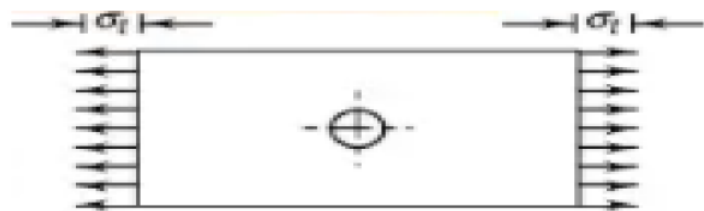


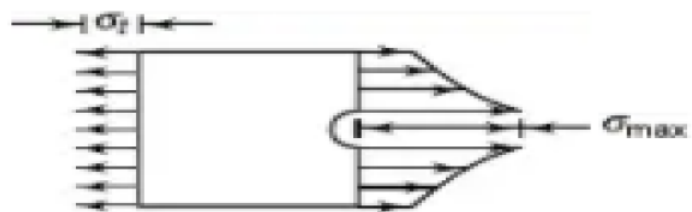
stress concentration

Whenever a machine component changes the shape of its cross-section, the simple stress distribution no longer holds good and the neighborhood of the discontinuity is different. This irregularity in the stress distribution caused by abrupt changes of form is called stress concentration.

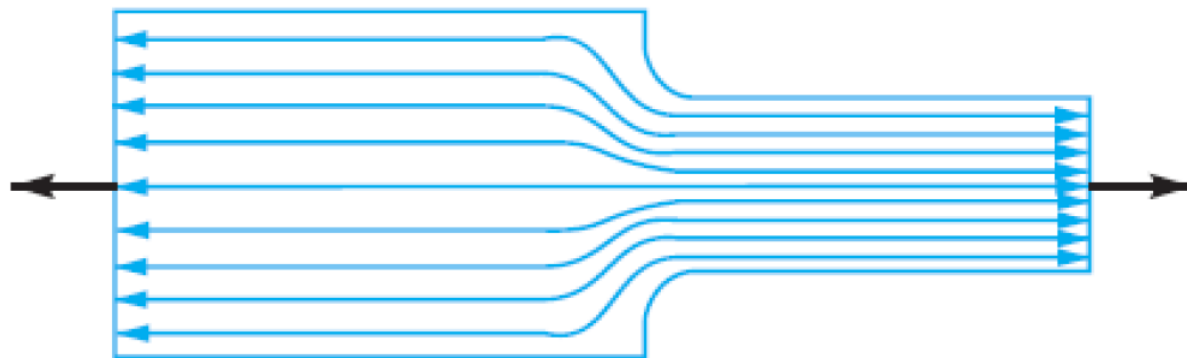
It occurs for all kinds of stresses in the presence of fillets, notches, holes, keyways, splines, surface roughness or scratches etc .



(a)



(b)



Theoretical Stress Concentration Factor (K_t)

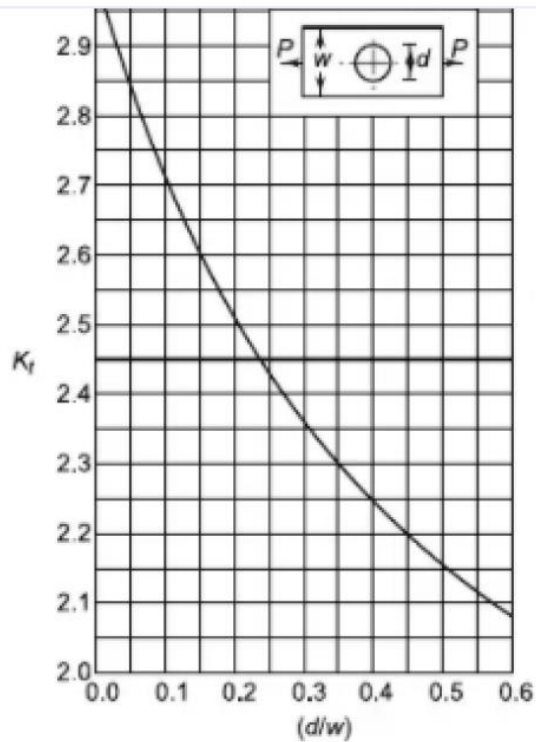
The theoretical stress concentration factor is defined as the ratio of the maximum stress in a member (at a notch or a fillet) to the nominal stress at the same section based upon net area.

$$K_t = \frac{\text{Highest value of actual stress near discontinuity}}{\text{Nominal stress obtained by elementary equations for minimum cross-section}}$$

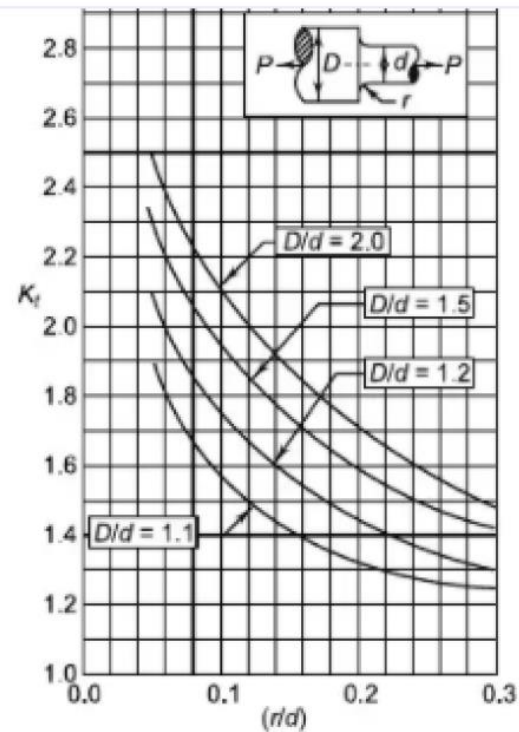
$$K_t = \frac{\text{Maximum stress}}{\text{Nominal stress}}$$

$$K_t = \frac{\sigma_{max}}{\sigma_0} = \frac{\tau_{max}}{\tau_0}$$

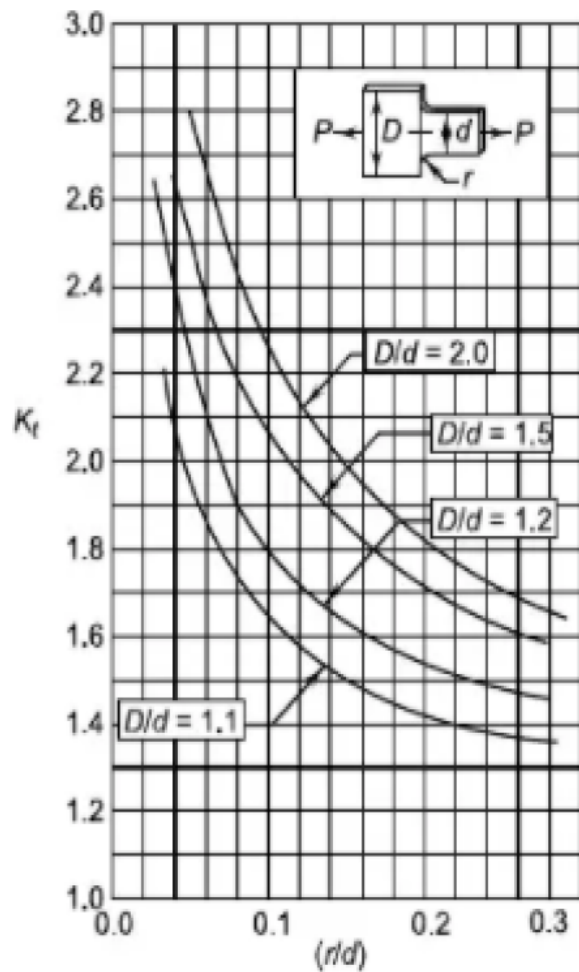
The value of K_t depends upon the material and geometry of the component



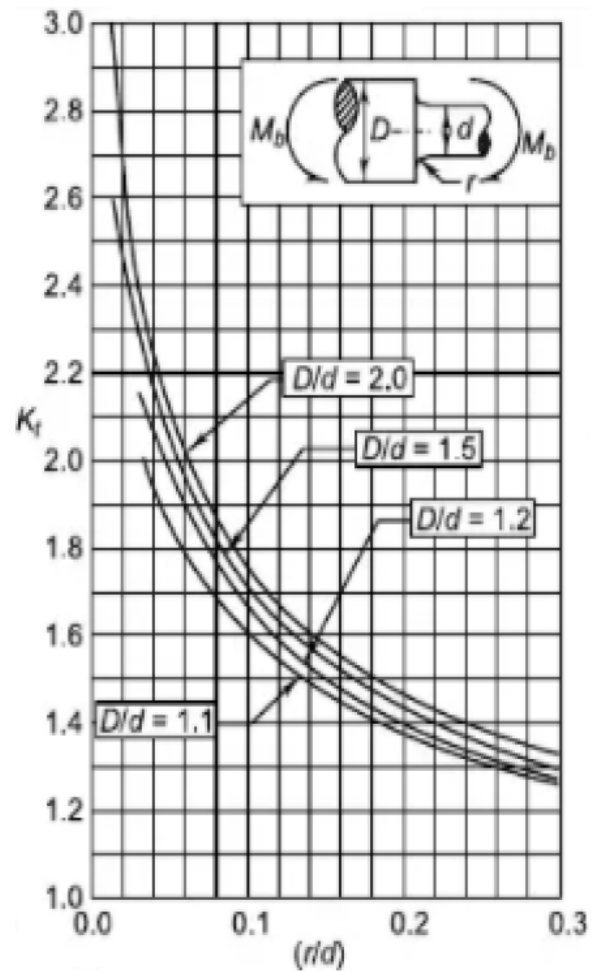
Stress Concentration Factor (Rectangular Plate with Transverse Hole in Tension or Compression)



Stress Concentration Factor (Round Shaft with Shoulder Fillet in Tension)



Stress Concentration Factor (Flat Plate with



Stress Concentration Factor (Round Shaft with Hole)

nominal stress σ_o in this case is given by,

$$\sigma_o = \frac{P}{(w-d)t}$$

where t is the plate thickness.

Tensile Force

$$\sigma_o = \frac{P}{\left(\frac{\pi}{4} d^2\right)}$$

Torsional Moment

$$\tau_o = \frac{M_t r}{J}$$

where, $J = \frac{\pi d^4}{32}$ and $r = \frac{d}{2}$

The nominal stress σ_o for this case is given by,

$$\sigma_o = \frac{P}{dt}$$

Bending Moment

$$\sigma_o = \frac{M_b y}{I}$$

where $I = \frac{\pi d^4}{64}$ and $y = \frac{d}{2}$

The Cause of Stress Concentration :

1- Variation in properties of materials

- a. Internal Crakes & Flaws lick blow holes
- b. Cavity in Weld
- c. Air hole in steel component
- d. Non metallic or foreign inclusion

2- Load application

- (a) Contact between the meshing teeth of the driving and the driven gear
- (b) Contact between the cam and the follower
- (c) Contact between the balls and the races of ball bearing
- (d) Contact between the rail and the wheel
- (e) Contact between the crane hook and the chain

3- Abrupt change in section

mount gears, sprockets, pulleys and ball bearing

features of machine components such as oil holes or oil grooves, keyways and splines, and screw threads result in discontinuities in the cross-section of the component.

4- M/C Scratches

Machining scratches, stamp marks or inspection marks are surface irregularity .

Stress Concentration Factors Determine by two method

1 Mathematical method based on theory of elasticity

2- Experimental Method