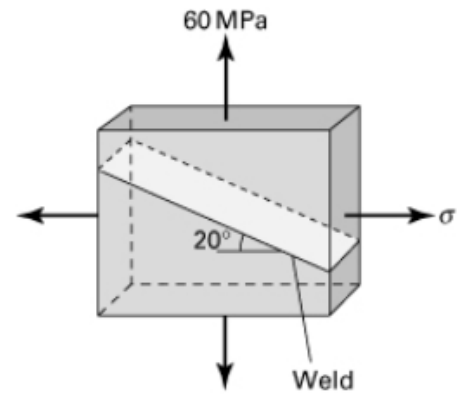


Problem 1 (20 pts)

A welded plate carries uniform biaxial tension. Determine the maximum stress σ if the weld has an allowable normal stress of 80 MPa .

(Ans: 231 MPa)



Problem 2 (30 pts)

A steel plate ($E = 200 \text{ GPa}$ and $\nu = 0.29$) is subjected to a state of plane stress ($\sigma_x = -80 \text{ MPa}$, $\sigma_y = 100 \text{ MPa}$, and $\sigma_{xy} = 50 \text{ MPa}$). Report the associated tensorial strains and determine the dilatation.

(Ans: $[\epsilon] = \begin{bmatrix} -545 & 322.5 & 0 \\ 322.5 & 616 & 0 \\ 0 & 0 & -29 \end{bmatrix} \mu; e = 42\mu$)

Problem 3 (20 pts)

The stress state in a component of the roof rack on an automobile as it passes over a speed bump is defined by the following stress tensor (relative to an x, y, z coordinate system):

$$\begin{bmatrix} 0 & 3 & 0 \\ 3 & 4 & 0 \\ 0 & 0 & 7 \end{bmatrix} MPa$$

Determine

(a) the principal stresses ($\sigma_1, \sigma_2, \sigma_3$) (Ans: $\sigma_{1,2,3} = 7, 5.6, -1.6 MPa$)

(b) the eigenvector, or direction cosines (l, m, n), associated with the minimum principal stress. (Ans: $[0.88, -0.47, 0]^T$)

