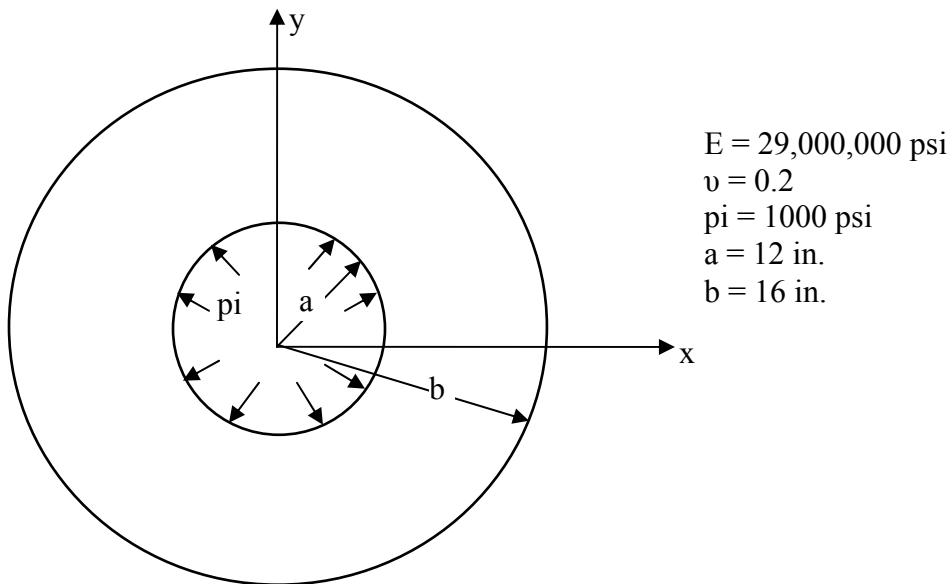


CE-5155

Finite Element Analysis of Structural Systems

Assignment#3

(50 Marks)



A thick-walled cylinder shown above is subjected to internal pressure p_i . Determine the distribution of radial stress σ_r and tangential stress σ_θ through the thickness of the cylinder due to applied internal pressure. **Use appropriate 2-D elements from SAP Element Library to model and solve the structure in the most efficient manner (your grade will depend upon the efficiency of modeling approach).** Draw a neat sketch of your model with boundary conditions and applied loadings.

- a) Make a suitable mesh to capture the stress gradients and utilize the symmetry of the structure to solve the problem. (15 marks)
- b) Refine the mesh so that numerical results are within 5% of the exact solution. (15 marks)
- c) Plot a comparison of the analytical radial stress and tangential stress as compared to numerically obtained stresses. (20 marks)

The exact solution is given as follows:

$$\sigma_r = \frac{a^2 p_i}{b^2 - a^2} \left(1 - \frac{b^2}{r^2} \right)$$
$$\sigma_\theta = \frac{a^2 p_i}{b^2 - a^2} \left(1 + \frac{b^2}{r^2} \right)$$