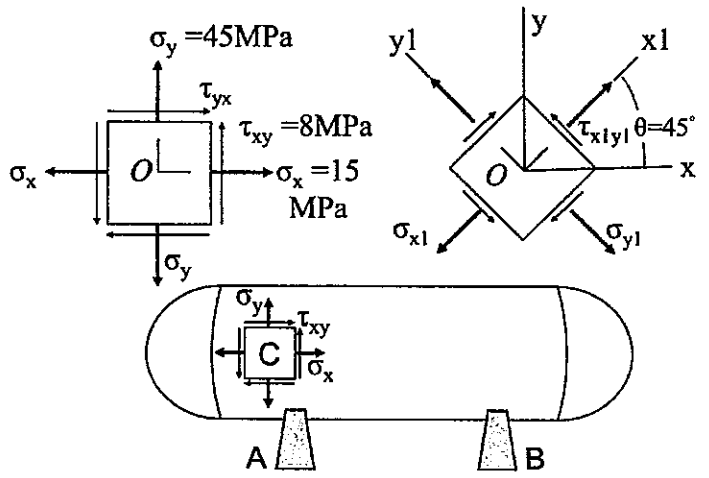
1. (25%) Considering a cylindrical pressure vessel is supported simply at points *A* and *B*, but the support at point B got rotated. The vessel wall experiences internal pressure, resulting in a longitudinal stress of σ_x =15 MPa and a circumferential stress of σ_y = 45 MPa on a stress element at point *C*. The rotated support *B* applied a torsional moment to the vessel. It results in a shear stress of τ_{xy} = 8 MPa. Determine the stresses acting on the element *C* when it is rotated through an angle of θ = 45°(see the figure after rotation). Please find:

(A) (8%) σ_{x1}=?

(B) (8%) σ_{y1}=?

(C) (9%) τ_{x1y1} =?

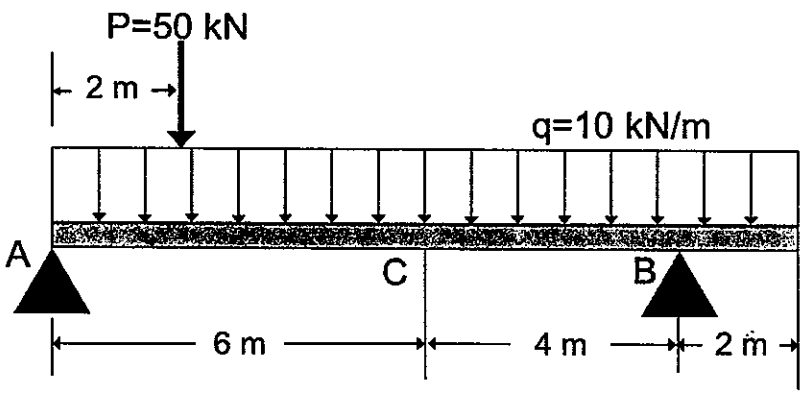


2. (25%) A simply supported beam that has a uniform loading and a concentrated loading is shown in the following figure. The uniform loading is q = 10 kN/m, and the concentrated loading is P = 50 kN. Please find:

(A) (6%) Calculate the reaction forces at supports *A* and *B*.

(B) (9%) Draw the shear and moment diagrams.

(C) (10%) Determine the shear force *V* and bending moment *M* at cross-section *C*.



見背面

3. (30%) Considering an elastoplastic I beam subjected to a moment M, please answer the following questions:
h = 25 cm, t = 2.5 cm, w = 30 cm, b = 5cm, the yield stress is 200 MPa.

(A) (4%) Determine the moment of inertia I

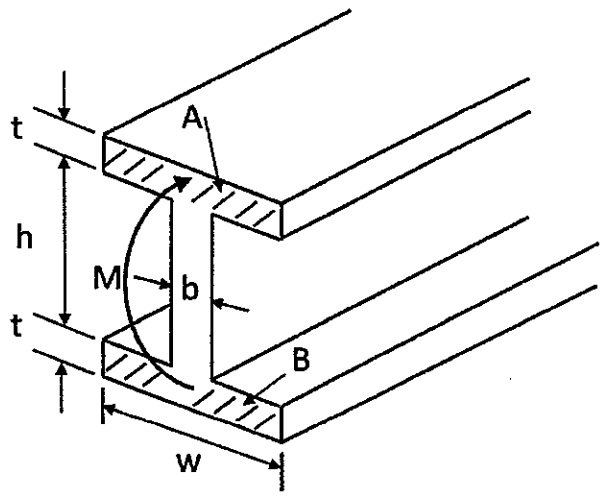
(B) (7%) Determine the maximum moment M_{max} that this I-beam can carry without exceeding the yield stress.

(C) (3%) Draw the axial stress distribution on the cross-section of the I-beam.

(D) (5%) Determine the resultant force F_R acting on the top board A.

(E) (3%) In the case that the board A and B have reached the yield stress, draw the axial stress distribution on the cross-section of the I-beam. (Assume perfect plastic yielding)

(F) (8%) Determine the moment M_y of (E).



4. (20%) A hollow steel shaft is fabricated to transmit T = 1500 N · m torque. The shear modulus is G = 80 GPa. The maximum acceptable shear stress is $\tau_a = 45$ MPa, and the maximum rate of twist is 0.9°/m. The inner diameter and the wall thickness of the shaft are d_0 and $0.1d_0$.

(A) (4%) Determine the polar moment in terms of d_0.

(B) (6%) Find the d_0 that the shaft just does not exceed τ_a.

(C) (6%) Find the d_0 that the shaft that just does not exceed the maximum rate of twist

(D) (4%) Based on your finding on (B) and (C), what is the required d_0.

試題隨卷繳回