

Topic

Torsion

Governing Equations and Assumptions

$$\Theta = \frac{\phi}{L} \quad \gamma = \frac{S\phi}{L} \quad \gamma_{max} = \frac{r\phi}{L}$$

$$\tau = \frac{T S}{I_P} \quad \tau_{max} = \frac{T r}{I_P}$$

$$\phi = \frac{TL}{GI_P} \quad I_P = \frac{\pi}{32} d^4, \quad I_{P_{tube}} = \frac{\pi}{32} (d_2^4 - d_1^4)$$

=> Plane sections remain plane and normal
(small deformations)

Process

- ① Determine the number of segments
 - => Change in diameter
 - => Change in the applied torque
- ② Determine the internal torque for each segment
 - => Make cut + enforce equilibrium
- ③ Determine the angle of twist and other quantities