Module – 2 Mechanics of Materials

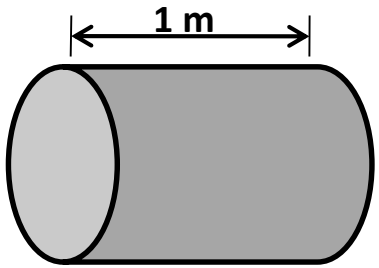
- Pressure Vessels

  hoop stress, radial stress, axial stress

- 2D – Stress States

  Mohr's circle, principal stresses, Hooke's law

Problem 10 –Pressure Vessel

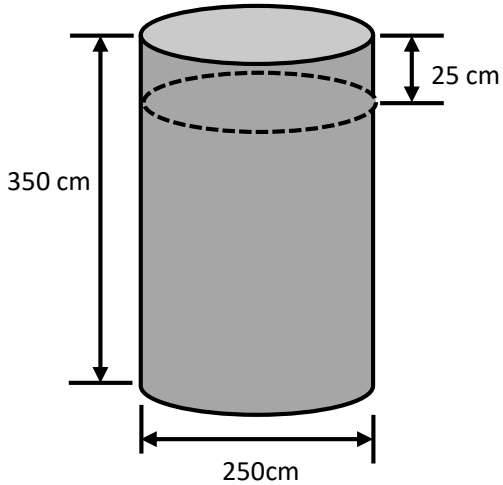


wall thickness 5 mm
internal radius 40 cm

A cylindrical pressure vessel is subjected to an internal pressure P. If the maximum allowable tensile stress that can be sustained by the vessel is 275 MPa what is the highest value of P permitted.

(A) 1.5 MPa (B) 2.5 MPa (C) 3.5 MPa (D) 4.5 MPa

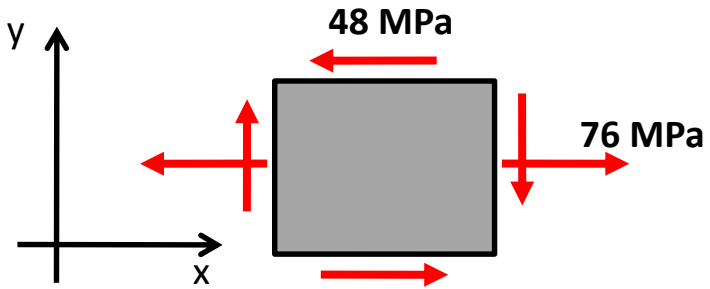
Problem 11 – Water Storage Tank



An open end cylindrical water storage tank is fabricated to the dimensions shown from 6 mm thick steel plate. At the water level indicated estimate the maximum stress generated in the side wall at the bottom of the tank. The weight of water is 9.8×10^3 N/m^3 .

(A) 0.6 MPa (B) 6.5 MPa
(C) 65 MPa (D) 650 MPa

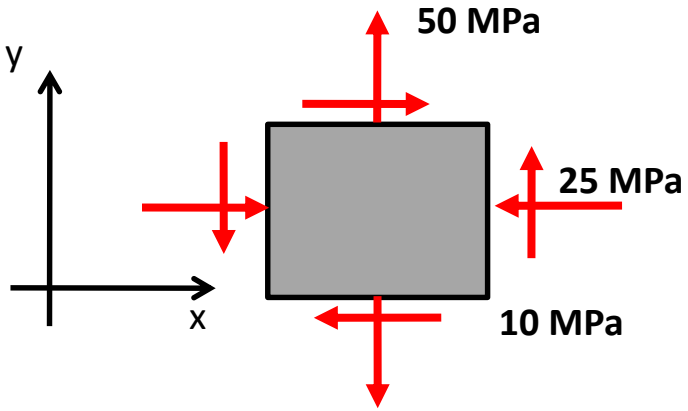
Problem 12 - Principal Stresses



A two dimensional stress state consists of a tension of 76 MPa and a shear of 48 MPa. Determine the minimum principal stress for this original stress state.

(A) -25 MPa (B) 25 MPa (C) 100 MPa (D) -100 MPa

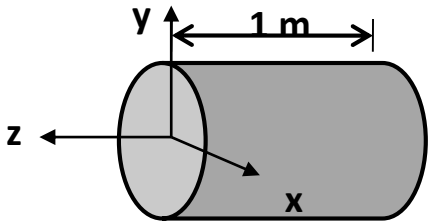
Problem 13 – Max Shear Stress



For the two dimensional stress state shown in the figure what is the maximum shear stress that occurs in the element?

(A) -40 MPa (B) 40 MPa (C) 20 MPa (D) 60 MPa

Problem 14 – 3 D Stresses

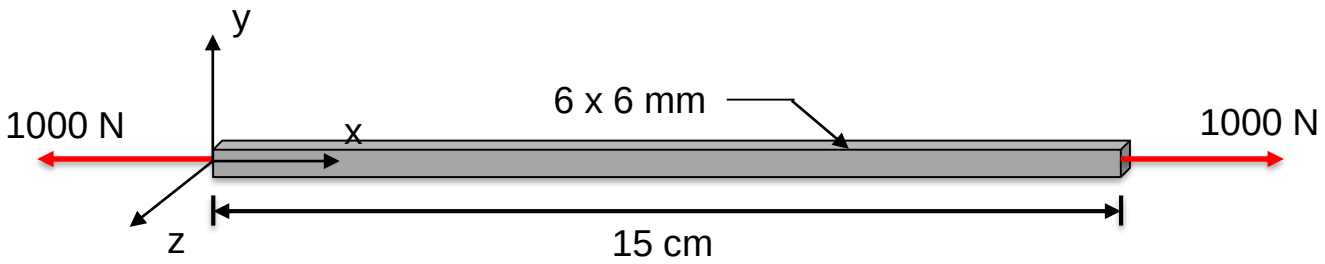


wall thickness 5 mm
internal radius 40 cm

In Problem 10 the allowable internal pressure using a material tensile strength of 275 MPa was determined based on thin wall theory to be 3.45 MPa. This pressure would produce a hoop stress of 275 MPa and an axial stress of 138 MPa with an internal surface radial stress of 3.45 MPa. For this three dimensional state of stress calculate the maximum shear stress in the material.

(A) 100 MPa (B) 140 MPa (C) 160 MPa (D) 180 MPa

Problem 15 – Hooke's Law



A 6 mm square cross section aluminum rod 15 cm long is placed in tension with an axial force of 1000 Newtons. Determine the lateral contraction (mm) of the rod under this applied load.

E = 200 GPa, Poison's ratio = 0.33

(A) -0.28×10^{-1} (B) -0.28×10^{-2} (C) -0.28×10^{-3} (D) -0.28×10^{-4}

Thanks for watching

and

on the exam !