Lab Report Outline—the Bones of the Story

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TITLE: Bungee I: Hooke's Law and Bungee Cord Characteristics

ABSTRACT:

For this experiment, we were testing to find the "k" constant in Hooke's Law (F=-kx). We used a ring stand and hung our bungee cord on that and attached different weights to it. We measured the different lengths that the cord stretched. We then multiplied the mass by gravity (9.81m/s^2) to find the force. We graphed the force vs. the amount that the cord stretched to determine the relationship between the two. The relationship between the two values gave the equation F=2.49x +0.423. The "k" value given by the equation is 2.49. By determining the "k" constant, we can now further experiment with the cord and its behavior.

INTRODUCTION*: Gives the purpose and conceptual or theoretical context.*

Purpose or question:
Determine the "k" value of Hooke's Law and whether the bungee is an ideal spring or not.
Relevant equation(s), identifying variables:
Hooke's Law: F=-kx
F (N) is the force of the system, k is the spring constant, and x (m) is the distance that the spring stretches.

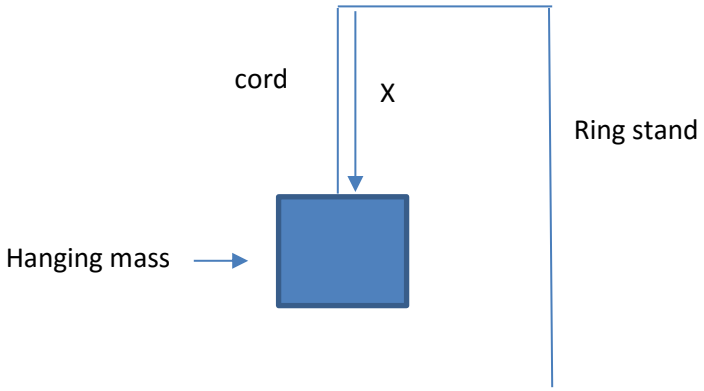
We compared our cord to an ideal spring to determine if there was a constant value for "k" that we could use in the bungee experiment. An ideal spring is one that feels no internal force.

Hypothesis:
If we hang various masses from a bungee cord and measure the distance that the cord is stretched, then the slope of the force vs. distance values will give the "k" constant from Hooke's law.

METHODS:

We hung our cord on a ring stand using loops that were tied in the cord about one meter apart. We then used a hook to attach various masses to the cord. We measured the distance in meters that the cord stretched and calculated the force by multiplying mass by gravity (9.81). The goal of these measurements was to determine the slope of the force plotted vs. the amount that the cord stretched. The slope of this comparison gives the "k" value of Hooke's law.

Measuring the change of x varied by weight



Length of cord=X

Procedure:

1. Tie two loops in the bungee cord about one meter apart. One loop should be at the end of the cord while the second should be one meter down the cord.
2. Hang the second loop (the one further down the cord) on the ring stand.
3. Measure the initial value of the length of the cord as the distance between the two knots is probably not exactly one meter.
4. Place the 50g hanger on the cord and measure the distance in meters that the cord stretches from knot to knot.
5. Continue to add mass in 25g increments until at 275g.
6. Calculate the amount of force at each mass by multiplying the mass by the gravitational force (9.81N).

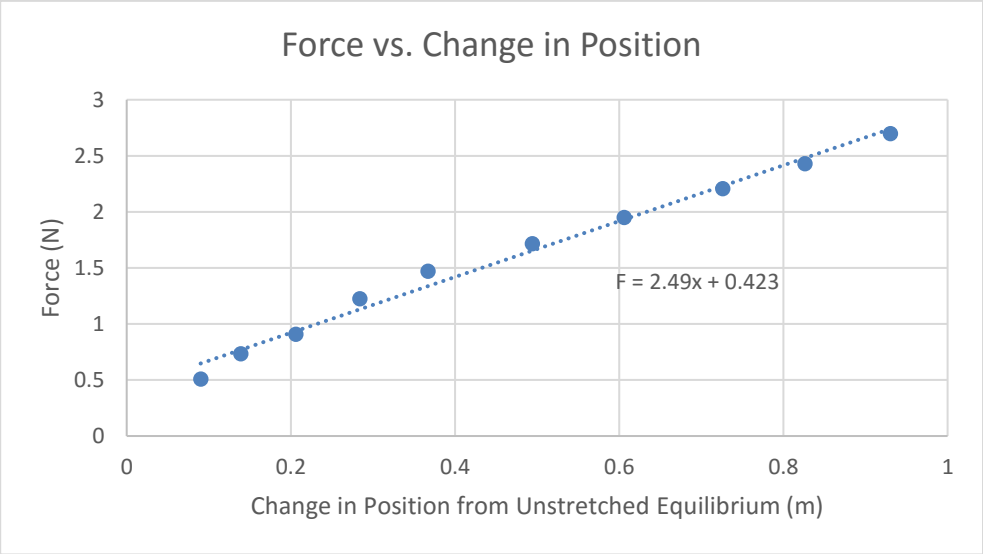
RESULTS:

We used different weights being hung from our cord to measure the distance the cord stretched and recorded that. We also calculated the downward force that the cord was feeling by multiplying the mass of the weights by the force of gravity. The relationship between these two values is the "k" constant that we are trying to determine.

Table:

Mass (kg) (±.000002)	Distance from unstretched equilibrium (m) (±.0005)	Force (N)
0	0	0
.05	0.09	0.51
.075	0.14	0.74
.1	0.21	0.91
.125	0.28	1.23
.15	0.37	1.47
.175	0.49	1.72
.2	0.61	1.95
.225	0.73	2.21
.25	0.83	2.43
.275	0.93	2.70

Graph:



Equation of the graph: F=2.49x+0.423
uncertainty for slope=.094 % uncert=3.78%

Values Obtained Through Analysis:

value obtained = Slope of the line="k" value in Hooke's Law

uncertainty of experimental value(s) =.094 % uncert=3.78%

Regression analysis was used to determine uncertainty.

The ratio between force and change in position in Hooke's Law is the value "k." We determined the "k" value to be 2.49.

DISCUSSION:

Our results for this experiment are acceptable as there is an extremely low uncertainty value. To test the error in our experiment, I would measure the same weight many times throughout the lab to see how the cord would have changed as we weighed many different things on it.

Sources of uncertainty:

- The tape measure not starting at the exact same place as the knot
- Cord stretching throughout the lab trials
- Small distance between cord and tape measure

By plotting the results on a graph, we determined that the "k" constant was 2.49.

CONCLUSION:

The experiment showed that by plotting the force vs. the displacement of the cord, we get a linear function similar to Hooke's law. Because the equation that we determined was similar to Hooke's law, we were able to determine the "k" constant of the cord. By determining the "k" constant, we can now begin to understand how the cord behaves when used as a bungee.

Report Outlines are *individual assignments*. Cite any work not your own, acknowledge any aid, and pledge the report:

On my honor, I have neither given nor received any unacknowledged aid on this assignment.

Pledged: Conlan O'Hara