Assignment 3: Spring Mass Damper System

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For a spring mass damper system, plot the position v/s time graph and velocity v/s time graph

M – Mass

K – Spring

B – Damper

Select M, K such that natural frequency of oscillation w_n = 10 rad/ sec.

$$\left(w_n = \sqrt{\frac{K}{M}} \text{ and } \zeta = \frac{B}{2}\sqrt{\frac{1}{M\,K}}\right)$$

Cases:

1. **Unforced System (ζ = 0, 0.4, 1, 1.2)**
   Initial deformation of Spring = -10 m
   Plot the position v/s time graph and velocity v/s time graph

2. **Forced System with Step Input as signal to Ideal Force Source (ζ = 0.2, 0.4, 0.6, 0.8)**
   Step Time = 0; Final Value of Step = 1.
   Initial Deformation of Spring = 0 m.
   A. **For each value of ζ, plot the position v/s time Graph showing the given parameters:**
      1. **Rise Time:** The rise time is the time required for the response to rise from 0% to 100% of its final value. **(Take 0% to 100%)**
      2. **Maximum overshoot:** The maximum overshoot is the maximum peak value of the response curve measured from unity.
      3. **Peak Time:** The time at which the maximum overshoot occurs
      4. **Time Period of oscillation (Td):** Time between 2 successive peaks or valleys
      5. **Damped Frequency (w_d)**

   B. **Plot the velocity v/s Time Graph**

3. **Forced System with Pulse Input as signal to Ideal Force Source (ζ = 0.4, 0.7)**
   Pulse Amplitude = 1, Time Period = 10 seconds, Duty Cycle = 50%
   Initial Deformation of Spring = 0 m.
   Plot the position v/s time graph and velocity v/s time graph.

Assignment format shown on the following pages.

Name: **Entry No:2020JIDXXXX** **Assignment No: 3**

1. **Unforced System**

Paste your model here

a) **ζ = 0**

M =

B =

K =

Initial Deformation of Spring = -10 m

(Position v/s Time Plot)

(Velocity v/s Time Plot)

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2. Forced System with Step Input as signal to Ideal Force Source

Paste your model here

a) **ζ = 0.2**

M =

B =

K =

Initial Deformation of Spring = 0 m

(Position v/s Time Plot with all calculations)

(Velocity v/s Time Plot with all calculations)

Table for Forced System with Step Input as signal to Ideal Force Source (ζ = 0.2, 0.4, 0.6, 0.8)

S. No	w_n	ζ	Rise Time (sec)	Peak Overshoot (%)	Peak Time	Time Period of Oscillations	Damped Frequency (rad/sec)

3. Forced System with Pulse Input as signal to Ideal Force Source

(Paste your model here)

a) **ζ = 0.2**

M =

B =

K =

Initial Deformation of Spring = 0 m

(Position v/s Time Plot)

(Velocity v/s Time Plot)