EXAMPLE 6-6

Multiaxial Fluctuating Stresses

Problem **Determine the safety factors for the bracket tube shown in Figure 5-9**

Given **The material is 2024-T4 aluminum with S_y = 47 000 psi, and S_{ut} = 68 000 psi. The tube length l = 6 in and arm a = 8 in. The tube outside diameter OD = 2 in and inside diameter ID = 1.5 in. The applied load varies sinusoidally from F = 340 to –200 lb.**

Assumptions **The load is dynamic and the assembly is at room temperature. Consider shear due to transverse loading as well as other stresses. A finite-life design will be sought with a life of 6E7 cycles. The notch radius at the wall is 0.25 in and stress-concentration factors are for bending, K_t = 1.7, and for shear, K_{ts} = 1.35.**

Solution **See Figure 5-9, repeated here. Also see Example 4-9 (p. 180) for a more complete explanation of the stress analysis for this problem.**

1 Aluminum does not have an endurance limit. Its endurance strength at 5E8 cycles can be estimated from equation 6.5c (p. 330). Since the S_{ut} is larger than 48 kpsi, the uncorrected $S_{f'@5E8}$ = 19 kpsi.

2 The correction factors are calculated from equations 6.7 (pp. 330–335) and Figure 6-25 (p. 332) and used to find a corrected endurance strength at the standard 5E8 cycles.

$$C_{load} = 1: \quad \text{for bending}$$

$$C_{size} = 0.869\left(d_{equiv}\right)^{-0.097} = 0.869\left(\sqrt{\frac{0.01046d^2}{0.0766}}\right)^{-0.097} = 0.869(.739)^{-0.097} = 0.895$$

$$C_{surf} = 2.7\left(S_{ut}\right)^{-0.265} = 2.7(68)^{-0.265} = 0.883 \qquad (a)$$

$$C_{temp} = 1$$

$$C_{reliab} = 0.753: \quad \text{for } 99.9\%$$

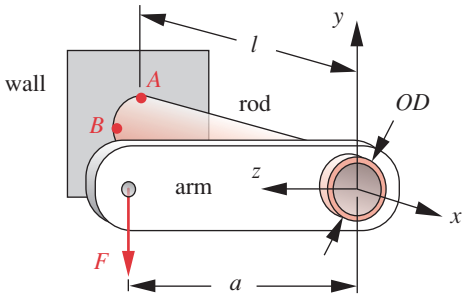

FIGURE 5-9 Repeated
Bracket for Example 6-6