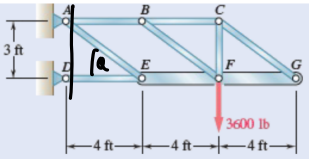
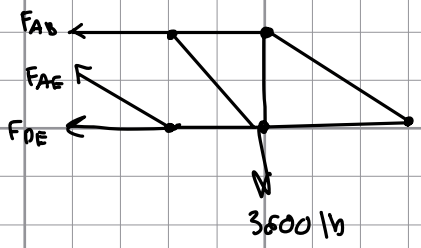
P8.9)

The rigid bar *EFG* is supported by the truss system shown. Knowing that the member *CG* is a solid circular rod of 0.75-in. diameter, determine the normal stress in *CG*.



$$\theta = \tan^{-1}\left(\frac{3}{4}\right) = 36.87^\circ$$

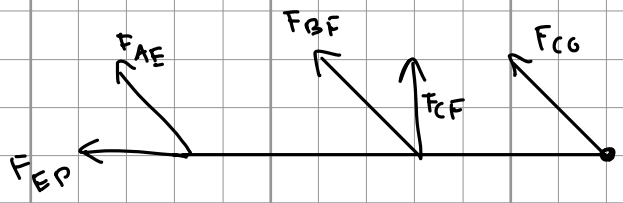


$$\Sigma F_y = 0 \Rightarrow F_{AE}\sin(36.87) - 3600 = 0$$

$$0.6\,F_{AE} - 3600 = 0$$

$$F_{AE} = 6000\ \text{lb}$$

II:



$$\Sigma M_F = 0 \Rightarrow F_{CG}\sin(36.87) + F_{AE}\sin(36.87) = 0$$

$$F_{CG} = -F_{AE}$$

$$F_{CG} = 6000\ \text{lb}$$

$$\sigma_{CG} = \frac{F_{CG}}{A} = \frac{6000}{\frac{\pi}{4}(0.75)^2} = 13591.2218\ \text{psi}$$

P 8.197)

$\phi_{bolt} = 12$ mm

$\phi_{washer(inner)} = 16$ mm

$\sigma_{avg} = 36$ MPa

$\sigma_{plank} = 8.5$ MPa

$$\sigma_{avg} = \frac{F_{bolt}}{\frac{\pi}{4} D^2} \quad \Rightarrow \quad 36 = \frac{F_{bolt}}{\frac{\pi}{4}(12)^2 mm}$$

$$F_{bolt} = \frac{\pi}{4}(12)^2 \cdot 36 = 4071.5 \text{ N}$$

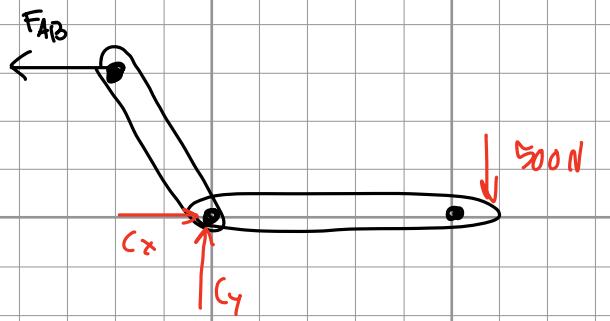
$$8.5 = \frac{F_{bolt}}{\frac{\pi}{4}(D^2)} \quad \Rightarrow \quad 4071.5 = 8.5\left(\frac{\pi}{4}(D_{out}^2 - D_{in}^2)\right)$$

$$479 = \frac{\pi}{4}(D_{out}^2 - 16^2)$$

$D_{outer} = 29.426$ mm

P 8.23)

a)



$\Sigma M_C = 0 \Rightarrow (500)(300) - F_{AB}(125) = 0$

$F_{AB} = 1200\ N$

$\Sigma F_x = 0 \Rightarrow C_x - 1200 = 0$

$C_x = 1200\ N$

$\Sigma F_y = 0 \Rightarrow C_y - 500$

$C_y = 500\ N$

$|C| = \sqrt{(1200)^2 + (500)^2} = 1300\ N$

a) Shear stress

$\tau = \frac{V}{2A} \Rightarrow \tau = \frac{1300}{2\left(\frac{\pi}{4}(6)^2\right)} = 22.989\ \frac{N}{mm^2}\ (MPa)$

b) Bearing stress:

$\sigma = \frac{1300\ N}{(6 \times 9)\ mm^2} = 24.074\ MPa$

c) $1300/2 = 650$:

$\sigma = \frac{650}{6 \times 5} = \frac{650}{30}$

$\sigma = 21.667\ MPa$

P 8.31) $\phi_{outer} = 400\ mm$

$\theta = 20°$ $P = 300\ KN$

thickness = 10 mm

$\phi_{inner} = 400 - 2(10) = 380\ mm$

$A = \frac{\pi}{4}(D_{out}^2 - D_{in}^2) = \frac{\pi}{4}(400^2 - 380^2) = 12{,}252.211\ mm^2$

$$\sigma = \frac{300\ KN}{12252.211\ mm^2}\sin^2(20) = 0.0216\ GPa$$

$$\tau = \frac{300\ KN}{2(12252.211)\ mm^2}\sin 2(20) = 0.00787\ GPa$$

P 9.147

$$\delta = \frac{PL}{AE}$$

$E = 70\ GPa$

Area $= 900\ mm^2$ $\quad L_{AB} = 1750\ mm$

a) $P_{AB} = 25000\ N$

$$\delta = \frac{PL}{AE} = \frac{(25000\ N)(1750\ mm)}{(900\ mm^2)(70 \times 10^3\ MPa)}$$

$$\delta_{AB} \leq 0.78125\ mm$$

b) $\delta_{AB} + \delta_{BC} + \delta_{CD} =$

$$0.78125 + \frac{(125000\ N)(1250 mm)}{(900\ mm^2)(70 \times 10^3\ MPa)} + \frac{(50000)(1500\ mm)}{(500\ mm^2)(70 \times 10^3)}$$

$$\Delta P = 5.7143\ mm$$

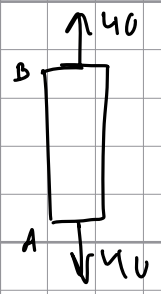
P 9.16)

$\delta = \frac{PL}{AE}$

$E_{steel} = 29 \times 10^6$ psi

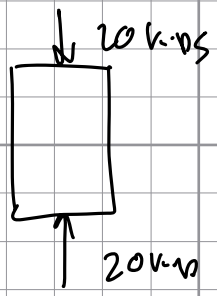
$E_{brass} = 15 \times 10^6$ psi

AB: $A = \frac{\pi}{4} d^2 = \frac{\pi}{4}(2\text{in})^2 = 3.142$



$\delta_{AB} = \frac{(40 \times 10^3)(40)}{(3.142)(29 \times 10^6)} = 0.01756$ in

BC:



$\delta_{BC} = \frac{(20 \times 10^3)(30)}{\left(\frac{\pi}{4}(3)^2\right)(15 \times 10^6)} = -0.00566$ in

a) $\Sigma \delta = 0.01756 - 0.00566 = 0.0119$

b) deflection at B: $\delta_{BC} = -0.00566$ in

P 9.19)

$E = 200\ GPa$

$A_{BD} = 1926\ mm^2$

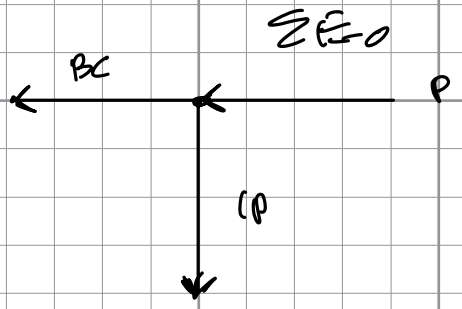
$\Delta l_{max} = 1.6\ mm$

$l_{initial} \Rightarrow \quad l = \sqrt{(5)^2 + (6)^2} = 7.81\ m = 7,810.23\ mm$

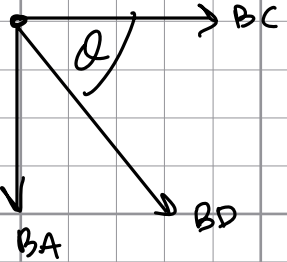
internal force in diagonal BD (F_{BD}):

$$\delta_L = \frac{F_{BD}\, L}{A_{BD}\, E} \Rightarrow F_{BD} = \frac{\delta_L \cdot A_{BD} \cdot E}{L}$$

$$F_{BD} = \frac{(1.6\,mm)(1920\,mm^2)(200\,GPa)}{(7810.23\,mm)} = 78.66\ kN$$



$P = -BC$



$$\theta = \arctan\left(\frac{6}{5}\right) = 50.194°$$

$$\Sigma F_x = 0 \Rightarrow BD\cos\theta + BC = 0$$

$$78.66\cos(50.194) = P$$

$$P = 50.357\ kN$$