Mechanical Vibrations of Spring Systems

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1 Introduction

The goal of this project is to demonstrate the mathematical and visual properties of mechanical vibrations. These vibrations are visualized through a mass-spring system, where a hanging solid has its position, velocity and acceleration determined by a set of environmental variables. Mechanical vibrations are described with a set of differential equations: when solved, we can find the position equation $y(t)$. This solution was used to graph the position of an object using JavaScript in a web browser application, where the use can set the environmental variables.
In this project, we explored four types of equations, each one including different environmental factors:

1. Undamped Free Vibration
2. Damped Free Vibration
3. Undamped Forced Vibration
4. Damped Forced Vibration

The simplest, Undamped Free Vibration, satisfies the homogeneous differential equation $my'' + \omega_0^2 y = 0$. This equation has a simple solution, solely depending upon the values of the spring constant k, the mass of the weight m, initial velocity v_0, and intial position y_0, and where $\omega_0^2 = k/m$
Damped Free Vibration includes a damping term upon the equation

2