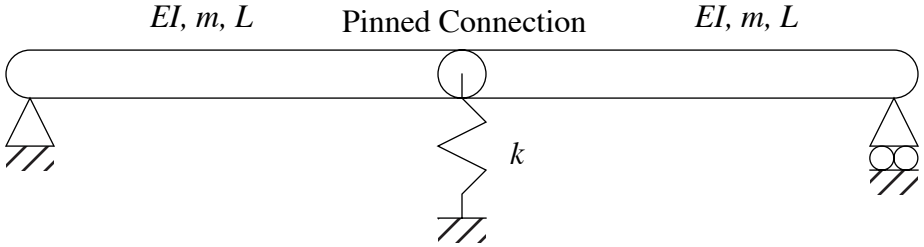
ME 710
Computational Methods in Structural Dynamics
Winter 1996
Final Exam
Open Class Text, Open Notes

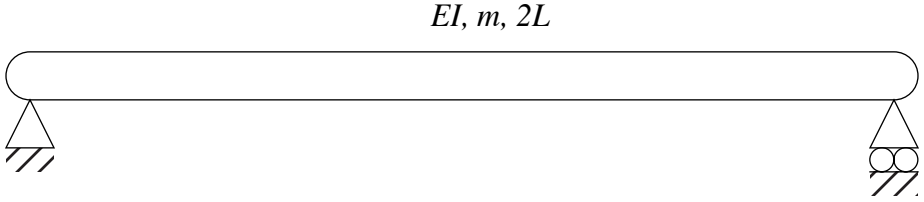
1) Find the first natural frequency and mode shape of a string using a 2-term approximation for the mode shape. The string has a length of 1 m, $T = 4$ N, $m(x) = 1$kg/m and a point mass of 1 kg attached at the center. Choose the best reasonable 2-term series.

2) The equation of motion for a simply supported beam with a constant compressive end load P is $\left(EI\frac{\partial^4}{\partial x^4} + P\frac{\partial^2}{\partial x^2} \right) w(x,t) + m\frac{\partial^2}{\partial x^2} w(x,t) = 0$. Determine for what values of P the system is stable. What is this value of P called?

3) Obtain the equation(s) of motion for the following system of beams shown below. The beam stiffness, EI, and linear mass density, m, are constant along the beam.



Is there any similarity between the modes of the system above and the modes of the simply supported beam below?



4) a) Solve A**x** = **y**. b) Complete one cycle of the Jacobi method (3 individual rotations) on the matrix A.

$$A = \begin{bmatrix} 2 & -1 & -1 \\ -1 & 6 & -2 \\ -1 & -2 & 4 \end{bmatrix}, \mathbf{y} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$