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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% AAE 20300 Extra Credit Assignment
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% Professor: Professor Ye
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DECLARATIONS

```

g = 9.8; % gravitational acceleration (m/s^2)
m = 50; % mass of object (kg)

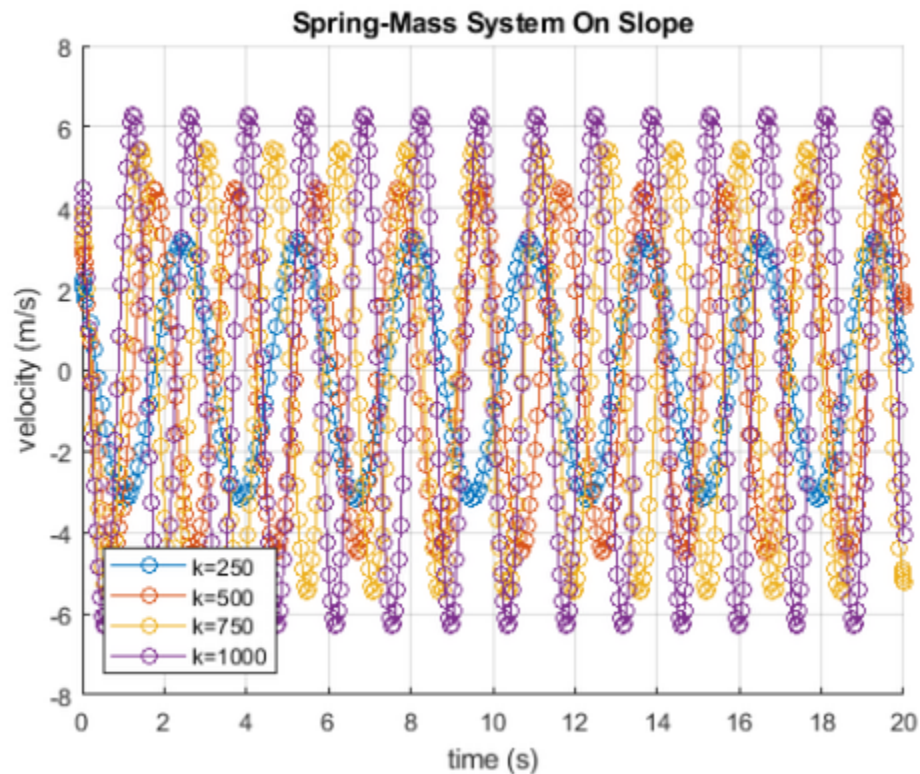
```

VELOCITY VS TIME

```

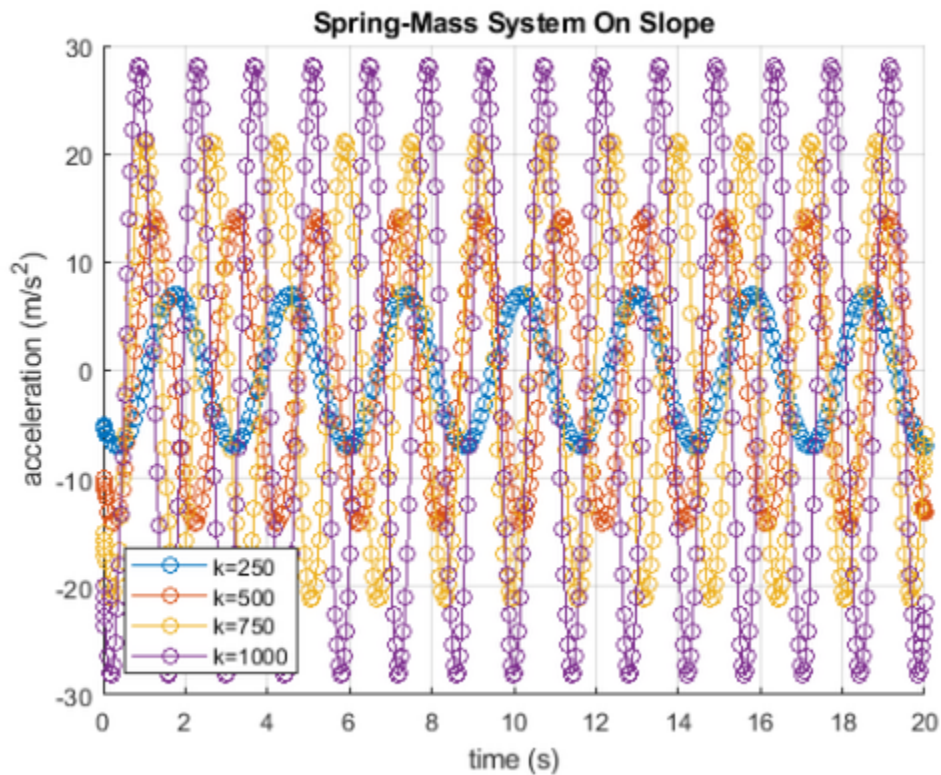
figure
% initial value v(0)= sqrt(k/m), vp(0)= -k/m
for k = 250:250:1000 % spring constant (N/m)
    [t,v] = ode45(@diffFcn1,t,v,m,k), [0,20], [sqrt(k/m);-k/m]);
    % plotting
    hold on
    plot(t,v(:,1),'-o');
    title('Spring-Mass System On Slope');
    xlabel('time (s)');
    ylabel('velocity (m/s)');
    grid on;
end
legend('k=250','k=500','k=750','k=1000','location','southwest');
hold off

```



ACCELERATION VS TIME

```
figure
% initial value a(0)= -k/m, ap(0)= -(k/m)^(3/2)
for k = 250:250:1000 % spring constant (N/m)
    [t,v] = ode45(@(t,a) diffFcn2(t,a,m,k), [0,20], [-k/m;-(k/
m)^(3/2)]);
    % plotting
    hold on
    plot(t,v(:,1),'-o');
    title('Spring-Mass System On Slope');
    xlabel('time (s)');
    ylabel('acceleration (m/s^2)');
    grid on;
end
legend('k=250','k=500','k=750','k=1000','location','southwest');
hold off
```



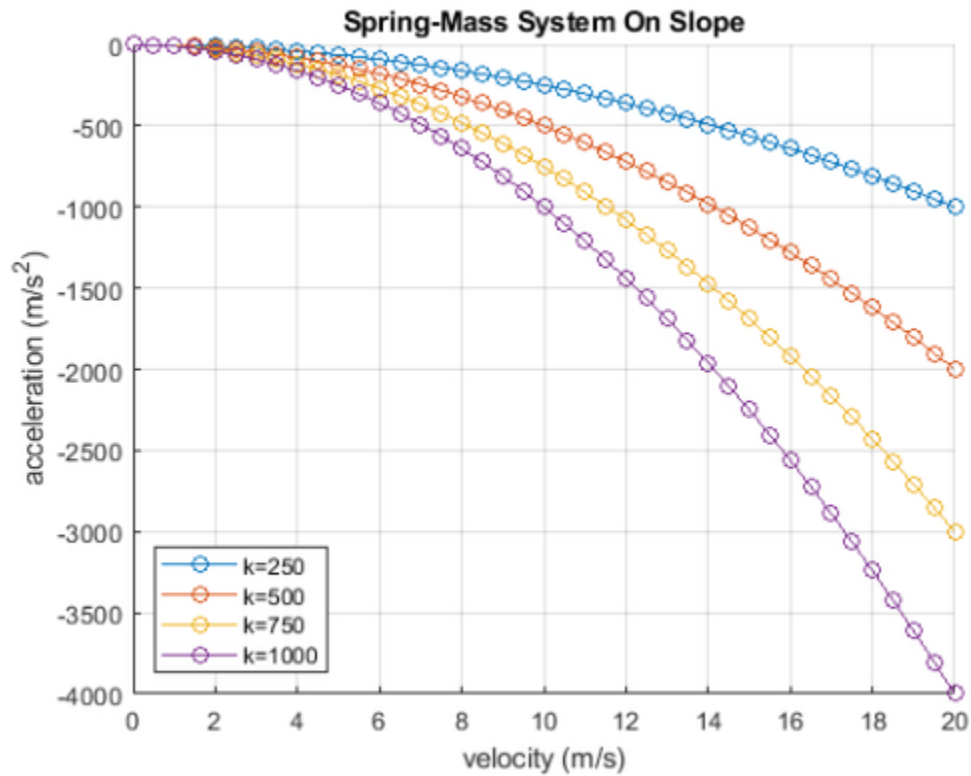
ACCELERATION VS VELOCITY

```
figure
% initial value a(0) = 0
for k = 250:250:1000 % spring constant (N/m)
    [v,a] = ode45(@(v,a) -k/m.*v, [0,20], 0);
    % plotting
    hold on
    plot(v,a(:,1),'-o');
    title('Spring-Mass System On Slope');
```

```

    xlabel('velocity (m/s)');
    ylabel('acceleration (m/s^2)');
    grid on;
end
legend('k=250','k=500','k=750','k=1000','location','southwest');
hold off

```



FUNCTION DEFINITIONS

```

% declaring the differential equation (VELOCITY VS TIME)
function dvdt = diffFcn1(t,v,m,k)
dvdt = zeros(2,1);
dvdt(1) = v(2);
dvdt(2) = -k/m.*v(1);
end
% declaring the differential equation (ACCELERATION VS TIME)
function dadt = diffFcn2(t,a,m,k)
dadt = zeros(2,1);
dadt(1) = a(2);
dadt(2) = -k/m.*a(1);
end

```

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