

PROBLEM 10.10

KNOWN: A thin-walled cylindrical shell of length L and radius r is subjected to a uniform internal pressure p .

FIND: (a) The normal stress σ in the wall of the cylinder. (b) The radial displacement u_r of the cylinder wall.

ASSUMPTIONS: (1) The cylinder is thin-walled, i.e., $r \gg t$. (2) The material is isotropic and linearly elastic.

PROPERTIES: The material has a Young's modulus E and a Poisson's ratio ν .

ANALYSIS: (a) Consider a half-cylinder of length L and radius r as shown in the figure. The internal pressure p acts on the inner surface of the cylinder. The normal stress σ acts on the outer surface of the cylinder. The weight of the cylinder is neglected.

(b) The radial displacement u_r of the cylinder wall is given by the following equation:

$$u_r = \frac{pr}{E} \left[\frac{1-\nu}{2} \left(\frac{r}{t} \right) + \frac{1+\nu}{2} \right]$$

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