Mechanics of Materials I:

Fundamentals of Stress & Strain and Axial Loading

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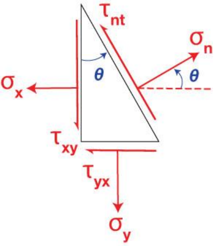
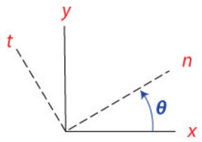
Module 23 Learning Outcome

- Represent the transformation of plane stress using Mohr's Circle



Plane Stress



Mohr's Circle

Graphical tool for the depiction of the transformation equations for plane stress

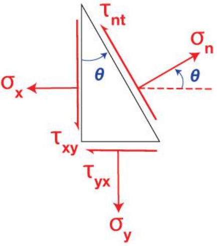
$$\left(\sigma_n - \frac{\sigma_x + \sigma_y}{2}\right)^2 + (\tau_{nt} - 0)^2 = \left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2$$

Radius = $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

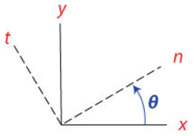
Center: $\left(\frac{\sigma_x + \sigma_y}{2}, 0\right) = (\sigma_{AVG}, 0)$

The angle on Mohr's circle is 2 times the stress block angle

Mohr's circle is a circle where each point represents the stress σ and τ on a particular plane through a single point



Plane Stress



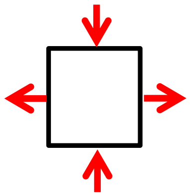
Mohr's Circle

$$\left(\sigma_n - \frac{\sigma_x + \sigma_y}{2}\right)^2 + (\tau_{nt} - 0)^2 = \left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2$$

Radius = $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$ **Center:** $\left(\frac{\sigma_x + \sigma_y}{2}, 0\right) = (\sigma_{AVG}, 0)$

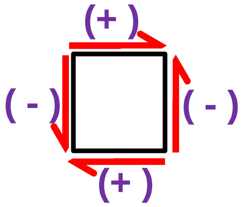
Sign Convention

Normal



(+) Tension
(-) Compression

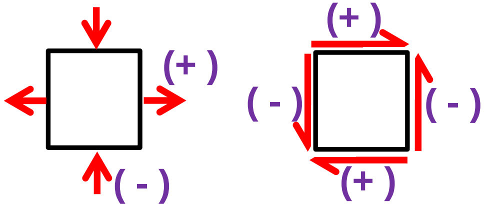
Shear



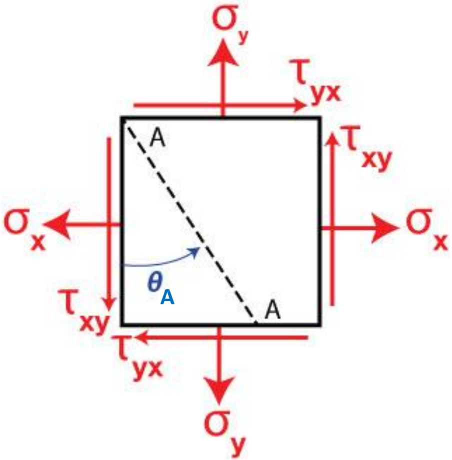
Clockwise (+)
Counterclockwise (-)

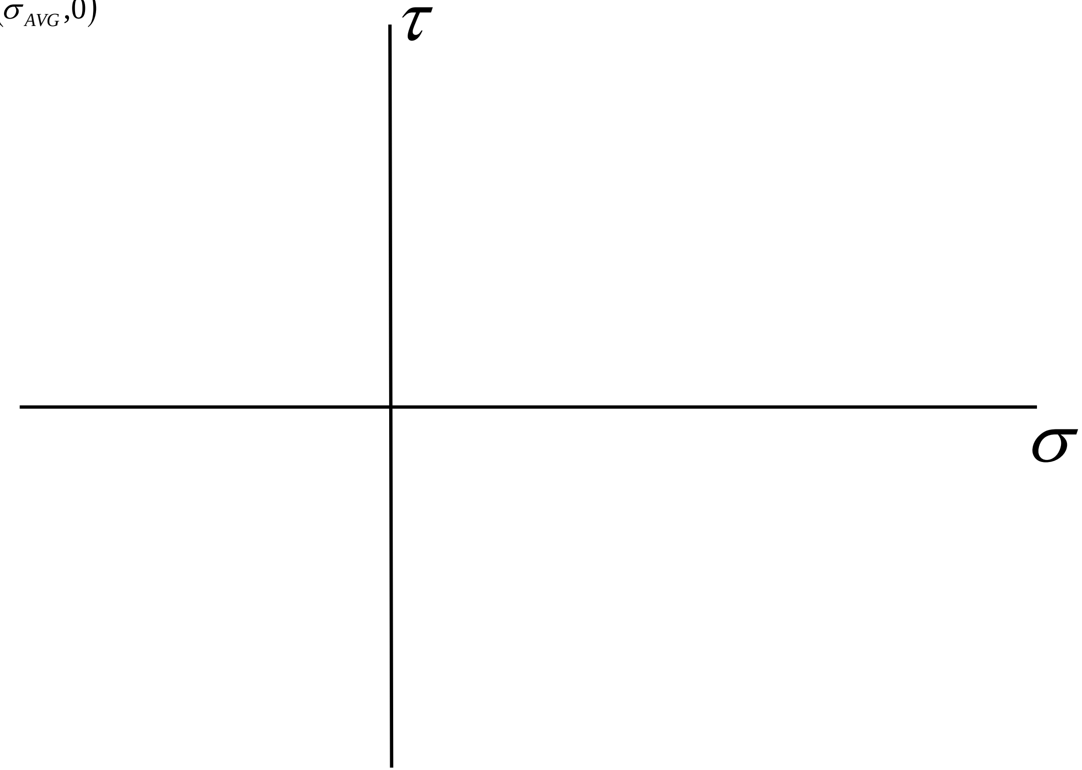
Mohr's Circle

$$\left(\sigma_n - \frac{\sigma_x + \sigma_y}{2}\right)^2 + (\tau_{nt} - 0)^2 = \left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2$$



Radius = $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$ **Center:** $\left(\frac{\sigma_x + \sigma_y}{2}, 0\right) = (\sigma_{AVG}, 0)$





Horizontal face

$$H = (+\sigma_y, +\tau_{yx})$$

Vertical face

$$V = (+\sigma_x, -\tau_{xy})$$