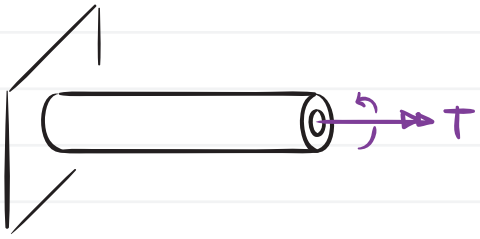
Torsional stress

Problem statement

A hollow shaft is to transmit 4200 N·m of torque and is to be sized so that the torsional stress does not exceed 120 MPa



(a) If the shaft is 70% of the outside diameter, what size of shaft should be used?
(b) what is the stress on the inside of the shaft when full torque is applied?

Solution

From (3-37) + (3-39),

$$\tau_{max} = \frac{T(d_o/2)}{\frac{\pi}{32}\cdot(d_o^4 - d_i^4)} \qquad d_i = 0.7 \cdot d_o = \alpha \cdot d_o$$

Solve for d_o

↓

preferred size

↓

(a)

↓

$$\tau_i = \frac{T(d_i/2)}{\frac{\pi}{32}\cdot(d_o^4 - d_i^4)}$$

↓

(b)