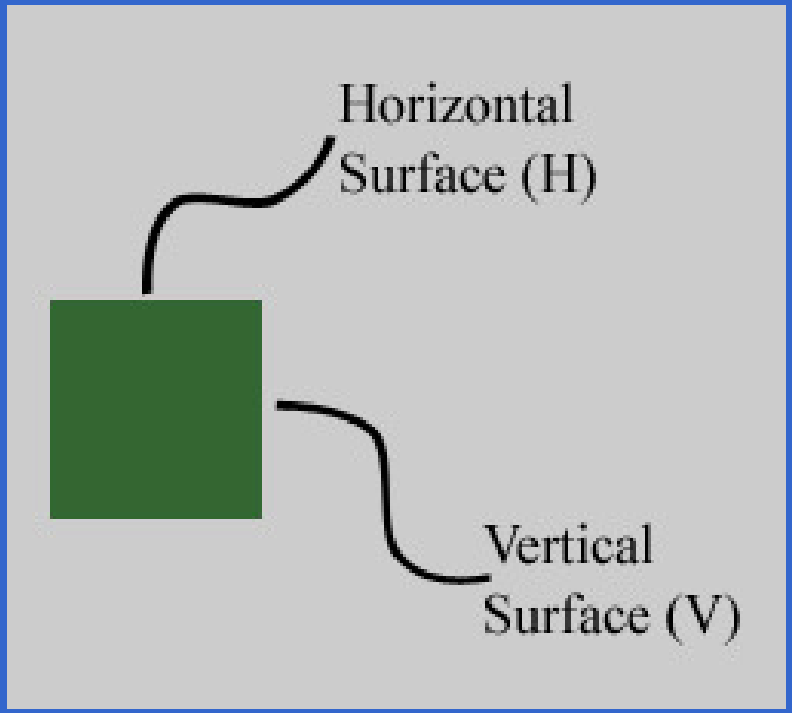
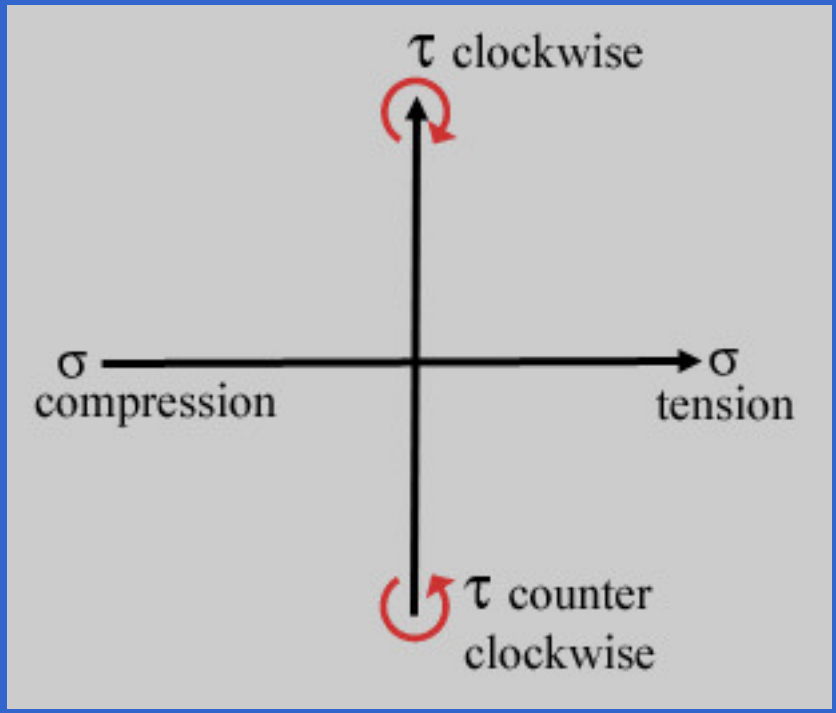
Mohr's Circle: Definitions





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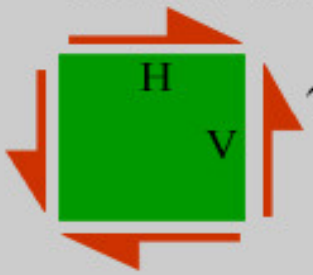
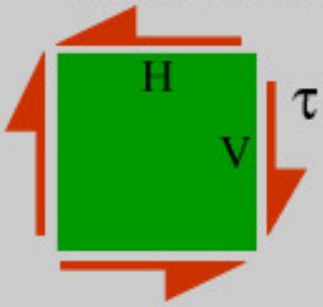
Mohr's Circle: Plotting Stresses

τ on H produces clockwise moment; plots in top half of Mohr's Plane



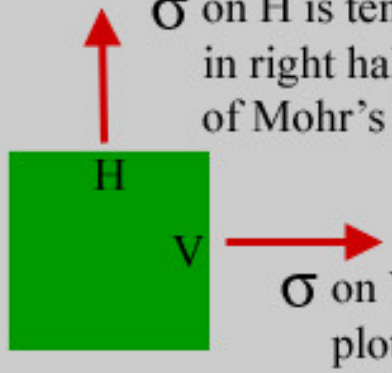
τ on V produces counter clockwise moment; plots in bottom half of Mohr's Plane

τ on H produces counter clockwise moment; plots in lower half of Mohr's Plane



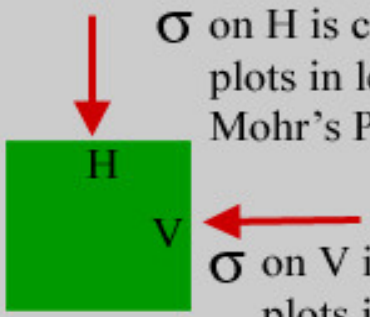
τ on V produces clockwise moment; plots in upper half of Mohr's Plane

σ on H is tension; plots in right half of Mohr's Plane



σ on V is tension; plots in right half of Mohr's Plane

σ on H is compression; plots in left half of Mohr's Plane



σ on V is compression; plots in left half of Mohr's Plane

Mohr's Circle: Stress-States

- Plot stress-state on vertical surface as point V with coordinates (σ_V , τ_V).
- Plot stress-state on horizontal surface as point H with coordinates (σ_H , τ_H).

Mohr's Circle: Center and Radius

- Center of Mohr's Circle: $(\sigma_C\ , 0)$

$$\sigma_C = \frac{1}{2}(\sigma_V + \sigma_H)$$

- Radius of Mohr's Circle: (R)

$$R = \frac{1}{2}\sqrt{(\sigma_V - \sigma_H)^2 + 4\tau_{xy}^2}$$

Principal Stresses:

- Principal Normal Stresses:

$$\sigma_{p1}, \sigma_{p2} = \sigma_C \pm R$$

- Principal Shear Stress:

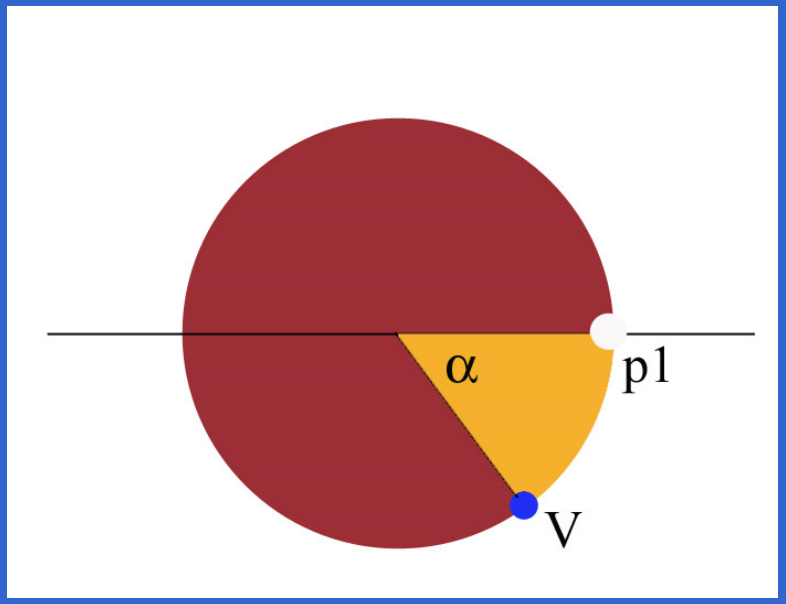
$$\tau_p = R$$

Maximum Shear Stress:

Maximum Shear Stress:

$$\tau_{max} = Max\ of\left(\frac{\sigma_{p1} - \sigma_{p2}}{2}, \frac{\sigma_{p1}}{2}, \frac{\sigma_{p2}}{2}\right)$$

Calculating θ_p ; Case-1

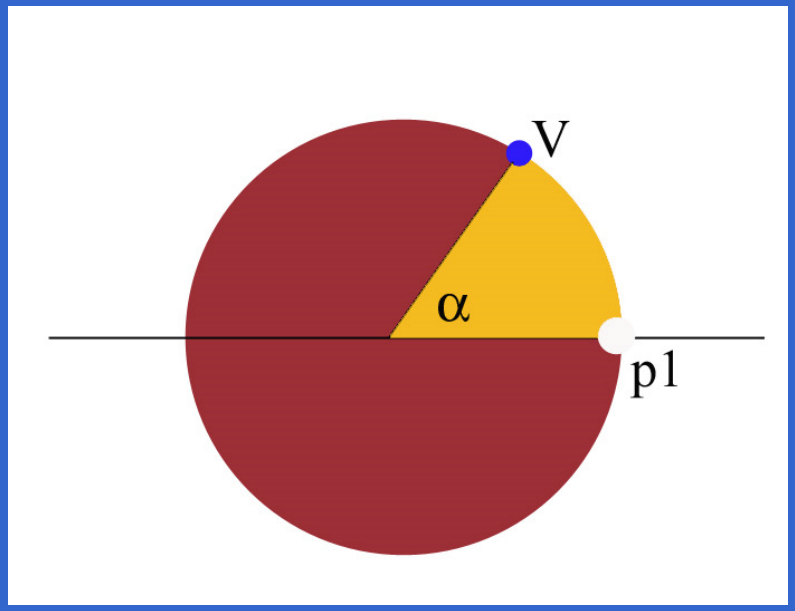


$$\alpha = tan^{-1}\left(\left|\frac{\tau_V}{\sigma_V - \sigma_C}\right|\right)$$

$$\theta_p = \frac{\alpha}{2}$$

$$(\ CCW\ from\ V\ to\ p1, hence\ positive\ )$$

Calculating θ_p ; Case-2

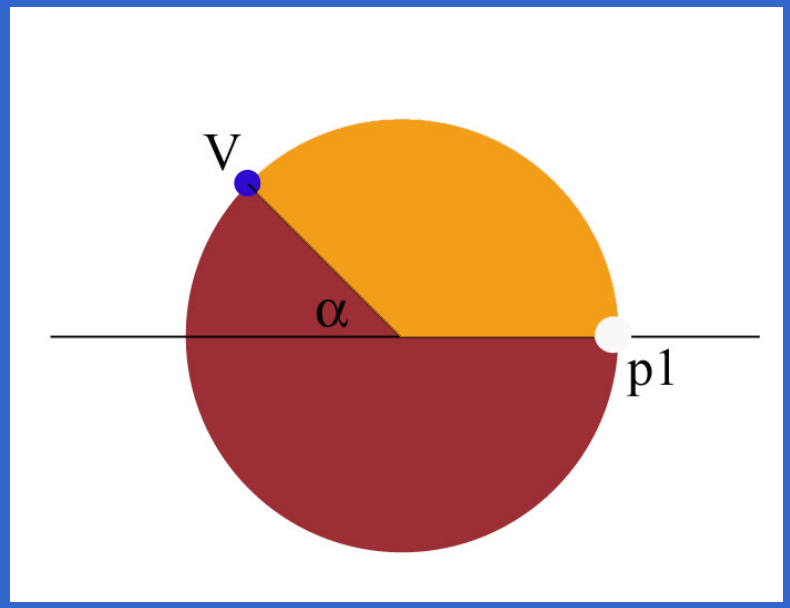


$$\alpha = tan^{-1}\left(\left|\frac{\tau_V}{\sigma_V - \sigma_C}\right|\right)$$

$$\theta_p = \frac{\alpha}{2}$$

$$(\ CW\ from\ V\ to\ p1, hence\ negative\ )$$

Calculating θ_p ; Case-3

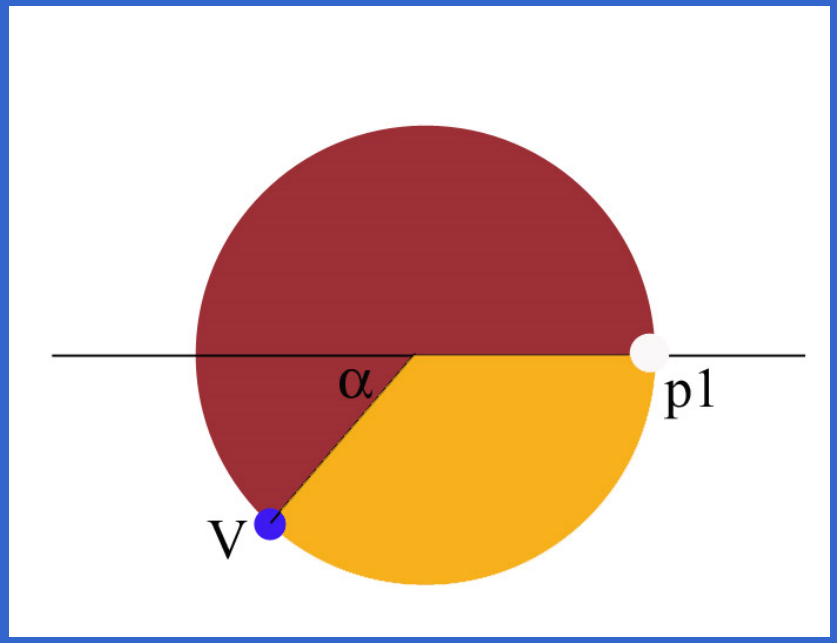


$$\alpha = tan^{-1}\left(\left|\frac{\tau_V}{\sigma_V - \sigma_C}\right|\right)$$

$$\theta_p = 90^o - \frac{\alpha}{2}$$

$$(CW\ from\ V\ to\ p1, hence\ negative)$$

Calculating θ_p ; Case-4



$$\alpha = tan^{-1}\left(\left|\frac{\tau_V}{\sigma_V - \sigma_C}\right|\right)$$

$$\theta_p = 90^o - \frac{\alpha}{2}$$

$$(CCW\ from\ V\ to\ p1, hence\ positive)$$