Homework 01

Question 01

An aluminum cylinder (E=70 GPa, ν=0.33) with outer diameter of 300 mm and inner diameter of 100 mm is to be press-fitted over a solid steel shaft (E=200 GPa, ν=0.29).
Maximum diametral interference at the interface between aluminum cylinder and steel shaft is 0.093 mm. Calculate the resulting contact pressure at the interface.

$$a := 0 \cdot mm \qquad c := 150 \cdot mm$$

$$E_o := 70 \cdot GPa \qquad \nu_o := 0.33 \qquad E_i := 200 \cdot GPa \qquad \nu_i := 0.29$$

Basic Diameter $\qquad D := 100 \cdot mm$

Max Interference: $\qquad \delta_{max} := 0.093 \; mm$

Worst Case of Contact Pressure $\qquad \delta := \dfrac{\delta_{max}}{2} = 0.047 \; mm \qquad R := \dfrac{D}{2} = 50 \; mm$

$$P := \dfrac{\delta}{R \cdot \left(\dfrac{1}{E_o} \left(\dfrac{c^2 + R^2}{c^2 - R^2} + \nu_o \right) + \dfrac{1}{E_i} \left(\dfrac{R^2 + a^2}{R^2 - a^2} - \nu_i \right) \right)} = 35.603 \; MPa$$