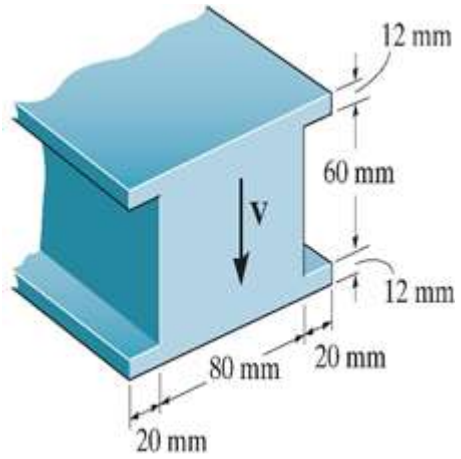
Mechanics of Materials

Problem 1

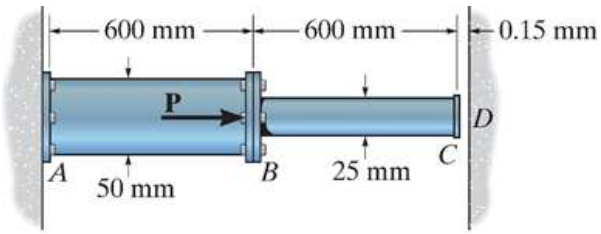
For the strut shown below:

1. Determine the section's moment of inertia
2. Determine the maximum shear force V that the strut can support if the allowable stress for the material is τ_{allow} = 50 MPa.



Problem 2

If the gap between the end of the cylinder (Point C in the figure shown below) and point D on the rigid wall is initially 0.15 mm, determine the support reactions at A and D when the force P = 180KN is applied at point B. Modulus of elasticity for the steel cylinders = 200 GPa



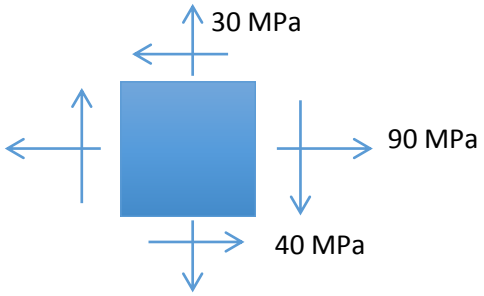
Problem #3

A plane element is subjected to the stresses as shown. Determine:

(a) Principal stresses in the plane;

(b) The maximum shear stress and the directions of the planes relative to the horizontal direction.

(c) In the structure design and material selection, determine the minimum yield strength of the material required to make the structure not yield under this stress state, based on von Mises and Tresca yield criteria, respectively.



Problem 4

The two shafts shown in the figure below are made of A-36 steel. Each has a diameter of 25 mm and they are connected using the gears fixed to their ends. Their other ends are attached to fixed supports at A and B. They are also supported by journal bearings at C and D, which allow free rotation of the shafts along their exes. If a torque of 500 N.m is applied to the gear at E as shown in the figure, determine the reactions at A & B. For A-36 Steel: E = 200 GPa and G = 75 GPa.