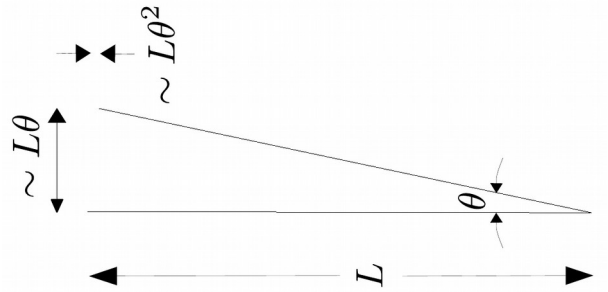
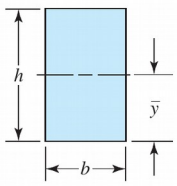
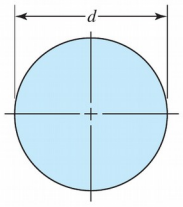
Déformation (traction axiale) : $\epsilon = \delta / L_0$
Loi de Hooke : $F = kx, M = k\theta, \sigma = E\epsilon$
Axial : $\sigma = P/A$
Cisaillement : $\tau = P/A$
Torsion : $\tau = Tr/J$ (barre ronde)
Flexion : $\sigma = My/I$
Concentration : $\sigma_{\max} = K_t \sigma_{\text{nom}}, \tau_{\max} = K_t \tau_{\text{nom}}$





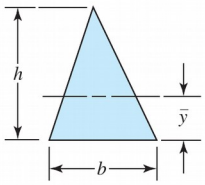
Rectangle

$$A = bh \qquad I = \frac{bh^3}{12} \qquad Z = \frac{bh^2}{6}$$



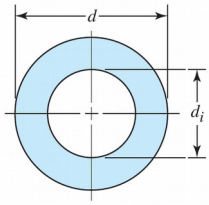
Circle

$$A = \frac{\pi d^2}{4} \qquad I = \frac{\pi d^4}{64} \qquad Z = \frac{\pi d^3}{32} \qquad J = \frac{\pi d^4}{32} \qquad \rho = \frac{d}{4}$$



General triangle

$$A = \frac{bh}{2} \qquad I = \frac{bh^3}{36} \qquad Z = \frac{bh^2}{24}$$

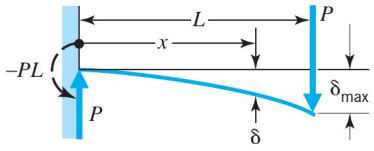


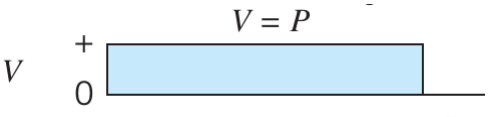
Hollow circle

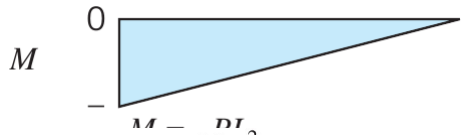
$$A = \frac{\pi}{4}(d^2 - d_i^2) \qquad I = \frac{\pi}{64}(d^4 - d_i^4) \qquad Z = \frac{\pi}{32d}(d^4 - d_i^4) \qquad J = \frac{\pi}{32}(d^4 - d_i^4) \qquad \rho = \sqrt{\frac{d^2 + d_i^2}{16}}$$

1. Concentrated load at end

$$\theta = \frac{PL^2}{2EI} \qquad \delta_{\max} = \frac{PL^3}{3EI} \qquad \delta = \frac{Px^2}{6EI}(3L - x)$$

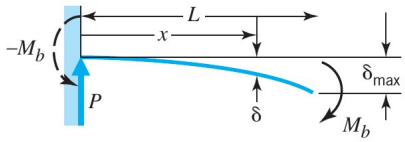






4. Moment load at free end

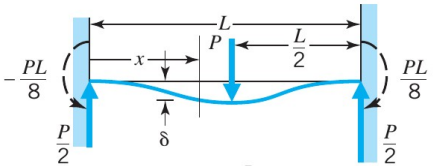
$$\theta = \frac{M_b L}{EI} \qquad \delta_{\max} = \frac{M_b L^2}{2EI} \qquad \delta = \frac{M_b x^2}{2EI}$$

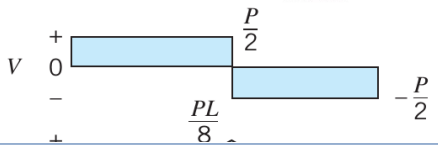


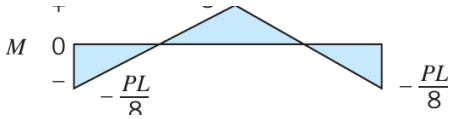
1. Concentrated center load

At center: $\delta_{\max} = \frac{PL^3}{192EI}$

For $0 \le x \le L/2$: $\delta = \frac{Px^2}{48EI}(3L - 4x)$

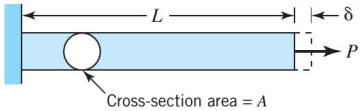






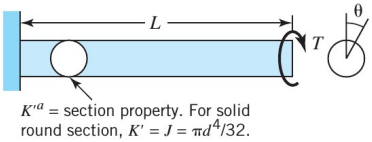
Tension or compression

$$\delta = \frac{PL}{AE} \qquad k = \frac{P}{\delta} = \frac{AE}{L}$$



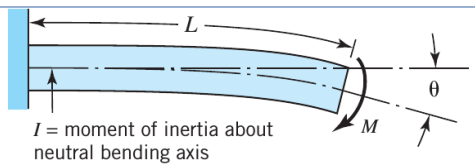
Torsion

$$\theta = \frac{TL}{K'G} \qquad K = \frac{T}{\theta} = \frac{K'G}{L}$$



For solid round bar and deflection in degrees,

$$\theta^\circ = \frac{584TL}{d^4 G}$$



$$\theta = \frac{ML}{EI} \qquad K = \frac{M}{\theta} = \frac{EI}{L}$$

$$\delta = \frac{ML^2}{2EI} \qquad k = \frac{M}{\delta} = \frac{2EI}{L^2}$$

$$\delta = \frac{PL^3}{3EI} \qquad k = \frac{P}{\delta} = \frac{3EI}{L^3}$$