all
N=input('Enter number of interval:');
lwrlmt=0;
uprlmt=pi;
dx=(uprlmt-lwrlmt)/N;
x= (lwrlmt+dx/2):dx:(uprlmt-dx/2);
f=(sin(2*pi*x));
Squarearea=integrate(N,dx,f)
Trapezoidalarea=trapezoidal(N,dx,f)
end

function [r]=integrate(N,dx,f)
r=0;
for i=1:N
    r=r+f(i)*dx
end
end

function [t]=trapezoidal(N,dx,f)
sum=0;
for i=2:N-1
    sum=sum+f(i);
end
    t=(dx/2)*(f(1)+f(N)+(2*sum))
end
```

Exercise 1

- Solving the beam problem in Homework 2