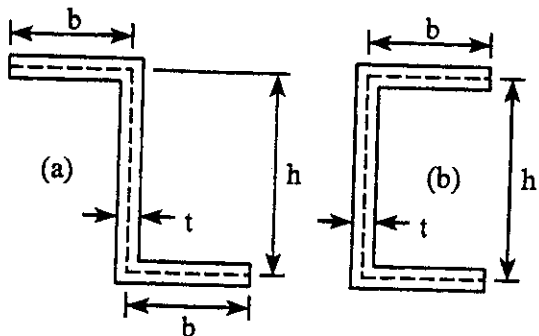
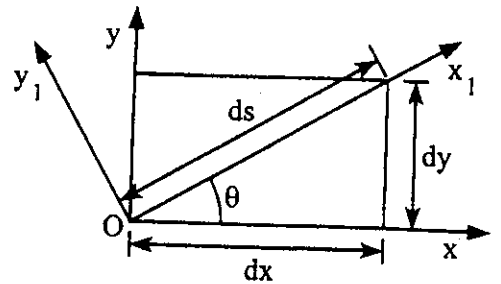


本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

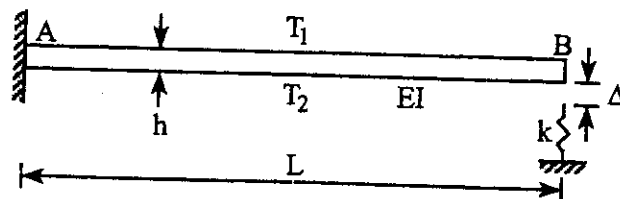
1. Draw appropriate deformation shapes of a plane strain element subjected to ϵ_x , ϵ_y , γ_{xy} separately and derive the following strain transformation equation. (20%)

$$\gamma_{x_1 y_1} = -2(\epsilon_x - \epsilon_y)\sin\theta\cos\theta + \gamma_{xy}(\cos^2\theta - \sin^2\theta)$$

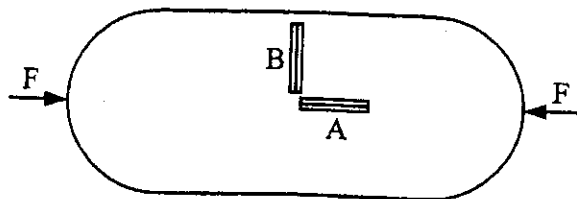


2. Determine the locations of the shear centers S of the (a) Z section and (b) channel section with uniform thickness t? (20%)

3. A cantilever beam AB of length L and height h is subjected to a temperature change varying linearly between the top and bottom of the beam. Let the temperature at the top be T_1 and at the bottom be T_2 ($T_1 > T_2$). Before the temperature changes, a small gap Δ exists between end B and the top of a spring (stiffness k). If the deflection of end B is greater than Δ , compute the force in the spring. (20%)



4. A cylindrical tank having radius $r = 0.5$ m and wall thickness $t = 15$ mm is subjected to internal pressure $p = 2.4$ MPa and an axial compressive force $F = 471$ kN. Two strain gages are mounted on the surface of the tank as shown. Assume that the recorded strains are $\epsilon_a = 355 \times 10^{-6}$ and $\epsilon_b = 30 \times 10^{-6}$. Calculate (i) the modulus of elasticity E and the Poisson's ratio ν of the tank, (ii) the absolute maximum shear stress τ_{max} in the tank. (20%)



5. A circular tube and a square tube are constructed of the same material and subjected to the same torque T. Both tubes have the same length L, same wall thickness t, and same cross-sectional area. (i) What are the ratios of their shear stresses τ_1/τ_2 and angle of twist ϕ_1/ϕ_2 ? (ii) Which tube is more efficient than the other? Why? (20%)

