Mechanics of Materials and Lab.

Homework #3 (Torsion)

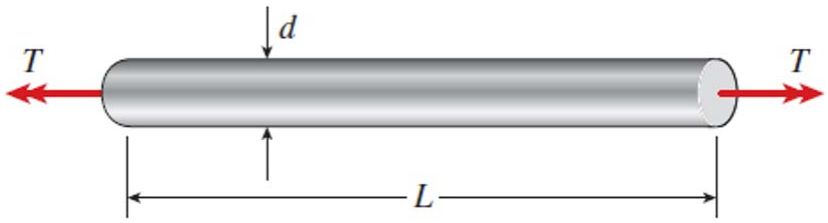
Due 24th April (Tu) 10am

Problem # 1

3.3-4 An aluminum bar of solid circular cross section is twisted by torques T acting at the ends (see figure). The dimensions and shear modulus of elasticity are as follows: $L = 1.8$ m $d = 30$ mm and $G = 40$ GPa

(a) Determine the torsional stiffness of the bar.

(b) If the angle of twist of the bar is 5°, what is the maximum shear stress? What is the maximum shear strain (in radians)?

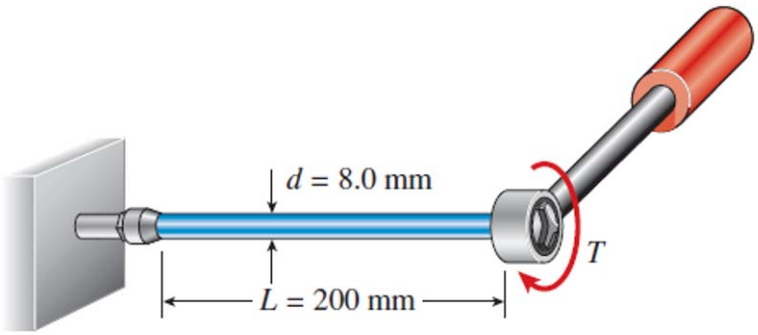


Problem #2.

3.3-6 The steel shaft of a socket wrench has a diameter of 10.0 mm. and a length of 200 mm (see figure).

If the allowable stress in shear is 60 MPa, what is the maximum permissible torque T_{max} that may be exerted with the wrench?

Through what angle ϕ (in degrees) will the shaft twist under the action of the maximum torque? (Assume $G = 80$ GPa and disregard any bending of the shaft.)



Problem #3.

3.3-8 A propeller shaft for a small yacht is made of a solid steel bar 120 mm in diameter. The allowable stress in shear is 40 MPa and the allowable rate of twist is 2.0°in 3.5 meters.

Assuming that the shear modulus of elasticity is $G =$ 80 GPa, determine the maximum torque T_{max} that can be applied to the shaft.