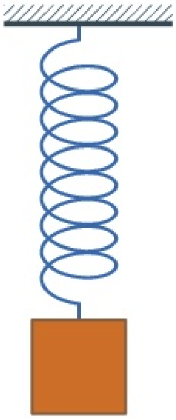
Harmonic Oscillator

Introduction

Harmonic oscillatory movement describes movement in which an object that has been displaced from its point of equilibrium is acted upon by a restoring force directly proportional to the amount of displacement. The classic model of such a movement is a weight attached to a spring, oscillating between the two extremes of maximum compression and maximum extension. In a simple (ideal) system as described, no energy is lost and the weight will oscillate for an infinite amount of time between the two extremes [1]. Based on these principles, the position, velocity, and acceleration of such a weight can be modeled by sinusoidal equations, as demonstrated below [2].

Equations



Simple harmonic oscilator - example

Equations used to model simple harmonic oscillation in the case of a spring include:

- Restoring force: $F = -k \cdot x$

k is the spring constant; x is the displacement from position of equilibrium; F is the restoring force [1]

- Position of the body: $y = A \cdot \sin(\omega \cdot t + \varphi)$

Y is position relative to the point of origin; A is maximum elongation; ω is angular frequency (given by $\omega = 2 \cdot \pi \cdot f = (2 \cdot \pi)/T$); T is the time to make one full oscillation; φ is the phase difference which gives the position of the body at $T = 0$ and its direction [2]

- Maximum velocity: $V_{max} = A \cdot \omega$ [3]
- Instantaneous velocity: $V = V_{max} \cdot \cos(\omega \cdot T)$ [3]

Links

Related Articles

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Bibliography

1. University of Winnipeg. *Simple Harmonic Motion* [online]. ©1997. The last revision 1997-09-10, [cit. 2012-12-10]. <Simple Harmonic Motion (http://theory.uwinnipeg.ca/physics/shm/node2.html)>.
2. Proyecto Newton. MEC. *SIMPLE HARMONIC MOVEMENT* [online]. ©2012. [cit. 2012-12-10]. <Simple Harmonic Movement (http://recursostic.educacion.es/newton/web/materiales_didacticos/shm/aulashm.pdf)>.
3. AMLER, Evžen. *Acoustics* [lecture for subject Biophysics, specialization General Medicine, The 2nd faculty of medicine Charles University in Prague]. Prague. 2012-11-12. .