Equations

Problem 6.7
For a brass alloy, the stress at which plastic deformation begins is 345 MPa and the modulus of elasticity is 103 GPa

\[ \sigma = 345 \text{ [MPa]} \]  \hspace{1cm} (1)
\[ E = 103000 \text{ [MPa]} \]  \hspace{1cm} (2)

(a) What is the maximum load that can be applied to a specimen with a cross sectional area of 130 mm\(^2\) without plastic defromation

\[ A = 130 \text{ [mm}^2] \]  \hspace{1cm} (3)
\[ F_{\text{max}} = \sigma \cdot A \]  \hspace{1cm} (4)

(b) If the original specimen length is 76 mm what is the maximum length to which it can be stressed without causing plastic deformation?

\[ L = 76 \text{ [mm]} \]  \hspace{1cm} (5)
\[ \epsilon = \frac{\sigma}{E} \]  \hspace{1cm} (6)
\[ \Delta L = \epsilon \cdot L \]  \hspace{1cm} (7)
\[ L_{\text{max}} = L + \Delta L \]  \hspace{1cm} (8)

Solution

\[ A = 130 \text{ [mm}^2] \quad \Delta L = 0.2546 \text{ [mm]} \]
\[ E = 103000 \text{ [N/mm}^2] \quad \epsilon = 0.00335 \]
\[ F_{\text{max}} = 44850 \text{ [N]} \quad L = 76 \text{ [mm]} \]
\[ L_{\text{max}} = 76.25 \text{ [mm]} \quad \sigma = 345 \text{ [MPa]} \]