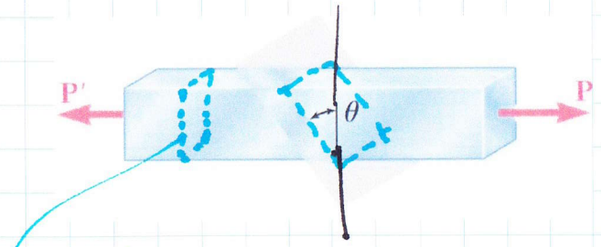
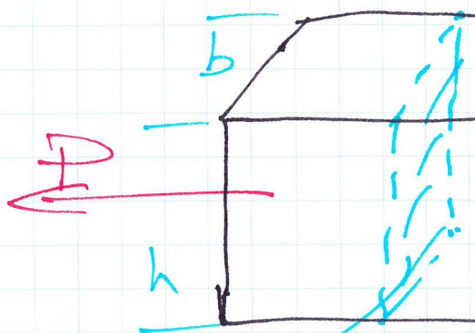
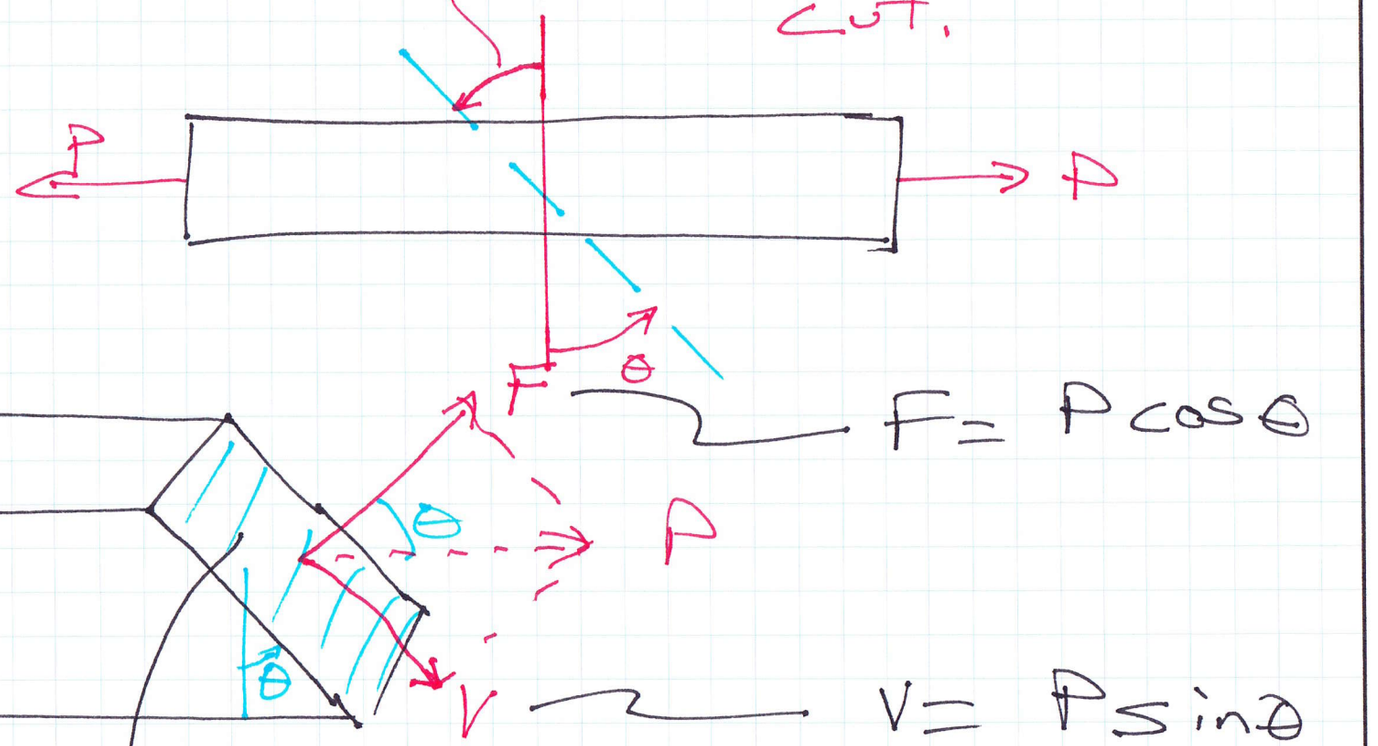
Stress on an Oblique Plane Under Axial Loading



A_o



$A_o = bh$



Measured CCW from a transverse cut.

$F = P\cos\theta$

$V = P\sin\theta$

$A_\theta = b\frac{h}{\cos\theta} = \frac{A_o}{\cos\theta}$

$$\sigma_\theta = \frac{P\cos\theta}{A_o/\cos\theta}$$

$$\sigma_\theta = \frac{P}{A_o}\cos^2\theta$$

$$\tau_\theta = \frac{P\sin\theta}{A_o/\cos\theta}$$

$$\tau_\theta = \frac{P}{A_o}\sin\theta\cos\theta$$

P - assumed to be in Tension
θ - measured CCW from a transverse cut

$$\sigma_\theta = \frac{P}{A_0}\cos^2\theta$$

$$\sigma_{max} = \frac{P}{A_0} \quad \text{when } \theta = 0$$

$$\tau_\theta = \frac{P}{A_0}\sin\theta\cos\theta$$

$$\tau_{max} = \frac{P}{2A_0} \quad \text{when } \theta = 45^\circ$$