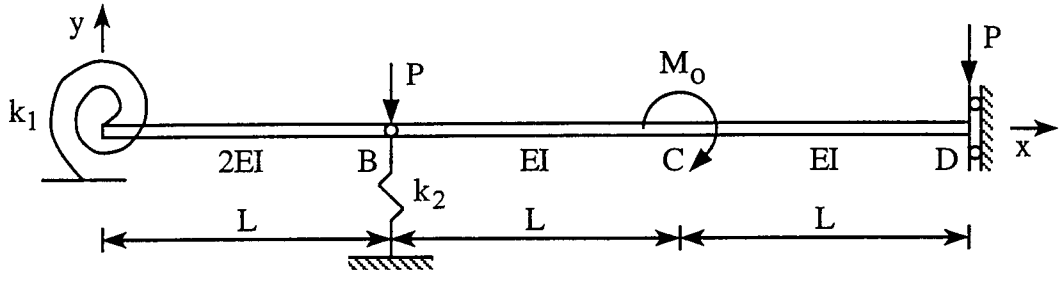
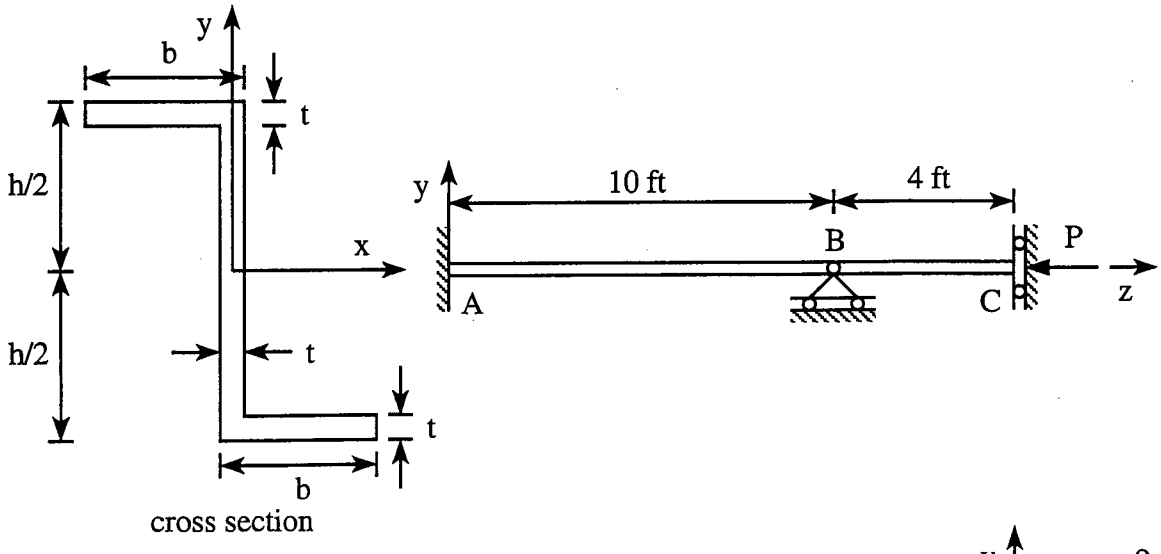
1. The beam ABCD has a rotational spring support (spring constant k_1) at A, a translational spring support (spring constant k_2) with an internal hinge at B, and a sliding support at D. The beam is subjected to a concentrated moment M_o at C and two concentrated forces P at B and D. The flexural rigidities of AB, BC and CD portions are 2EI, EI, and EI, respectively. (i) Set up the load-deflection differential equations for the beam. (ii) Write down the boundary conditions to determine the deflection of the beam. Do not solve the differential equations. (20%)

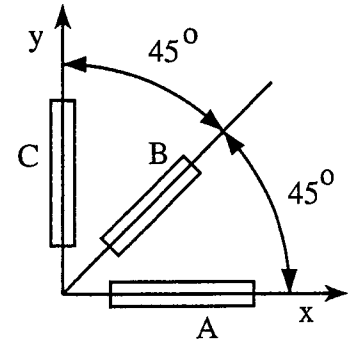


2. A column ABC, having a fixed support at A, a roller with an internal hinge at B and a sliding support at C, is subjected to an axial compressive force P. The cross section of the column is shown below with b = 3.5 in., h = 8 in., t = 0.55 in. Assume E = 30 Msi. If the column is free to buckle in any direction in x-y plane, calculate the critical buckling load P_{cr} of the column. (25%)

Hint: $I_{x1} = \frac{I_x + I_y}{2} + \frac{I_x - I_y}{2}\cos 2\theta - I_{xy}\sin 2\theta$

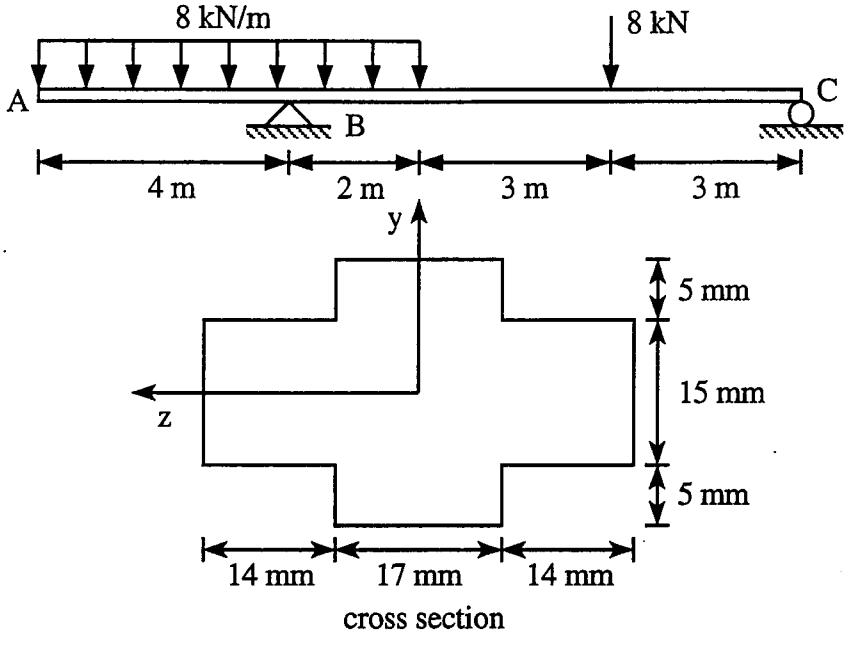


3. A 45° strain rosette mounted on the surface of a structure being tested gives the following readings: gage A, 310μ; gage B, 180μ; and gage C, -160μ. Determine the principal strains and maximum shear strains and show these strains on properly oriented elements. Note: $\mu = 10^{-6}$. (20%)



(背面仍有題目,請繼續作答)

4. An overhanging beam ABC is subjected to loads as shown. The cross section of the beam is also shown below. Calculate the maximum normal stress σ_{max} and the maximum transverse shear stress τ_{max} in the beam. (20%)



5. A steel tube (G = 76 GPa) having the cross section shown below. The tube has length L = 1.5 m and is subjected to a torque T. If the shear stress τ in the tube can not exceed 35 MPa and the angle of twist ϕ can not exceed 0.4^{o}, calculate the maximum permissible torque T_{max} that may be applied to the tube. (15%)