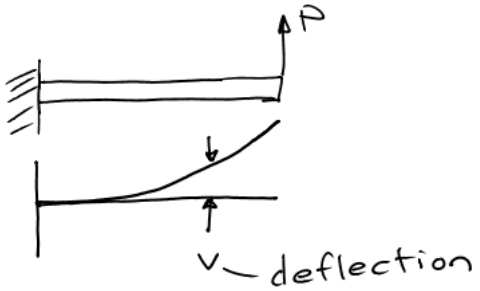
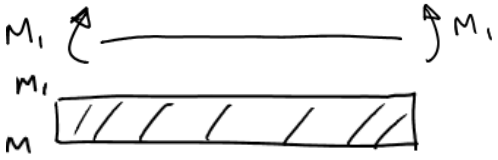
Deflection

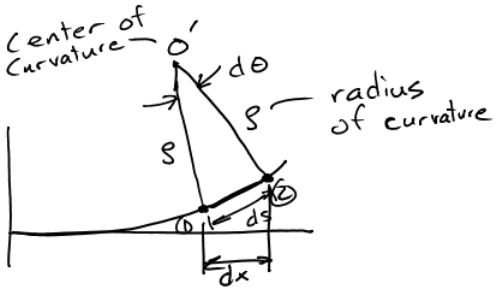


Pure Bending



Curvature

$$\kappa = \frac{1}{\rho}$$ (Curvature)



$$ds = \rho\, d\theta$$

$$\frac{1}{\rho} = \frac{d\theta}{ds} = \kappa$$

Assume => Small Deflections

$$ds \approx dx$$

$$\boxed{\kappa = \frac{d\theta}{dx}}$$

Bending Stresses Formula

$$\boxed{\sigma = -\frac{My}{I}}$$

M = Bending Moment

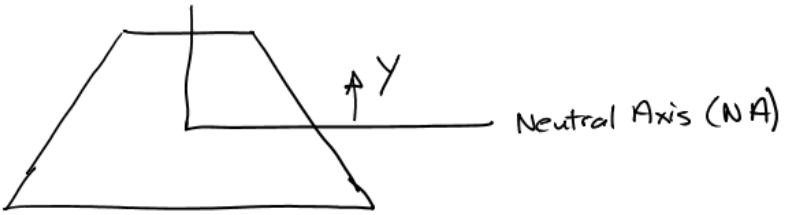
y = Vertical Distance from the Neutral Axis

I = Moment of Inertia about the Neutral Axis

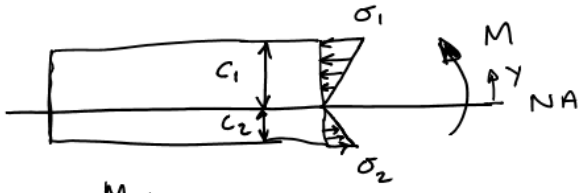
Length does not change

Location of the Neutral Axis

- Corresponds to the centroid of the cross-section



Positive Bending

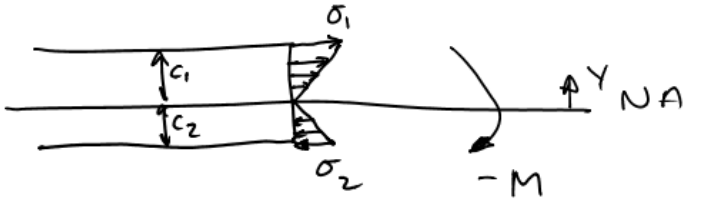


$$\sigma = -\frac{My}{I}$$

$$\sigma_1 = -\frac{(M)(c_1)}{I} \Rightarrow \text{Compression}$$

$$\sigma_2 = \frac{-(M)(-c_2)}{I} \Rightarrow \text{Tension}$$

Negative Bending



$$\sigma_1 = -\frac{(-M)(c_1)}{I} \Rightarrow \text{Tension}$$

$$\sigma_2 = -\frac{(-M)(-c_2)}{I} \Rightarrow \text{Compression}$$