

Spring Mastery Lab

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1 Synopsis

Springs are great, simple harmonic oscillators. They can either be compressed or stretched, which allows them to "spring" out or pull back in. This creates the back-and-forth movement known as "oscillation," which is the process of restoring the spring back to equilibrium. The focus of this lab is to analyze the spring force and the *spring constant* of a spring under tension of a block of different masses. We took the measurements of the spring in two instances, which were the spring in a *dead hang* and *simple harmonic motion* with different masses attached. Below is a breakdown of the materials needed, procedure, and calculated analysis of the lab.

2 Bill of Materials

- **Stable laboratory table**
- **Computer** – laptop or desktop with analysis software
- **I/O interface box (DAQ)** – analog input channels to connect multiple sensory peripherals
- **Meter stick** – 1 m length, with centimeter notches
- **Support rods & mounting clamps** – steel lab rods with base plates and adjustable right-angle clamps
- **Spring** – helical steel spring, we'll be finding the spring constant of this
- **Force sensor** – bidirectional
- **Mass hanger** – 50 g (or similar) for stacking slotted masses
- **Set of blocks with different masses** – assorted regular blocks

3 Procedure

3.1 Overview

The experiment aims to determine any distinguishable difference in the spring constant coefficient ' k ' between a spring in a dead hang, acting as a tension string, and being displaced a vertical distance, and a spring oscillating in simple harmonic motion, also in the vertical direction.

3.2 Environment Set Up

We set up our environment by clamping the rods to the table, connecting the I/O interface box to the computer, and making sure that the force sensor was properly connected to the I/O box.



(Here's how the force sensor should be hanging from the rods clamped to the table.)

After the setup is complete, we place our spring in position and find the point of equilibrium without any additional mass by measuring the length of the spring. This will help us find the total displacement of the spring later on. The measurement of our spring was 5.9 centimeters.

3.3 Spring Force and Displacement (dead hang)