Class of Structure of Dynamics

Faculty of Engineering «Department of Civil Engineering»

Prof. A. Gholizad

Email: gholizad@uma.ac.ir

Homework #4 (Total Points 100/100)

α_1: 11^{th} *digit of your student ID*

For Example if your student ID:

40044404135

α_1: 5 *if* $\alpha_1 = 0 \Longrightarrow \alpha_1 = 1$

Note: If the 11th digit of the student number is zero, the number 1 should be used for α_1.

PROBLEM1:

Figure 1 shows a one degree of freedom model of a motor vehicle traveling in the horizontal direction. Find the relative displacement of the vehicle as it travels over a road bump of the form $y(s) = Y \sin(\pi s/\delta)$.

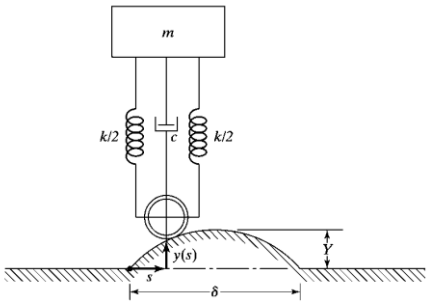

Figure 1-Vehicle traveling on road bump

PROBLEM2:

Use the Dahamel integral method to derive expressions for the response of an undamped system subjected to the forcing functions shown in Figure 2 .

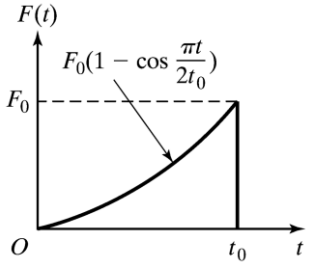

Figure 2- forcing function

PROBLEM3:

An automobile once with a passenger and once without a passenger is traveling a rough path with a Find the response of the rigid bar shown in Figure 3 using convolution integral when the end P of the spring PQ is subjected to the displacement, $x(t) = x_0 e^{-\alpha_1 t}$. Data: $k = 500 \times \alpha_1 \frac{N}{m}$, $l = 1 \times \alpha_1\, m$, $m = 10\, kg$, $x_0 = 1 \times \alpha_1\, cm$.

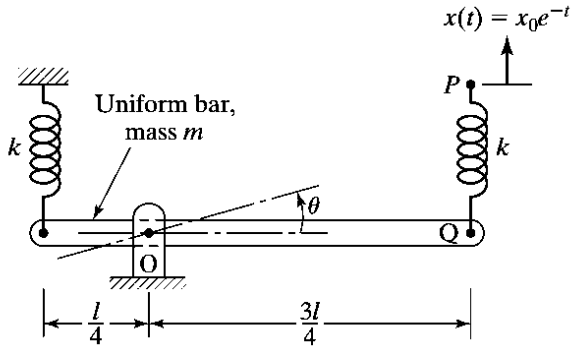

Figure 3-Rigid bar undergoing rotational motion

PROBLEM4:

Find the response of the mass shown in Figure 4under the force $F(t) = F_0 e^{-\alpha_1 t}$ using convolution integral. Data: $k_1 = 1000 \times \alpha_1 \frac{N}{m}$, $k_1 = 500 \times \alpha_1 \frac{N}{m}$, $r = 6 \times \alpha_1\, m$, $m = 20\, kg$, $J_0 = 1 \times \alpha_1 kg - m^2$ $F_0 = 50 \times \alpha_1\, N$.

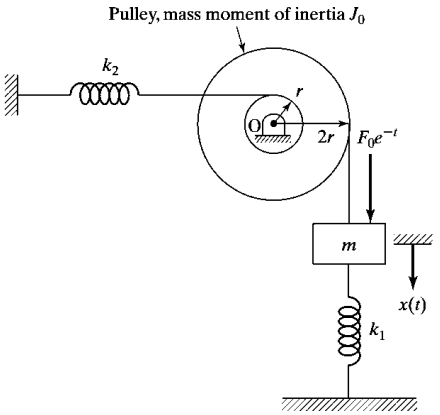

Figure 4-Pulley-mass-spring system subjected to force

Good luck