**Homework 06**

Mech307

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1)



Ymax = 20.9829 at t = 4.9540

Y = 0 at t = 13.9965

2)



Ymax = 15 when c = 1.60

3)



Xpeak,1 = 0.5000 m at t = 0.0000 s.

Xpeak,2 = 0.2280 m at t = 3.1660 s.

Xpeak,3 = 0.1040 m at t = 6.3320 s.

Xpeak,4 = 0.0474 m at t = 9.4970 s.

Tpeak,2 - Tpeak,1 = 3.1660

Tpeak,3 - Tpeak,2 = 3.1660

Tpeak,4 - Tpeak,3 = 3.1650

Xpeak,1 / Xpeak,2 = 2.1930

Xpeak,2 / Xpeak,3 = 2.1930

Xpeak,3 / Xpeak,4 = 2.1930

4)



Y approaches to 110.6509 as time goes to infinity.

5)



For y(10) = 120 , c = 57.4

6)



Ymax = 173.7232 m at t = 2.2300 s.

**Matlab Codes:**

Pr1:

clc

clear all

close all

h = 0.001;

y(1) = 10;

a = 0; %t final

while (y(end)>0)

a = a+h;

t = 0:h:a;

for (i=1:(length(t)-1))

dydt = 5 - 0.4\*t(i) - t(i)\*exp(-0.1\*t(i));

y(i+1) = y(i) + dydt\*h;

end

end

I = find(max(y)==y);

fprintf('\nProblem 1\n\nYmax = %.4f at t = %.4f\n',y(I),t(I));

t0 = (t(length(t))\*2-h)/2;

fprintf('\nY = 0 at t = %.4f\n',t0);

plot(t,y,'m-','linewidth',1), xlabel('t [s]'), ylabel('Y [m]'), grid on, axis equal, axis([0 15 0 25]);

Pr2:

clc

clear all

close all

h = 0.0001;

c = 0.4:0.1:5;

y(1) = 10;

for (j = 1:length(c))

x = 0:h:14;

for (i = 1:length(x)-1)

dydt = 5 - c(j)\*x(i) - x(i)\*exp(-0.1\*x(i));

y(i+1) = y(i) + dydt\*h;

end

yMax(j) = max(y);

end

I = find(yMax<=15.1 & yMax>=14.9);

fprintf('\nProblem 2\n\nYmax = 15 when c = %.2f\n',c(I));

plot(c,yMax,'b-','linewidth',1), xlabel('c'), ylabel('yMax'), grid on

Pr3:

clc

clear all

close all

h = 0.001;

m = 10; c = 5; k = 40;

t = 0:h:20;

x(1) = 0.5;

xp(1) = 0;

for (i = 1:length(t)-1)

x(i+1) = x(i) + xp(i)\*h;

xp(i+1) = xp(i) + h\*(-c\*xp(i) - k\*x(i))/m;

end

xP(1) = x(1); tP(1) = t(1); %at t = 0.000

a = 2;

for (i = 2:length(x)-1)

if (x(i)>x(i-1) && x(i)>x(i+1))

xP(a) = x(i);

tP(a) = t(i);

a = a+1;

end

if(a==5), break, end

end

fprintf('\nProblem 3\n\n');

for (i = 1:4), fprintf('Xpeak,%.0f = %.4f m at t = %.4f s.\n',i,xP(i),tP(i)); end

disp(' ');

for (i = 1:3), fprintf('Tpeak,%.0f - Tpeak,%.0f = %.4f\n',i+1,i,tP(i+1)-tP(i)); end

disp(' ');

for (i = 1:3), fprintf('Xpeak,%.0f / Xpeak,%.0f = %.4f\n',i,(i+1),xP(i)/xP(i+1)); end

plot(t,x,'k-','linewidth',1), xlabel('t [s]'), ylabel('X(t) [m]'), grid on

Pr4:

clc

clear all

close all

h = 0.0001;

t = 0:h:500;

y(1) = 100;

for (i = 1:length(t)-1)

dydt = (30\*exp(-0.1\*t(i)))/(1+sqrt(y(i)))-t(i)\*exp(-0.25\*t(i));

y(i+1) = y(i)+h\*dydt;

end

fprintf('\nProblem 4\n\nY approaches to %.4f as time goes to infinity.\n',y(length(t)));

plot(t,y,'g-','linewidth',1), xlabel('t'), ylabel('Y'), grid on

Pr5:

clc

clear all

close all

h = 0.01;

t = 0:h:10;

N = length(t); y = zeros(1,N);

c = 0;

while (y(N)<120)

c = c+0.1;

y(1) = 100;

for (i = 1:N-1)

dydt = (c\*exp(-0.1\*t(i)))/(1+sqrt(y(i))) - t(i)\*exp(-0.25\*t(i));

y(i+1) = y(i) + h\*dydt;

end

end

fprintf('\nProblem 5\n\nFor y(10) = 120 , c = %.1f\n',c);

plot(t,y,'c-','linewidth',1), xlabel('t'), ylabel('Y'), grid on

Pr6:

clc

clear all

close all

h = 0.0001;

t = 0:h:5;

y(1) = 10;

yp(1) = 100;

ypp(1) = 0;

for (i=1:length(t)-1)

ypp(i+1) = ypp(i) + (-0.5\*y(i) - 0.3\*t(i))\*h;

yp(i+1) = yp(i) + ypp(i)\*h;

y(i+1) = y(i) + yp(i)\*h;

end

I=(find(max(y)==y));

fprintf('\nProblem 6\n\nYmax = %.4f m at t = %.4f s.\n',y(I),t(I));

plot(t,y,'r-','linewidth',1), xlabel('t [s]'), ylabel('Y [m]'), grid on