

Lecture 25 Homework

Problem 25.1

The uniform bar has a length L , a mass m_1 , a centroidal moment of inertia J_G and is supported by two springs of stiffness k . The mass m_2 is hung from the bar by means of another spring, k_2 , and is subjected to the force $F(t)$ as shown.

- Assuming small angles, and using the coordinates shown below, determine the differential equations of motion of the system using Lagrange's equations. Write the equations in 2nd order matrix form.
- If $k = 1000$ N/m, $k_2 = 1500$ N/m, $L = 0.5$ m, $e = 0.1$ m, $m_1 = 0.5$ kg, and $m_2 = 0.4$ kg determine the natural frequencies and natural modes. Report the modes in three different ways 1) the modes directly from Matlab, 2) the modes normalized so that $x_2 = 1$, and 3) unit normalized modes, that is, the magnitudes of the eigenvectors are one.

