CHAPTER 6

6.10 Consider a cylindrical specimen of a steel alloy (Figure 6.22) 10.0 mm (0.39 in.) in diameter and 75 mm (3.0 in.) long that is pulled in tension. Determine its elongation when a load of 20,000 N (4,500 lb$_f$) is applied.

6.12) As noted in Section 3.15, for single crystals of some substances, the physical properties are anisotropic—that is, they depend on crystallographic direction. One such property is the modulus of elasticity. For cubic single crystals, the modulus of elasticity in a general [uvw] direction, E_{uvw}, is described by the relationship

$$\frac{1}{E_{uvw}} = \frac{1}{E_{\langle 100 \rangle}} - 3\left(\frac{1}{E_{\langle 100 \rangle}} - \frac{1}{E_{\langle 111 \rangle}} \right)\left(\alpha^2\beta^2 + \beta^2\gamma^2 + \gamma^2\alpha^2 \right)$$

where $E_{\langle 100 \rangle}$ and $E_{\langle 111 \rangle}$ are the moduli of elasticity in the [100] and [111] directions, respectively; α, β, and γ are the cosines of the angles between [uvw] and the respective [100], [010], and [001] directions. Verify that the $E_{\langle 110 \rangle}$ values for aluminum, copper, and iron in Table 3.4 are correct.

6.19) Consider a cylindrical specimen of some hypothetical metal alloy that has a diameter of 8.0 mm (0.31 in.). A tensile force of 1000 N (225 lb$_f$) produces an elastic reduction in diameter of 2.8 × 10^{-4} mm (1.1 × 10^{-5} in.). Compute the elastic modulus of this alloy, given that Poisson's ratio is 0.30.

6.26) A cylindrical specimen of a brass alloy having a length of 60 mm (2.36 in.) must elongate only 10.8 mm (0.425 in.) when a tensile load of 50,000 N (11,240 lb$_f$) is applied. Under these circumstances, what must be the radius of the specimen? Consider this brass alloy to have the stress–strain behavior shown in Figure 6.12.