8.6 We are asked to determine if an aircraft component will fracture for a given fracture toughness $\left(40\right.$ MPa $\sqrt{\text{m}}$), stress level (260 MPa), and maximum internal crack length (6.0 mm), given that fracture occurs for the same component using the same alloy for another stress level and internal crack length. It first becomes necessary to solve for the parameter Y, using Equation 8.5, for the conditions under which fracture occurred (i.e., $\sigma = 300$ MPa and $a = 4.0$ mm). Therefore,

$$Y = \frac{K_{Ic}}{\sigma\sqrt{\pi a}} = \frac{40 \ \text{MPa}\sqrt{\text{m}}}{(300 \ \text{MPa})\sqrt{(\pi)\left(\dfrac{4 \ \text{x} \ 10^{-3} \ \text{m}}{2}\right)}} = 1.68$$

Now we will solve for the product $Y\sigma\sqrt{\pi a}$ for the other set of conditions, so as to ascertain whether or not this value is greater than the K_{Ic} for the alloy. Thus,

$$Y\sigma\sqrt{\pi a} = (1.68)(260 \ \text{MPa})\sqrt{(\pi)\left(\dfrac{6 \ \text{x} \ 10^{-3} \ \text{m}}{2}\right)}$$

$$= 42.4 \ \text{MPa}\sqrt{\text{m}} \quad (39 \ \text{ksi}\sqrt{\text{in.}})$$

Therefore, fracture *will* occur since this value $\left(42.4 \ \text{MPa}\sqrt{\text{m}}\right)$ is greater than the K_{Ic} of the material, $40 \ \text{MPa}\sqrt{\text{m}}$.