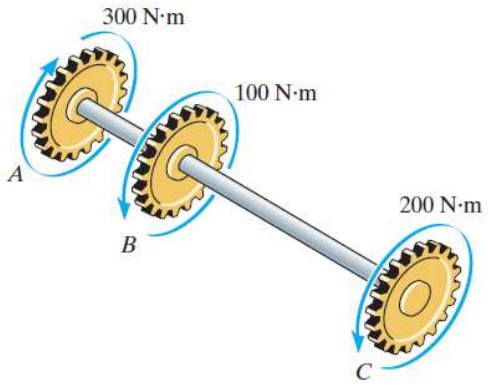
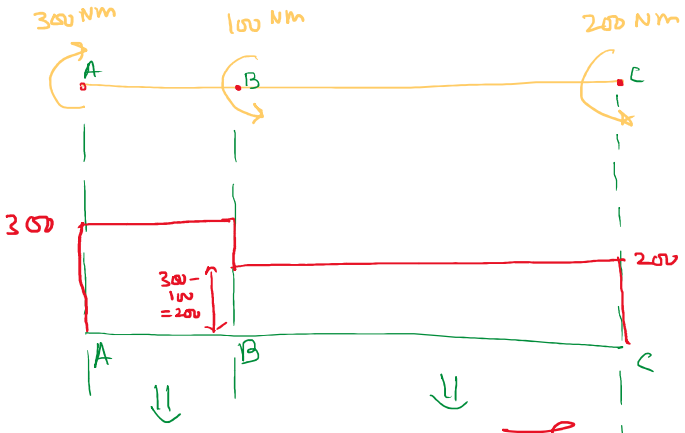
Torsion in Shafts. Question 5-27 Solution:

Sunday, 9 March, 2025 06:56 AM

5-27. The A-36 steel shaft is supported on smooth bearings that allow it to rotate freely. If the gears are subjected to the torques shown, determine the maximum shear stress developed in the segments AB and BC. The shaft has a diameter of 40 mm.

5–27. The A-36 steel shaft is supported on smooth bearings that allow it to rotate freely. If the gears are subjected to the torques shown, determine the maximum shear stress developed in the segments *AB* and *BC*. The shaft has a diameter of 40 mm.





$T_{max, AB} = 300$ $T_{max, BC} = 200$

Solved by Civil Thinking [Copy-righted content]

$$\frac{\tau}{R} = \frac{T}{J}$$ [Torsion Equation]

$$\Rightarrow \tau_{max} = \frac{R}{J} \times T$$

$$\Rightarrow \tau_{max, AB} = \frac{0.020}{\frac{\pi}{2}(0.020)^4} \times 300$$

$$\Rightarrow \tau_{max, AB} = 23.9 \text{ MPa}$$

$\because$ Radius, $R = \frac{dia}{2} = \frac{40mm}{2} = 20mm = 0.020m$

J = Polar Moment of inertia of solid circle $= \frac{\pi}{2} R^4$

$$\Rightarrow \tau_{max,BC} = \frac{0.020}{\frac{\pi}{2}(0.020)^4} \times 20$$

$$\Rightarrow \tau_{max,BC} = 15.9\ MPa$$

Solved by Civil Thinking [copy-sighted content]