

Answers of Problems 7

7.1

Material A

Young's modulus: $E_A = \frac{100P}{A}$, yield stress: $\sigma_{Ay} = \frac{P}{A}$, tensile strength: $\sigma_{AB} = \frac{2P}{A}$

Material B

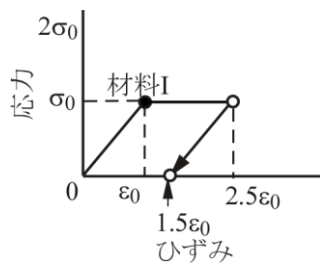
Young's modulus: $E_B = \frac{150P}{A}$, yield stress: $\sigma_{By} = \frac{3P}{2A}$, tensile strength: $\sigma_{BB} = \frac{9P}{4A}$

7.2

Material I: $E_A = \frac{4P_{A1}L_A}{\pi D_A^2(L_{A1} - L_A)}$, Material II: $E_B = \frac{4P_{B2}L_B}{\pi D_B^2(L_{B2} - L_{B1})}$

7.3

Material I: $E_I = \frac{\sigma_0}{\varepsilon_0}$, Material II: $E_{II} = \frac{\sigma_0}{2\varepsilon_0}$



7.4

(1) Longitudinal elastic modulus: $E = \frac{P_A/A}{(L_A - L_0)/L_0} = \frac{P_A L_0}{A(L_A - L_0)}$, yield stress: $\frac{P_A}{A}$, tensile

strength: $\frac{P_B}{A}$

(2) $L_Q - \frac{P_Q}{A} \frac{1}{E} L_0 = L_Q - \frac{P_Q}{A} \frac{A(L_A - L_0)L_0}{P_A L_0} = L_Q - \frac{P_Q}{P_0} (L_A - L_0)$

(3) $5P_B$

7.5

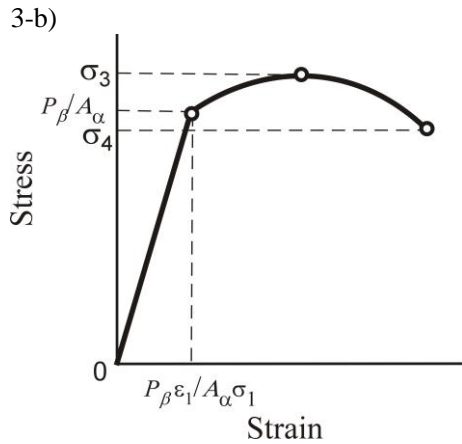
(1) Longitudinal elastic modulus: σ_1/ε_1 , yield stress: σ_1 , tensile strength: σ_3

2-a) L_0

2-b) $L_B - (P_B/A_0 E)L_0 = L_B - \frac{P_B \varepsilon_1}{A_0 \sigma_1} L_0$

2-c) $\sigma_3 A_0$

3-a) $\frac{P_\beta}{A_\alpha E} = \frac{P_\beta \varepsilon_1}{A_\alpha \sigma_1}$



7.6

(1) Young's modulus: $\frac{P_1}{A} \frac{L_0}{L_1 - L_0}$, yield stress: $\frac{P_1}{A}$, tensile strength: $\frac{P_2}{A}$

(2) $L = L_A - \frac{P_A}{A} \frac{1}{E} L_A = L_A - \frac{P_A}{A} \frac{(L_1 - L_0)A}{P_1 L_0} L_A = L_A \left(1 - \frac{P_A}{P_1} \frac{L_1 - L_0}{L_0} \right)$

(3) L_A

7.7

(1) $E = \frac{50F_A}{\pi R^2}$, $\sigma_{yp} = \frac{F_A}{\pi R^2}$

(2) $L_C = 1.07L_0$

(3) $L_D = 1.06L_0$

7.8

(1) $L + \frac{F_A \epsilon_1}{A \sigma_1} L$

(2) $\left(1 + \frac{\epsilon_B \sigma_1 - \epsilon_1 \sigma_B}{\sigma_1} \right) L$

(3) $(1 + \epsilon_B) L$

7.9

(1) $\epsilon_A - \frac{\sigma_A}{\sigma_1} \epsilon_1$

(2) $a - v \frac{P_B \epsilon_1}{a \sigma_1}$

(3) $\frac{\sigma_2 a^2}{S}$