4/5/18 – Thursday

Numerical Methods 2:30pm – 4:40pm

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Lab #1

Problem: In the study of unforced oscillating systems, either mechanical (springs) or electrical (circuits), the differential equations governing them produce solutions of the form:

$y = Ae^{-kt}\sin(\omega t + \varphi)$ where A, k, ω, ϕ are constants, with A, k>0.

Procedure:

1. Set A=10, k=.25, omega = 2.5, phi = 1.5.
2. Create a t-vector of 100 values ranging from 0 to 10 spaced equally.
3. Create a vector of the corresponding y values.
4. Plot the equation.
5. What affect does A have on the graph? What about k? What about omega? Choose different parameters and see what happens.
6. Create a new script. In that script, define two functions to plot varying the parameter omega and k to demonstrate the effect.
7. Plot all 3 graphs on the same plot. Each plot needs to have a different color and style. Plot the graph from 0 to 6pi. Have a legend.
8. You should be able to run your script from the command window by typing in the name of the file.

My Solution:

(Simply type file name into command window to run)

Lab1.m

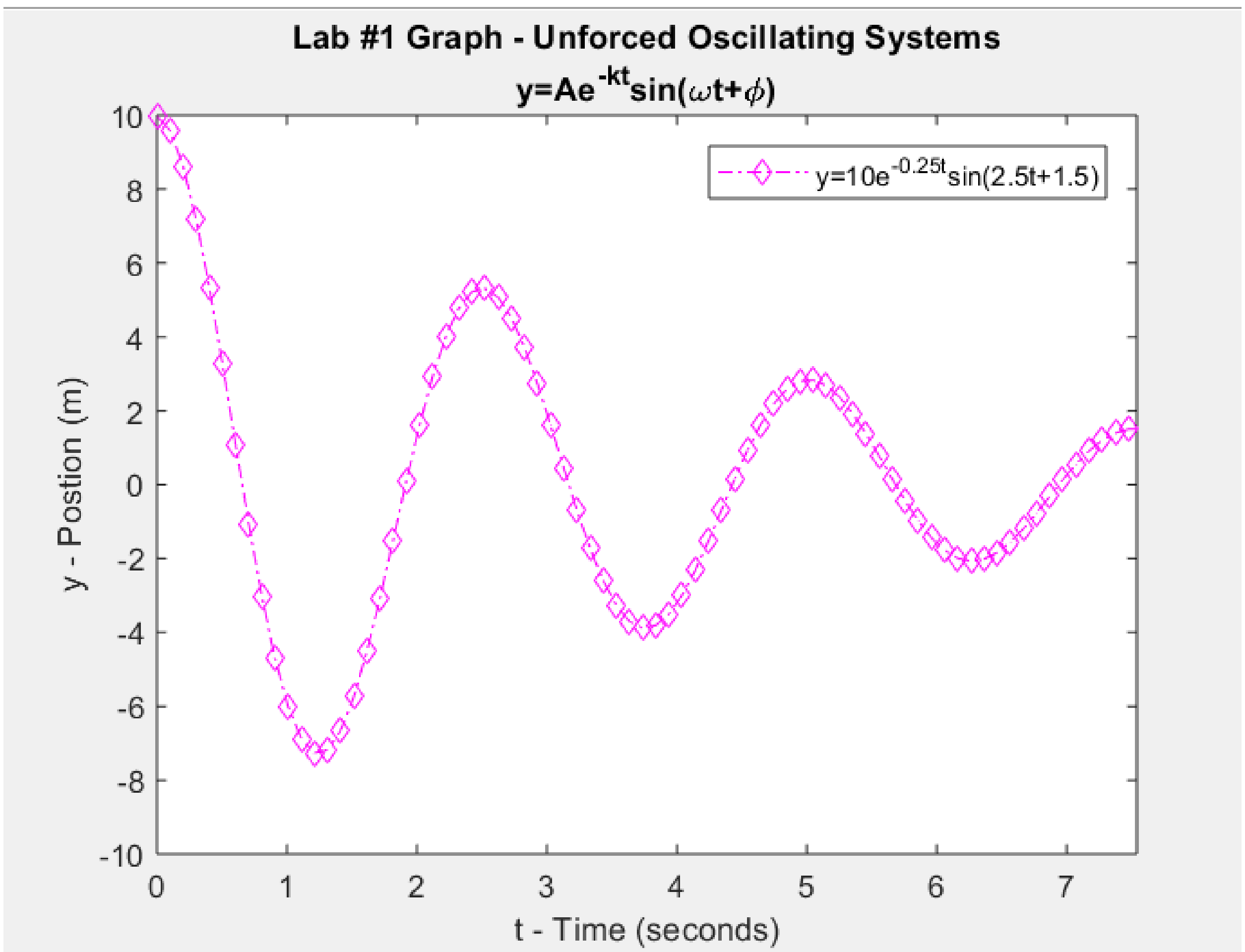
```
%Lab Assignment #1
%Studying unforced oscillating systems. A dying spring.

A=10;
k=.25;
omega=2.5;
phi=1.5;

t=linspace(0,10);

%Our function
y=A.*exp(-k.*t).*sin(omega.*t+phi);

%Plot
plot(t,y,'-.dm');hold on;
title({'Lab #1 Graph - Unforced Oscillating Systems';'y=Ae^{-kt}sin({\omega}t+{\phi})'})
xlabel('t - Time (seconds)')
ylabel('y - Postion (m)')
axis([0 6*pi./omega -10 10])
legend('y=10e^{-0.25t}sin(2.5t+1.5)')
```



Lab1plot.m

```
%Varying A changes the maximum amplitude of the spring (where you start
%it) & Varying omega changes the period of oscillation


c=2;

%Vary The Amplitude
y2=c.*exp(-k.*t).*sin(omega.*t+phi);
plot(t,y2,'--xg');hold on;

%Varying Omega
y3=A.*exp(-k.*t).*sin(c.*t+phi);
plot(t,y3,'-*c');

legend('y=10e^{-0.25t}sin(2.5t+1.5)','y=2e^{-0.25t}sin(2.5t+1.5)','y=10e^{-0.25t}sin(2t+1.5)')
axis([0 6*pi./c -10 10])
```