# Vibration Description



## *Numerical descriptors of machine vibration*

**Amplitude;** The amplitude of vibration is the magnitude of vibration. Vibration amplitude is thus an indication of the severity of vibration.

**In general, the severity or amplitude of vibration relates to:**

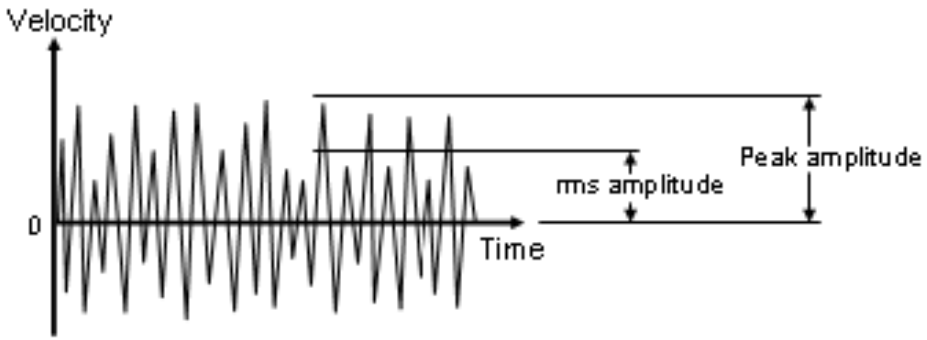
- The size of the vibratory movement,
- The speed of the movement,
- The force associated with the movement,

# Vibration Description



## Numerical descriptors of machine vibration

**Velocity Amplitude;** velocity is simply speed measured in a particular direction. Velocity amplitude can be expressed in terms of its peak value, or what is known as its root-mean-square value. The peak velocity amplitude of a vibrating machine is simply the maximum (peak) vibration speed attained by the machine in a given time period.

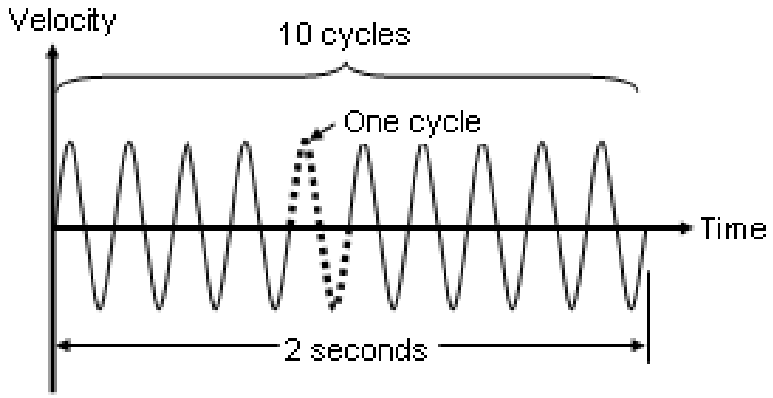


# Vibration Description



## Numerical descriptors of machine vibration

**Frequency;** The rate at which a machine component oscillates is called its oscillation or vibration frequency. The higher the vibration frequency, the faster the oscillation. You can determine the frequency of a vibrating component by counting the number of oscillation cycles that are completed every second.

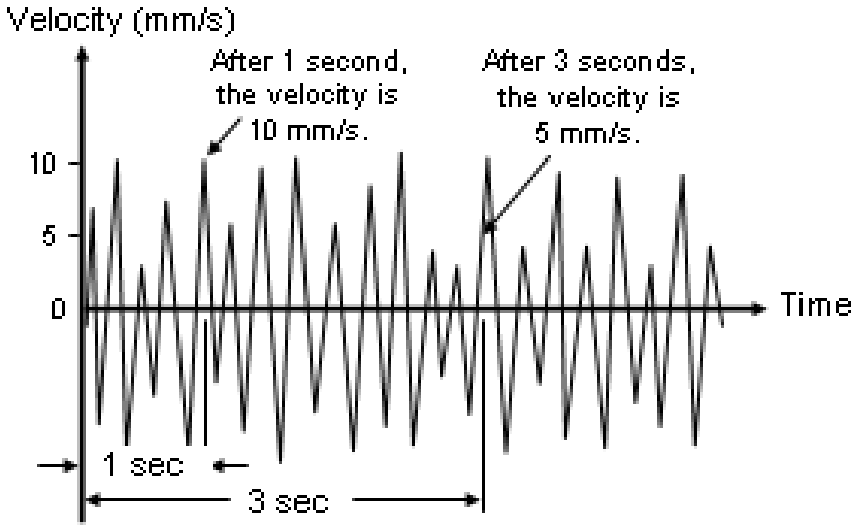


# Vibration Description



## Numerical descriptors of machine vibration

**Waveform;** A waveform is a graphical representation of how the vibration level changes with time. A velocity waveform is simply a chart that shows how the velocity of a vibrating component changes with time.

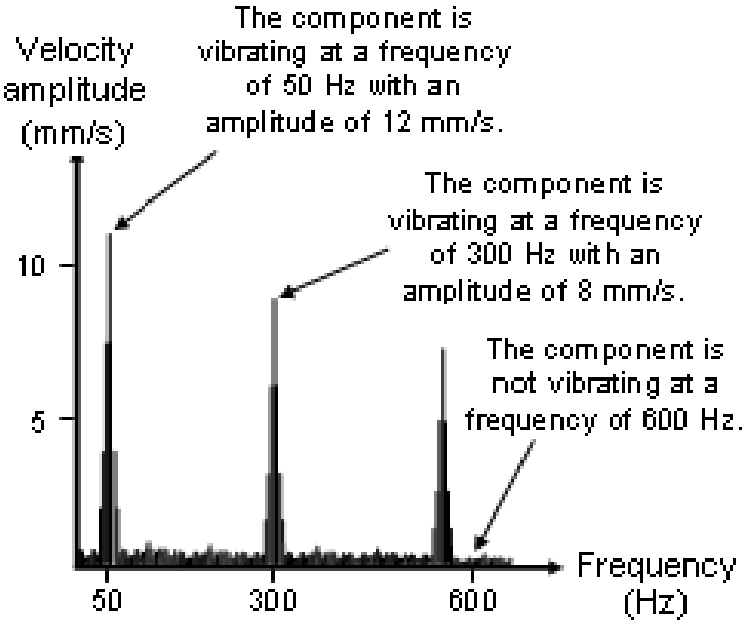


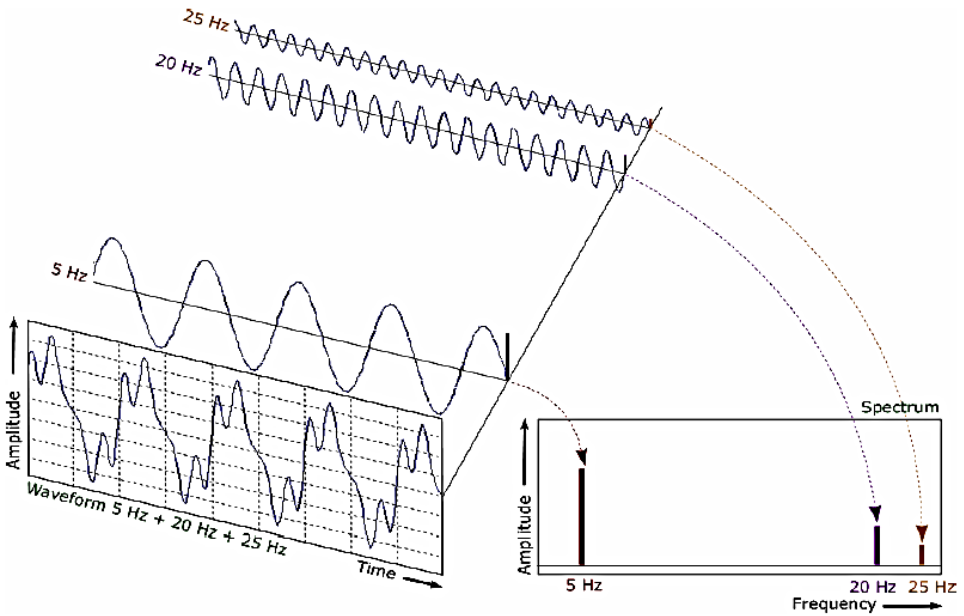
# Vibration Description



## Numerical descriptors of machine vibration

**Spectrum;** Another kind of display commonly used by vibration analysts is the spectrum. A spectrum is a graphical display of the frequencies at which a machine component is vibrating, together with the amplitudes of the component at these frequencies.



# Vibration Measurement



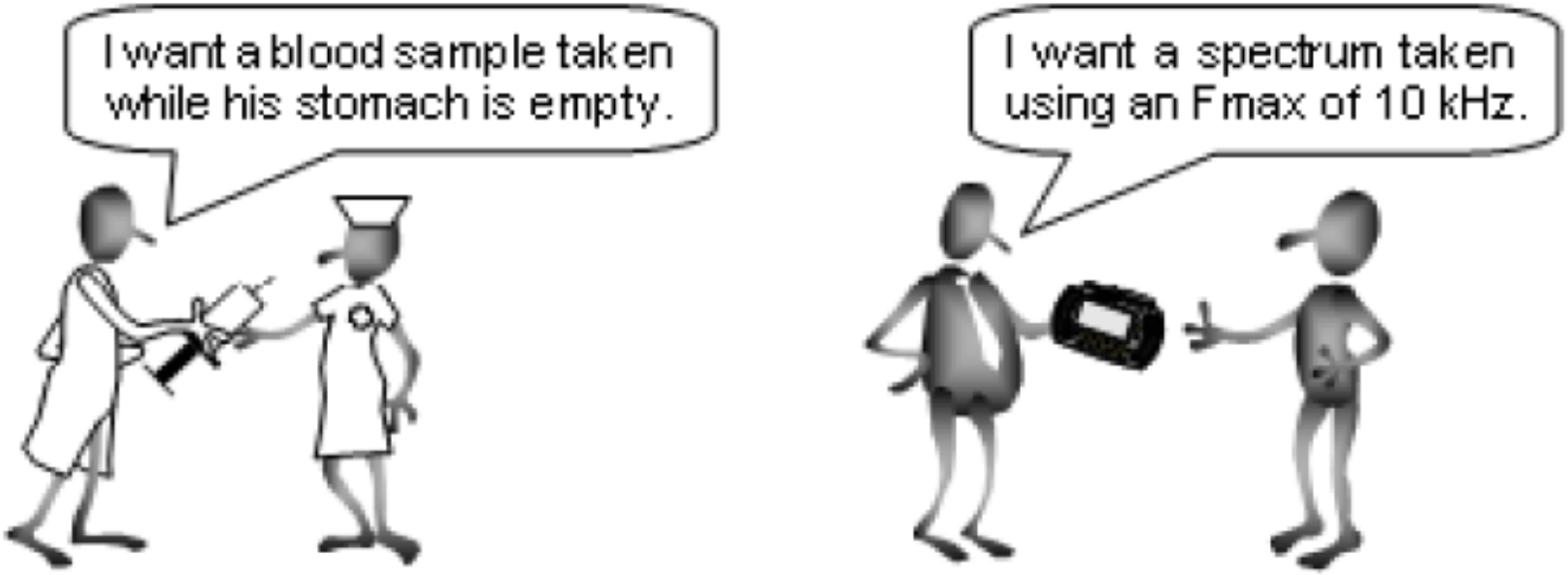
Measurements should be made to produce the data needed to draw meaningful conclusions from the system under test. These data can be used to minimize or eliminate the vibration and thus the resultant noise.


### (i) Transducers

In general, the transducers employed in vibration analyses convert mechanical energy into electrical energy; that is, they produce an electrical signal which is a function of mechanical vibration. In the following section, both velocity pickups and accelerometers mounted or attached to the vibrating surface will be studied.

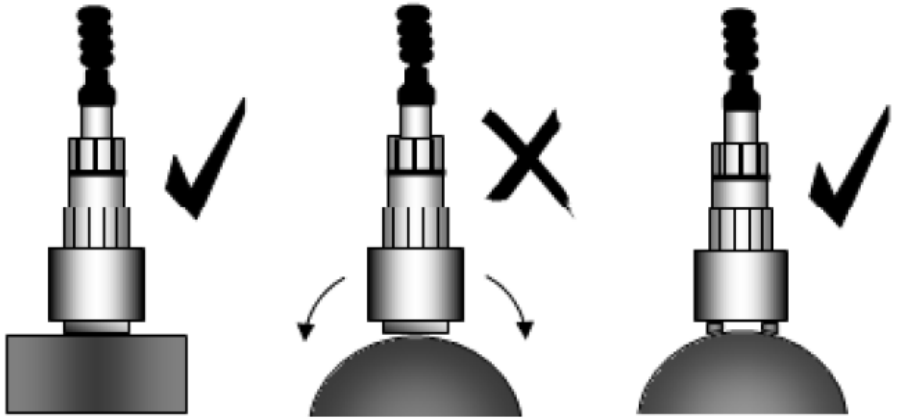
# Vibration Measurement

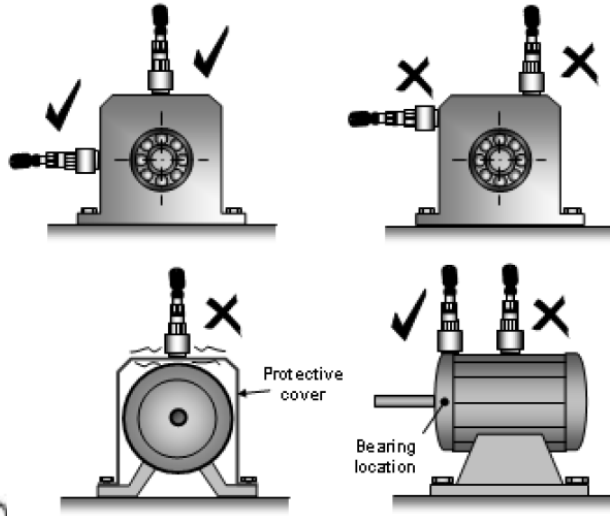




# Vibration Measurement





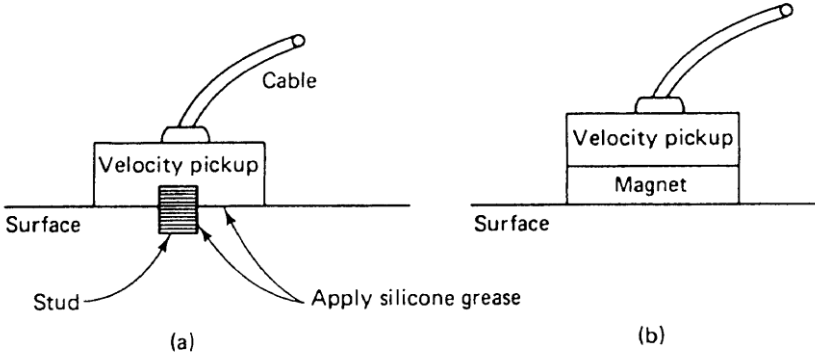


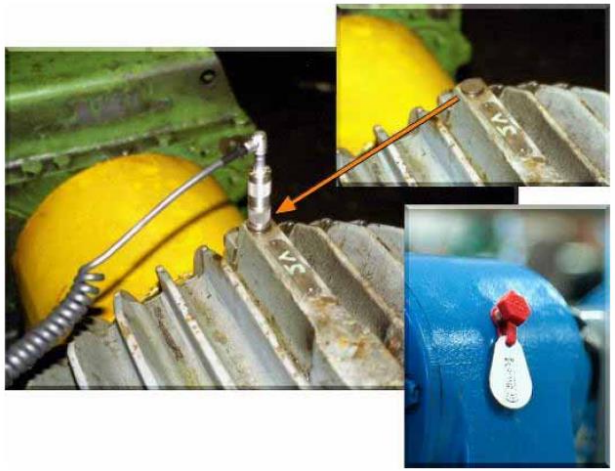

# Vibration Measurement

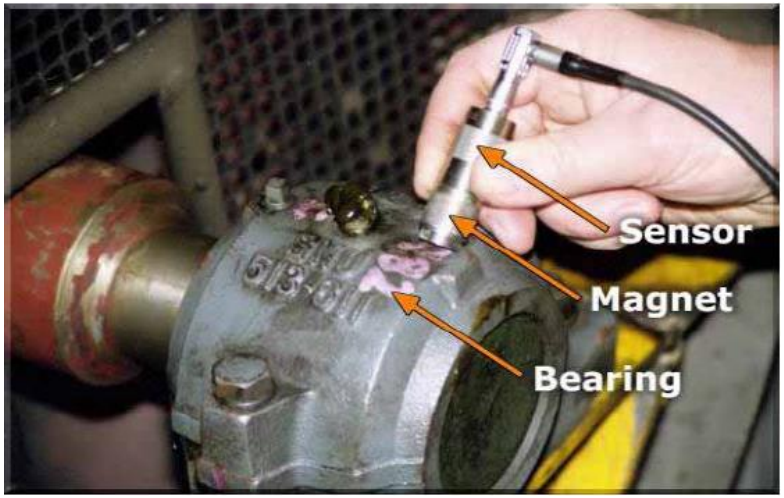


## (a) Velocity pickups

The electrical output signal of a velocity pickup is proportional to the velocity of the vibrating mechanism.



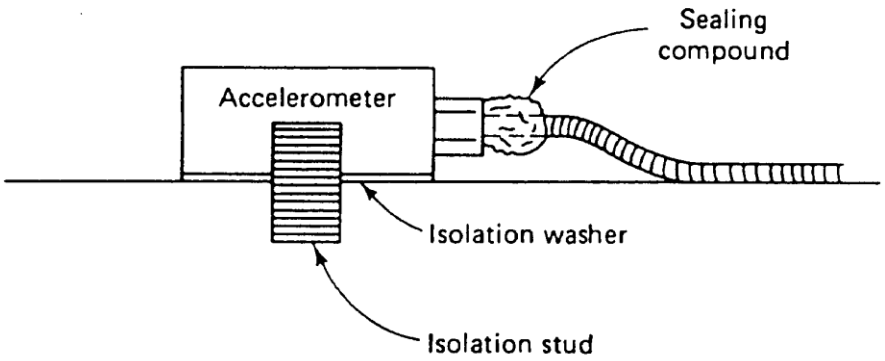


# Vibration Measurement



### (b) Accelerometers

The accelerometer generates an output signal that is proportional to the acceleration of the vibrating mechanism.



# Vibration Measurement



### (iii) Processing and display equipment

The instruments used for the processing and display of vibration data are, with minor modifications, the same as those described earlier for noise analyses. The processing equipment is typically some type of spectrum analyzer. The analyzer may range from a very simple device which yields, for example, the rms value of the vibration displacement, to one that yields an essentially instantaneous analysis of the entire vibration frequency spectrum.

# Vibration Monitoring



Monitoring the vibration characteristics of a machine gives us an understanding of the 'health' condition of the machine. We can use this information to detect problems that might be developing.

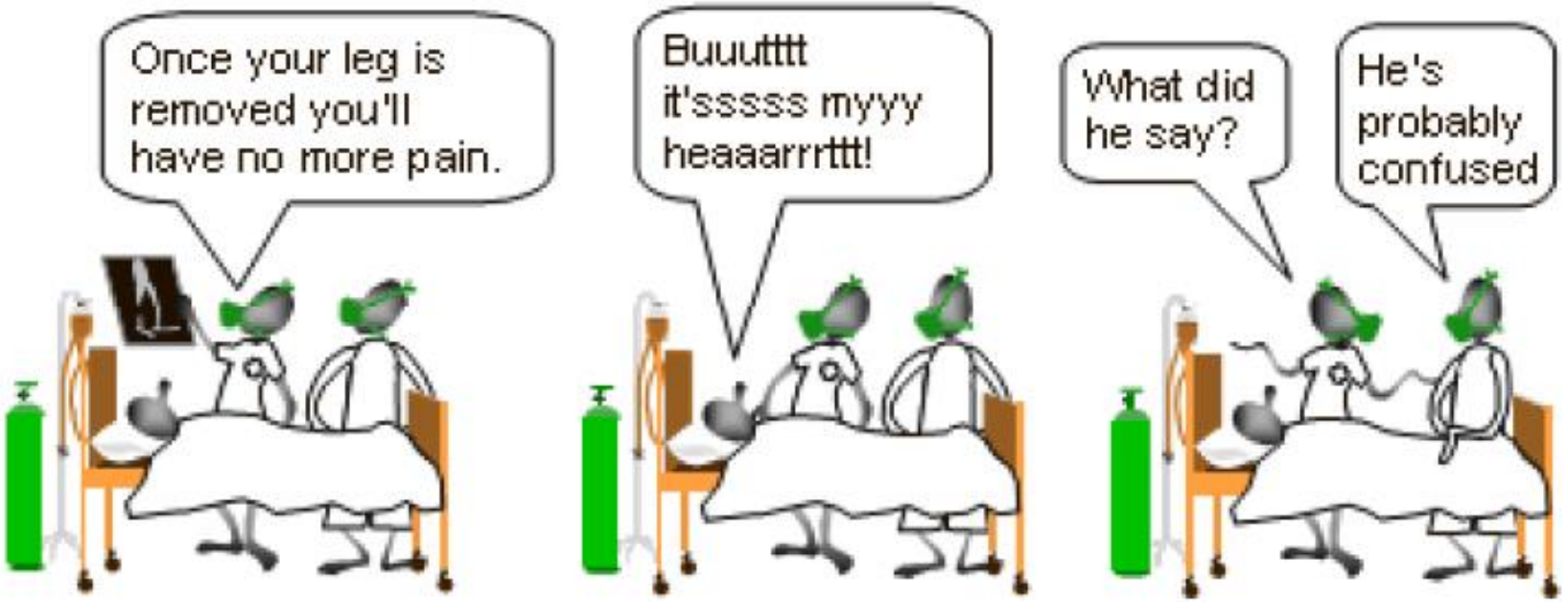
**(a) Severe Machine Damage**

**(b) High Power Consumption**

**(c) Machine Unavailability**

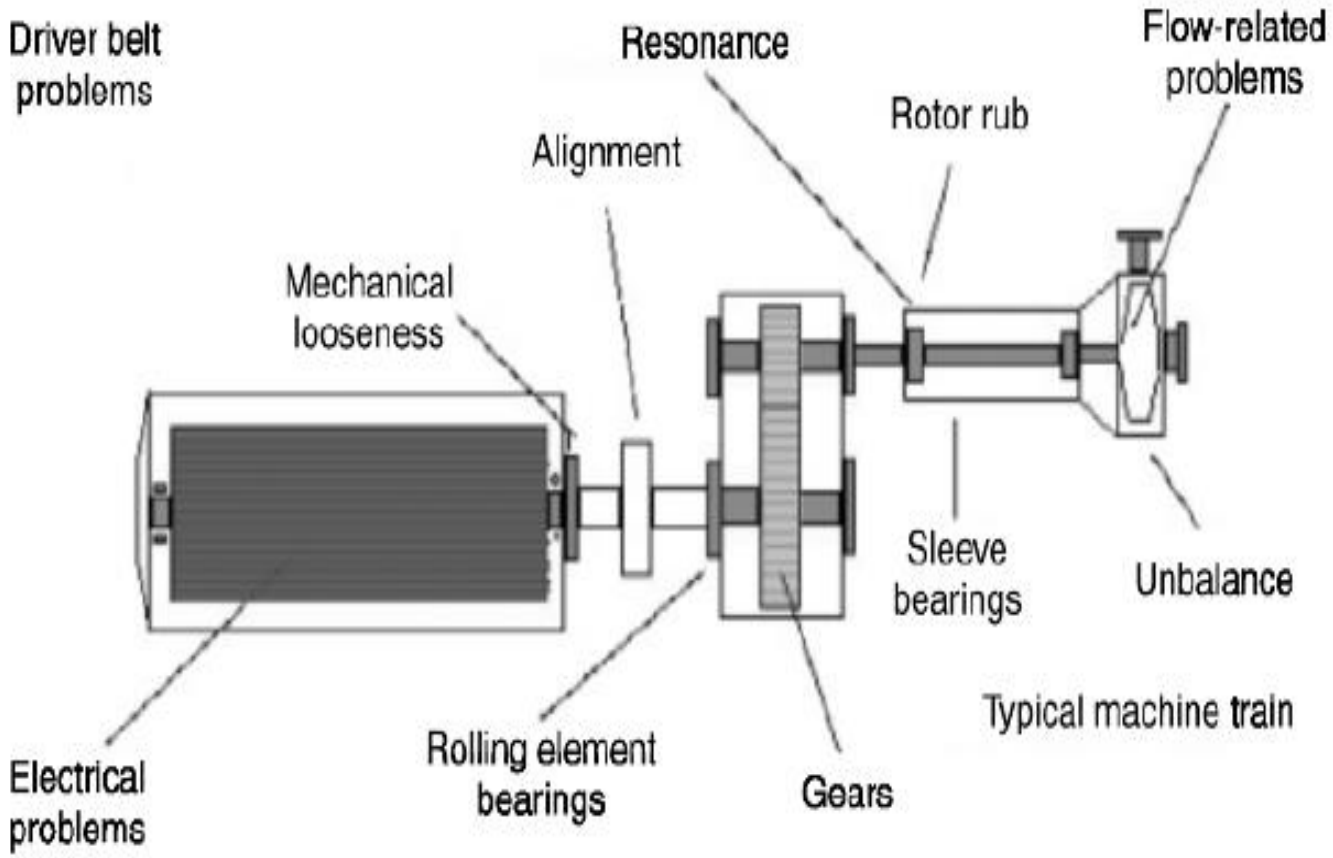
# Diagnose of Vibration Causes and Fault Detection





# Diagnose of Vibration Causes and Fault Detection





# Diagnose of Vibration Causes and Fault Detection



**Common defects that cause high vibrations levels in machines are:**

- Unbalance of rotating parts
- Misalignment of couplings and bearings
- Bent shafts
- Worn or damaged gears and bearings
- Bad drive belts and chains
- Torque variations
- Electromagnetic forces
- Aerodynamic forces
- Hydraulic forces
- Looseness
- Rubbing
- Resonance.