

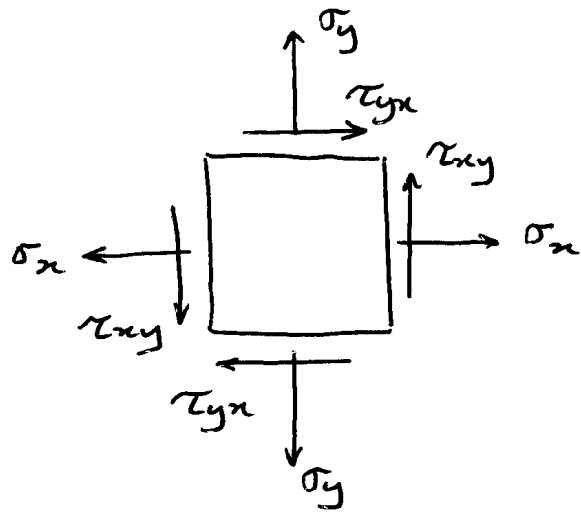
1.

State of stress

$$\sigma_x = 40 \text{ MPa}$$

$$\sigma_y = 30 \text{ MPa}$$

$$\tau_{xy} = -20 \text{ MPa}$$



Stress transformation equations :

$$\sigma_\phi = \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y) \cos 2\phi + \tau_{xy} \sin 2\phi$$

$$\tau_\phi = -\frac{1}{2}(\sigma_x - \sigma_y) \sin 2\phi + \tau_{xy} \cos 2\phi$$

At $\phi = 40^\circ$

$$\sigma_{40} = \frac{1}{2}(40 + 30) + \frac{1}{2}(40 - 30) \cos 80^\circ$$

$$- 20 \sin 80^\circ$$

$$= 35 + 0.87 - 19.7 = \underline{16.17 \text{ MPa}}$$

$$\tau_{40} = -\frac{1}{2}(40 - 30) \sin 80^\circ - 20 \cos 80^\circ$$

$$= -4.92 - 3.47 = \underline{-8.39 \text{ MPa}}$$

