

# **Physics - Simple Harmonic Motion (SHM)**

**Topics :** <u>Computer engineering</u> Written on <u>March 18, 2024</u>

## 1. Simple Harmonic Motion (SHM):

Simple Harmonic Motion (SHM) is a type of periodic motion characterized by an object oscillating back and forth around an equilibrium position.

#### 2. Key Characteristics:

- **Periodic Motion:** Motion repeats itself at regular intervals.
- **Linear Restoring Force:** Force acting on the object is directly proportional to its displacement from the equilibrium position and always directed towards it.
- **Simple Harmonic Oscillator:** Any system exhibiting SHM, such as a mass-spring system or a pendulum.

## 3. Mathematical Representation:

- Displacement (x) of an object undergoing SHM:  $x(t)=A \cdot sin(\omega t+\phi)$ 
  - x(t): Displacement at time t
  - A: Amplitude (maximum displacement)
  - ω: Angular frequency
  - t: Time
  - φ: Phase angle (initial phase)

## 4. Important Quantities:

- **Amplitude (A):** Maximum displacement from the equilibrium position.
- Frequency (f): Number of oscillations per unit time (measured in hertz, Hz).
- $\circ~$  **Period (T):** Time taken for one complete oscillation (measured in seconds, s).
- Angular Frequency ( $\omega$ ): Rate of change of phase with respect to time.

#### 5. Examples of SHM:

- Oscillation of a mass-spring system.
- Motion of a simple pendulum.
- $\circ\,$  Vibrations of a guitar string.

## 6. Applications:

 $\circ\,$  SHM finds applications in physics and engineering, including oscillating systems design and wave behavior analysis.

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