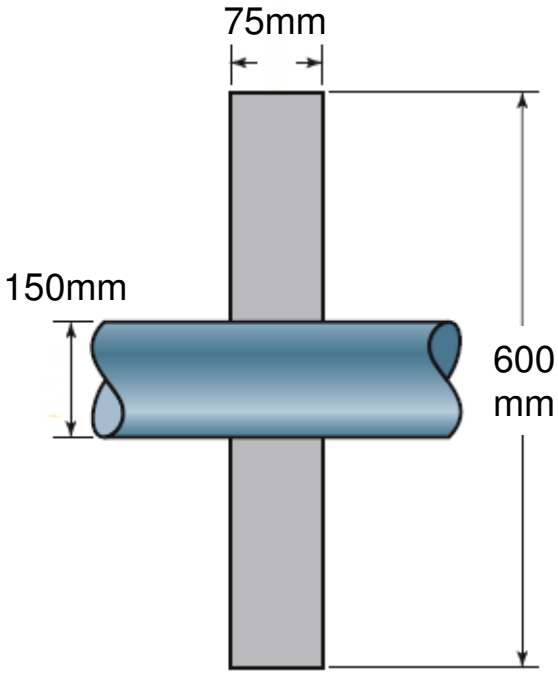
MEEG3311 Homework 8 – Chapter 10

8.1

A flat, 600 mm outer-diameter, 150 mm inner-diameter, 75mm thick steel disk shown here is shrink
fit onto a steel shaft. The coefficient of friction is 0.25. The steels have a Young's modulus of 207 GPa and a Poisson's ratio of 0.3.



If the assembly is to transmit a torque of 90 kN-m, determine the fit pressure and the total radial interference.

Hint: First calculate the radii.

8.2

A 55 mm diameter steel shaft and a 30 mm long cylindrical bushing (ring) of the same material with an outer diameter of 100 mm have been incorrectly shrink fit together and have to be disassembled. The steel has a Young's modulus of 207 GPa.

If the diametral interference is 50 μm and the coefficient of friction is 0.2, what axial force is needed for this operation?

Hints: Draw a good sketch. A μm is a micron = one millionth of a meter.

8.3

A steel gas cylinder has an inner diameter of 150mm and a wall thickness of 30mm. It will be pressurized to an internal pressure of 80MPa.

Calculate the tangential and axial stresses at the inner wall, using both thin wall and thick wall analysis.

8.4

A 400 mm outer-diameter, 120 mm thick flat disk is shrink fit onto a solid 80 mm diameter shaft.
Both the shaft and the disk are made of high-carbon steel with a modulus of 207 GPa and a coefficient of thermal expansion of 11×10^{-6} m/m°C. The assembly transmits 15 MW at 1800 rpm. The coefficient of friction is 0.25.

Calculate the minimum temperature increase that the disk must be heated with for this shrink fit – in both degrees C and F.