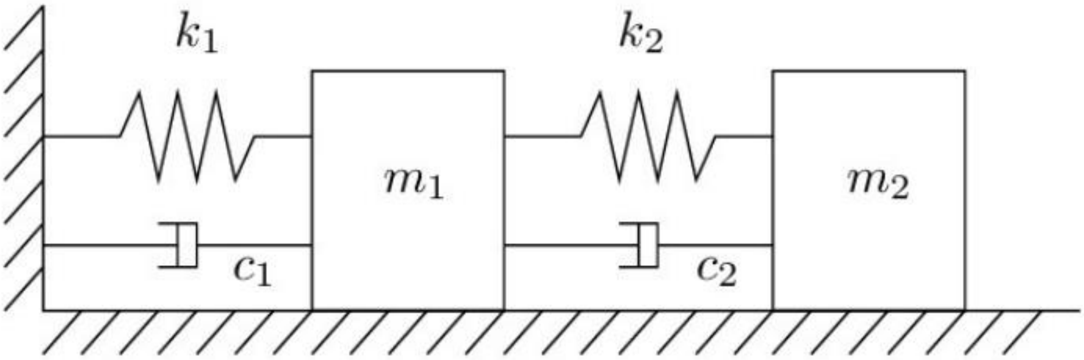
Question – 1:



Considering the displacement of mass m1 is +x1 and displacement of mass m2 is +x2 along the right side and -x1 and -x2 along the left side.

The following equations has been derived for position and velocities:

Freebody equation for mass m1:

$$m_1.x_1'' = k_2 (x_2 – x_1) + c_1 (x_2' – x_1') – k_1 x_1 – k_2 x_2$$

Freebody equation for mass m2:

$$m_2.x_2'' = - k_2 (x_2 – x_1) - c_1 (x_2' – x_1')$$

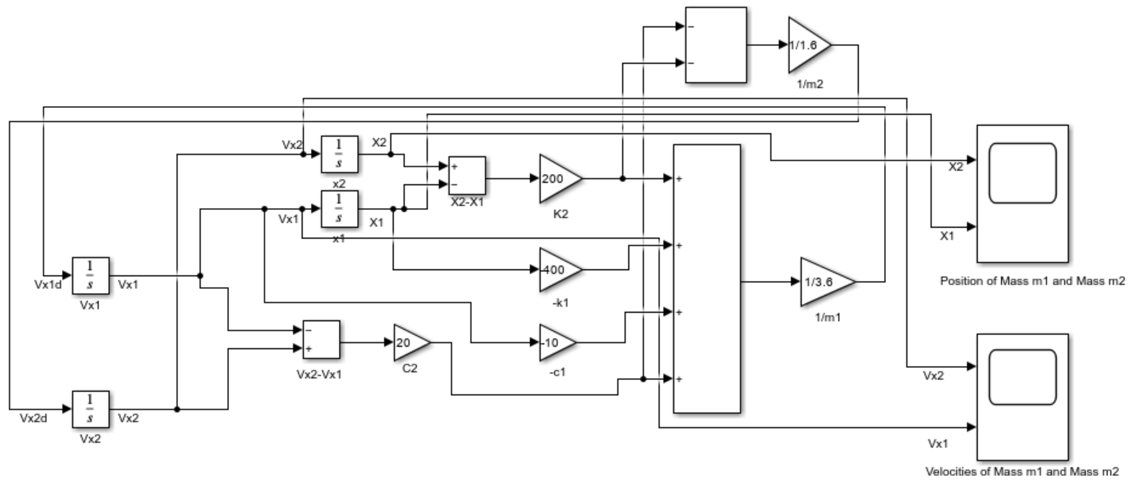
Where m1 and m2 are masses of the blocks in Kg’s

c1 and k2 are Spring stiffness coefficients in N/m

c1 and c2 are Damping coefficients in N.S/m

x0_1 and x_02 are spring initial conditions

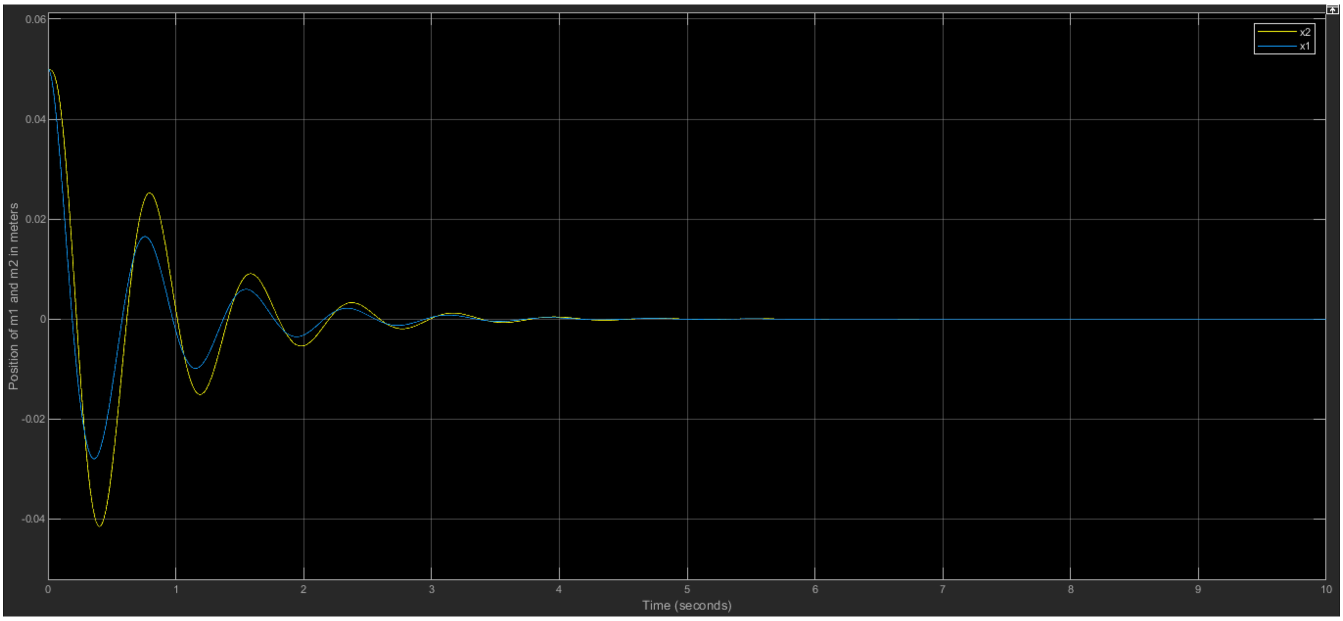
Positions and Velocity Graphs for Double mass system using Simulink, Simscape1D and Simscape3D



Simulink

Position

plot



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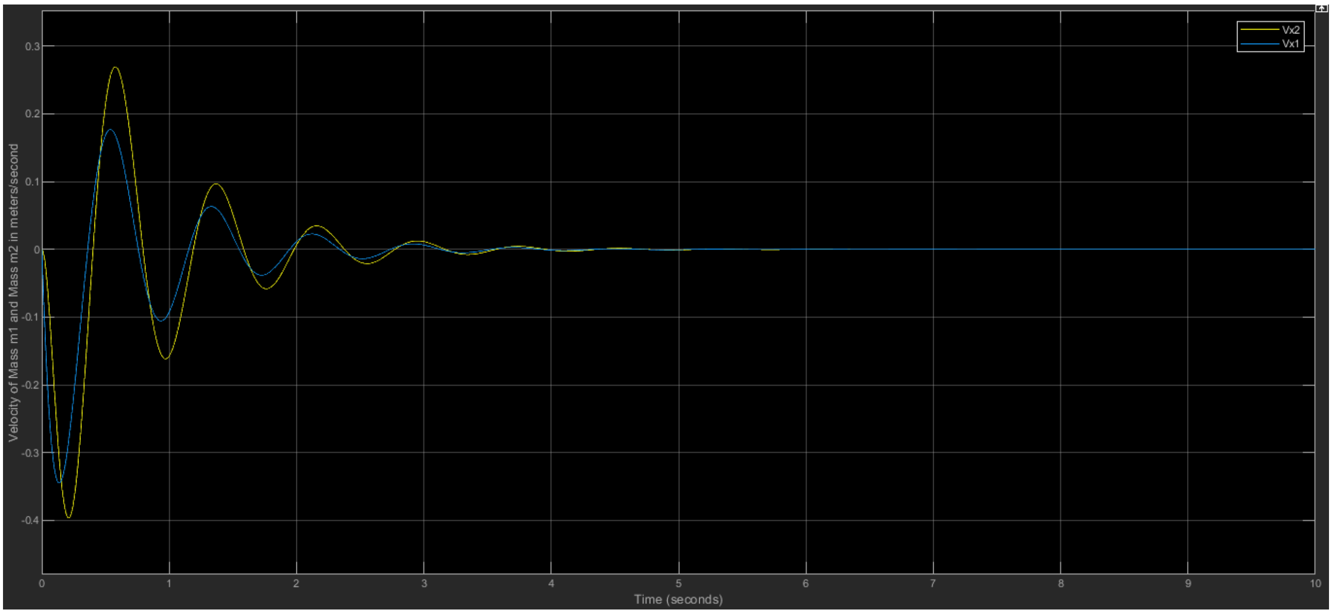
<tr><td>Simulink
Velocity
plot</td><td>
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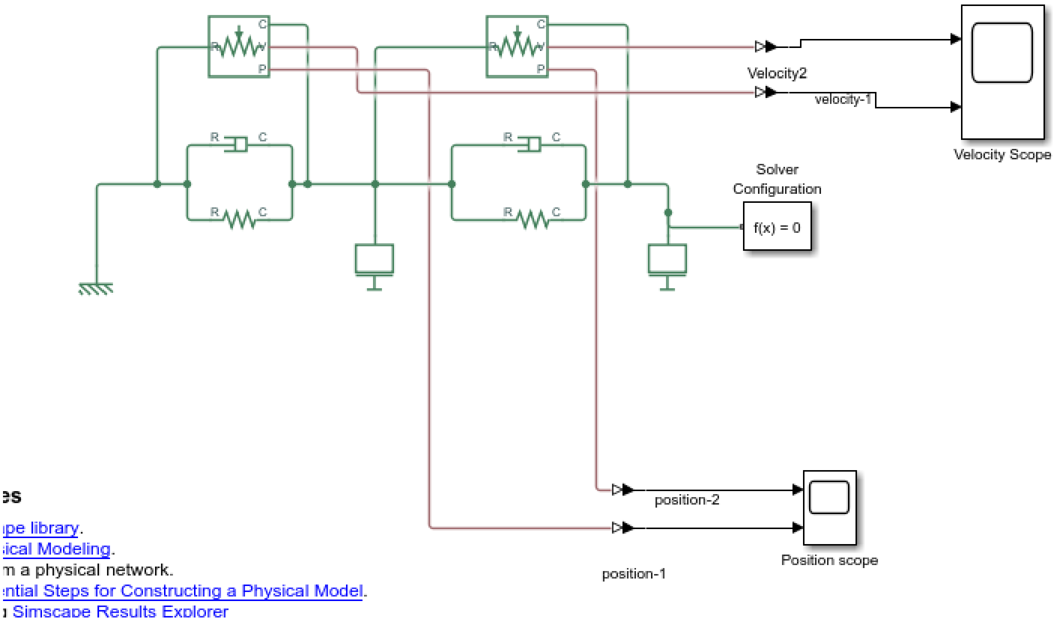
<tr><td colspan="2">
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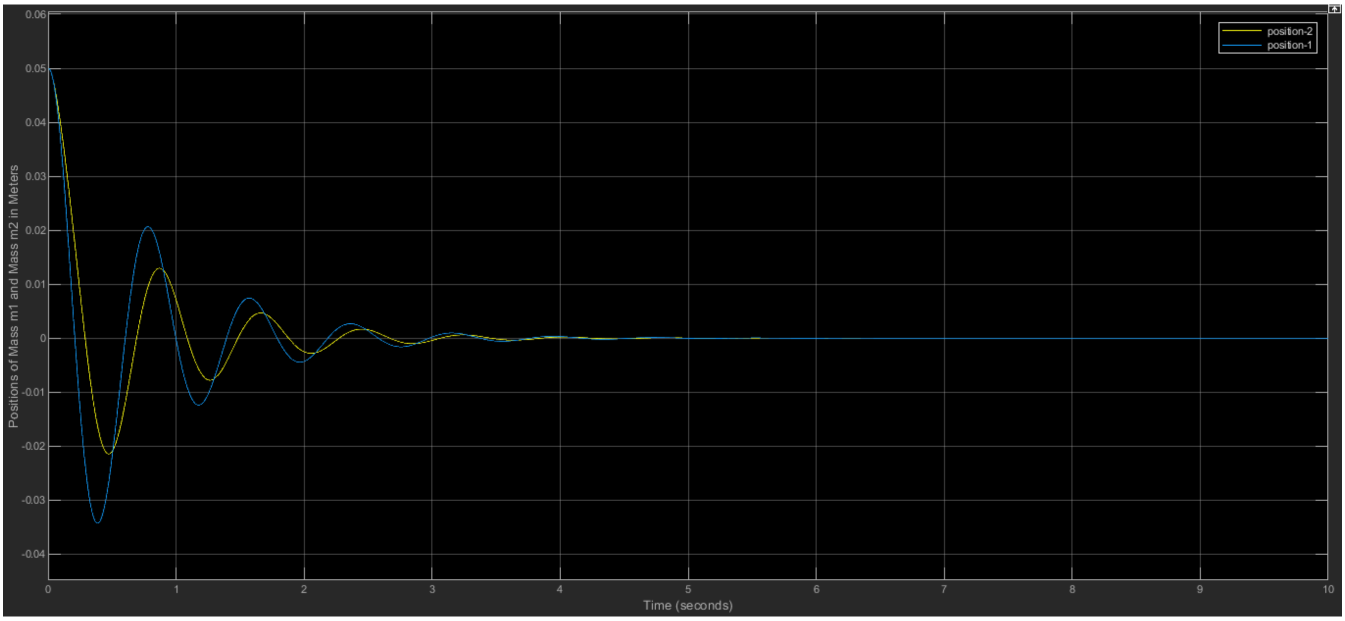
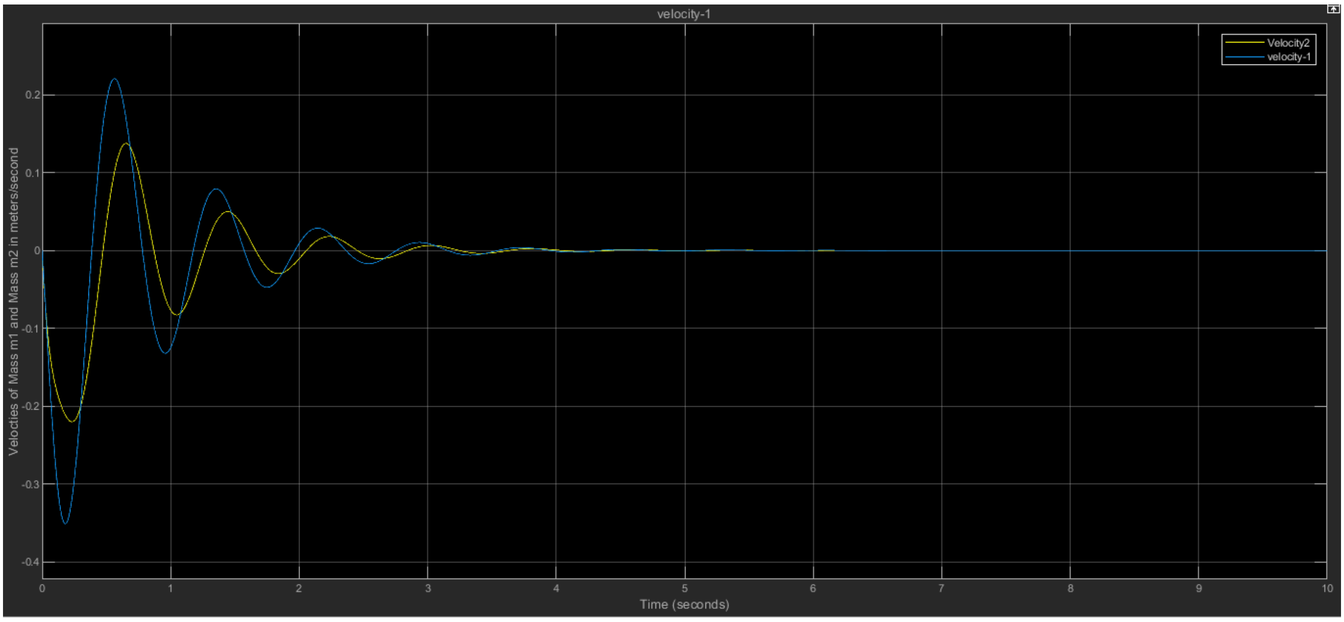
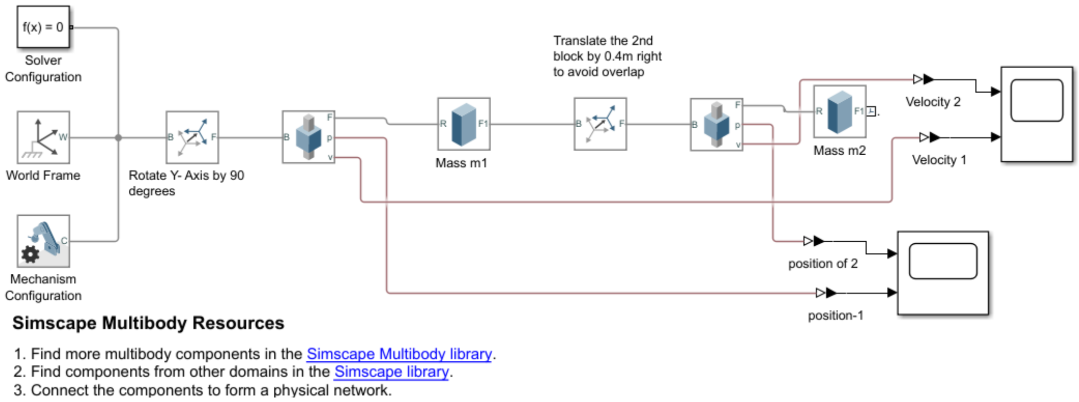
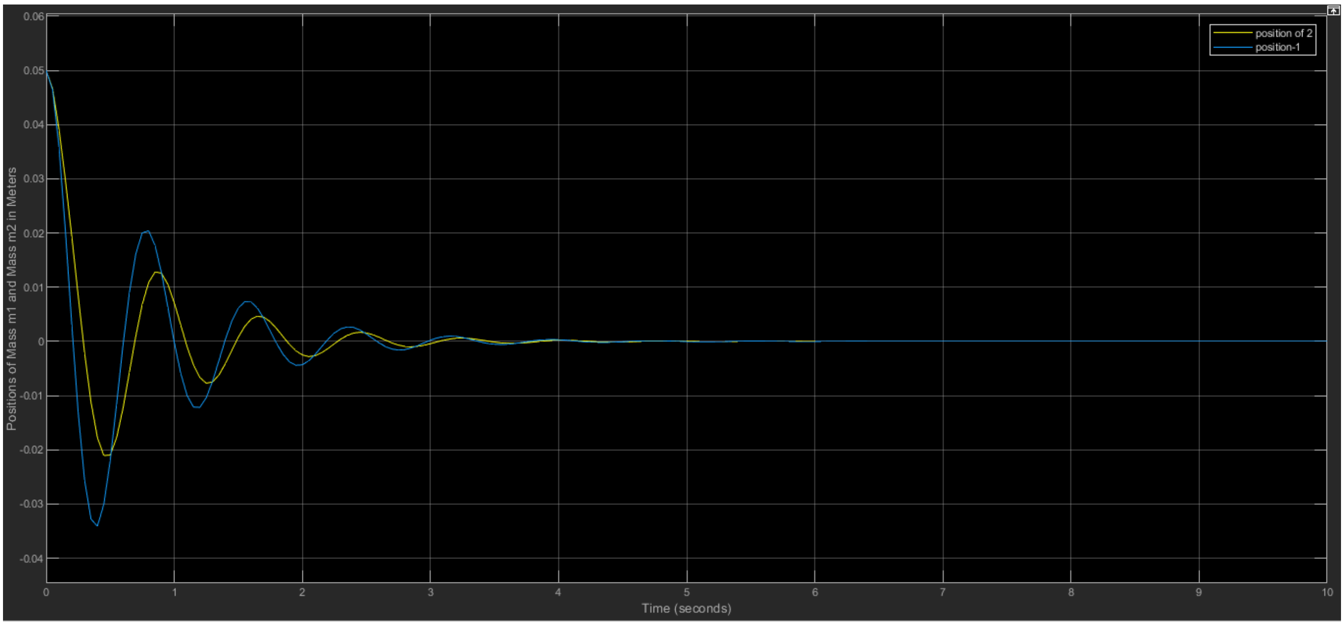
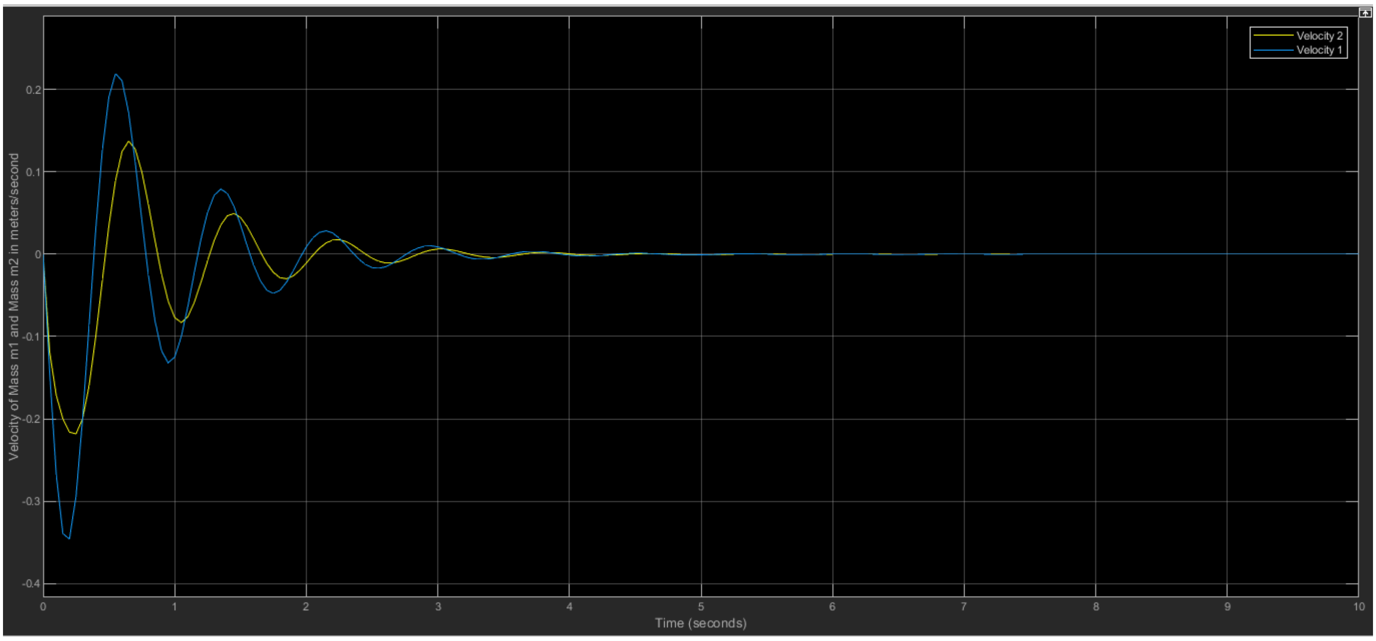
Simscape1D Position plot	
Simscape1D Velocity plot	



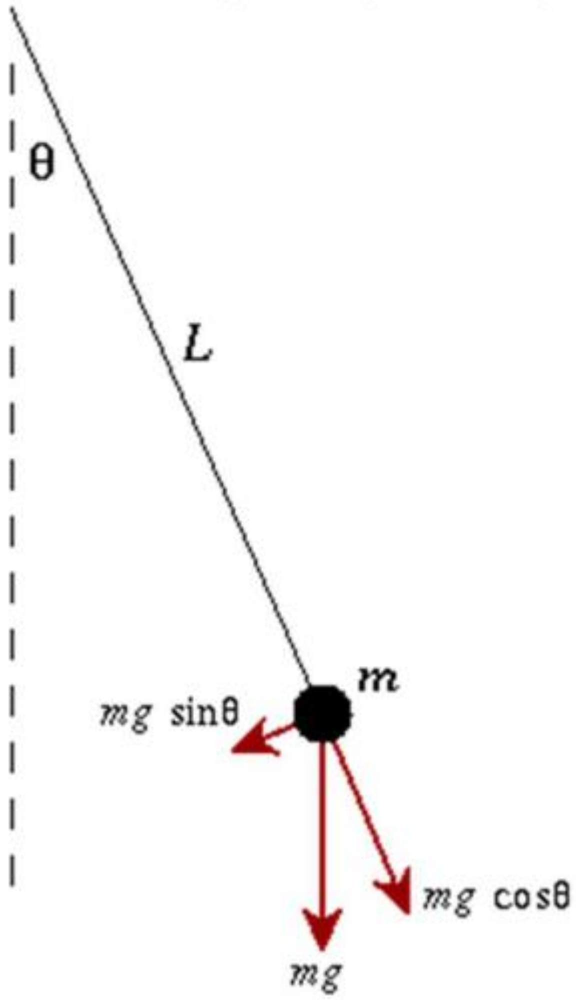
Simscape3D

position plot



Simscape3D Velocity plot	

Question 2:



Given Parameters are as follows

mass = 1 => mass of ball (kg)

c = 1 => damping coefficient (N*m/(rad/s))

l = 1 => length of string (m)

theta_0 = 10 => initial angular deformation (degree)

Equation for Simple pendulum with damping due to air resistance:

$$m.\theta'' = - c\ \theta\ ' - m\frac{g}{l}\sin(\theta)$$

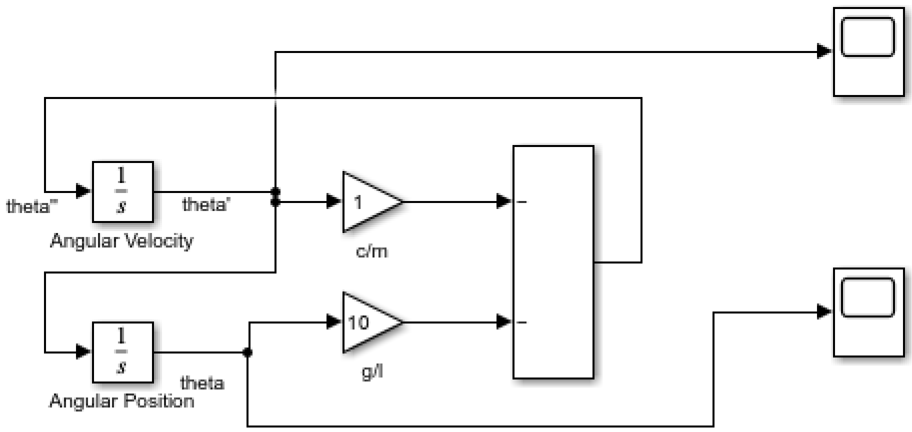
where, m represents mass of ball in k.g

c = Damping coefficient N*m/(rad/s))

l = length of spring in m

θ = initial angular deformation in degrees

Angular positions and Angular velocity plot in Simulink, simscape1D and Simscape3D are Tabulated below:

<table>
<tr><td colspan="2">
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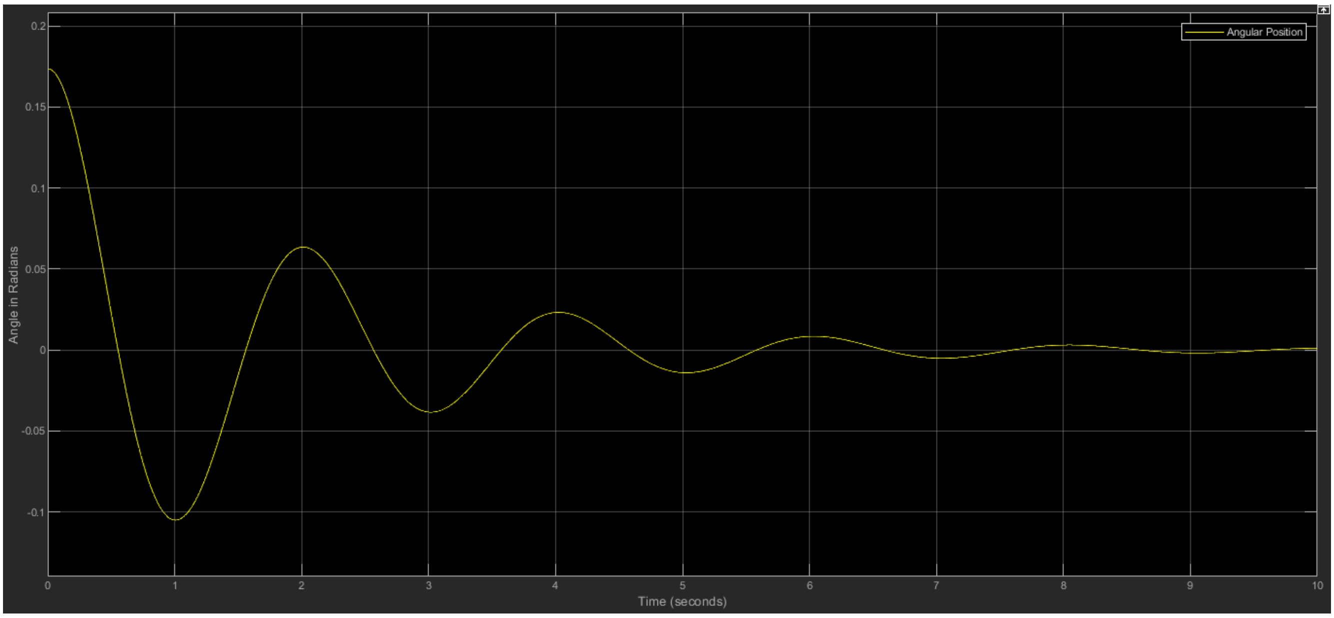
<tr><td>Simulink
Angular
Position plot</td><td>
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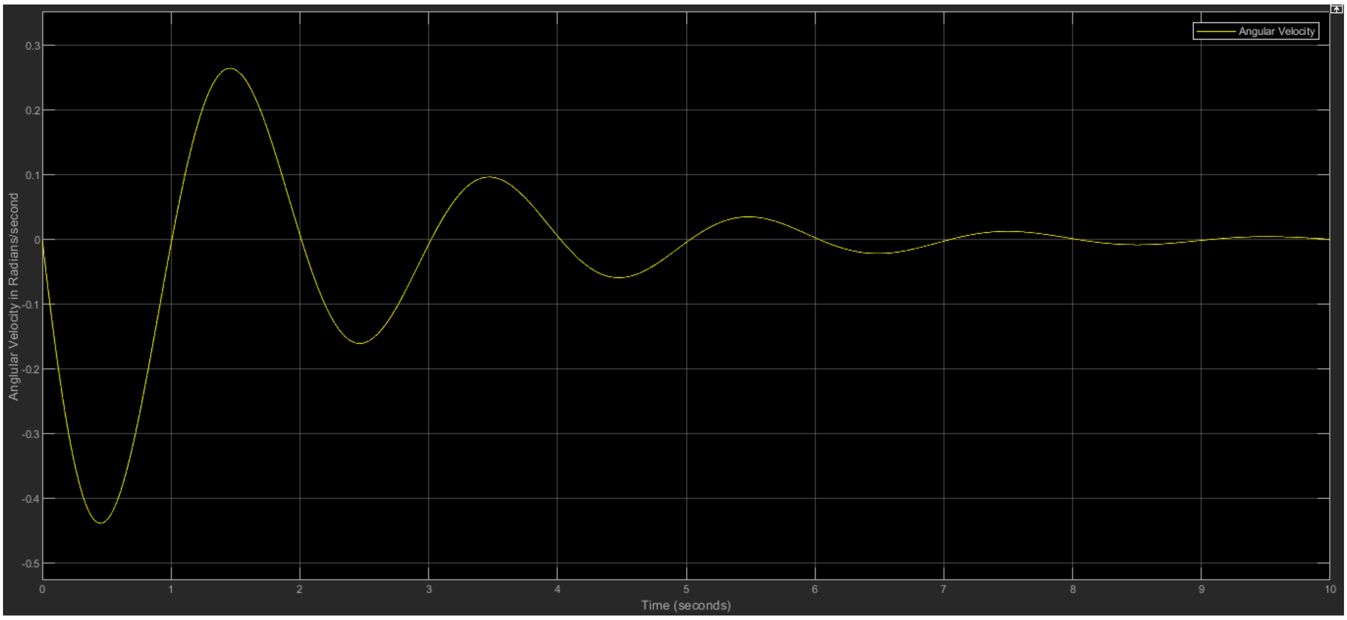
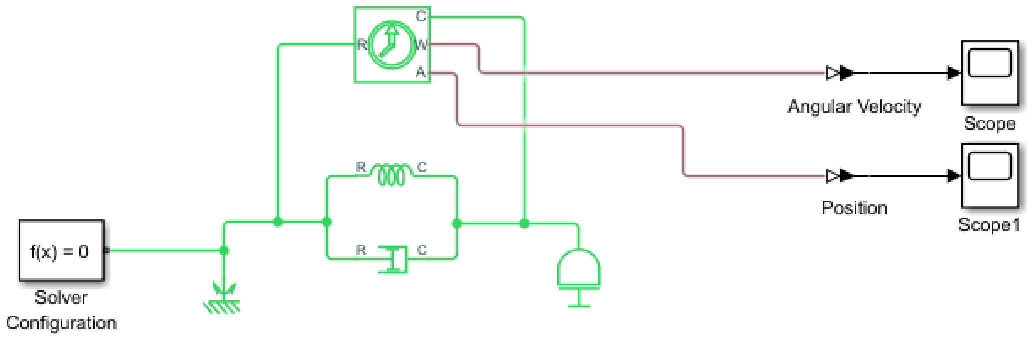
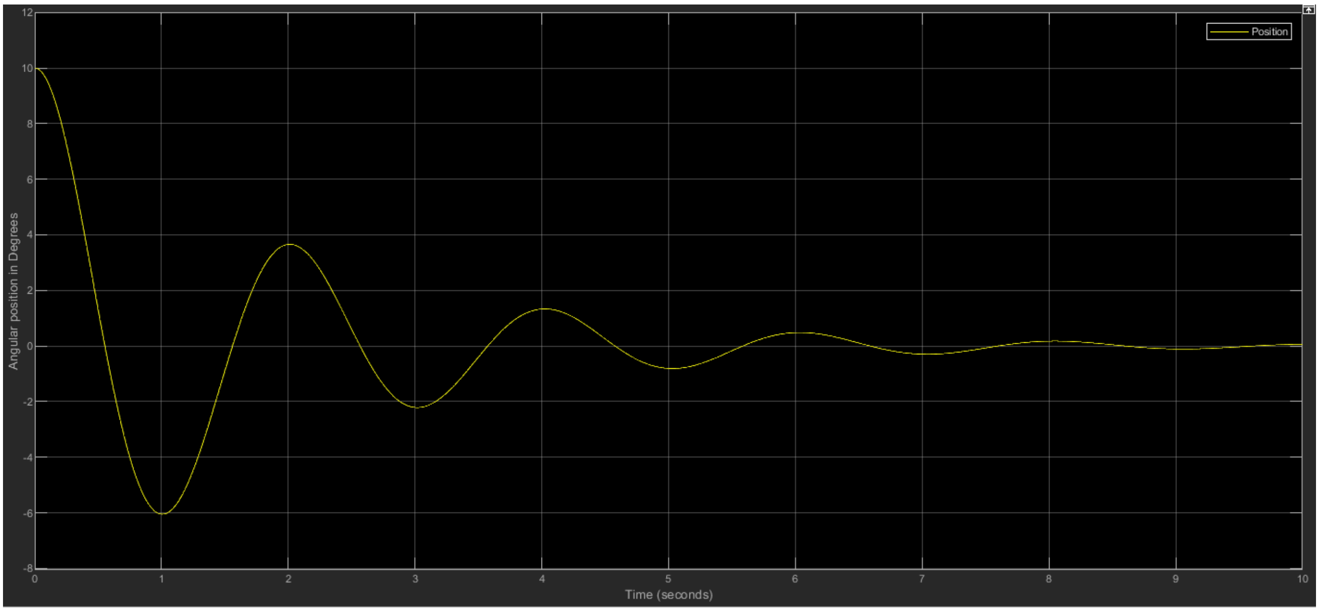
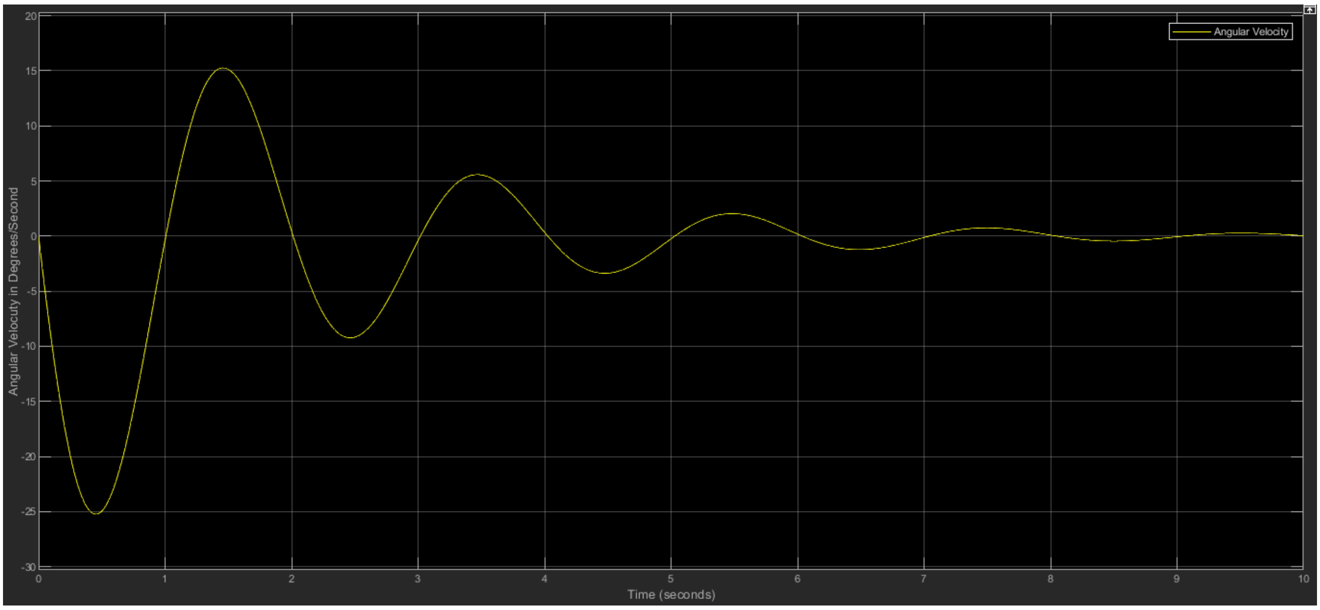
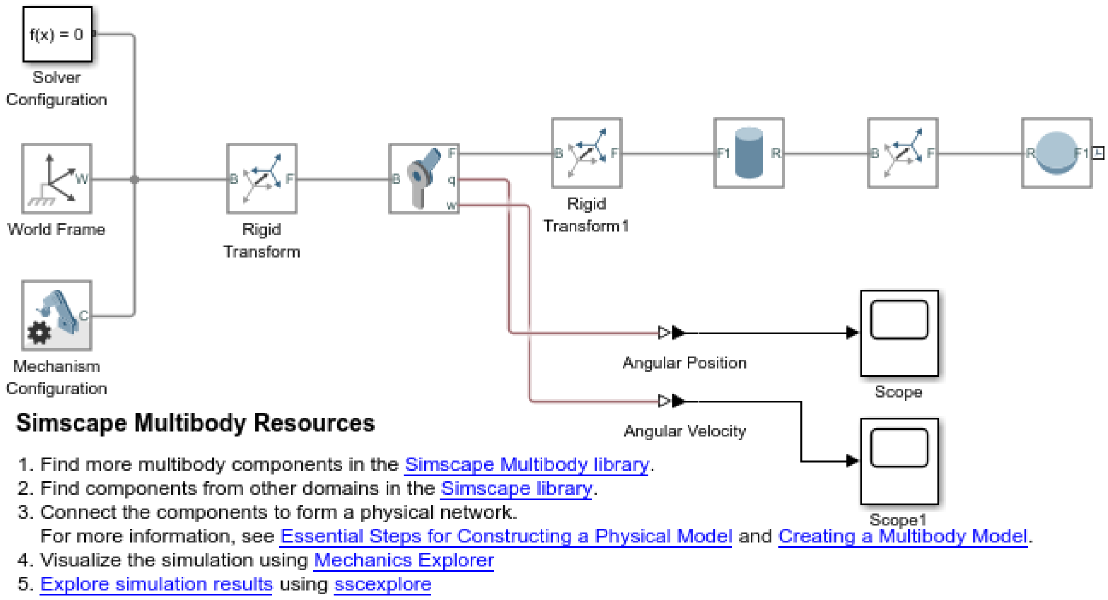
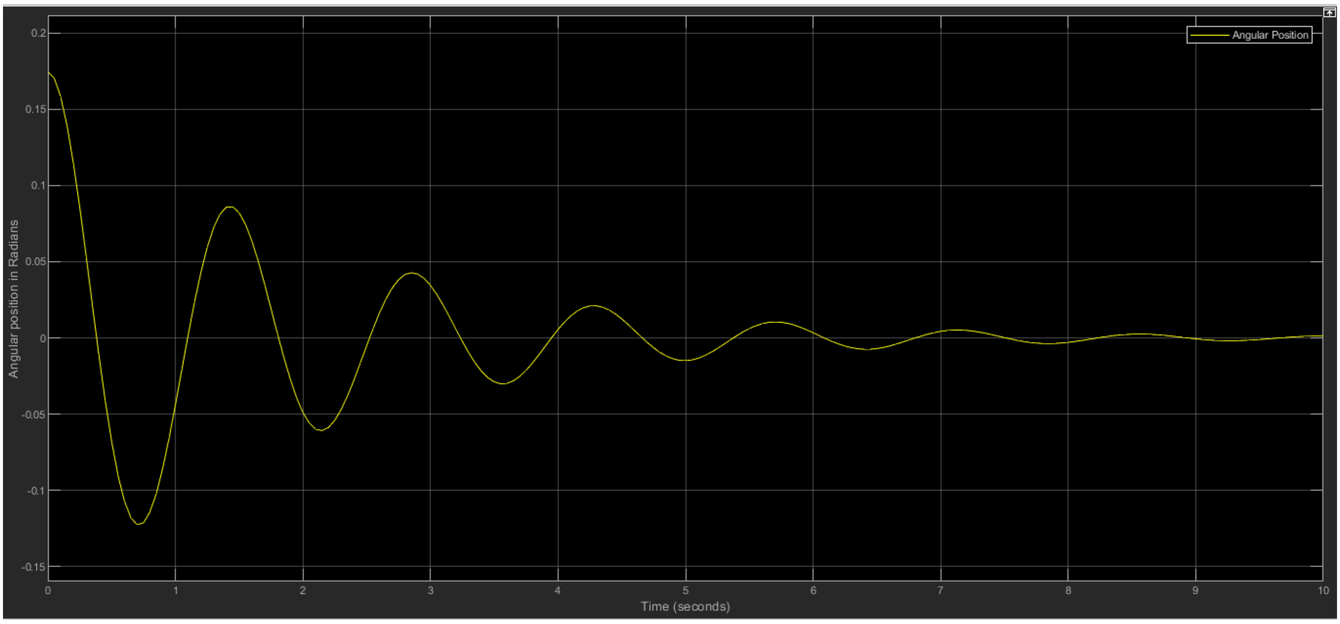
Simulink Angular Velocity plot	
 	

Simscape1D Angular Position plot	
Simscape1D Angular Velocity plot	

	
Simscape3D Angular position plot	

Simscape3D Angular Velocity plot