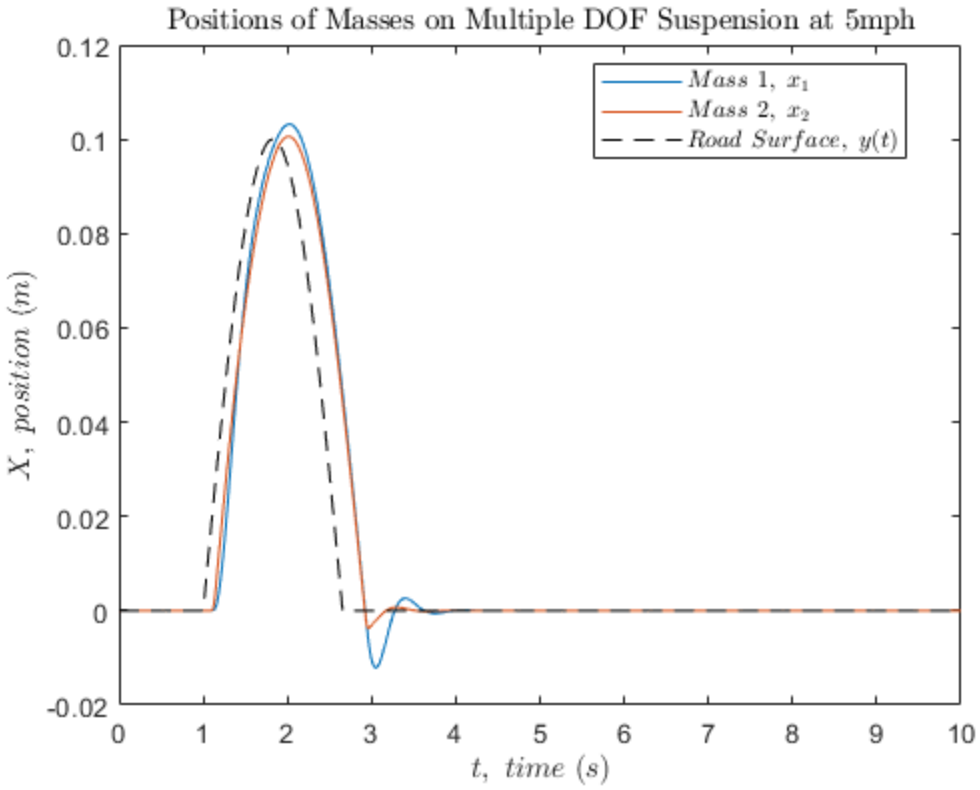
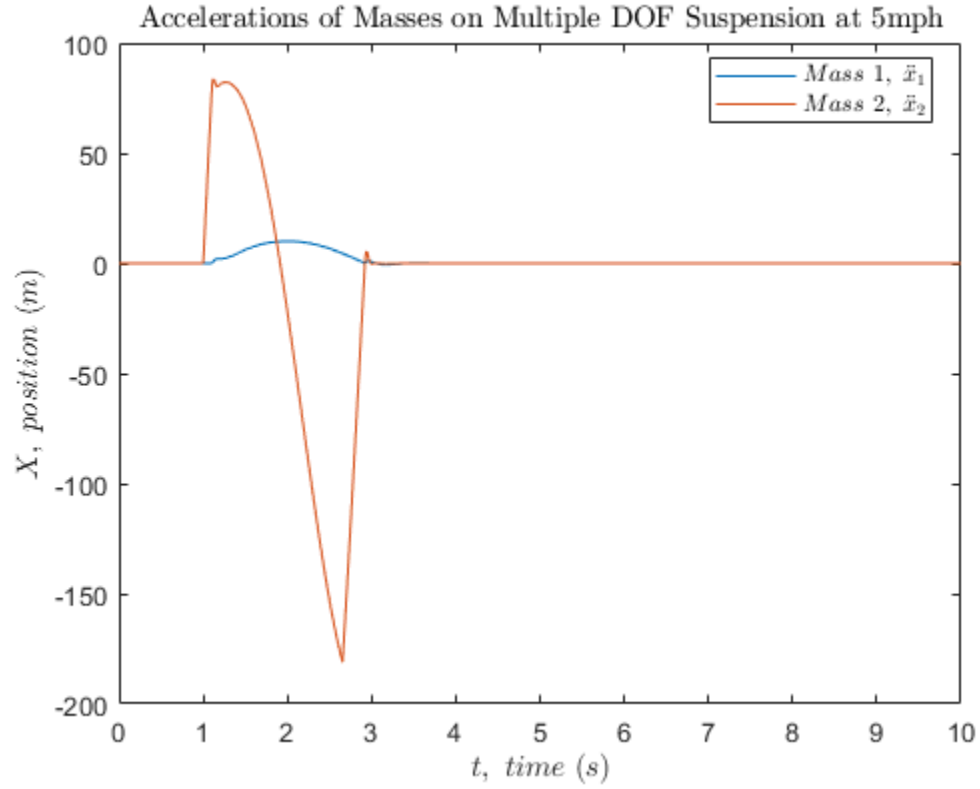
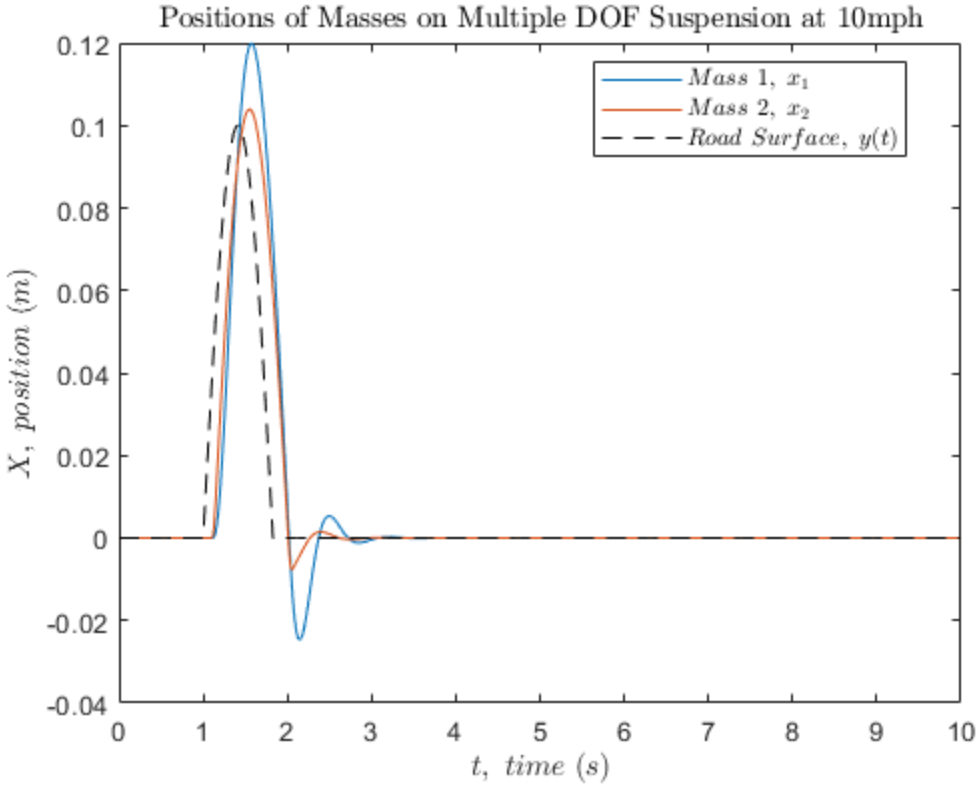
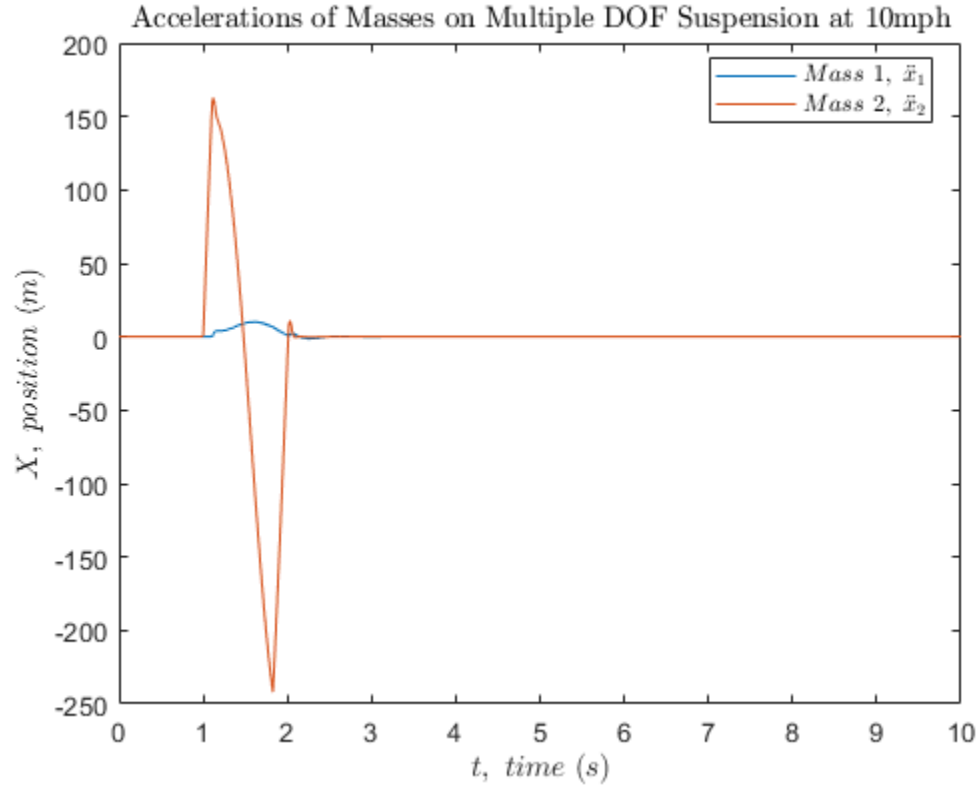
```
clear ; clc ; close all ;

m = [320,44];
k = [3.2*10^4,1.8*10^5];
c = [3430];

v = [5,10,35] * 5280*12*0.0254/3600;

h = 0.1;
L = 3.7;

resolution = 1500;
tStart =0; % time starts at 0 seconds
tEnd = 10; % time ends at this amount of time
% specify the time vector
time = linspace(tStart, tEnd, resolution);
yTime = linspace(tStart,tEnd+1,resolution);
% initial conditions
x_0 =[0,0]; % in m
x_dot_0 =[0,0]; % in m / s
IC =[ x_0(1) , x_0(2) , x_dot_0(1), x_dot_0(2) ]';


for i = 1:length(v)
    d = 1*v(i);
    y = zeros([1,length(time)]);
    [ ~, idxStart] = min(abs(time - d/v(i) ));
    [ ~, idxEnd] = min(abs(time - (d+L)/v(i) ));
    y(idxStart:idxEnd) = h*sin( (pi*v(i)/L) * (time(idxStart:idxEnd) - d/
v(i) ));

    % using the ode solver
    [t , z]= ode45 ( @ (t , z )
 multipleDOF_Car_Suspension_Function(t,z,y,yTime,m,c,k) , time , IC );
    %only passing time into function, and not just ode45, so that it can
    %interpolate the input y for any time t
    figure;
    plot(t , z(: ,1)) %plots all of z_1, aka, all of x_1
    hold on
    plot(t , z(: ,2)) %plots all of z_2, aka, all of x_2
    hold on
    plot(t,y,'k--')
    legendStuff = ["$Mass \ 1, \ x_{1}$","$Mass \ 2, \ x_{2}$","$Road \
 Surface, \ y(t)$"];
    lgnd= legend(legendStuff);
    set(lgnd, 'Interpreter','latex')
    lgnd.Location = 'best';
    title( strcat("Positions of Masses on Multiple DOF Suspension at ",
 num2str(v(i)/(5280*12*0.0254/3600)) ,"mph"),'Interpreter','latex')
    xlabel("$ t, \ time \ (s) $",'Interpreter','latex')
    ylabel("$X, \ position \ (m)$",'Interpreter','latex')
    hold off;
```

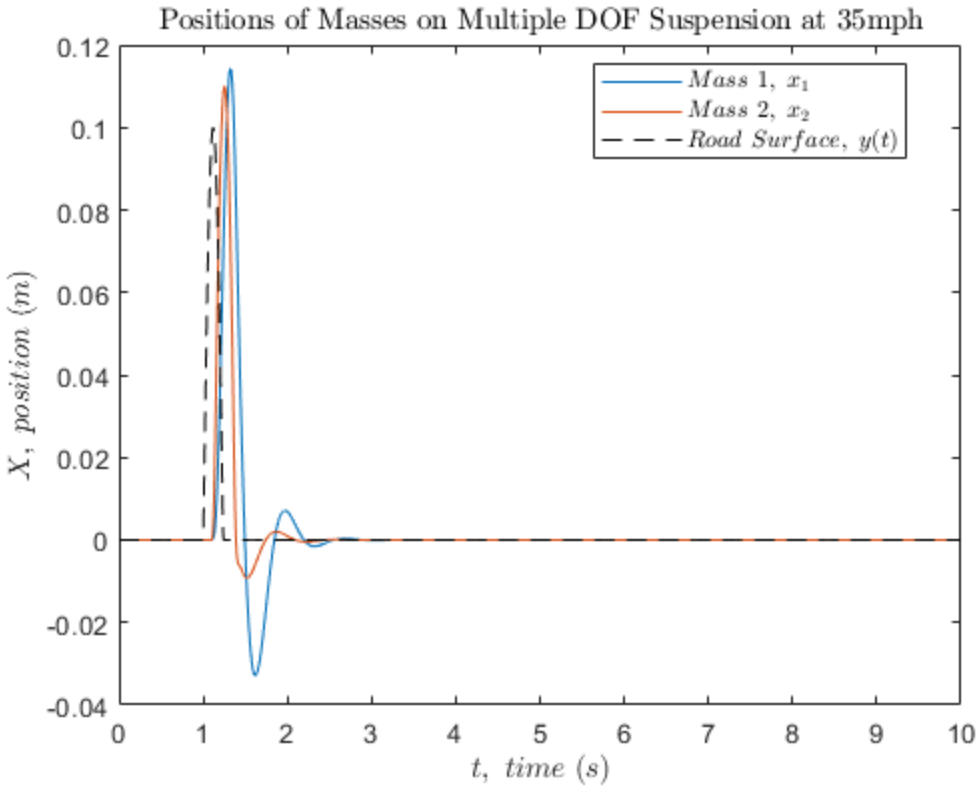
```
    plot1 = strcat("Positions of Masses on Multiple DOF Suspension at ",
 num2str(v(i)/(5280*12*0.0254/3600)) ,"mph");
    print('-r600','-dpng',plot1);

    figure;
    plot(t , (1/m(1))*( c(1)*z(:,4)+k(1)*z(:,2)-c(1)*z(:,3)-
k(1)*z(1) ) ) %plots all of dot_dot_z_1, check formula on state space work
    hold on
    %(1/m(2))*( k(2)*y'+c(1)*z(:,3)+k(1)*z(:,1)-c(1)*z(:,4)-
(k(1)+k(2))*z(:,2) )
    %(1/m(2))*( -k(2)*(z(:,2)-y') + k(1)*(z(:,1)-z(:,2)) + c(1)*(z(:,3)-
z(:,4)) )
    plot(t , (1/m(2))*( k(2)*y'+c(1)*z(:,3)+k(1)*z(:,1)-c(1)*z(:,4)-
(k(1)+k(2))*z(:,2) )  ) %plots all of dot_dot_z_2, check formula on state
 space work
    legendStuff = ["$Mass \ 1, \ \ddot{x}_{1}$","$Mass \ 2, \ \ddot{x}_{2}$"];
    lgnd= legend(legendStuff);
    set(lgnd, 'Interpreter','latex')
    lgnd.Location = 'best';
    title( strcat("Accelerations of Masses on Multiple DOF Suspension at ",
 num2str(v(i)/(5280*12*0.0254/3600)) ,"mph"),'Interpreter','latex')
    xlabel("$ t, \ time \ (s) $",'Interpreter','latex')
    ylabel("$X, \ position \ (m)$",'Interpreter','latex')
    hold off;

    plot1 = strcat("Accelerations of Masses on Multiple DOF Suspension at ",
 num2str(v(i)/(5280*12*0.0254/3600)) ,"mph");
    print('-r600','-dpng',plot1);
end
```

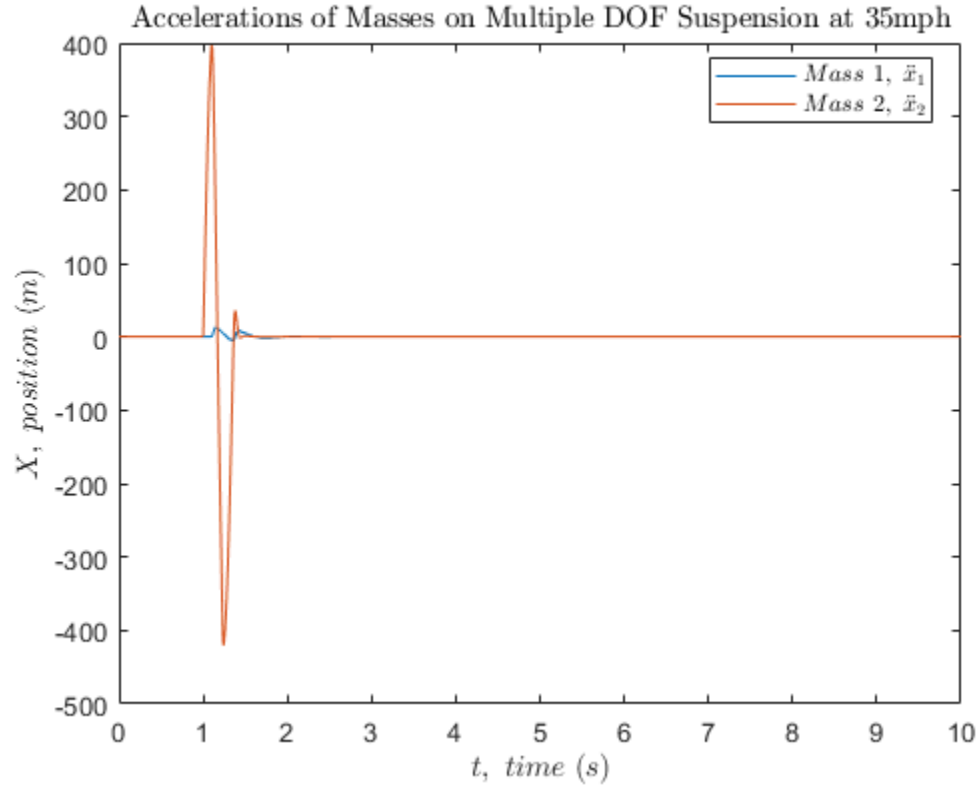

Positions of Masses on Multiple DOF Suspension at 5mph
Mass 1, x_1
Mass 2, x_2
Road Surface, $y(t)$
X, position (m)
t, time (s)
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
0
1
2
3
4
5
6
7
8
9
10


Accelerations of Masses on Multiple DOF Suspension at 5mph
Mass 1, $\ddot{x}_1$
Mass 2, $\ddot{x}_2$
X, position (m)
t, time (s)
100
50
0
-50
-100
-150
-200
0
1
2
3
4
5
6
7
8
9
10


Positions of Masses on Multiple DOF Suspension at 10mph
Mass 1, x_1
Mass 2, x_2
Road Surface, $y(t)$
X, position (m)
t, time (s)
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
0
1
2
3
4
5
6
7
8
9
10


Accelerations of Masses on Multiple DOF Suspension at 10mph
Mass 1, $\ddot{x}_1$
Mass 2, $\ddot{x}_2$
X, position (m)
t, time (s)
200
150
100
50
0
-50
-100
-150
-200
-250
0
1
2
3
4
5
6
7
8
9
10


Positions of Masses on Multiple DOF Suspension at 35mph
Mass 1, x_1
Mass 2, x_2
Road Surface, $y(t)$
X, position (m)
t, time (s)
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
0
1
2
3
4
5
6
7
8
9
10


Accelerations of Masses on Multiple DOF Suspension at 35mph
Mass 1, $\ddot{x}_1$
Mass 2, $\ddot{x}_2$
X, position (m)
t, time (s)
400
300
200
100
0
-100
-200
-300
-400
-500
0
1
2
3
4
5
6
7
8
9
10

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