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King Abdulaziz University
Engineering College
Department of MENG
8th Homework Assignment

Mechanical Vibrations
MENG 470
Spring 1425 H
Due Sat.: 12/3/1425 H

Q1. Use Lagrange's equation to find the equation of motion for the system shown in Figure 1. The variables $y_1(t)$ and $y_2(t)$ represent known positions as a function of time so x is the only unknown quantity. Let k_1 = 50 N/m, k_2=20 N/m, c = 2 N-s/m, and m= 10 kg.

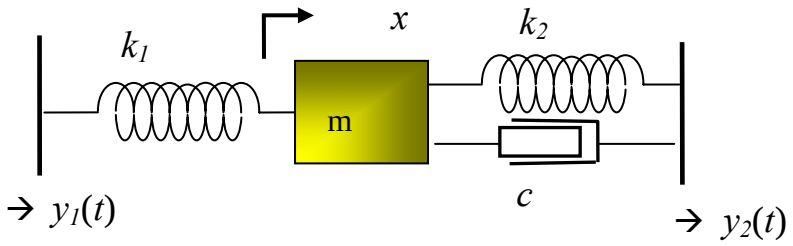

Figure 1

Q2. For the system shown in Figure 2:

1. Use Newtonian approach to find the equation of motion
2. Use Lagrange's equation to find the equation of motion
3. Find the natural frequencies and mode shapes.

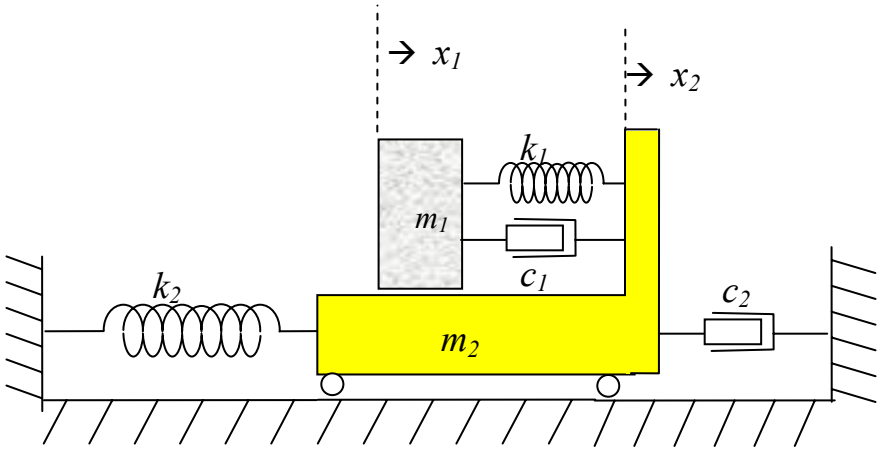

Figure 2

Q3. Use Lagrange's equation to find the equation of motion for the pendulum shown. Here y(t) is known function of time. Use small angle theory to linearize the EOM in terms of θ.

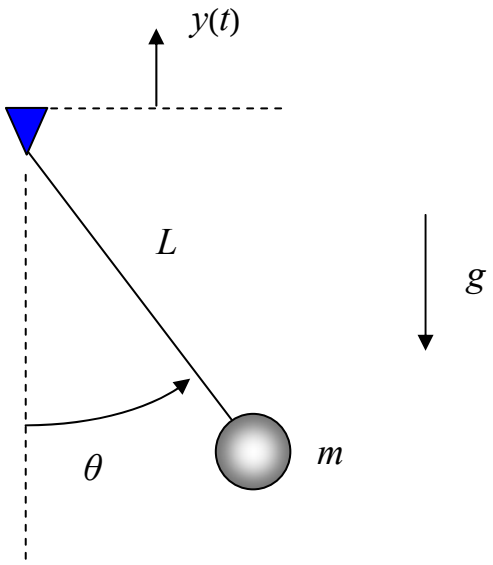

Figure 3

Q4. For the system shown in Figure 4:

a) Use Newtonian approach to find the equation of motion

b) Use Lagrange's equation to find the equation of motion

c) Find the natural frequencies and mode shapes.

d) If c=0, model the system as SDOF systems using modal transformation.

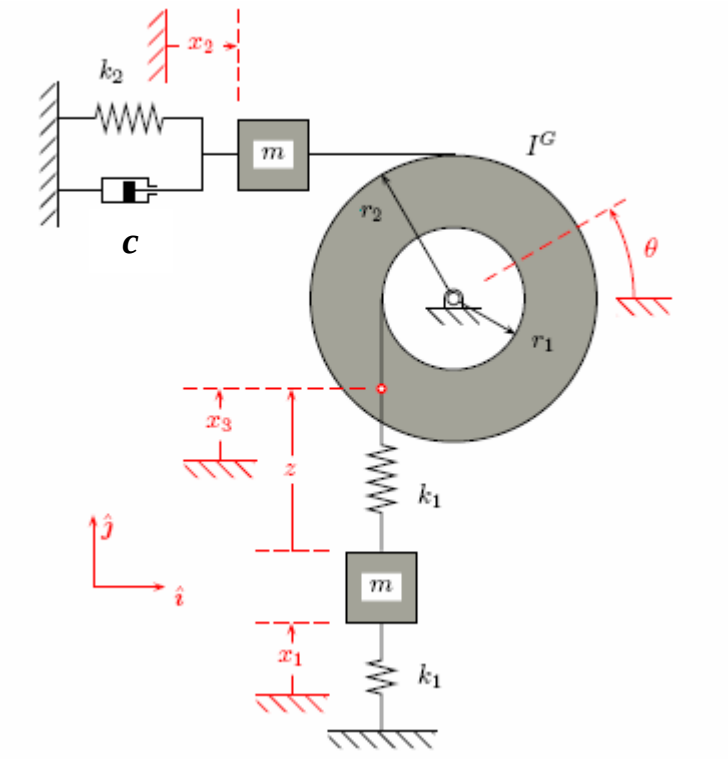

Figure 4