

Mechanical



Topics

- Vibration
- Valves
- Steam Traps
- Flow sheets

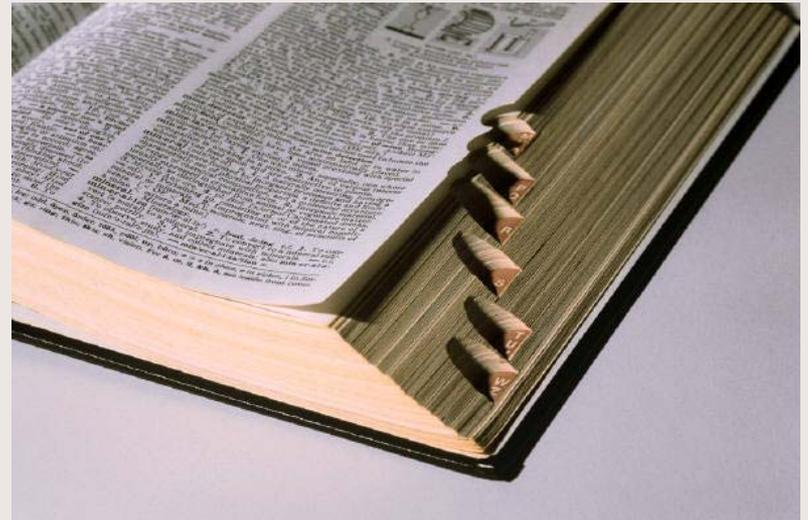


Vibration

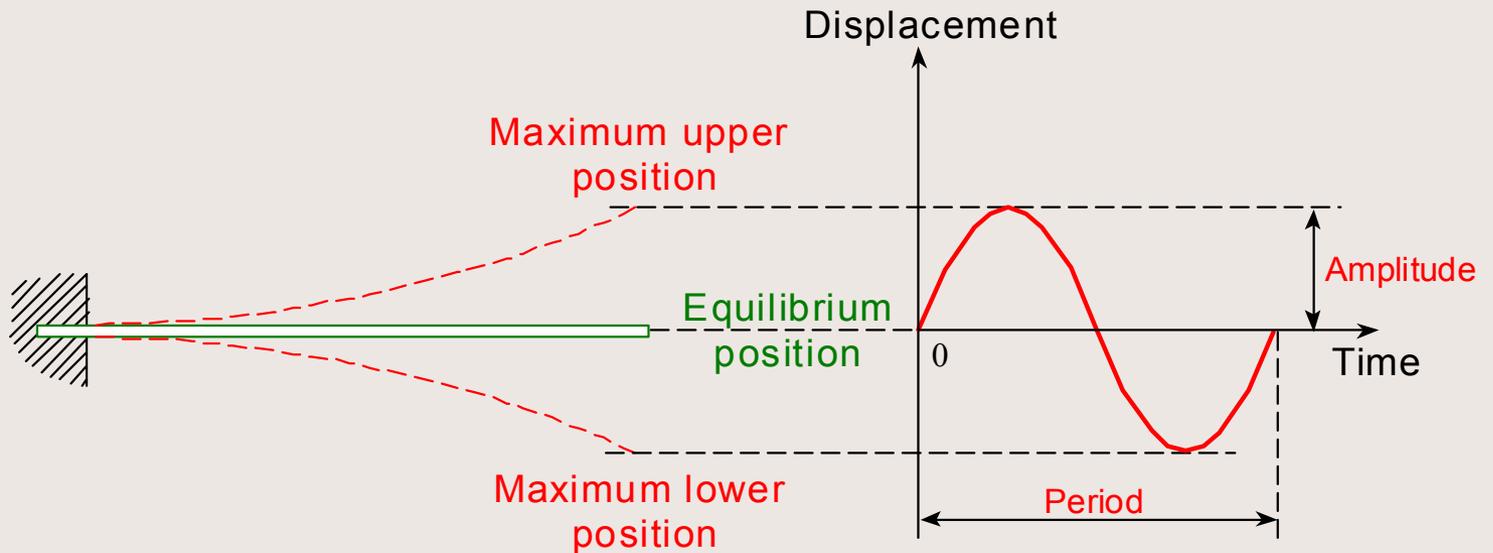


Definitions

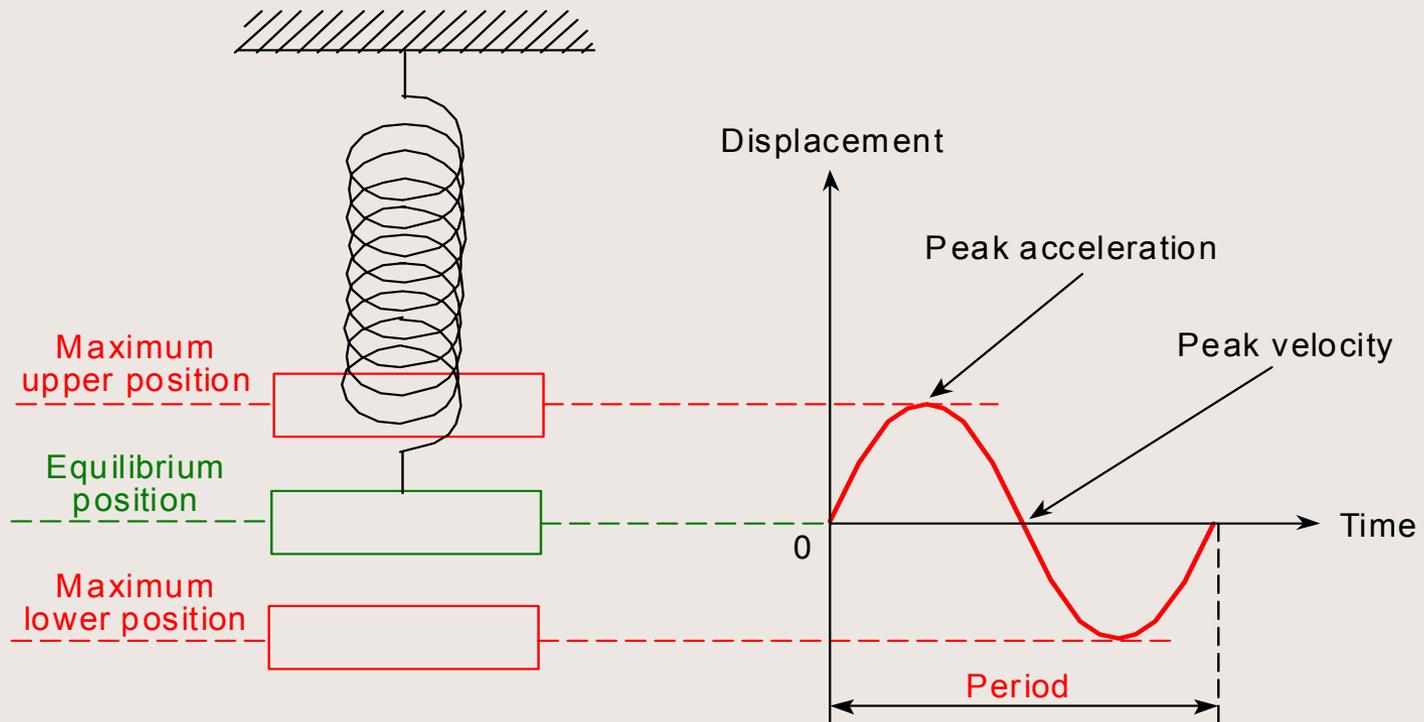
- Amplitude
- Frequency
- Natural Frequency
- Forcing Frequency
- Damping
- Resonance
- Critical Speed



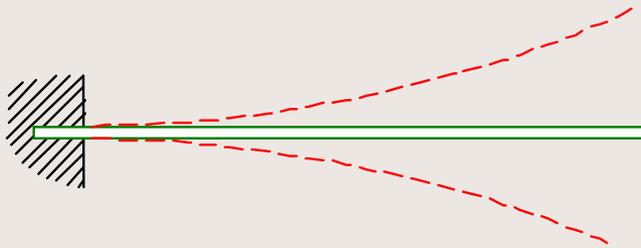
Amplitude & Frequency



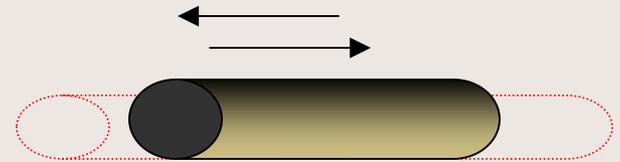
Natural Frequency



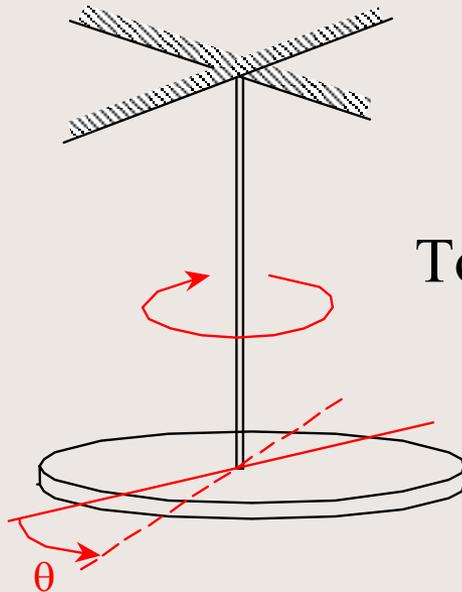
Types of Vibration



Lateral



Axial



Torsional

Modes of Vibration

Stiff Shaft in
Loose Bearings



Flexible Shaft in
Stiff Bearings

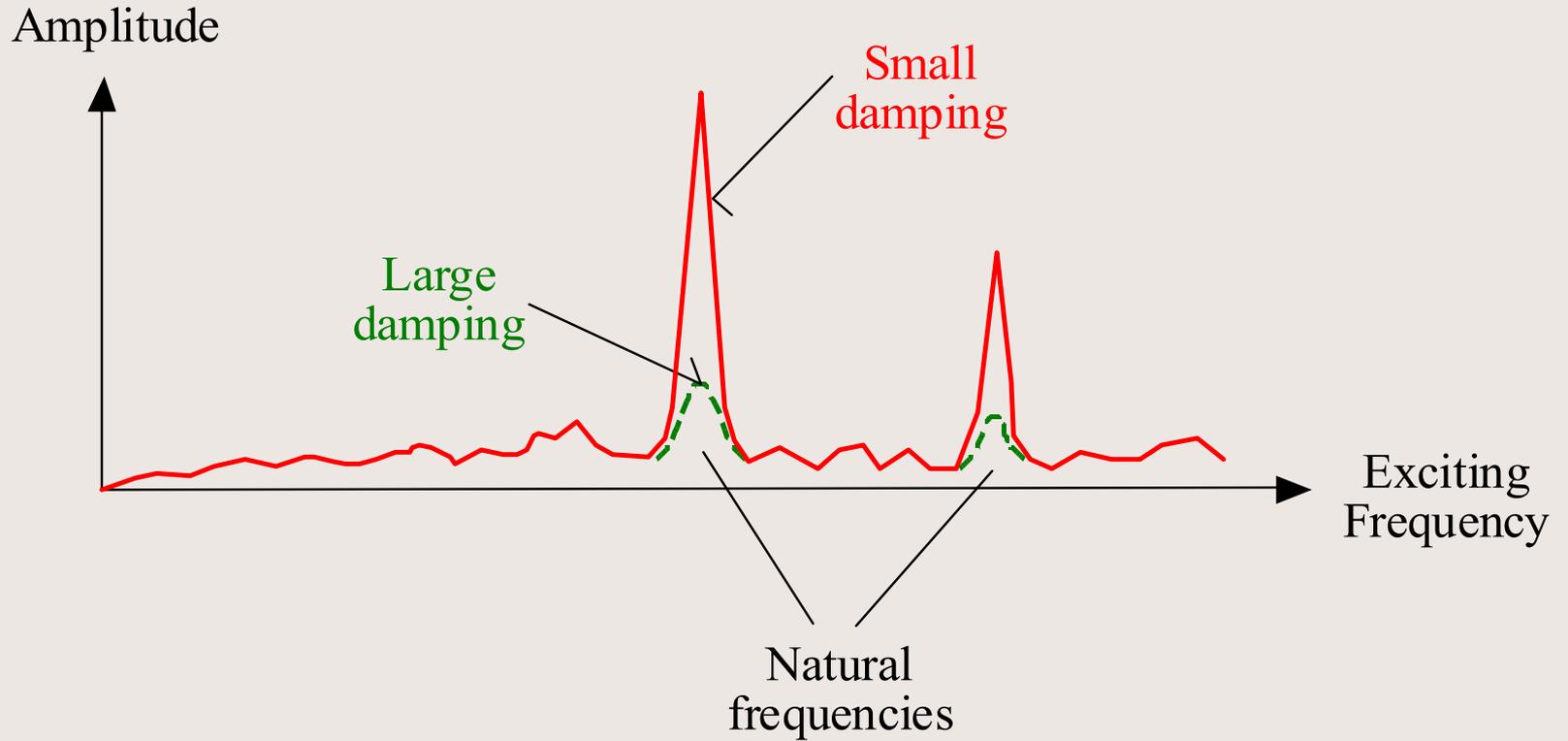


2 Nodes



3 Nodes

Natural Frequency



Factors Affecting Natural Frequencies

Inertia 

Frequency 

Rigidity 

Frequency 

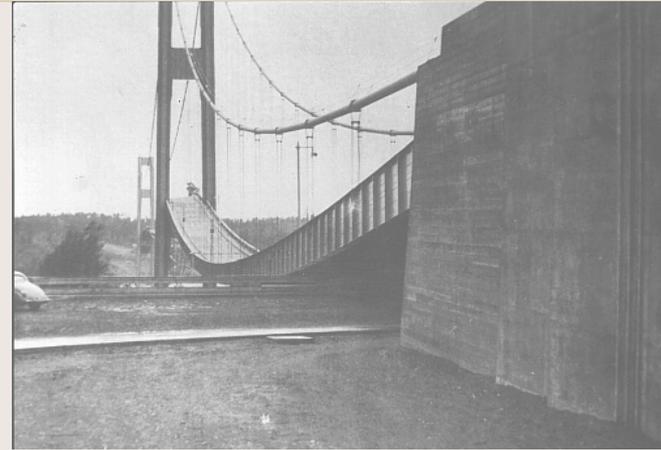
Damping



- Internal friction
- Friction between object and its surroundings
- Friction between object and surrounding fluid



Resonance



When a forcing frequency is equal to a natural frequency

Critical Speed

- Every rotating machine has them
- The speed of rotation is equal to a resonant frequency of the support structures
- Vibrations are high
- Don't leave machine spinning at critical speeds



Vibration Damage

- Fatigue
- Rubbing or Fretting
- Impact
- Loosening of parts

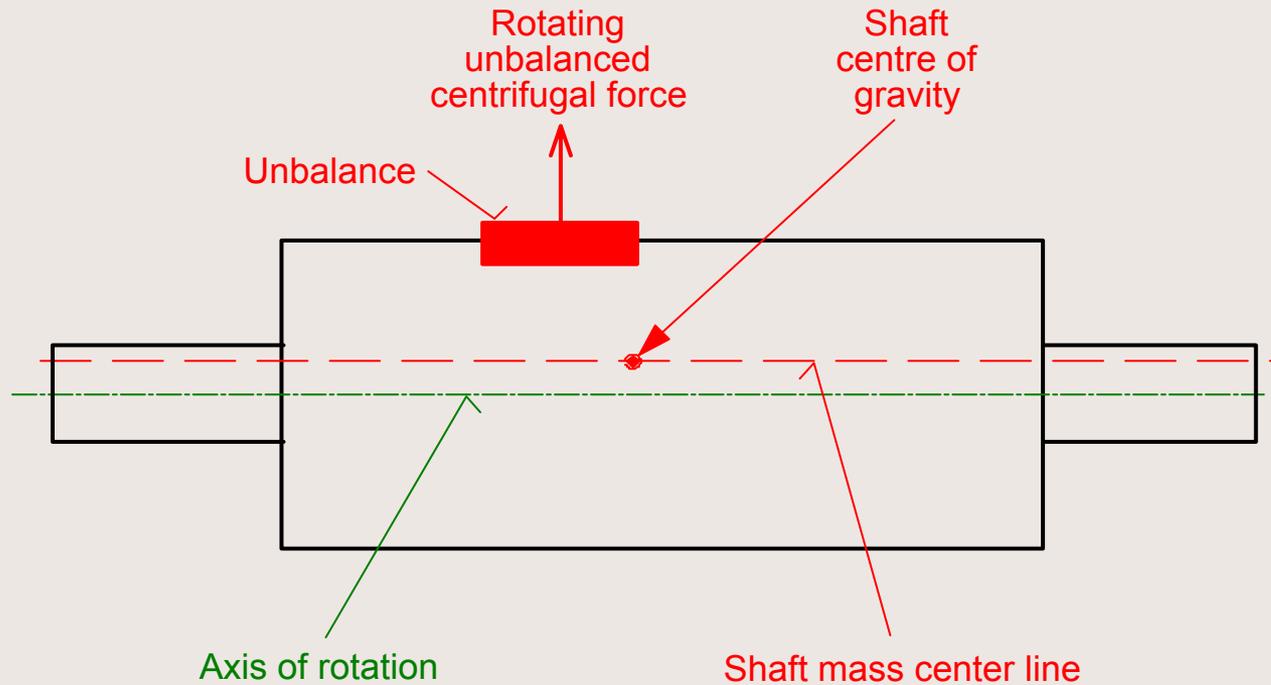


Sources of Vibration

- Mass Unbalance
- Misalignment
- Eccentricity

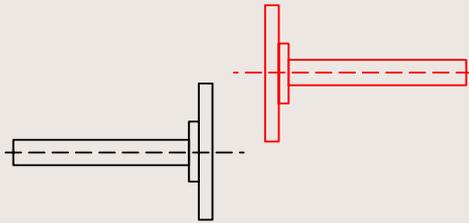


Mass Unbalance

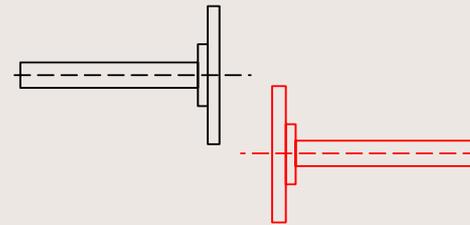


Coupling Misalignment

Parallel Misalignment

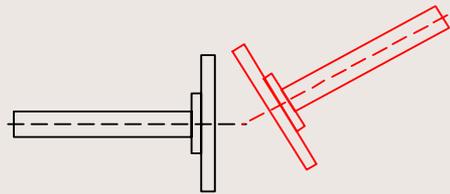


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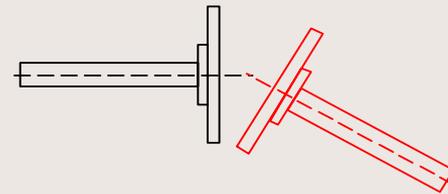


II

Angular Misalignment

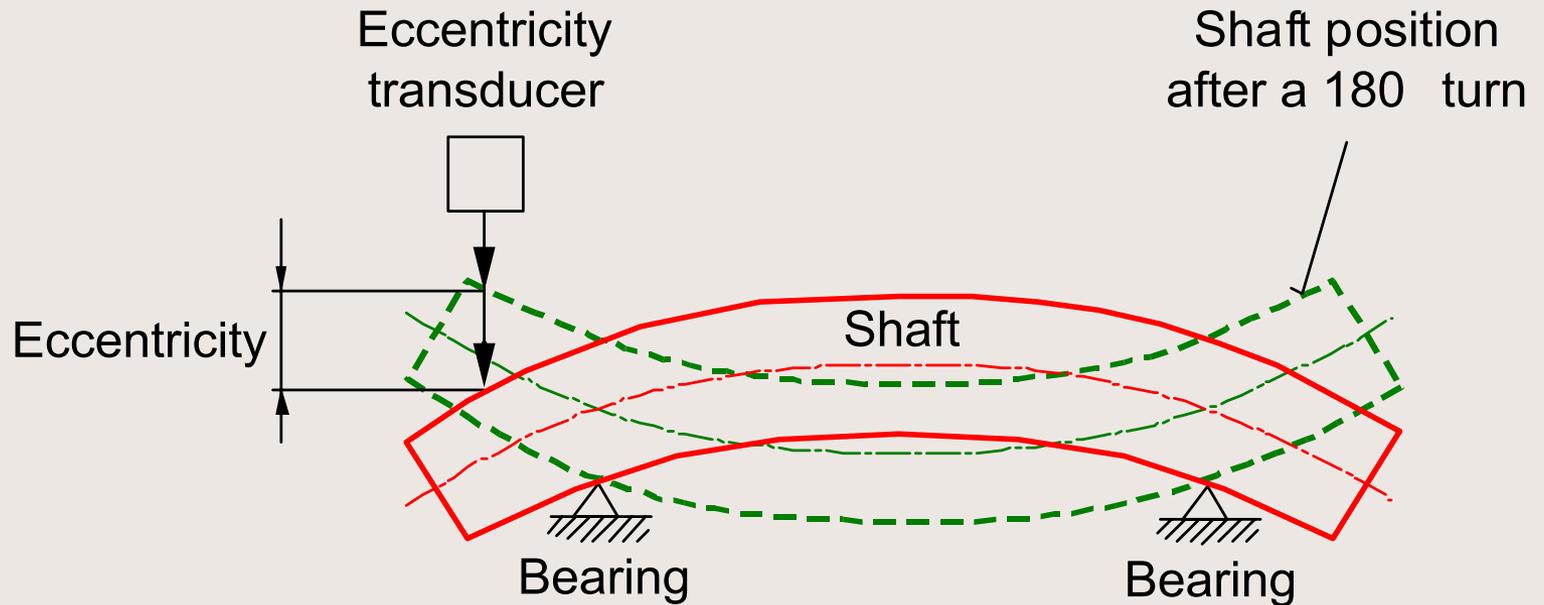


III



IV

Eccentricity





You

- Read the section titled Vibration
- Answer the questions page 22