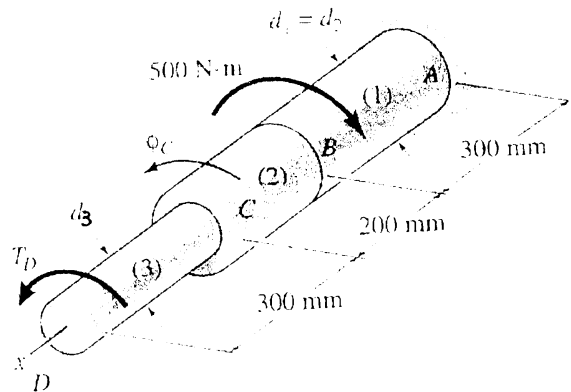
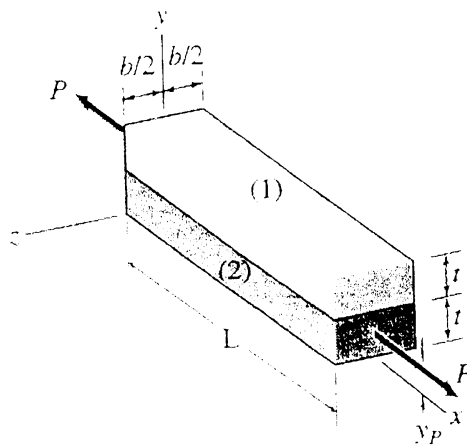


1. (25%) The steel shaft AD in the figure below (Young's modulus (E) = 210GPa, Poisson's ratio (ν) = 0.3) is subjected to torsional loads at sections B and D , as shown in the figure. The diameters are: $d_1 = d_2 = 40$ mm, and $d_3 = 25$ mm. (a) Determine the value of the torque T_D added at D that would make the rotation at C equal to zero, that is, make $\phi_C = 0$. (b) For the loading as determined in Part (a), determine the maximum shear stress in each of the three rod segments.

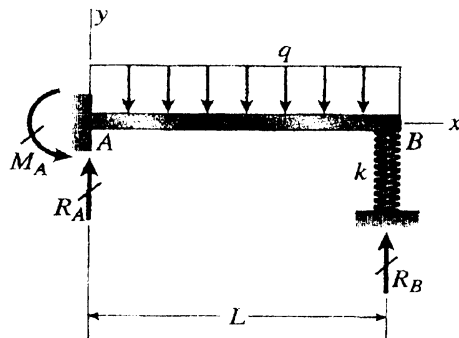


2. (25%) A bimetallic bar is made by bonding together two homogeneous rectangular bars, each having a width b , thickness t , and length L . The moduli of elasticity of the bars are E_1 and E_2 , respectively. An axial P is applied to the ends of the bimetallic bar at location ($y=y_p, z=0$) such that the bar undergoes axial deformation. Let $L = 50$ in., $b = 2$ in., $t = 1$ in., $E_1 = 10 \times 10^3$ ksi, $E_2 = 30 \times 10^3$ ksi, $P = 12$ kips. (a) Determine the normal stress in each material; that is, determine σ_{x1} and σ_{x2} . (b) Determine the value of y_p . (c) Determine the elongation of the bar.



(背面仍有題目,請繼續作答)

3. (25%) A cantilever beam AB of length L has a fixed support at A and a spring support at B (as shown below). The spring behaves in a linearly elastic manner with stiffness k . If a uniform load of intensity q acts on the beam,
- (a) what is the displacement δ_B of end B of the beam? and
- (b) what is the angle of rotation θ_B of end B of the beam, when the stiffness of the spring is infinite, i.e., $k \rightarrow \infty$?



4. (25%) Consider a column that is fixed at the base and pinned at the top (as shown below). It is uniform and of bending stiffness EI .
- (a) Derive the buckling equation for the buckling load P_{cr} of the system.
- (b) Estimate the buckling load P_{cr} by using the concept of effective length.

