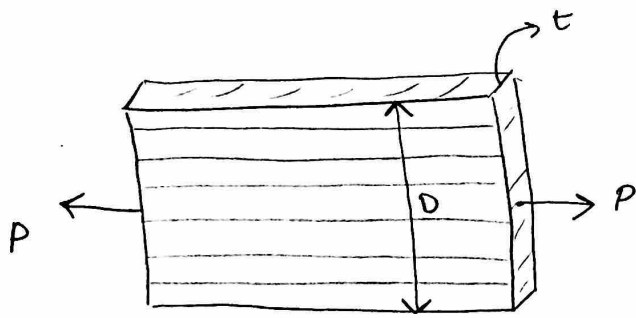
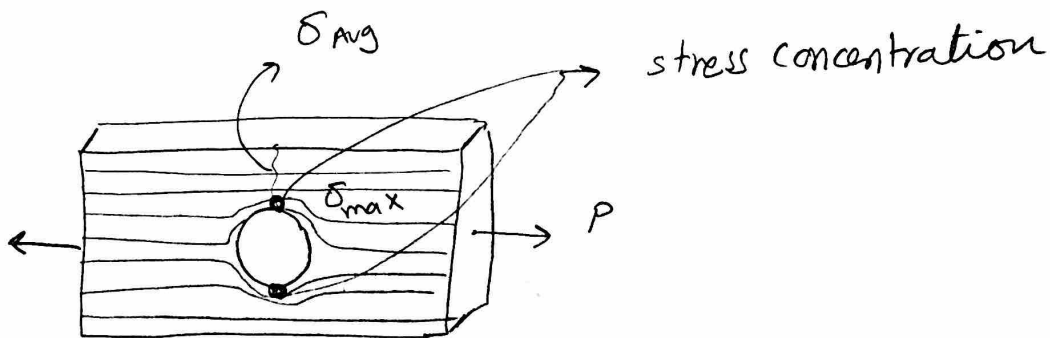


* Stress Concentration Factor (Ch. 2, Ch. 3, Ch. 4)



$$\sigma = \frac{P}{A} \quad , \quad A = tD$$

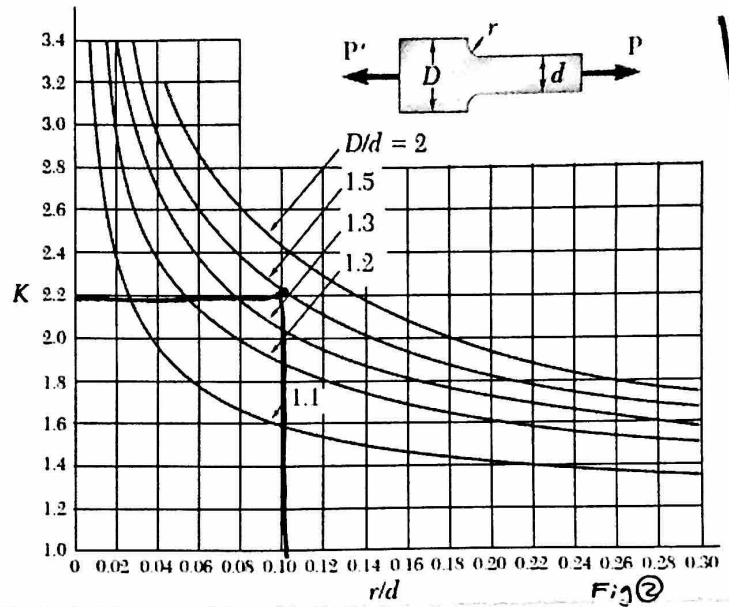
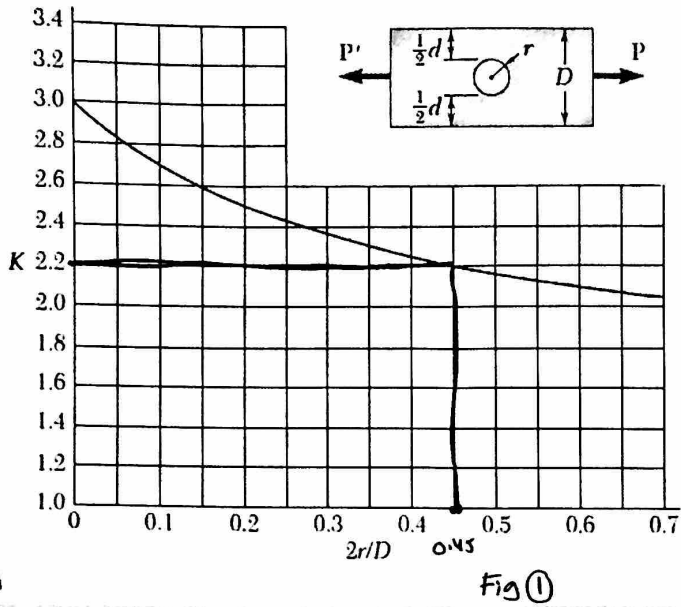


* Geometry changes causes stress concentration

* Stress concentration is often measured by stress concentration factor (K)

$$K = \frac{\text{max. stress}}{\text{Average stress (nominal)}} \Rightarrow K = \frac{\sigma_{max}}{\sigma_{avg}} \quad [\text{unitless}]$$

* Average stress is computed on "narrowest" section



In Figure ①

$$\sigma_{Avg} = \frac{P}{A}, \quad A = t(D-d) \quad ; \quad t: \text{plate thickness}$$

Example

Find K for $r = 2.25 \text{ mm}$, $D = 10$

Solution

$$2r/D = \frac{(2)(2.25)}{10} = \frac{4.5}{10} \Rightarrow 2r/D = 0.45 \Rightarrow K = 2.2$$

In Figure ②

$$\sigma_{Avg} = \frac{P}{A}, \quad A = td \quad ; \quad t: \text{plate thickness}$$

Example

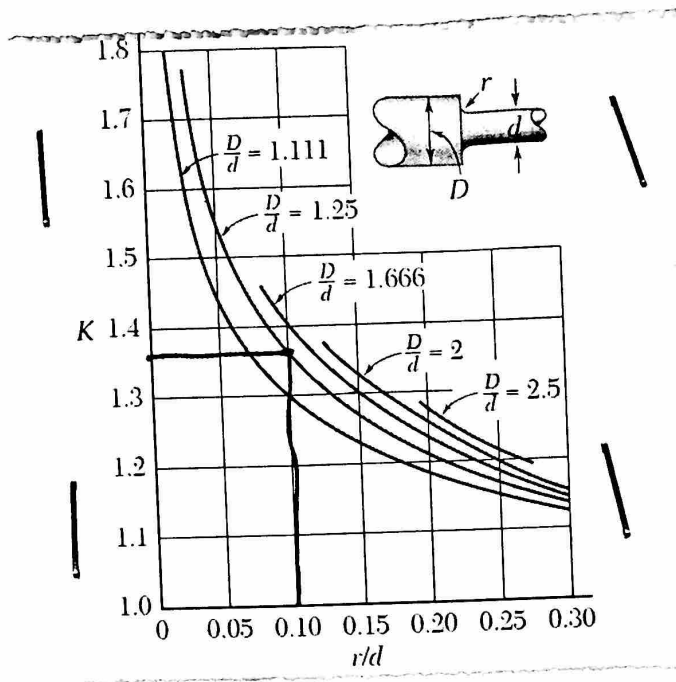
Find K for $r = 1 \text{ mm}$, $d = 10 \text{ mm}$, $D = 15 \text{ mm}$

Solution

$$r/d = \frac{1}{10} = 0.1, \quad \frac{d}{D} = \frac{10}{15} = 1.5$$

$$r/d = 0.1, \quad \frac{d}{D} = 1.5 \Rightarrow K = 2.2$$

chapter 3



$$\sigma_{Avg} = \frac{T d/2}{J} \quad \Rightarrow \quad J = \frac{\pi}{2} \left(\frac{d}{2} \right)^4$$

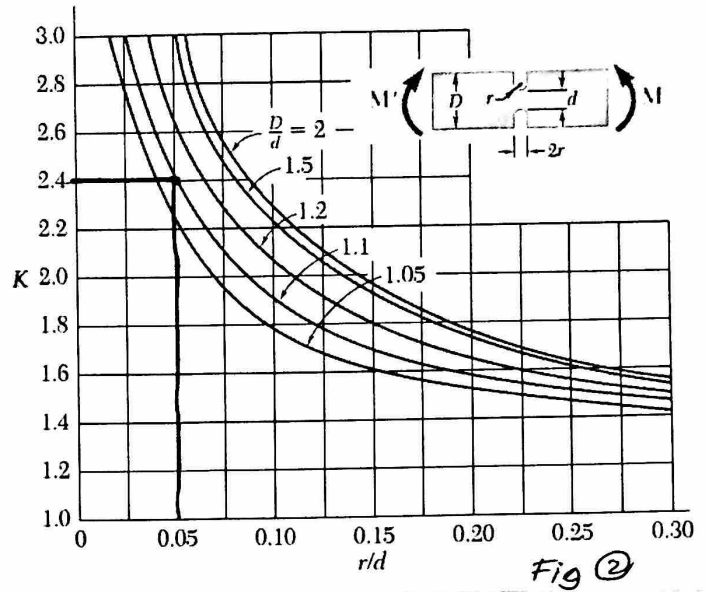
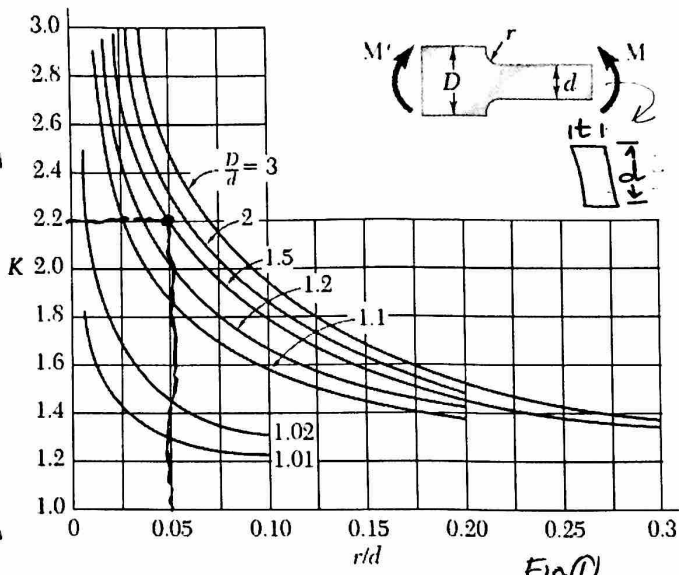
Example

Find K for $r = 1 \text{ mm}$, $d = 10 \text{ mm}$, $D = 12.5 \text{ mm}$

Solution

$$\frac{r}{d} = \frac{1}{10} = 0.1, \quad \frac{D}{d} = \frac{12.5}{10} = 1.25$$

$$K \approx 1.36$$



In Figure (1)

$$\sigma_{Avg} = \frac{M d/2}{I} \quad , \quad I = \frac{1}{12} t d^3 \quad t: \text{plate thickness}$$

Example

Find K : $r = 0.5 \text{ mm}$, $d = 10 \text{ mm}$, $D = 15 \text{ mm}$

Solution

$$\frac{r}{d} = \frac{0.5}{10} = 0.05, \quad \frac{D}{d} = \frac{15}{10} = 1.5$$

$$K = 2.2$$

In Figure (2)

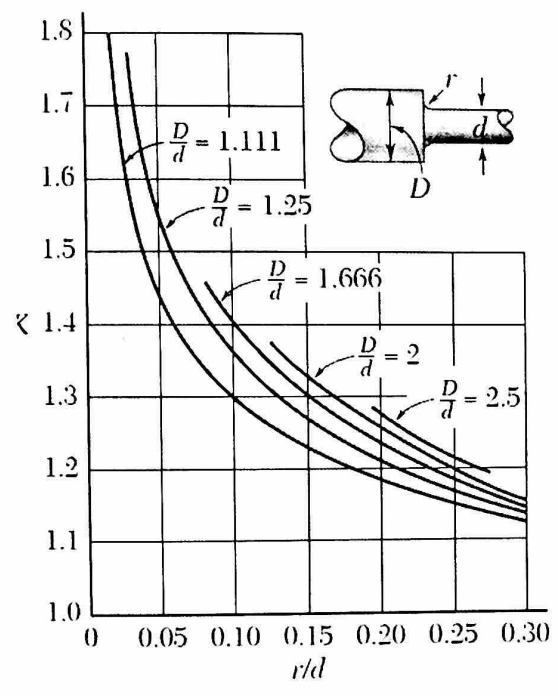
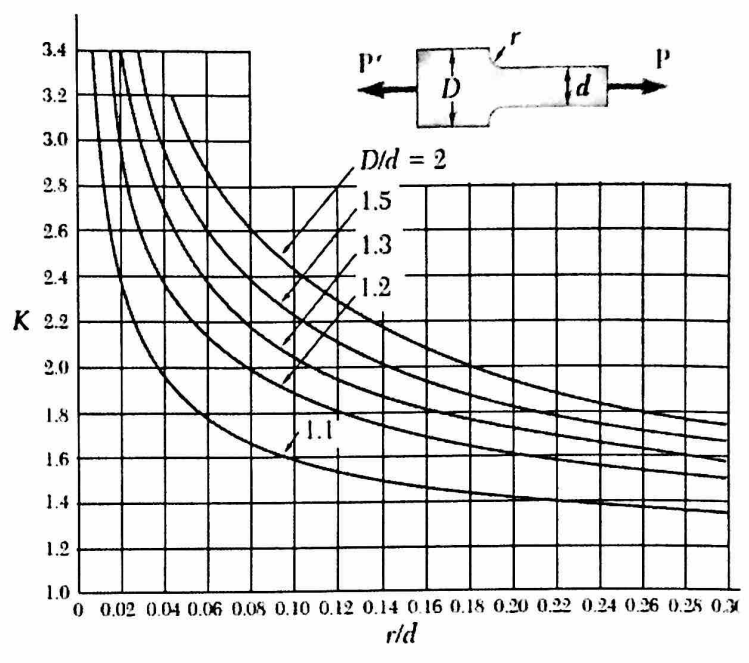
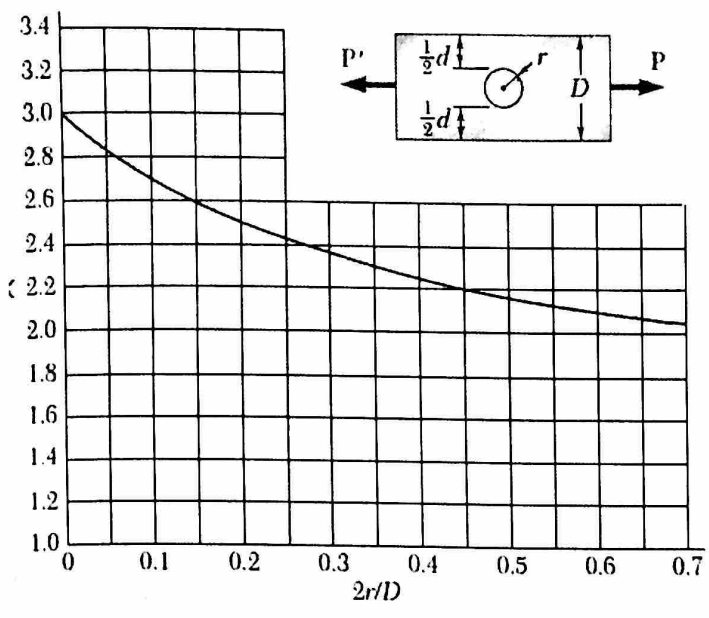
$$\sigma_{Avg} = \frac{M d/2}{I} \quad , \quad I = \frac{1}{12} t d^3 \quad , \quad t: \text{plate thickness}$$

Example

Find K , $r = 0.5 \text{ mm}$, $d = 10 \text{ mm}$, $D = 11 \text{ mm}$

Solution

$$\frac{r}{d} = \frac{0.5}{10} = 0.05, \quad \frac{D}{d} = \frac{11}{10} = 1.1 \quad \Rightarrow \quad K = 2.4$$



Stress Concentration Factor Plots for Chapter 2, 3 and 4

