PHYS 223 Notes

Professor: Dr. Tracy Furratani   —   Quarter: Spring 2025

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3.1   Objectives

- Determine the connection between the mass on a spring and the period of an ideal spring

- Determine the connection between the amplitude of oscillation and the period of an ideal spring

- Determine the type of damping occuring in a spring system with air resistance

- Determine the angular frequency of oscillation of these spring system

- Performing data analysis on these measurements including the determination of uncertianties

- Propogating uncertianty in a simple ratio

3.2   Equipment

- Metal hanging masses set

- Short spring

- Meter stick

- Paper plate

- Masking tape

- Ringstand, long rod, clamp

- Motion Sensor

- Laptop w/ Logger Pro

3.3   Prelab Questions

- 1. Find an equation

$$F = k_{Hooke}x + b \tag{1}$$

  by finding 10 points. Perform linear regression, ideally your r^2 value should be close to 1 and b should be close to 0.

- Use the equation:

$$T^2 = \frac{4\pi^2(m+M)}{k} \tag{2}$$

$as : T^2 = y, \frac{4\pi^2}{k} = slope, M = x$

3.4 Procedure

1. Measure the spring constant k_{Hooke} of the spring as a function of the mass's displacement.

2.

3.5 Lab Members

Kris Birch, Arin Kharkar, Emmett Stevens, Joshua Wagonblast, Emma Sweden

3.6 Data Table 1 (Static Hanging Mass)

Mass (kg)	Uncertianty (kg)	Displacement (m)	Uncertianty (m)
0.0049611	1e-6	0.218	0.001
0.0059588	1e-6	0.251	0.001
0.0069575	1e-6	0.288	0.001
0.0079536	1e-6	0.315	0.001
0.0089685	1e-6	0.355	0.001
0.0099364	1e-6	0.387	0.001
0.0109410	1e-6	0.421	0.001
0.0119545	1e-6	0.454	0.001
0.0129478	1e-6	0.489	0.001
0.0139463	1e-6	0.521	0.001
0.0149364	1e-6	0.554	0.001

3.7 Data Table 2 (Simple Harmonic Motion)

Mass (kg)	Displacement (m)	Uncertianty (m)	Angular Frequency (rad/s)	Uncertianty (rad/s)	Period (s)
0.0049611	0.01542	0.0002994	7.516	0.006733	0.835974628
0.0059588	0.01572	0.0001691	6.921	0.003732	0.907843564
0.0069575	0.0172	0.00022	6.140	0.004167	1.023320083
0.0079536	0.01929	0.0001777	6.017	0.003193	1.044238874
0.0089685	0.01727	0.0002292	5.715	0.004703	1.099420001
0.0099364	0.01946	0.0001423	5.408	0.002495	1.161831603
0.0109410	0.02338	0.0003181	5.168	0.004843	1.215786631
0.0119545	0.02184	8.056e-05	4.959	0.001296	1.26702668
0.0129478	0.02655	0.001473	4.772	0.001296	1.316677558
0.0139463	0.02136	0.0003114	4.588	0.005038	1.369482412
0.0149364	0.01832	0.0002812	4.409	0.005356	1.425081721

3.8   Data Table 3 (Simple Harmonic Motion w/ Varying Amplitude)

Mass (kg)	Displacement (m)	Uncertianty (m)	Angular Frequency (rad/s)	Uncertianty (rad/s)	Period (s)
0.0049611	0.01929	7.1525e-05	7.535	0.001286	0.833866663
0.0049611	0.01572	0.0001691	7.537	0.0007757	0.83364539
0.0049611	0.09124	0.008569	7.536	0.03259	0.833756012

3.9   GUM uncertianty

$$k_{Hooke} = \frac{F}{x} = \frac{mg}{x} \tag{3}$$