PROBLEM S2-1 QUESTION

Discontinuity Analysis at the Joint of Cylindrical Pipes of Different Wall Thickness

Two sections of stainless steel cylindrical piping of different wall thickness are joined by welding. Before an internal pressure p_i (above atmospheric) is applied (assume no outside pressure above atmospheric), the geometry of the piping is as shown in Fig. 1. The numerical values of geometry and pressure p_i are given in Table 1. You can assume the piping is capped at both ends to hold the internal pressure. Stainless steel properties are given in Table 1.

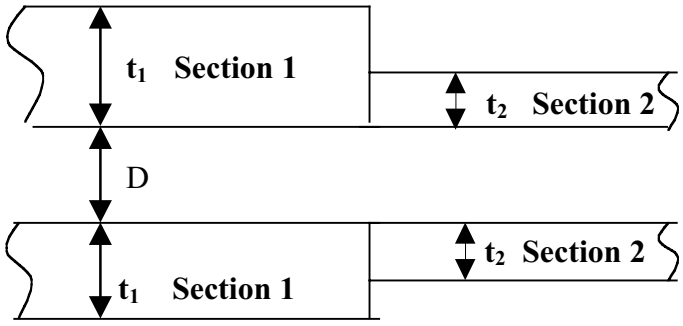

Figure 1 (not to scale)

Table 1
D, cm = 46
t_1, cm = 4
t_2, cm = 2
p_i, MPa = 5

Table 2. Stainless Steel	
Modulus of elasticity, E	2 x 10^5 MPa
Poisson's ratio, γ	0.3
Density, ρ	8000 kg/m^3

QUESTIONS

A. What is the magnitude and location of the maximum principle stress within the piping when the internal pressure p_i (above atmospheric) is applied. You may neglect the discontinuity stresses.

B. Sketch the geometry of the piping after internal pressure p_i (above atmospheric) is applied. Your sketch should clearly show the relative displacements of the two pipe sections and rotations of the material about the location they are joined. Further you should explain and justify the key features of your sketch in words.