

8.9 This problem asks us to calculate the maximum internal crack length allowable for the Ti-6Al-4V titanium alloy in Table 8.1 given that it is loaded to a stress level equal to one-half of its yield strength. For this alloy, $K_{Ic} = 55 \text{ MPa}\sqrt{\text{m}}$ ($50 \text{ ksi}\sqrt{\text{in.}}$); also, $\sigma = \sigma_y/2 = (910 \text{ MPa})/2 = 455 \text{ MPa}$ ($66,000 \text{ psi}$). Now solving for $2a_c$ using Equation 8.7 yields

$$2a_c = \frac{2}{\pi} \left(\frac{K_{Ic}}{Y\sigma} \right)^2 = \frac{2}{\pi} \left[\frac{55 \text{ MPa}\sqrt{\text{m}}}{(1.5)(455 \text{ MPa})} \right]^2 = 0.0041 \text{ m} = 4.1 \text{ mm} \quad (0.16 \text{ in.})$$