Photonics

Lecture 6

Parametric Oscillation

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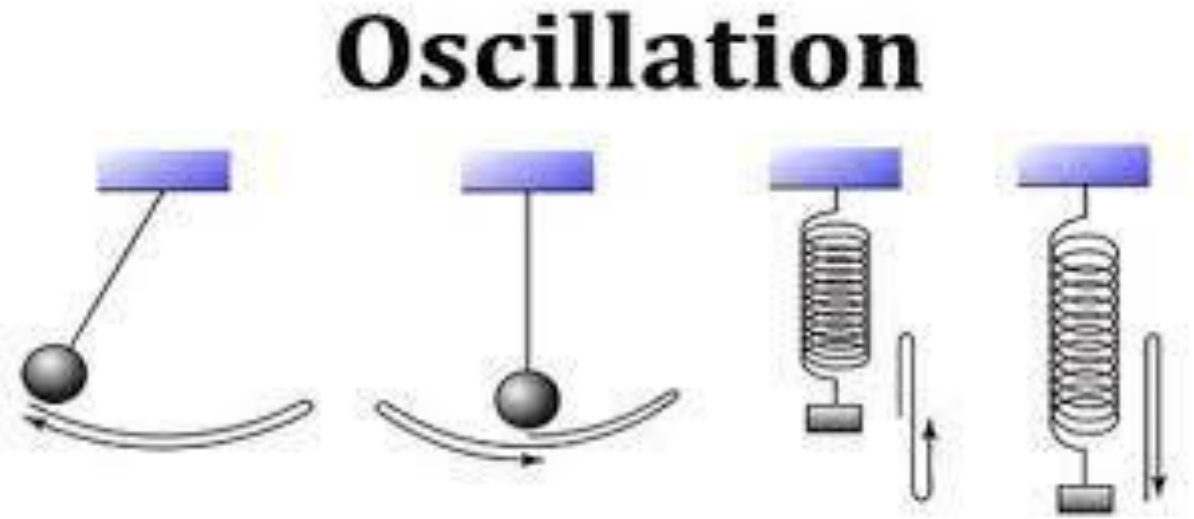
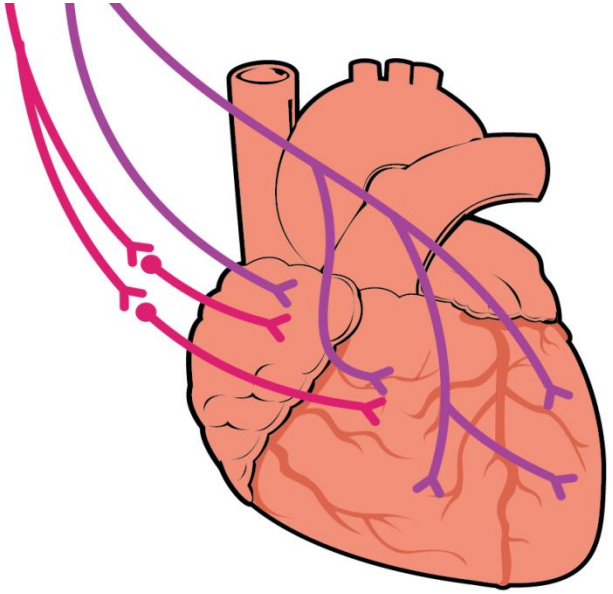
Oscillation

Oscillation is defined as the process of repeating variations of any quantity or measure about its equilibrium value in time. Oscillation can also be defined as a periodic variation of a matter between two values or about its central value.



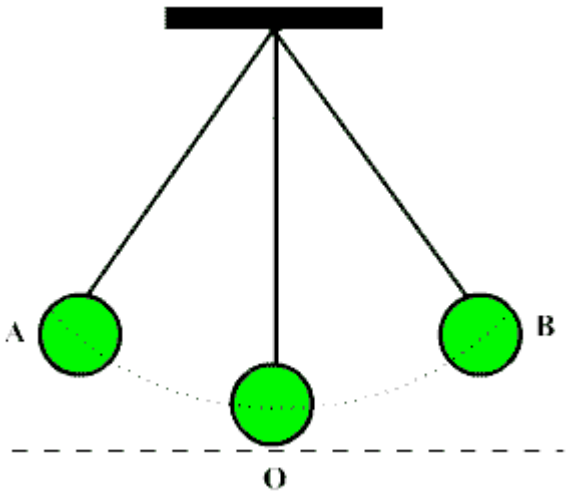
The term vibration is used to describe the mechanical oscillations of an object. However, oscillations also occur in dynamic systems or more accurately in every field of science. Even the beating of our heart creates oscillations. Meanwhile, objects that show motion around an equilibrium point are known as oscillators.



Examples of Oscillations

The most common examples of oscillation are the tides in the sea and the movement of a simple pendulum in a clock. The vibration of strings in guitar and other string instruments are also examples of oscillations.

The pendulum moves back and forth and hence it creates an oscillating movement. Mechanical oscillations are called vibrations. A particle being vibrated means it oscillates between two points about its central point.



Likewise, the movement of spring is also oscillation. The spring moves downward and then upward repeatedly and hence it produces an oscillating movement.

A sine wave is a perfect example of oscillation. Here the wave moves between two points about a central value. The height or the maximum distance that the oscillation takes place is called the amplitude and the time taken to complete one complete cycle is called the time period of the oscillation. Frequency is the number of complete cycles that occur in a second. Frequency is the reciprocal of the time period.

$F = 1 / T$

Where F is the frequency of oscillation

And T is the time period of the oscillation.

Difference between Oscillatory Motion and Periodic Motion

Periodic motion is defined as the motion that repeats itself after fixed intervals of time. This fixed interval of time is known as time period of the periodic motion. Examples of periodic motion are motion of hands of the clock, motion of planets around the sun etc.

Oscillatory motion is defined as the to and fro motion of the body about its fixed position. Oscillatory motion is a type of periodic motion. Examples of oscillatory motion are vibrating strings, swinging of the swing etc.

Types of Oscillatory Motion

There are two types of oscillatory motions, namely, Linear Oscillatory Motion and Circular Oscillatory Motion.

In linear motion, the object moves left and right or up and down. Some examples of this type of linear motion are as below:

1.The vibration of strings of the musical instruments,

2.Movement of the fluid in a U-tube column and

3.Floating of ships or big vessels in the sea.

In the circular motion, though the object moves left to right but in circular form. Some examples of this type of motion are as below:

1.The motion of the solid sphere in a half hollow sphere
2.The motion of the pendulum in watch
3.A stringed object suspended on a nail
4.Motion of swing
5.The motion of a wheel

Circular