

Problem Set #8 1.050 Solid Mechanics

Fall 2004

(Due Friday, 5 November)

Problem 8.1

A solid aluminum, circular shaft has length 0.35 m and diameter 6 mm . How much does one end rotate relative to the other if a torque about the shaft axis of $10\text{ N}\cdot\text{m}$ is applied?

Problem 8.2

What if a solid circular shaft is replaced by a square shaft whose **diagonal** is equal to the diameter of the original circular shaft; How does the torsional stiffness change; For the same torque, how does the maximum shear stress change?

What if the solid circular shaft is replaced by a square shaft whose **side** is equal to the diameter of the original circular shaft; How do these change?

Problem 8.3

A thin Aluminum tube, whose wall thickness is 1 mm , carries a torque 80% of the torque required for the onset of yield. The radius of the tube is 20 mm .

Show that an estimation of shear stress, based upon the assumption that it is uniformly distributed over the thickness of the tube (and using an estimate of J that is linear in the wall thickness), gives a value within 10% of that computed using the full expressions for shear stress and polar moment of inertia.