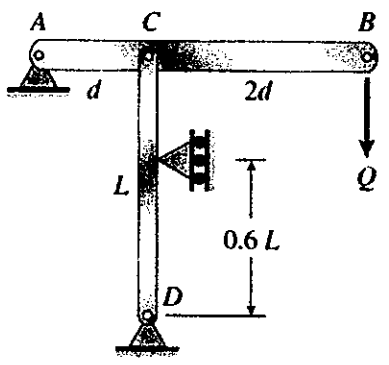
Problem 1 (25%)

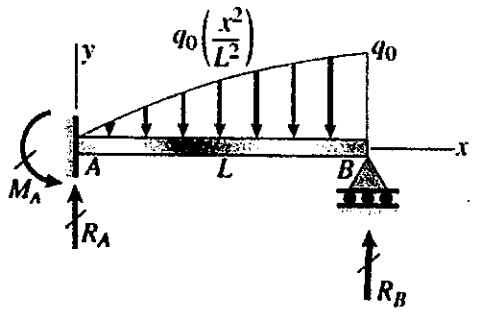
A horizontal beam AB is pin-supported at end A and carries a load Q at joint B, as shown in the figure. The beam is also supported at C by pinned-end column of length L; the column is restrained laterally at 0.6L from the base at A. Assume the column can only buckle in the plane of the frame.

The column is a solid aluminum bar (E = 70 GPa) of square cross section having length L = 0.75 m and side dimensions b = 38 mm. Let dimension d = L/2. Based upon the critical load of the column, determine the maximum force Q without buckling the column.



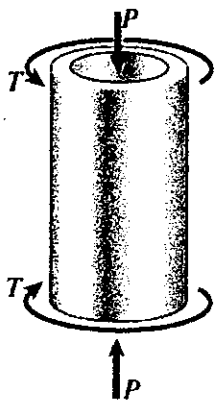
Problem 2 (25%)

A propped cantilever beam of length L is loaded by a parabolically distributed load with maximum intensity q_0 at B. Use the fourth-order differential equation of the deflection curve to solve for reactions at A and B and also the equation of the deflection curve.



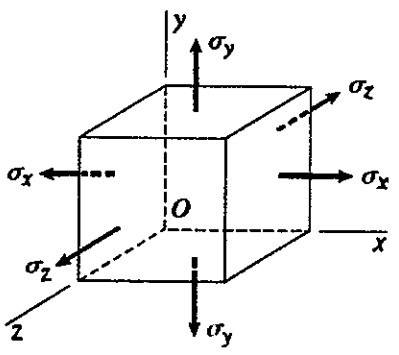
Problem 3 (25%)

A segment of generator shaft of hollow circular cross section is subjected to a torque T = 25 kN·m shown in the figure. The outer and inner diameters of the shaft are 200 mm and 160 mm, respectively. What is the maximum permissible compressive load P that can be applied to the shaft if the allowable in-plane shear stress τ_{allow} = 45 MPa?



Problem 4 (25%)

An element of aluminum is subjected to triaxial stresses shown in the figure. Determine the bulk modulus K for the aluminum if the following stress and strain data is known: normal stress σ_x = 36 MPa (tension), σ_y = -33 MPa (compression), and σ_z = -21 MPa (compression) and normal strain in the x and y directions are $\varepsilon_x = 713.8\times10^{-6}$ (elongation) and $\varepsilon_y = -502.3\times10^{-6}$ (shortening).



試題隨卷繳回