A LECTURE NOTE
ON
TH.1 THEORY OF MACHINE
SEMESTER -4

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Vibrations

It is a mechanical phenomenon where any machine parts or device oscillations occure about an equilibrium point is known as vibration.

causes

1) Unbalance - when the CG of a rotating m/c parts is not exactly on the centre, it causes machine unbalance and produce vibration.

2) Dry friction bet^n the 2 mating surface - when there is dry friction b/w two mating surface, it cause produce vibration.

3) Misalignment - when two shaft is not alignment properly, it cause produce vibration.

4) Earthquakes - The failure of many dam & buildings due to earthquakes.

5) Winds - The vibrations of transmission & telephone lines under certain condition due to wind.

6) Loose parts - m/c bearing & bolts are loose.

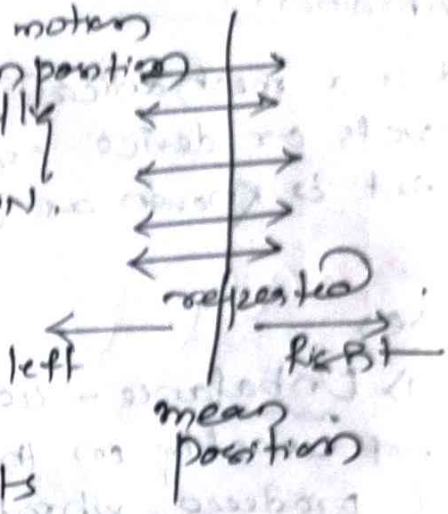
Effects

1) Excessive stresses.
2) Looseness of parts.
3) Undesirable noise
4) Failure of parts.

Vibrations

→ motion on left to right — To & fro motion abt mean position repeatedly = VIBRATION.

→ Repeatation



Def^n

When a body is displaced from its equilibrium position by the application of external force & then released it commences to perform to & fro motion.

↓
start

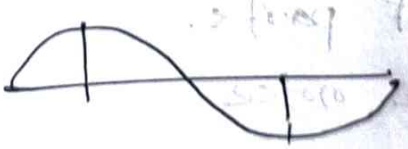
Terms Used

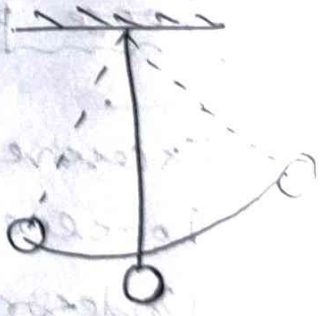
1) Time period – It is the time interval after which the motion is repeated itself. It expressed in sec.

2) Cycle – It is the motion completed during 1 T.P.

3) Frequency – It is the no. of cycle described in one sec. SI unit Hertz (Hz). $F = 1/T$

4) Amplitude – The max displacement of vibrating body from mean position.

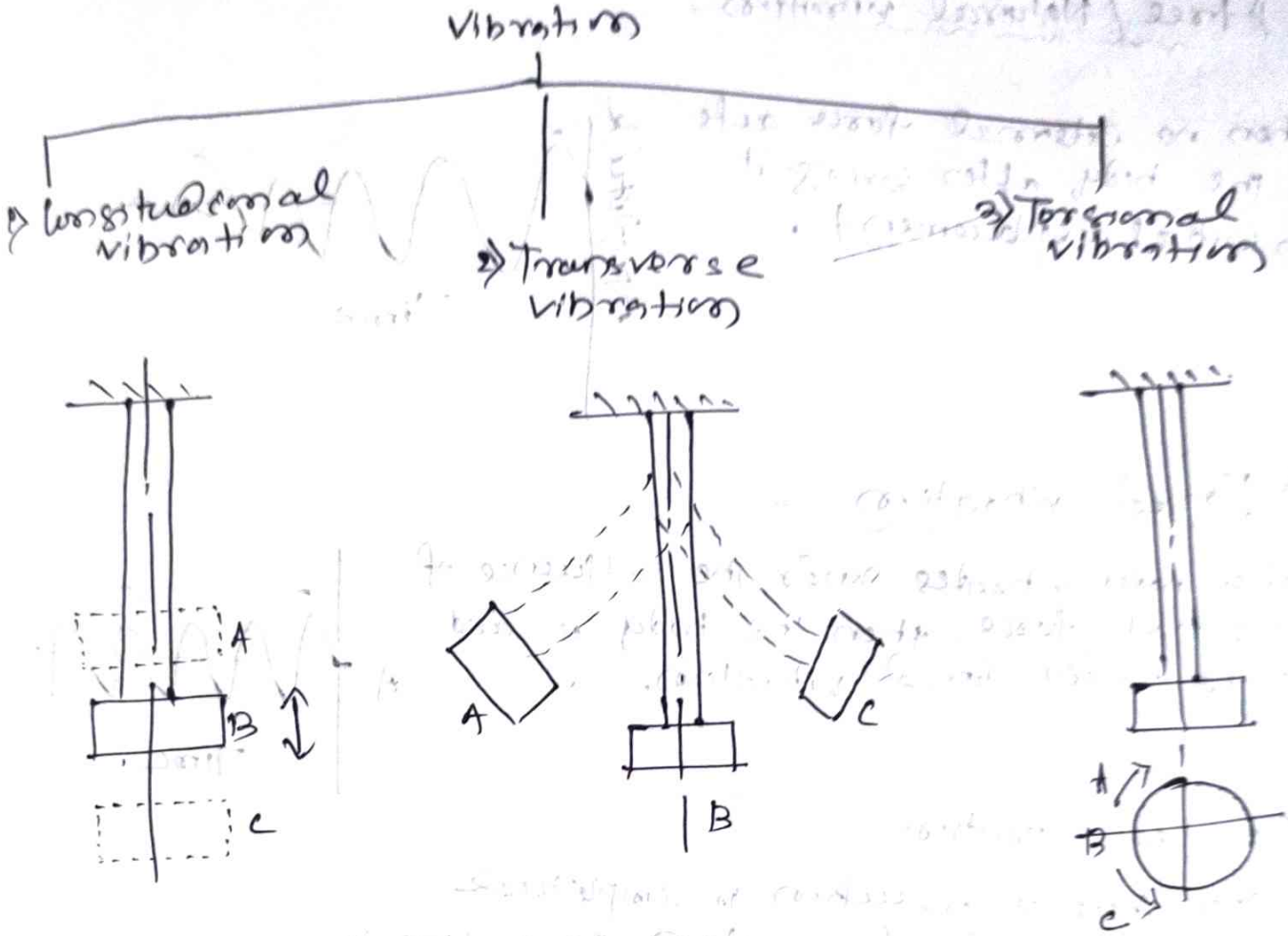




5) Periodic motion – Any motion that repeat itself after regular interval of time.

6) Simple harmonic motion – It is the simplest type of periodic motion in which acceleration is always directed towards the mean position.

Types of free vibration



1) Longitudinal vibration – when the particle of shaft or disc moves parallel to the axis of shaft. In this case the shaft is elongate & shortened alternately & thus the tensile & compressive stresses are induced alternately in the shaft.

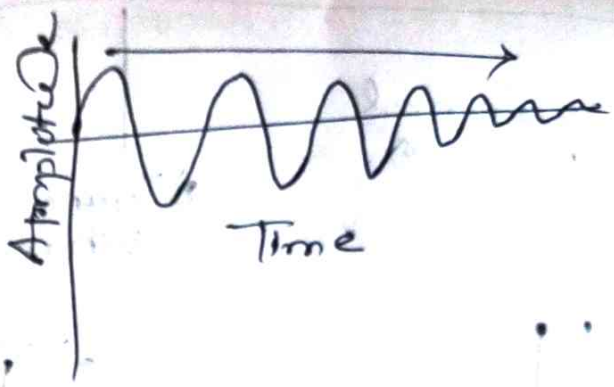
2) Transverse vibration – when the particle of shaft or disc moves approx. perpendicular to the axis of shaft. In this case the shaft is sharply & bent alternately & bending stresses are induced on the shaft.

3) Torsional vibration – when the particle of shaft or disc moves in a circle about the axis of the shaft. In this case the shaft is twisted & untwisted alternately & the torsional shear stresses are induced in the shaft.

Types of vibratory motion

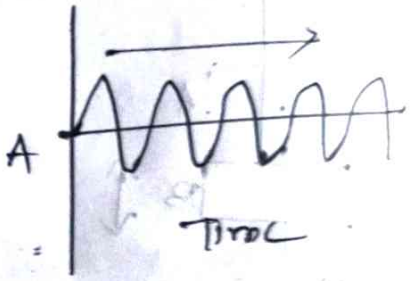
1) Free / Natural vibrations -

when no external force acts on the body, after giving it an initial displacement.



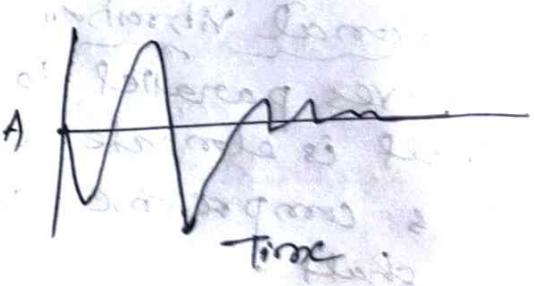
2) Forced vibrations -

when body vibrates under the influence of external force, then the body is said to be under forced vibration.



3) Damped vibration -

When there is reduction in amplitude over every cycle of vibration, the motion is said to be damped vibrations.



Remedies of vibration

1) Proper balancing
2) Proper alignment
3) Tightening connections.
4) Lubrication
5) Active vibration control systems
6) Add damping materials
7) Use of vibration isolators.