Mechanics of Materials I:

Fundamentals of Stress & Strain and Axial Loading

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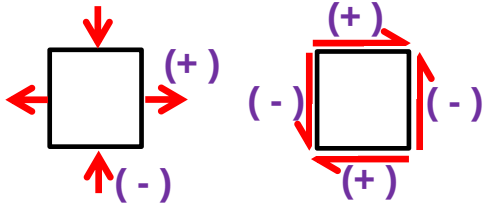
Module 24 Learning Outcome

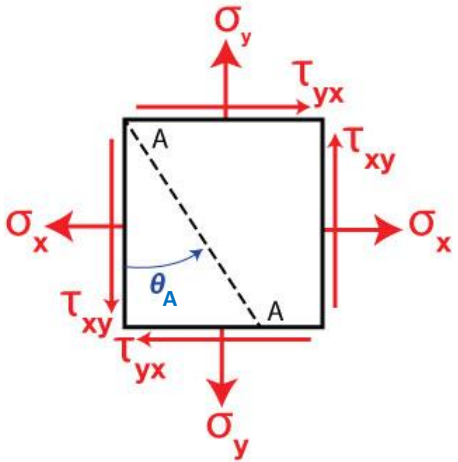
- For a given set of plane stress conditions at a point, determine the Principal Stresses, Principle Planes, and Maximum Shear Stress using Mohr's Circle

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

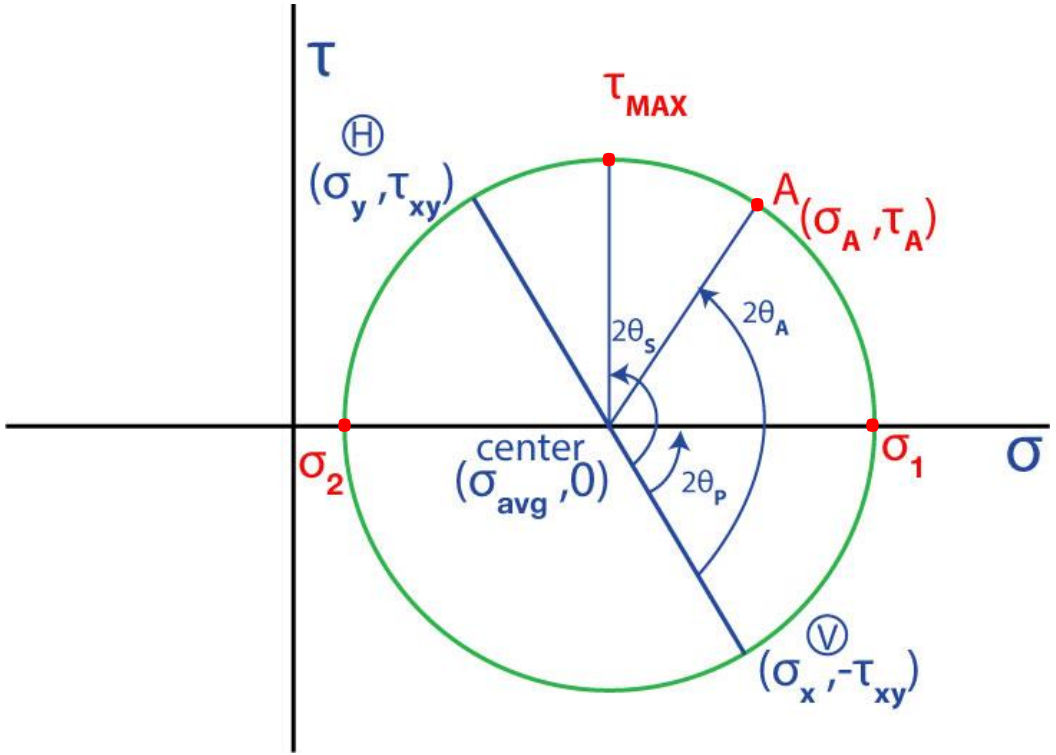


Horizontal face

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

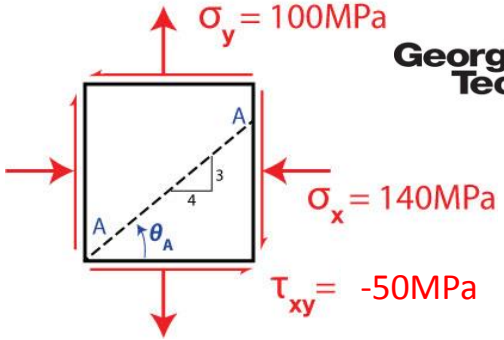
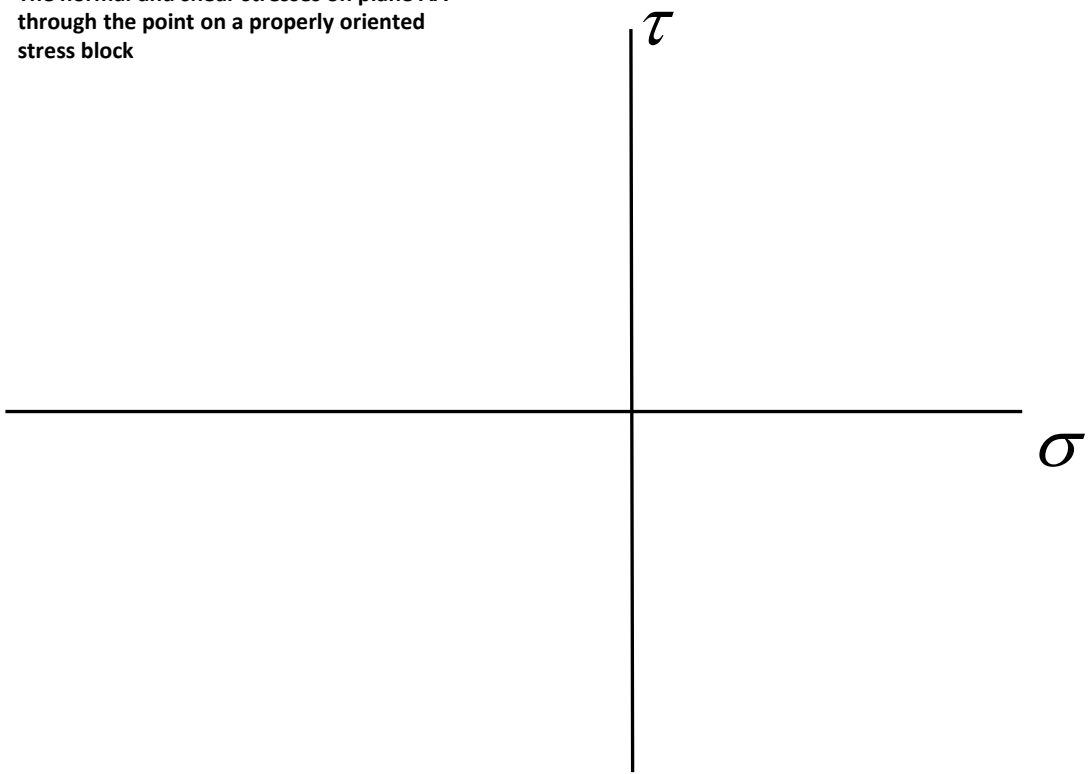
Vertical face

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



Example

The stress block shown represents the stresses on two orthogonal planes through a point in a structural member. Using Mohr's circle, find:

a) The principal stresses and the maximum shear stress at that point, and show the planes on which they act on a properly oriented stress block

b) The normal and shear stresses on plane AA through the point on a properly oriented stress block