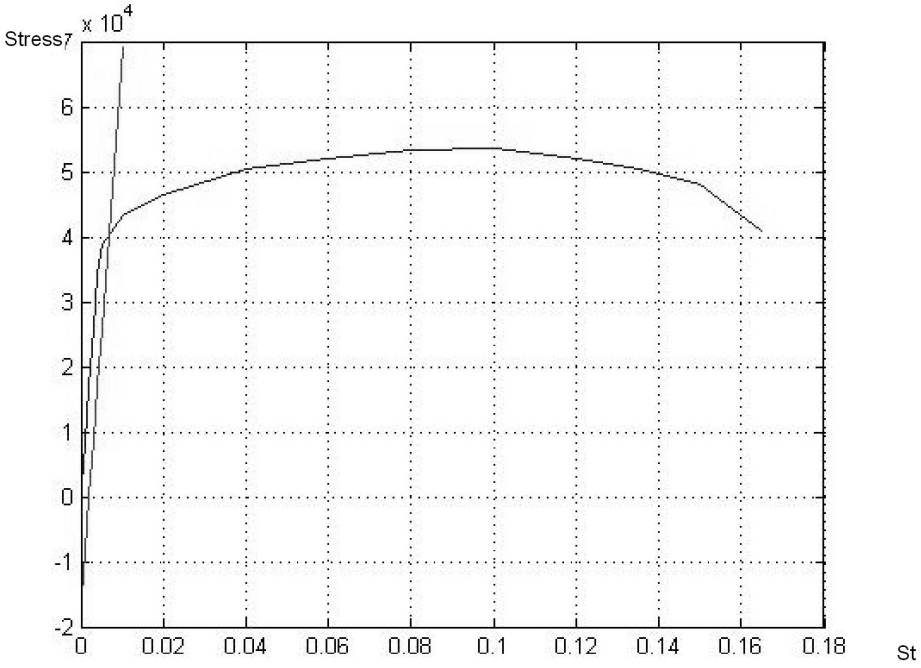
p6-29



Equations

Problem 6-29

Cylindrical specimen has the following parameters

$$d_0 = 0.505 \tag{1}$$

$$A_0 = \pi/4 \cdot d_0^2 \tag{2}$$

$$L_0 = 2.0 \tag{3}$$

(a) The load - length information is processed with Matlab. You may inspect the m-file if you wish.

Here are the results of the analysis

(b)

$$E = 8.63 \cdot 10^6 \ \left[\mathrm{lbf/in^2}\right] \tag{4}$$

(c)

$$\sigma_y = 40250 \ \left[\mathrm{lbf/in^2}\right] \tag{5}$$

(d)

$$\sigma_{TS} = 53500 \tag{6}$$

(e)

$$\textit{PercentElongation} = 16.025 \tag{7}$$

(f)

$$U_r = 93.9 \ \left[\mathrm{lbf/in^2}\right] \tag{8}$$

(g)

$$F_g = 3400 \tag{9}$$

$$\sigma_g = F_g / A_0 \tag{10}$$

This is less than yield. So we can consider the behavior to be perfectly elastic. We need a Poisson‘s Ratio whichwe loc
s appendix, page 744.

$$\nu = 0.33 \tag{11}$$

Calculate the axial strain, and then the transverse strain using Poisson’s ratio.

$$\epsilon_g = \sigma_g / E \tag{12}$$

$$\epsilon_{transverse} = -\nu \cdot \epsilon_g \tag{13}$$

We now get the new diameter and area

$$d_{old} = 0.505 \tag{14}$$

$$d_{new} = d_{old} + d_{old} \cdot \epsilon_{transverse} \tag{15}$$

$$A_{new} = \pi/4 \cdot d_{new}^2 \tag{16}$$

$$\Delta A = A_{new} - A_0 \tag{17}$$

(h)

The tabulated E is 10*10^6

$$E_{book} = 10 \cdot 10^6 \tag{18}$$

$$\textit{Error} = \frac{E_{book} - E}{E_{book}} \cdot 100 \tag{19}$$

About 14% off

Solution

$A_0 = 0.2003$

$A_{new} = 0.200036$

$\boxed{\Delta A = -0.0002599\,[\text{in}^2]}$

$d_0 = 0.505$

$d_{new} = 0.5047$

$d_{old} = 0.505$

$\boxed{E = 8.630 \times 10^6\,[\text{psi}]}$

$\epsilon_g = 0.001967$

$\epsilon_{transverse} = -0.0006491$

$\boxed{\mathit{Error} = 13.7}$

$E_{book} = 1.000 \times 10^7$

$F_g = 3400$

$L_0 = 2$

$\nu = 0.33$

$\boxed{\mathit{PercentElongation} = 16.02}$

$\sigma_g = 16975$

$\boxed{\sigma_{TS} = 53500\,[\text{psi}]}$

$\boxed{\sigma_y = 40250\,[\text{psi}]}$

$U_r = 93.9$