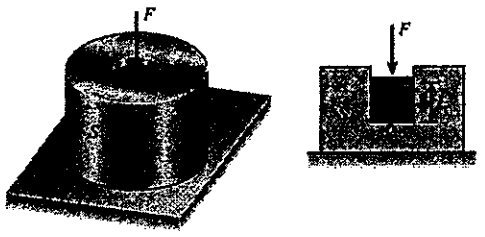
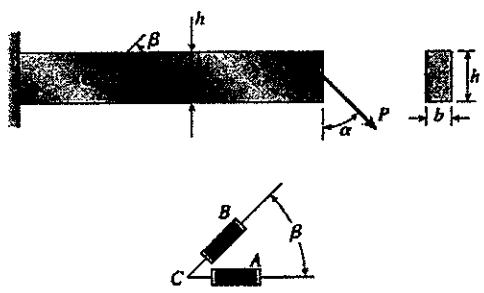
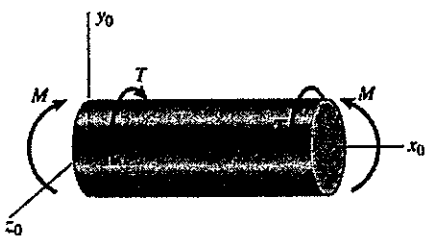
Question 1 (25%)
A rubber cylinder R of length L and cross-sectional area A is compressed inside a steel cylinder S by a force F that applies a uniformly distributed pressure to the rubber. Derive a formula for the shortening δ of the rubber cylinder.



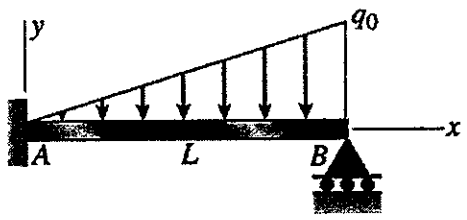
Question 2 (25%)
A cantilever beam of rectangular cross section (with b = 20 mm, height h = 175 mm) is loaded by a force P that acts at the mid-height of the beam and is inclined at an angle α to the vertical. Two strain gages are placed at point C, which is also located at the mid-height of the beam. Gage A measures the strain in the horizontal direction, and gage B measures the strain at an angle $\beta = 60^\circ$ to the horizontal. The measured strains are $\varepsilon_A = 145\times10^{-6}$ and $\varepsilon_B = -165\times10^{-6}$. Determine the force P and the angle α, assuming the material is steel with E = 200 GPa and $\nu = 1/3$.



Question 3 (25%)
A cylindrical pressure vessel with flat ends is subjected to a torque T and a bending moment M. The outer radius is 300 mm and the wall thickness is 25 mm. The loads are given as follows. T = 90 kN·m, M = 100 kN·m, and the internal pressure p = 6.25 MPa. Determine the maximum tensile stress σ_t, maximum compressive stress σ_c, and maximum shear stress τ_{max} on the wall of the cylinder. Show the results on a plot of Mohr's circle of stress.



Question 4 (25%)
A cantilever beam of length L and loaded by a triangularly distributed load of maximum intensity q_0 at B. Determine the reaction forces at A and B and the angle of rotation θ_B.



試題隨卷繳回