

8.7 This problem asks us to determine the stress level at which an a wing component on an aircraft will fracture for a given fracture toughness ($26 \text{ MPa}\sqrt{\text{m}}$) and maximum internal crack length (6.0 mm), given that fracture occurs for the same component using the same alloy at one stress level (112 MPa) and another internal crack length (8.6 mm). It first becomes necessary to solve for the parameter Y for the conditions under which fracture occurred using Equation 8.5. Therefore,

$$Y = \frac{K_{Ic}}{\sigma\sqrt{\pi a}} = \frac{26 \text{ MPa}\sqrt{\text{m}}}{(112 \text{ MPa})\sqrt{(\pi)\left(\frac{8.6 \times 10^{-3} \text{ m}}{2}\right)}} = 2.0$$

Now we will solve for σ_c using Equation 8.6 as

$$\sigma_c = \frac{K_{Ic}}{Y\sqrt{\pi a}} = \frac{26 \text{ MPa}\sqrt{\text{m}}}{(2.0)\sqrt{(\pi)\left(\frac{6 \times 10^{-3} \text{ m}}{2}\right)}} = 134 \text{ MPa} \quad (19,300 \text{ psi})$$