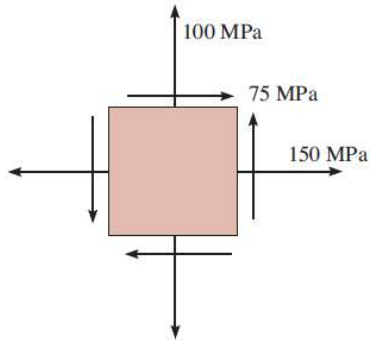


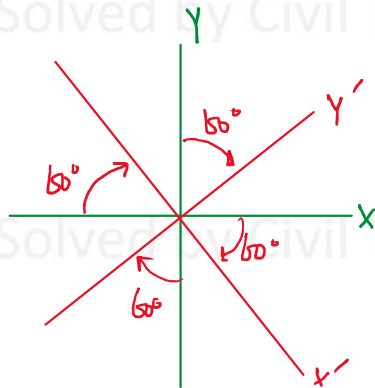
Plane Stress Transformation question solution using STRESS TRANSFORMATION EQUATIONS

9-11. Determine the equivalent state of stress on an element at the same point oriented 60° clockwise with respect to the element shown. Sketch the results on the element.



Prob. 9-11

Mechanics of Materials, R.C. Hibbeler 10th Ed. Pearson



$$\theta = -60^\circ \Rightarrow 2\theta = -120^\circ$$

$$\sigma_x = 150 \text{ MPa}, \sigma_y = 100 \text{ MPa}, \tau_{xy} = 75 \text{ MPa}$$

$$\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta = 47.55 \text{ MPa}$$

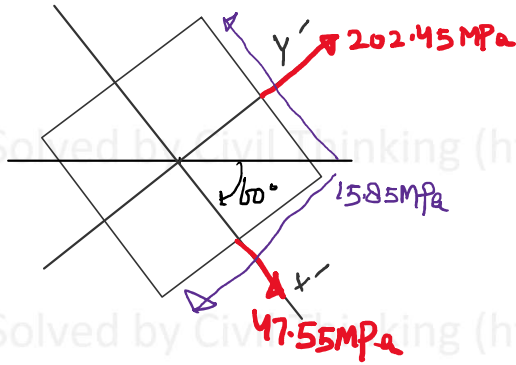
$$\sigma_{y'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2(90^\circ + \theta) + \tau_{xy} \sin 2(90^\circ + \theta)$$

$$90^\circ + \theta = 90^\circ + (-60^\circ) = 30^\circ; 2(90^\circ + \theta) = 2 \times 30^\circ = 60^\circ$$

$$\Rightarrow \sigma_{y'} = 202.45 \text{ MPa}$$

$$\tau_{x'y'} = \ominus \frac{\sigma_x - \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta = -15.85 \text{ MPa}$$

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