

6.31 This problem asks us to calculate the moduli of resilience for the materials having the stress-strain behaviors shown in Figures 6.12 and 6.21. According to Equation 6.14, the modulus of resilience U_r is a function of the yield strength and the modulus of elasticity as

$$U_r = \frac{\sigma_y^2}{2E}$$

The values for σ_y and E for the brass in Figure 6.12 are determined in Example Problem 6.3 as 250 MPa (36,000 psi) and 93.8 GPa (13.6×10^6 psi), respectively. Thus

$$U_r = \frac{(250 \text{ MPa})^2}{(2)(93.8 \times 10^3 \text{ MPa})} = 3.32 \times 10^5 \text{ J/m}^3 \quad (48.2 \text{ in.} \cdot \text{lb}_f/\text{in.}^3)$$

Values of the corresponding parameters for the steel alloy (Figure 6.21) are determined in Problem 6.24 as 1570 MPa (228,000 psi) and 210 GPa (30.5×10^6 psi), respectively, and therefore

$$U_r = \frac{(1570 \text{ MPa})^2}{(2)(210 \times 10^3 \text{ MPa})} = 5.87 \times 10^6 \text{ J/m}^3 \quad (867 \text{ in.} \cdot \text{lb}_f/\text{in.}^3)$$