Physics - Simple Harmonic Motion (SHM)

Topics : Computer engineering
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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).
   - **Period (T):** Time taken for one complete oscillation (measured in seconds, s).
   - **Angular Frequency (ω):** Rate of change of phase with respect to time.

5. **Examples of SHM:**

   - Oscillation of a mass-spring system.
   - Motion of a simple pendulum.
   - Vibrations of a guitar string.

6. **Applications:**

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