

Beam Bend Calculator

AMB Calculator

This calculator is used to check the deflection or twist in a beam (extrusion of uniform cross-section). It can be helpful for determining whether a profile or axle will be strong enough to carry the desired load. Note that this is not a replacement for proper Finite Element Analysis simulation and does not return the material stress.

Material & Cross-Section

Materials are defined with three values: Young's Modulus E , Shear Modulus G , and density ρ . You can choose one of the pre-defined materials or enter these values manually.

Five types of cross-sections are defined: hex, round, round tube, rectangular, and rectangular tube. Each cross-section geometry has its own equations to find the corresponding Area A , Area Moment of Inertia I , and Torsional Constant J . These can also be entered manually.

For hex beams with distance a between the flat sides:

$$A = \frac{3\sqrt{3}}{8}a^2 \quad I = 0.0601a^4 \quad J = 0.1154a^4 \quad (1)$$

For solid round beams with diameter D :

$$A = \frac{\pi}{4}D^2 \quad I = \frac{\pi}{64}D^4 \quad J = \frac{\pi}{32}D^4 \quad (2)$$

For round tubes with outside diameter D and thickness t :

$$A = \pi D \cdot t \quad I = \frac{\pi}{8}D^3t \quad J = \frac{\pi}{4}D^3t \quad (3)$$

For solid rectangular beams with width (perpendicular to the applied force) w and height (parallel to the applied force) h , and where a is the larger of w and h and b is the smaller:

$$A = w \cdot h \quad I = \frac{1}{12}wh^3 \quad J \approx \frac{1}{3}ab^3 - 0.21b^4 + 0.0175\frac{b^8}{a^4} \quad (4)$$

For rectangular tubes with width w , height h , and thickness t :

$$A = 2t(a + b) \quad I = \frac{1}{3}wh^2t \quad J = \frac{2t(w - 2)^2(h - t)^2}{w + h - t} \quad (5)$$