Spring Pendulum

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Abstract:

A **spring pendulum** is a mechanical system that performs oscillatory and periodic motion due to the combined effect of spring's elasticity and gravitational force. It is also known as an **Elastic pendulum.** This project aims to determine the time period of the pendulum and verify the relationship between time period, mass and spring constant (Hooke's law).

Practical visualization of the spring pendulum is provided through the **Spring pendulum App.**

In the app, spring is attached to a mass and it undergoes oscillatory and periodic motion. Motion is driven by **Hook's law**, so the time period of oscillation is given by,

$$T = 2\pi\sqrt{\frac{m}{k}}$$

where:

- T is the period of the oscillation,
- m is the mass,
- k is the spring constant.

- Other parameters:

PHYSICAL QUANTITY	FORMULA
Elongation	$x(t) = A\cos(\omega t + \phi)$
Velocity	$v(t) = -A\omega\sin(\omega t + \phi)$
Acceleration	$a(t) = -A\omega^2\cos(\omega t + \phi) = -\omega^2 x(t)$
Force	$F_{\text{spring}} = -kx$
Energy	$E = K + U = \frac{1}{2}kA^2$

Keywords: spring pendulum, oscillations, periodic motion, elasticity, force.