بسم الله الرحمن الرحيم

King Abdulaziz University
Engineering College
Department of MENG
7th Homework Assignment

Mechanical Vibrations
MENG 470
Spring 1425 H
Due Sat.: 27/2/1425 H

1. Two equal pendulums free to rotate about the *x-x* axis are coupled together by a rubber hose of torsional stiffness *k* lb.in/rad. as shown in Figure 1. Determine the natural frequencies for the normal modes of vibration, and describe how these motions may be started.

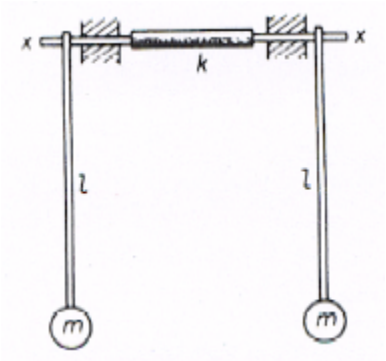

Figure 1

2. Setup the matrix equation of motion for the system shown in Figure 2. Using coordinates x_1.and x_2 and m and *2m.*

   (a) Determine the equation for the normal mode frequencies and describe the mode shapes.
   (b) If the coordinates x at m and θ are used, what form of coupling will result?

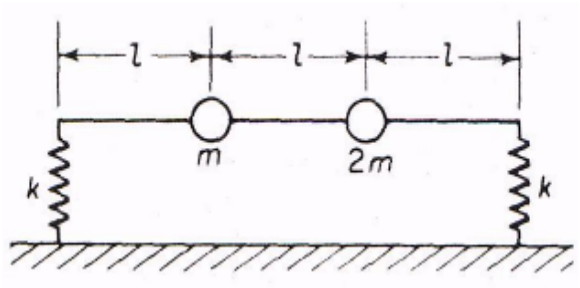

Figure 2

3. A two-story building is represented in Figure 3 by a lumped mass system in which $m_1 = \frac{1}{2} m_2$ and $k_1 = \frac{1}{2} k_2$. Show that its normal modes are

$$\left(\frac{x_1}{x_2}\right)^{(1)} = 2 \qquad \omega_1^2 = \frac{1}{2}\frac{k_1}{m_1}$$

$$\left(\frac{x_1}{x_2}\right)^{(2)} = -1 \qquad \omega_2^2 = \frac{1}{2}\frac{k_1}{m_1}$$

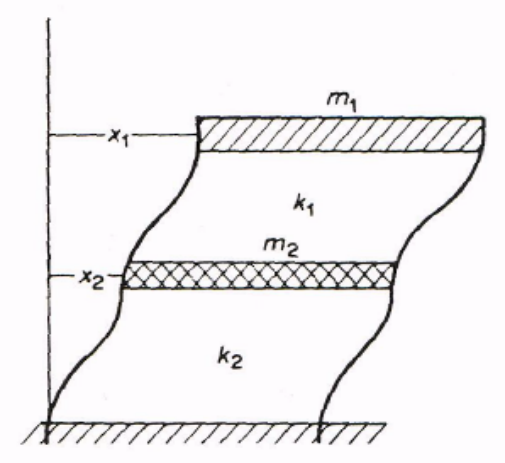

Figure 3

4. Determine the matrix equation of motion for the system shown in Figure 4.

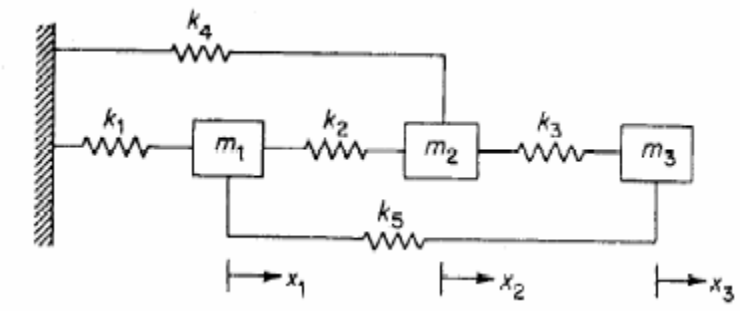

Figure 4

5. For the system shown in Figure 5, W_1 = 200 Ib and the absorber weight W_2 = 50 Ib. If W_1 is excited by a 2 Ib-in. unbalance rotating at 1800 rpm. determine the proper value of the absorber spring k_2. What will be the amplitude of W_2?

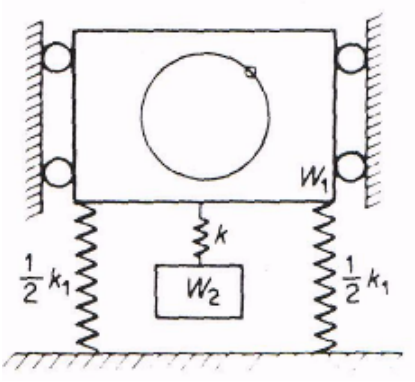

Figure 5