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ENME 351

SP4 – Modal Analysis

In this project you will determine the equations of motion of a two degree of freedom system which consists of two masses and 3 springs as shown in the diagram. In addition, you will solve the equations for 3 cases given below.

1. Draw the detailed free body diagrams of the masses of the system. Ignore gravity!
2. Using the free body diagrams, determine the equations of motion for the system.
3. For each case, what are the natural frequencies and the corresponding mode shapes?
4. Obtain the exact mathematical solution to these equations for the 3 cases defined below. In each case, the initial conditions are that m_1 is initially displaced by on centimeter vertically and that its velocity is zero. Also, m_2 has no initial displacement or velocity.

A. $m_1 = m_2 = 1\ kg,\ k_1 = k_2 = k = 10\ N/m$

B. $m_1 = 10\ m_2,\ m_2 = 1\ kg,\ k_1 = k_2 = k = 10\ N/m$

C. $m_1 = m_2 = 1\ kg,\ k_1 = k_2 = 10\ N/m,\ k = 100\ N/m$