Lab Report Outline—the Bones of the Story

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TITLE:

Dynamic Stretch Test

ABSTRACT:

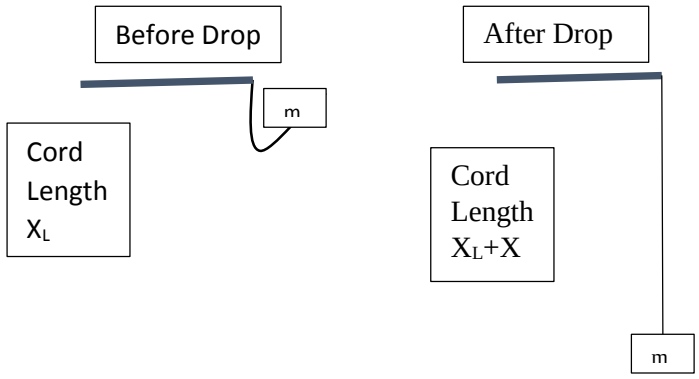
In this experiment, a bungee cord was treated as a series of springs, with the behavior of a spring. From our Bungee 1 experiment we had calculated a coefficient that related un-stretched length to the k constant, X_L=.8606/k. This was done by dropping metal weights from a hook tied to the end of a given length of cord and measuring the displacement of the cord for each amount of added mass. The displacement was then graphed versus the initial un-stretched length of the cord. The values of the stretched length determined were graphed versus the initial length of cord. This was repeated 3 times at various weights near the range of potential masses of which the final test will be (100-170g). This experiment showed that the stretch of the cord when dropped is directly proportional to the un-stretched length.

INTRODUCTION:

- The major experiment in Physics 113 is designing a bungee jump for a raw egg. In order to succeed with this project, it essential to know how far the cord will stretch when related to the un-stretched length of the cord.
- Hooke's law states that F_{spring} = -kx. F_{spring} is the x-component of the force exerted by the spring on an attached mass, k is the spring constant, which depends only on the spring used, and x is the x coordinate of the mass attached to the spring.
- The elastic bungee cord is assumed by our formula X_L=.8606/k to act as a spring.
- We expect that the length of the stretched cord will change proportionally to the length of the un-stretched cord.

METHODS:

Figure 1: Experiment Setup Diagram



Metal weights were dropped from an un-stretched length of bungee cord (X_L), exerting a force on the cord that caused it to stretch. The displacement of the cord (stretched length) could be recorded in slow motion and graphed un-stretched length of the cord.

- Metal support is attached to the table
- Cord was looped to attach to metal support and metal mass
- Measuring tape was hung behind cord when dropped to measure maximum stretched distance
- Drop was recorded via slow motion camera to record maximum stretch before spring brought it back up
- X_L was subtracted from measuring tape measurement to calculate X as that $X_L + X$ = total drop distance
- Masses on cord were 100g, 125g, and 150g

Materials needed

Bungee cord

Metal support

Measuring tape

Various hanging masses

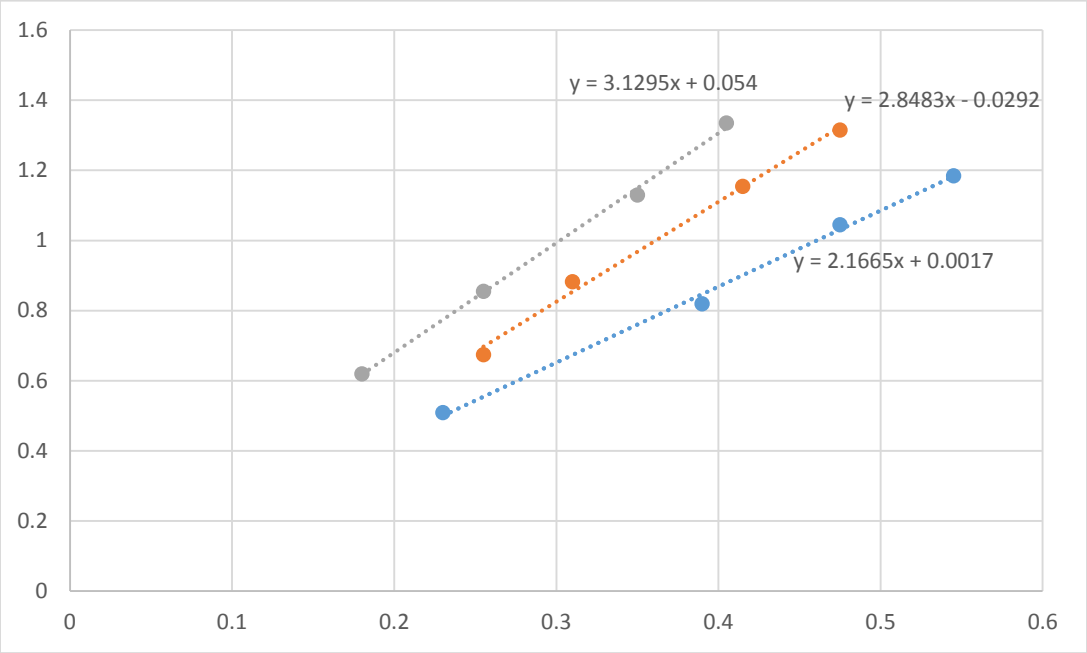
RESULTS:

The stretched displacement by each amount of added mass on each initial length of bungee cord was recorded and graphed.

Figure 2: Data Results

m = .100kg (±0.001kg)			m = .125kg (±0.001kg)			m = .150kg (±0.001kg)		
un-stretched length of cord X_L (m)	Stretched length of cord X (m)	K constant (N/m)	un-stretched length of cord X_L (m)	Stretched length of cord X (m)	K constant (N/m)	un-stretched length of cord X_L (m)	Stretched length of cord X (m)	K constant (N/m)
0.39	1.21	0.82	0.475	1.79	1.315	0.255	1.11	0.855
0.545	1.73	1.185	0.415	1.57	1.155	0.35	1.48	1.13
0.23	0.74	0.51	0.31	1.1925	0.8825	0.405	1.74	1.335
0.475	1.52	1.045	0.255	0.93	0.675	0.18	0.8	0.62

Figure 3: Graph of Data



Formulas:

Mass 100g: $X \approx 2.1704X_L$

Mass 125g: $X \approx 2.7723X_L$

Mass 150g: $X \approx 3.2968X_L$

Use *Excel* regression analysis on any graph that has a **linear** fit only (see EG), to obtain:

m = 100g

uncertainty for slope= 0.09598 % uncert= 3%

uncertainty for y-intercept= 0.04093

m = 125g

uncertainty for slope= 0.15322 % uncert= 4%

uncertainty for y-intercept= 0.05727

m = 150g

uncertainty for slope= 0.09786 % uncert= 2%

uncertainty for y-intercept= 0.03032

Primarily the uncertainty came from slight discrepancies in measurement and potential differences in drop height. Also it was clear through the experiment that dropping the weight at the wrong angle could affect the results, and those data were reproduced to minimize error.

DISCUSSION:

The main uncertainty in this lab came from the measurements of un-stretched and maximally stretched lengths of the cord. Also uncertainty came from slight discrepancies in differences in drop height. Also it was clear through the experiment that dropping the weight at the wrong angle could affect the results, and those data were reproduced to minimize error.

The value of X did change in linear proportion to X_L as we believed it would

CONCLUSION:

This experiment showed that the value of X will change with direct proportion to X_L when differentiated by mass being hung. While our initial formula calculated previously, $X_L = .8606/k$, will likely the most useful in determining our final equation and projecting the most correct values for our experiment, this experiment could be vital in confirmation of our results as we have determined a general formula for masses near to that of what our actual mass will be.

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED ANY UNACKNOWLEDGED AID ON THIS ASSIGNMENT.

Giovanni Esposito