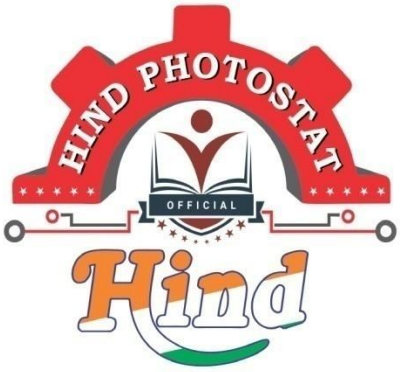

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MECHANICAL ENGINEERING

MACHINE DESIGN

By-PRAVEEN KULKARNI SIR

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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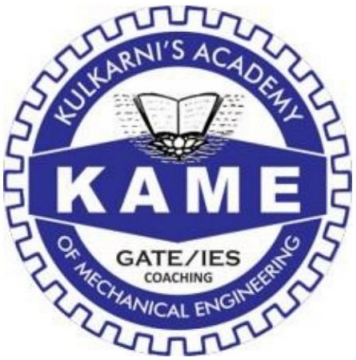

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Mechanical Engineering

By: Mr. Praveen Kulkarni

Index

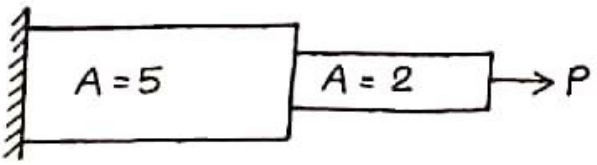
Chapter : 1

Design against dynamic loading

Design Against dynamic loading (Fluctuating loads)

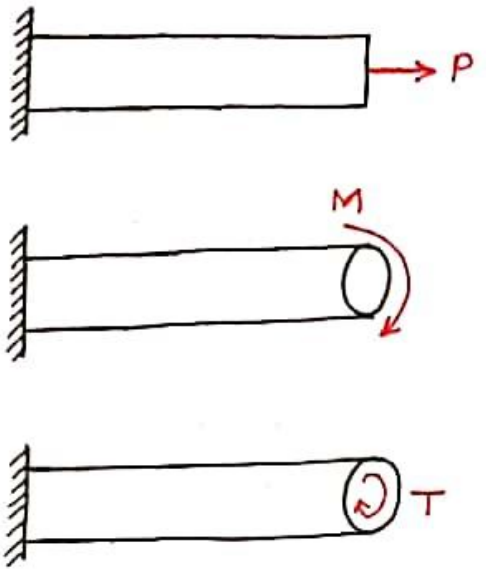
In the development of basic stress equations for various types of loads, it was assumed that there are no discontinuities or irregularities in the cross-section of members. However, most machine elements have dis-continuousities like sudden change in cross-section, holes etc. These dis-continuities in machine element change the stress distribution in their neighborhood so that elementory equations no longer describe the actual state of stress. Such, discontinuities are known as Stress Raisers.

Internal cracks, cavities in weld, blow holes are examples of stress raisers. To account for this a factor called stress concentration factor is introduced.



Stress distribution

Stress Redistribution



$\sigma = \frac{P}{A}$

$\sigma_b = \frac{MY}{I}$

$\tau = \frac{16T}{\pi d^3}$

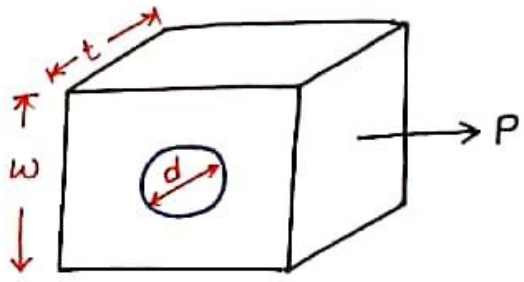
} Elementory equations

Theoretical stress concentration Factor: (k_t)

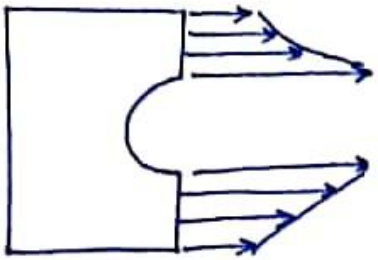
It is the ratio of maximum stress to the stress at min. cross-section obtained from elementary equations. This stress concentration factor is also known as theoretical stress concentration factor or form stress concentration factor because it depends only on geometry or shape of member. In actual practice, the stress concentration effect is less because of redistribution of stress.

$$K_t = \frac{\sigma_{max.}}{\sigma_{min.\ c/s}}$$

For Example:



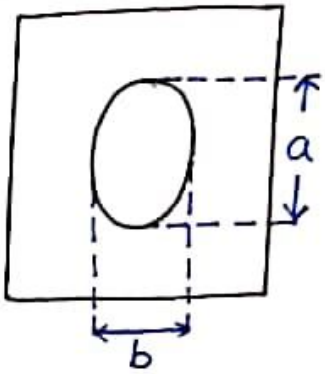
$$\sigma_{min.\ c/s} = \frac{P}{(w-d)t}$$



- For a plate with elliptical hole, $K_t = 1 + \frac{2a}{b}$

Where $a \rightarrow$ Major axis

$b \rightarrow$ Minor axis



- if the hole is circular; $a = b$

$K_t = 1 + 2 = 3$

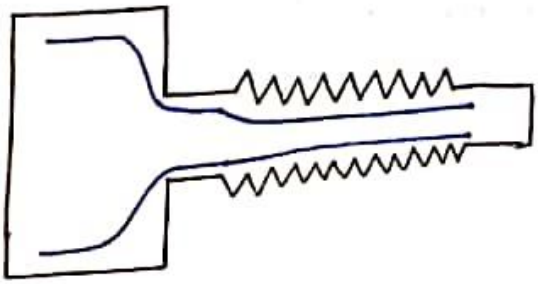
Examples:

(1)

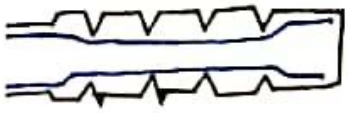
Bad design

Good design

(2)



Bad design



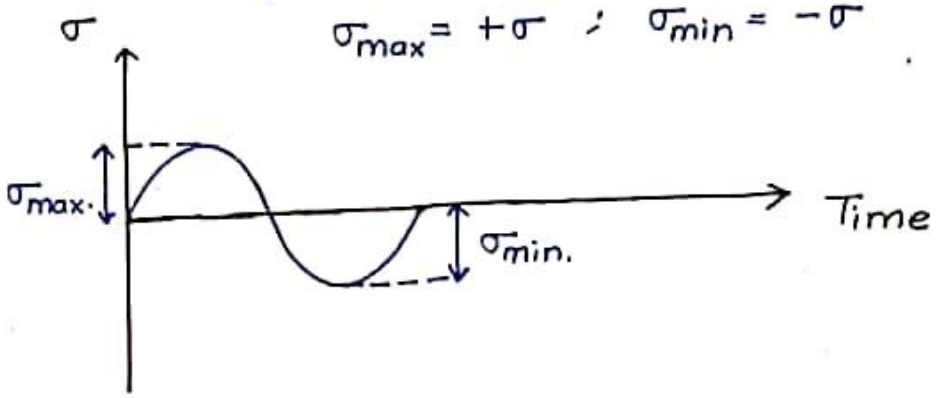
Good design

Type's of fatigue stresses:

(1) Completely reversed fatigue stress (cyclic stress):

Stress fluctuates between two limits having same magnitude but unlike in nature.

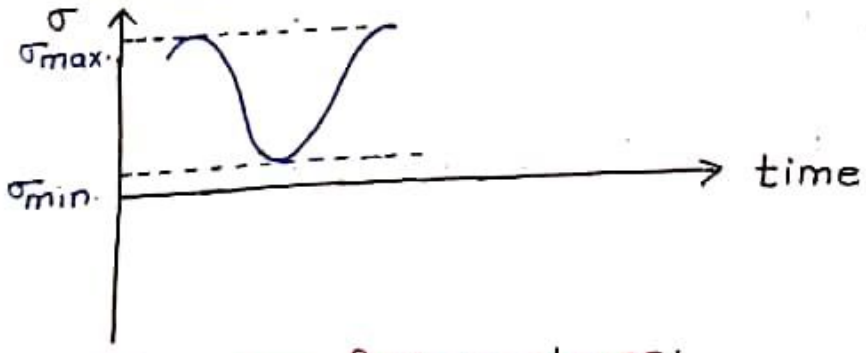
$\sigma_{max} = +\sigma$; $\sigma_{min} = -\sigma$



Ex: Gears, clutches

(2) Fluctuating fatigue stress:

Stress fluctuates between two limits having different magnitude but like in nature.



(3) Alternating fatigue stress:

Stress fluctuates between two limits having different magnitude but unlike in nature.