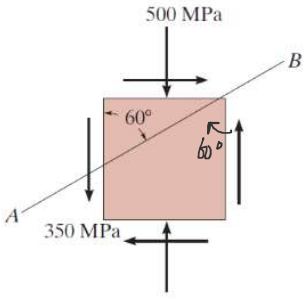
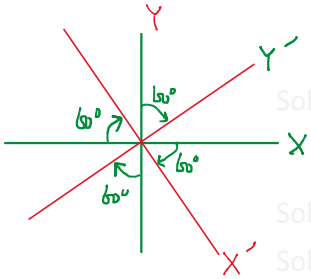
Plane Stress Transformation *question solution using Method of Equilibrium*

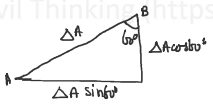
9–6. The state of stress at a point in a member is shown on the element. Determine the stress components acting on the inclined plane AB. Solve the problem using the method of equilibrium described in Sec. 9.1.

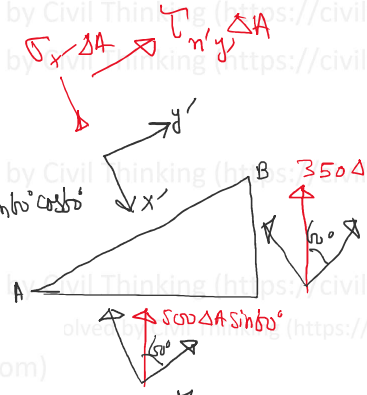


Prob. 9–6

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







$+\downarrow \Sigma F_{x'} = 0$:

$\sigma_{x'} \Delta A - 500\Delta A \sin 60^\circ \sin 60^\circ - 350\Delta A \sin 60^\circ \cos 60^\circ - 350\Delta A \cos 60^\circ \sin 60^\circ = 0$

$\Rightarrow \sigma_{x'} = 678.109 \text{ MPa}$

$+\rightarrow \Sigma F_{y'} = 0$:

$\tau_{n'y'} \Delta A + 350\Delta A \cos 60^\circ \cos 60^\circ + 500\Delta A \sin 60^\circ \cos 60^\circ - 350\Delta A \sin 60^\circ \sin 60^\circ = 0$

$\Rightarrow \tau_{x'y'} = -41.5 \text{ MPa} = 41.5 \text{ MPa} (\curvearrowleft)$

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