ME 594 – Numerical Methods – HW07

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“I pledge my honor that I have abided by the Stevens Honor System”

Text

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**MATLAB program:**

* ***Script for Force.m***

% Function to get the force

function F = Force(t,v)

n = length(t);

dt = t(2) - t(1);

W = 2400;

g = 32.2;

m = W/g;

ms\_per\_s = 1000;

ft\_per\_mi = 5280;

s\_per\_h = 3600;

conv = ms\_per\_s\*ft\_per\_mi/s\_per\_h;

F(1) = m\*(-3\*v(1)+4\*v(2)-v(3))/(2\*dt)\*conv;

F(n) = m\*(v(n-2)-4\*v(n-1)+3\*v(n))/(2\*dt)\*conv;

for i = 2:n-1

F(i) = m\*(v(i+1)-v(i-1))/(2\*dt)\*conv;

end

* ***Driver to run the above function***

% Q1 Driver  
  
clear all  
close all  
clc  
  
t = [0 10 20 30 40 50 60 70 80];  
v = [30 29.5 28 23 10 5 2 0.5 0];  
  
F = Force(t,v);  
F = F';  
disp(F)

**MATLAB output:**

1.0e+04 \*  
  
 0  
 -1.0932  
 -3.5528  
 -9.8385  
 -9.8385  
 -4.3727  
 -2.4596  
 -1.0932  
 0

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***Graphical user interface, text, application

Description automatically generated***

**MATLAB program:**

* ***Function to compute the bending moment***

% Function to compute the bending moment

function M = BendingMoment(x,y)

n = length(x);

dx = x(2)-x(1);

E = 29\*10^6;

I = 720;

I\_ft = 12;

M(1)=(2\*y(1)-5\*y(2)+4\*y(3)-y(4))/dx^2\*E\*I/I\_ft;

M(n) =(-1\*y(n-3)+4\*y(n-2)-5\*y(n-1)+2\*y(n))/dx^2\*E\*I/I\_ft;

for i = 2:n-1

M(i) = (y(i-1)-2\*y(i)+y(i+1))/dx^2\*E\*I/I\_ft;

end

plot(x,M)

xlabel('x(inch)')

ylabel('M(lbf\*ft)')

* ***Driver to run the above function:***

% Q2 driver  
  
clear all  
close all  
clc  
  
x = [0 24 48 72 96 120 144 168 192 216 264 288 312 336 360];  
y = [0 -0.111 -0.216 -0.309 -.386 -.441 -.473 -.479 -.458 -.412 -.345 -.263 -.174 -.090 -.026 0];  
  
M = BendingMoment(x,y);  
M = M';  
disp(M)

**MATLAB Output:**

1.0e+05 \*  
  
 0.0000  
 0.1813  
 0.3625  
 0.4833  
 0.6646  
 0.6948  
 0.7854  
 0.8156  
 0.7552  
 0.6344  
 0.4531  
 0.2115  
 -0.1510  
 -0.6042  
 -1.0573

Chart, line chart

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*Text, letter

Description automatically generated*

**MATLAB program:**

* ***Script for computing the error and plotting:***

% Function to get the error and plot it

function ef = ErrorFun(x)

dt = 0.2;

h = dt/2;

N = x/dt+1;

ef = zeros(1,N);

t = linspace(0,x,N);

ef(1) = 0;

for i = 2:N

local\_simp = h/3\*(feval('IntFun',t(i-1))+ 4\*feval('IntFun',t(i-1)+h) + feval('IntFun',t(i-1)+2\*h));

ef(i) = ef(i-1) + local\_simp;

end

ef = ef.\*2/sqrt(pi);

plot(t,ef)

title('error v/s x')

xlabel('x')

ylabel('erf(x)')

grid on

* ***Integral function for simpson’s method***

% script for intergral function

function f = IntFun(t)

f = exp(-1\*t^2);

* ***Driver for Q3***

% Driver for Q3

clear all

close all

clc

x = 2;

ef = ErrorFun(x);

**MATLAB Output**

% Driver for Q3  
  
clear all  
close all  
clc  
  
x = 2;  
ef = ErrorFun(x);

Chart, line chart

Description automatically generated

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**Graphical user interface

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**MATLAB program:**

* ***Trapezoid function script***

% Script to solve using trapezoid method

function Q = Trapezoid(v)

R = 2;

n = length(v);

h = R/(n-1);

r = linspace(0,R,n);

Q = 0;

for i = 1:n-1

Q = Q+0.5\*(v(i)\*r(i)+v(i+1)\*r(i+1));

end

Q = Q\*2\*pi\*h;

* ***Simpson’s function script***

% Script to solve using Simpson's method

function Q = Simpsons(v)

R = 2;

n = length(v);

h = R/(n-1);

r = linspace(0,R,n);

Q = 0;

for i=1:2:n-2

Q = Q + (v(i)\*r(i)+4\*v(i+1)\*r(i+1)+v(i+2)\*r(i+2));

end

Q = Q\*2\*pi\*h/3;

* ***Driver for Q4***

% Driver Q4  
clear all  
close all  
clc  
  
v = [38 37.6 36.2 33.6 29.7 24.5 17.8 9.6 0];  
  
Q\_t = Trapezoid(v);  
Q\_s = Simpsons(v);  
  
fprintf('Q\_t =')  
disp(Q\_t);  
fprintf('Q\_s =')  
disp(Q\_s);

**MATLAB Output:**

Q\_t = 245.8689  
  
Q\_s = 249.8090

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