MASSACHUSETTS INSTITUTE OF TECHNOLOGY
13.10J/1.573J/2
Problem Set 12

Assign : Nov. 20, 2002

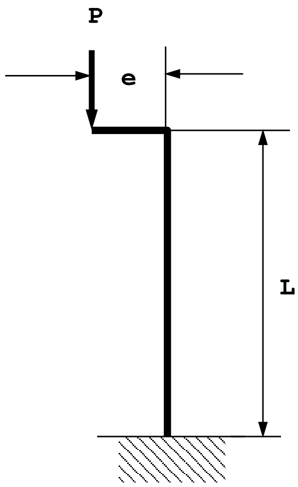
Due : Nov. 27, 2002

From book: 17.30, 17.37

1. The column shown in Figure 1 is fixed at the base and free at the upper end. A compressive load P acts at the top of the column with an eccentricity e from the axis of the column. The bending rigidity is EI. Beginning with the differential equation, show the followings:

   (a) the maximum tip deflection of the column $\delta = e(sec(kL) - 1) \quad where \;\; k = \sqrt{\frac{P}{EI}}$.

   (b) the maximum bending moment in the column $M_{max} = Pesec(kL)$.

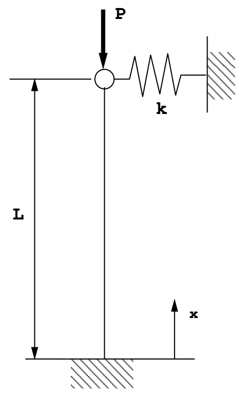


A diagram for Problem 1

2. Given the bending rigidity EI of a column of length L and the spring constant k as shown in Figure 2,

(a) derive an analytical formula for determining the critical buckling loads of the column-spring system and show that it satisfies the following relation:

$$k\sqrt{\frac{P}{EI}}L\cos\left(\sqrt{\frac{P}{EI}}L\right) - k\sin\left(\sqrt{\frac{P}{EI}}L\right) + P\sqrt{\frac{P}{EI}} = 0 \tag{1}$$



A diagram for Problem 2