Fundamentals of Civil Engineering

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TUTORIAL

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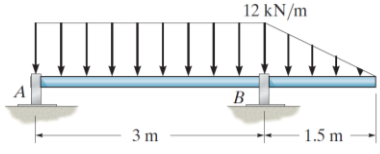
Problem 1

Determine the reactions.

Determine the Bending moment and shear force at the center of the beam portion AB.



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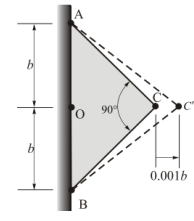
Problem 2

A thin, triangular plate ABC is uniformly deformed into a shape ABC', as shown by the dashed lines in the figure. Calculate (1) the normal strain along the centerline OC, (2) the normal strain along the edge AC, and (3) the shearing strain between the edges AC and BC.



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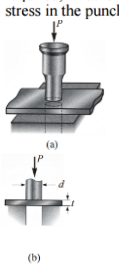
Problem 3

A punch for making holes in steel plates is shown in Fig. a. Assume that a punch having a diameter of 19 mm is used to punch a hole in a 6-mm plate, as shown in the cross-sectional view (see figure (b)). If a force $P = 125\,\text{kN}$ is required, what is the average shear stress in the plate and the average compressive stress in the punch?



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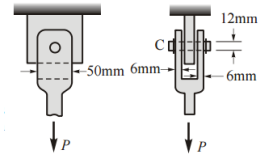
Problem 4

The connection shown in the figure is subjected to a load P = 20 kN. Calculate,

1. Shear stress in the pin at C
2. The maximum tensile stress in the clevis



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Problem 5

A cantilever steel bar (horizontal) is having a square hollow cross section with thickness 15mm and a side width of 150mm.

Determine the maximum tensile stress of the bar if,

a) The bar is subjecting to an axial tensile load of 20 kN
b) The bar is loaded vertically downward with a load of 20 kN at the tip of the bar
c) If both the loadings mentioned in (a) and (b) acting at the same time

(Young's Modulus of steel - 200 GPa)

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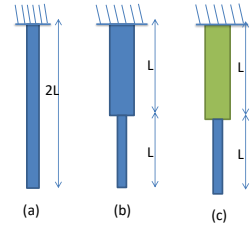
Problem 6



If a tensile load of P kN is applied at the end of the bar, determine the total change in length of the bar for the three cases shown. Neglect the self-weight of the bar.

a) Cross section A, Young's Modulus E
b) Cross section 2A and A, Young's Modulus E
c) Cross section 2A and A, Young's Modulus E and 2E

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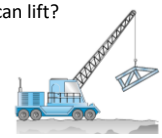
Problem 7

A steel cable with nominal diameter 25 mm is used in a construction yard to lift a bridge section weighing 38 kN, as shown in the figure. The cable has modulus of elasticity of 140 GPa.

(a) If the cable is 14 m long, how much will it stretch when the load is picked up?

(b) If the maximum allowable stress the cable can take is 150 MPa and the factor of safety of 1.5 is to be applied, what is the maximum load that the cable can lift?



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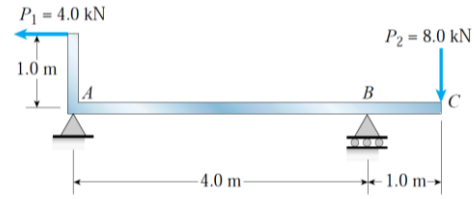
Problem 8

Determine the bending moment and shear force at a cross section located 3 m away from the left-hand support.



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