

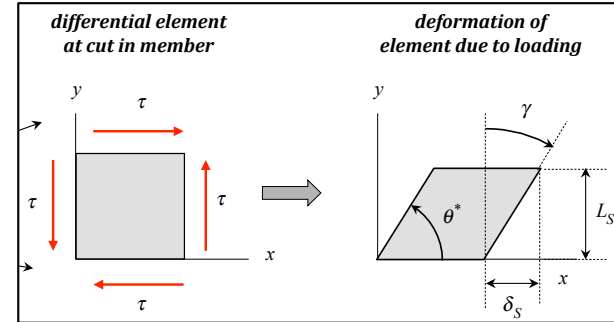
Summary: shear stress and strain

- SHEAR STRAIN AND STRESS:**

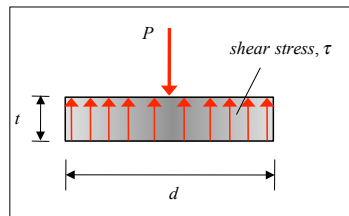
$$\gamma = \frac{\delta_s}{L_s}$$

$$\tau = G\gamma \quad ; \quad G = \frac{E}{2(1+\nu)}$$

- APPLICATIONS:**



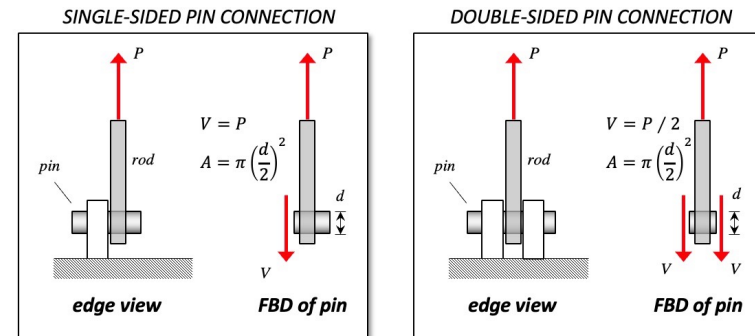
Punching a circular hole:



FBD of sheet metal slug under punch

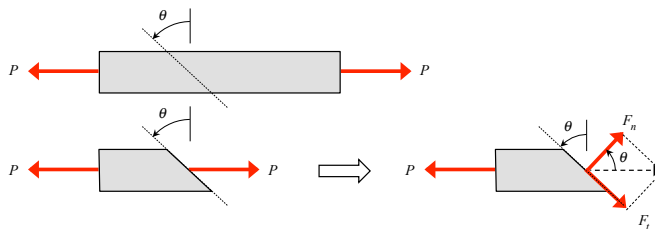
$$\tau = \frac{P}{A} \quad ; \quad A = \pi dt \quad (\text{for a circular hole})$$

Shear stress in pin:



$$\tau = V/A = 4P/\pi d^2 \quad \tau = V/A = 2P/\pi d^2$$

- YES, THERE IS SHEAR STRESS IN AXIAL LOADING!**



$$\sigma = \frac{F_n}{A_c} = \frac{P \cos \theta}{A / \cos \theta} = \frac{P}{A} \cos^2 \theta = \frac{P}{2A} (1 + \cos 2\theta)$$

$$\tau = \frac{F_t}{A_c} = \frac{P \sin \theta}{A / \cos \theta} = \frac{P}{A} \cos \theta \sin \theta = \frac{P}{2A} \sin 2\theta$$