CH_3

Hooke's Law

$$\sigma = E\varepsilon$$

- *E*: the modulus of elasticity of Youngs' modulus, which has the stress units

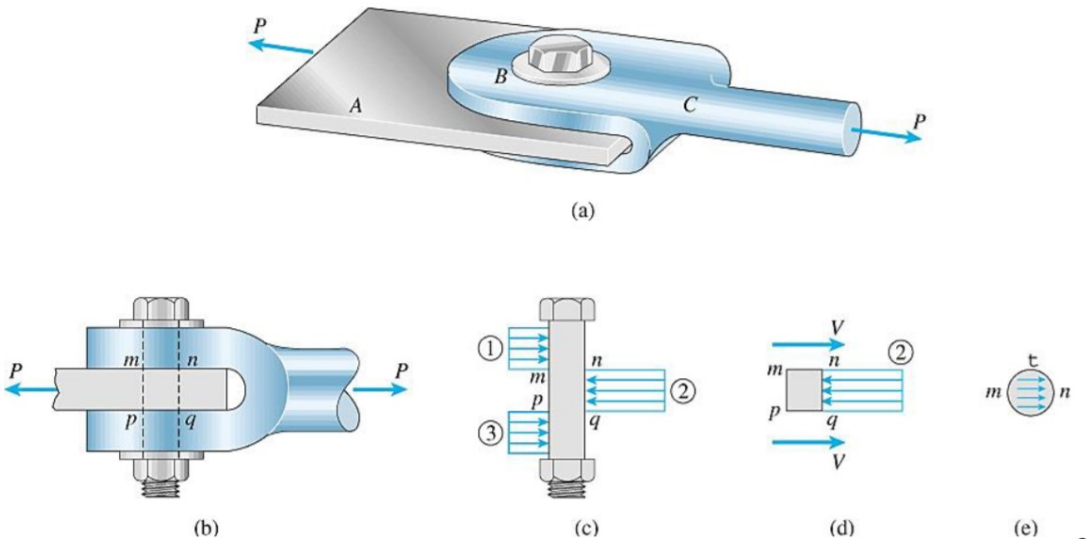
Poison Ratio

$$\nu = -\frac{\varepsilon'}{\varepsilon}$$

- ν: Poison Ratio
- ε: axial strain
- ε': lateral strain

Shear Stress

the stress component that act in the plane of the sectioned area



Average Bearing Stress

$$\sigma_b = \frac{F_b}{A_b}$$

- F_b: bearing force
- A_b: bearing area

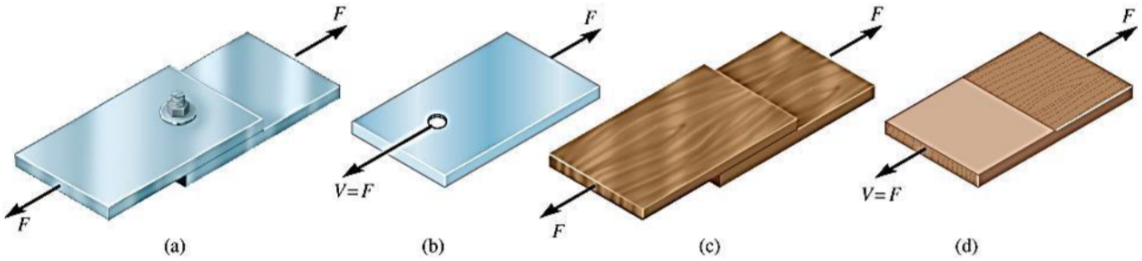
Average Shear Stress at Section

$$\tau_{aver} = \frac{V}{A}$$

- V: internal shear force at section determined from equations of equilibrium
- A: area of section

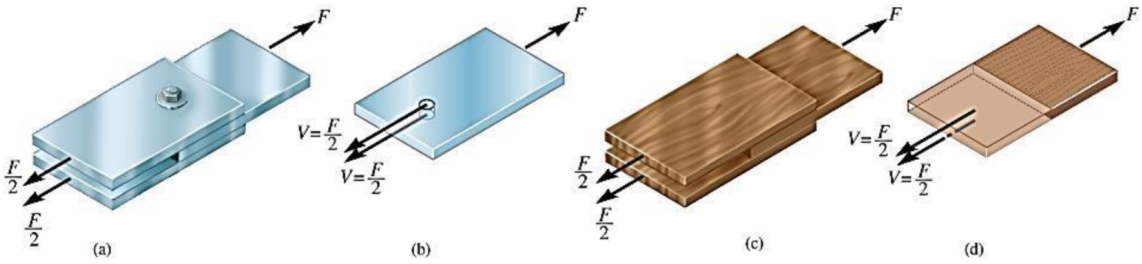
Single Shear

$$V = F$$



Double Shear

$$V = \frac{F}{2}$$



- Positive strain is when the angle between two positive faces is reduced
- Negative strain is when the angle between two positive faces is increased

Hooke's Law for Shear

$$\tau = G\gamma$$

$$G = \frac{E}{2(1+\nu)}$$

- G: shear modulus of elasticity

Allowable Stresses and Allowance Loads

When designing a structural member or mechanical element, the design interest is **strength**, that is *the capacity of the object to support or transmit loads*

- factor of safety (F.S.)

$$n = \frac{Actual\ Strength}{Required\ Strength}$$

- allowable strength

$$\sigma_{\text{allow}} = \frac{\sigma_Y}{n_1} \qquad \tau_{\text{allow}} = \frac{\tau_Y}{n_2}$$

- σ_Y and τ_Y are yield stresses
- n_1 and n_2 are the corresponding factors of safety.

Design for Axial Loads and Direct Shear

- determine the area of section subjected to a normal force

$$A = \frac{P}{\sigma_{allow}}$$

- determine the area of section subjected to a shear force

$$A = \frac{V}{\tau_{allow}}$$