CEN 102: Solid Mechanics

Tutorial-1

Topics: Tension

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1. A steel wire hangs vertically under its own weight. What is the greatest length it can have if the allowable tensile stress is 200 MPa? The specific weight of steel is 8000 kg/m^3.

2. A prismatic steel bar with cross-sectional area 10 cm^2 is subjected to axial loading as shown in Fig. 1. Find the net change in length of the bar. Assume $E = 200\ GPa$.

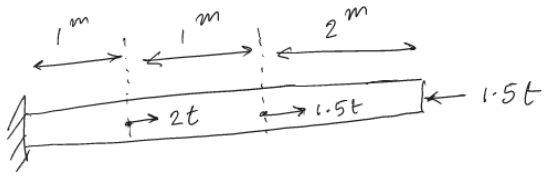

Figure 1:

3. A rigid bar AB is 8 m long and is suspended by two vertical rods at its ends and hangs in a horizontal position as shown in Fig. 1. The rod at A is made up of brass with cross-sectional area 10 cm^2, length 2 m and Young's modulus 110 GPa and the road at B is made up of steel with cross-sectional area 5 cm^2, length 5 m and Young's modulus 200 GPa. At what distance x from A may a vertical load P be applied such that the bar AB remains horizontal?

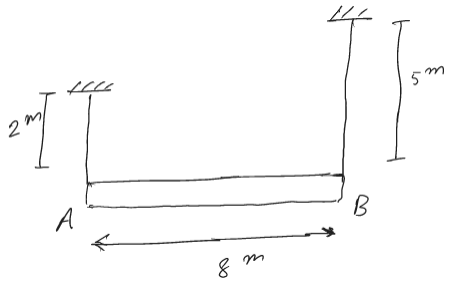

Figure 2:

4. A 75 cm long steel rod has a cross-sectional area of 15 cm^2 over 30 cm of its length and 20 cm^2 over the rest of its length. At a temperature $10°C$, the rod fits exactly between unyielding walls at its two ends. Compute the maximum compressive stress that the rod will experience at a temperature of $40°C$. The modulus of elasticity is 200 GPa and the coefficient of thermal expansion is $\alpha = 12 \times 10^{-6}/°C$.