

Stress Concentration Factors

Note: In your textbook, Fig. 4-25 (p. 165), the horizontal axis should be $\frac{2r}{W}$ not $\frac{r}{d}$.

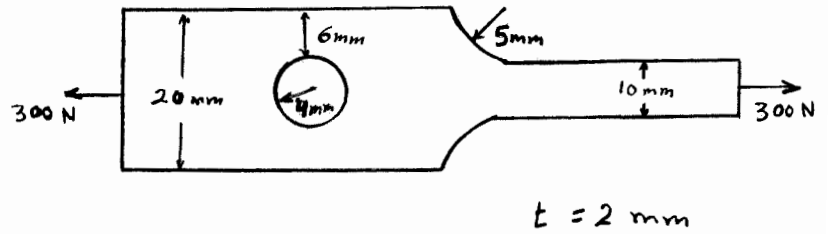
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Stress Concentrations

Example

Given:

The figure shown



Req'd:

The maximum normal stress (value & location)

Sol'n.:

From the figure, it is clear that there are two stress concentration factors (at the hole and the fillet).

$$\sigma_{max} = K \sigma_{ave}$$

First, consider the hole:

$$\sigma_{ave.} = \frac{300}{(20-8)2} = 12.5 \text{ MPa}$$

$$\frac{y}{d} = \frac{4}{12} = 0.333$$

\Rightarrow From the figure on the back, $K = 2.2$

$$\Rightarrow \sigma_{max}^{hole} = 2.2 (12.5) \Rightarrow \sigma_{max}^{hole} = 27.5 \text{ MPa}$$

Second, consider the fillet:

$$\sigma_{ave} = \frac{300}{10(2)} = 15 \text{ MPa}$$

$$\frac{D}{d} = \frac{20}{10} = 2.0$$

$$\frac{y}{d} = \frac{5}{10} = 0.5$$

$$\left. \begin{array}{l} \frac{D}{d} = 2.0 \\ \frac{y}{d} = 0.5 \end{array} \right\} \Rightarrow K \approx 1.43$$

$$\Rightarrow \sigma_{max}^{fillet} = 1.43 (15) = 21.45 \text{ MPa}$$

$$\Rightarrow \underline{\underline{\sigma_{max} = 27.5 \text{ MPa}}} \quad \underline{\underline{\text{on the section through the hole}}}$$