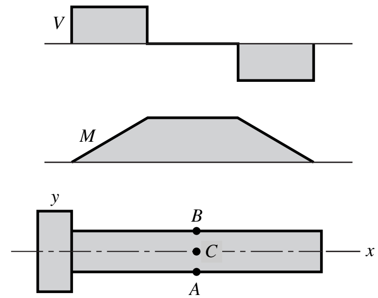
6-27 For the loading scheme shown in Figure (c),



$$M_{\max} = \frac{F}{2}\left(\frac{a}{2}+\frac{b}{4}\right) = \frac{4.4}{2}(6+4.5)$$
$$= 23.1\ \text{N}\cdot\text{m}$$

For a stress element at A:

$$\sigma_x = \frac{32M}{\pi d^3} = \frac{32(23.1)(10^3)}{\pi(12)^3} = 136.2\ \text{MPa}$$

The shear at C is

$$\tau_{xy} = \frac{4(F/2)}{3\pi d^2/4} = \frac{4(4.4/2)(10^3)}{3\pi(12)^2/4} = 25.94\ \text{MPa}$$

$$\tau_{\max} = \left[\left(\frac{136.2}{2}\right)^2\right]^{1/2} = 68.1\ \text{MPa}$$

Since $S_y = 220\ \text{MPa}$, $S_{sy} = 220/2 = 110\ \text{MPa}$, and

$$n = \frac{S_{sy}}{\tau_{\max}} = \frac{110}{68.1} = 1.62 \quad \textit{Ans.}$$

For the loading scheme depicted in Figure (d)

$$M_{\max} = \frac{F}{2}\left(\frac{a+b}{2}\right) - \frac{F}{2}\left(\frac{1}{2}\right)\left(\frac{b}{2}\right)^2 = \frac{F}{2}\left(\frac{a}{2}+\frac{b}{4}\right)$$

This result is the same as that obtained for Figure (c). At point B, we also have a surface compression of

$$\sigma_y = \frac{-F}{A} = \frac{-F}{bd} - \frac{-4.4(10^3)}{18(12)} = -20.4\ \text{MPa}$$

With $\sigma_x = -136.2$ MPa. From a Mohrs circle diagram, $\tau_{\max} = 136.2/2 = 68.1$ MPa.

$$n = \frac{110}{68.1} = 1.62\ \text{MPa} \quad \textit{Ans.}$$