Formal Lab
Hooke's Law

Physics 4A

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December 2022

Contents

Chapter 1

Purpose

To verify Hooke's law and calculate the spring constant.

Chapter 2

Theory

The force due to a spring stretched (or compressed) a distance Δx from the equilibrium position is given by the following expression:

$$\vec{F_s} = -k\Delta\vec{x}$$

where s = (force exerted by) spring
k = the spring constant (in N/m)

Chapter 3

Procedure

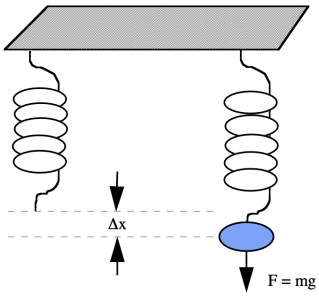
3.1 Procedure Equipment

The necessary equipment for this lab is as follow:

- Meter Stick
- Spring
- Weights
- Clamp
- Rods
- Suspension Clamp

3.2 Position Measurements

- The equipment is to be set up as shown below:



- Hang a weight from the end of the spring. For the lng spring use weights ranging from 0.5 kg to 2 kg and for the short spring use weights ranging from 2 kg to 4 kg. Make sure you do not select too heavy of a weight or the spring will permanently stretch.
- Measure the distance (Δx) the spring is stretched from its equilibrium position ($x = 0$).
- Repeat the above measurement for at least 7 more weights.

Chapter 4

Data

Data Collected					
Configuration of Mass	Mass is kg	x_i in meters	x_f in meters	Δx in meters	Experimental F in Nm
1	1.036	0.782	0.784	0.002	10.153
2	2.033	0.782	0.803	0.021	19.923
3	4.033	0.782	0.876	0.094	39.523
4	6.032	0.782	0.951	0.169	59.114
5	1.528	0.782	0.786	0.004	14.974
6	3.527	0.782	0.860	0.078	34.565
7	5.526	0.782	0.933	0.151	54.155
8	2.530	0.782	0.822	0.040	24.794

Chapter 5

Analysis

1. For each weight, calculate the force ($F = mg, g = 9.8\frac{m}{s^2}$) exerted on the spring by the Earth's gravitational force.

Force Calculated for each Configuration of Mass	
Configuration of Mass	Experimental F in Nm
1	10.153
2	19.923
3	39.523
4	59.114
5	14.974
6	34.565
7	54.155
8	24.794

2. Plot the force F versus the distance the spring is stretched (Δx). Based on Hooke's law your graph should follow a straight line.

3. Draw a best-fit line between the points and calculate the slope of the line. The slope of the line will correspond to the spring constant k.

4. Compare your experimental value(s) of k with the actual value(s) of k for your spring. (Long Spring k = 23 N/m & Short Spring k = 98 N/m)

5. Do your results agree with Hooke's law (i.e. is F directly proportional to x)?

Chapter 6

Error Analysis and Procedural Errors

Chapter 7

Conclusion

Chapter 8

Suggestions for Improvement