Problem Set #10 1.050 Solid Mechanics
Fall 2004

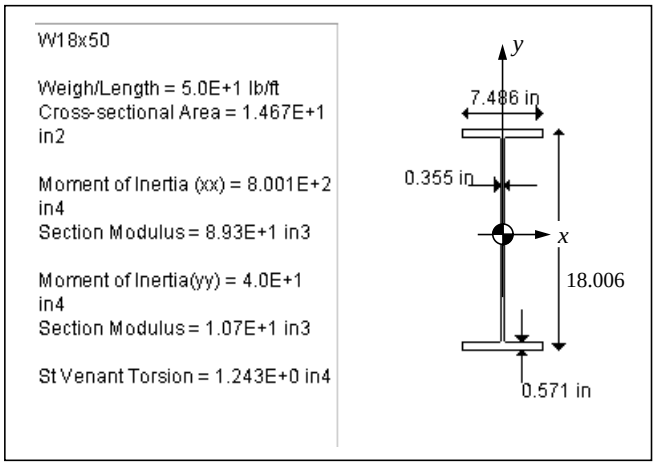
(Due Friday, 19 November)

Problem 10.1

1.1 For the "W18x50" section shown at the right: Verify the values given for the mass/length, the cross-sectional area, and the two moments of inertia. (Note that Moment of Inertia (xx) refers to the moment of inertia about the "x-x" axis, what we have labeled, "I"). That is

$$I = I_{(xx)} = \int_A y^2 \cdot dA$$

The (yy) refers to the moment of inertia about the "y-y" axis.

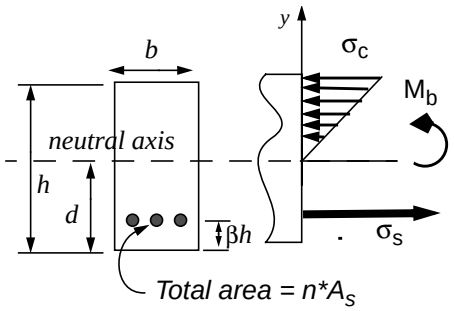


Problem 10.2

A steel wire, with a radius of *0.0625 in*, with a yield strength of *$120x10^3$ psi*, is wound around a circular cylinder of radius *R = 20 in.* for storage. What if your boss, seeking to save money on storage costs, suggests reducing the radius of the cylinder to *R = 12in.* How do you respond?

Problem 10.3

1.1 A steel reinforced beam is to be made such that the steel and the concrete fail simultaneously.



If E_s = 30 e06 psi steel
E_c= 3.6 e06 psi concrete
and taking
$\sigma_{\text{failure steel}}$ = 40,000 psi
$\sigma_{\text{failure concrete}}$ = 4,000 psi (compression)

how must β be related to d/h for this to be the case?

Now, letting $\lambda = \dfrac{2 \cdot E_s \cdot nA_s}{E_c \cdot bh}$ find d/h and β values for a range of "realistic" values for the area ratio, (nAs/bh), hence for a range of values for Λ.

Make a sketch of one possible composite cross-section showing the location of the reinforcing rod. Take the diameter of the rod as 0.5 inches.