# Confirming Hooke’s law and finding the spring constant.

The aim of the experiment is to; verify Hooke’s law, and to determine the spring constant (k value) for your spring.

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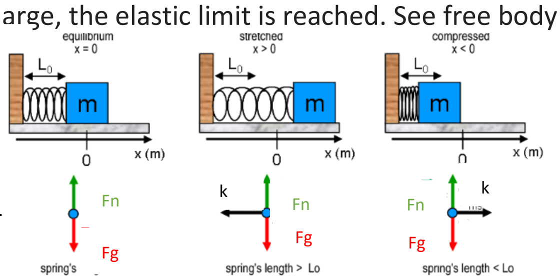
## Background.

Hooke's law is the law of elasticity discovered by the English scientist Robert Hooke in 1660, which states that for relatively small deformations of an object, the displacement or size of the deformation is directly proportional to the deforming force or load.

Hooke's law is remarkably general. Almost any object that can be distorted pushes or pulls with a restoring force proportional to the displacement from equilibrium towards the equilibrium position, for very small displacements. However, when the displacements become large, the elastic limit is reached. See free body diagram.

Fig 1




Constants

- Fg is the force of gravity.
- Fn is the normal force.
- k is the spring constant.

Hooke's law states that the stretch or compression of the spring has a linier relationship to the force or load applied to it.

Springs have their own natural "spring constants" or k value that define how stiff they are. That means that if the spring pulls back with an equal and opposite force of -0.2942N. the displacement is 40mm = 0.040m. k = -12.2575 N/m. the spring constant of this spring is 12.2575N/M.

Hooke's law doesn't apply only to conventional springs it also applies to almost all objects that can deform until the objects point of elasticity is reached.

**the following experiment demonstrates Hooke's law**

## Materials;

- Spring,
- ruler,
- 5x50g weights,
- spring hanging setup.

## Method

the spring hanger is placed on a level surface, the ruler is setup behind where the spring is hung, the spring gets hung on the hook, the weights are attached to the bottom of the spring and the stretch is recorded. This process is repeated four times.

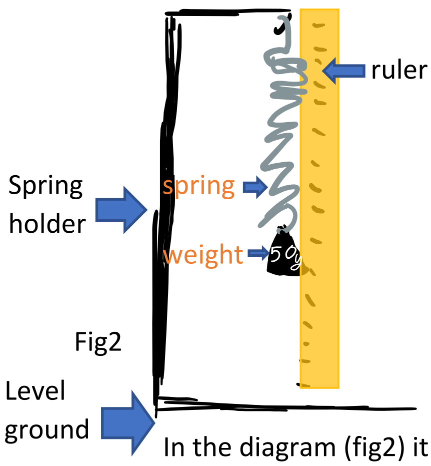



Fig2

In the diagram (fig2) it shows the setup of the experiment.

# Results.

| Mass(g) | Displacement(mm) | | | |
|---|---|---|---|---|
| | First | second | third | fourth |
| 50 | 40 | 42 | 39 | 40 |
| 100 | 80 | 82 | 78 | 80 |
| 150 | 110 | 109 | 111 | 110 |
| 200 | 142 | 143 | 142 | 142 |
| 250 | 181 | 180 | 182 | 181 |

fig 3

in the above table (fig 3) it shows the raw data od mass to displacement.

# Discussion

As can be seen by the experimental data input in the diagram below that the line follows a consistent route through the data points on the scatter graph. And although the data isn't always consistent this could be because the spring is old or damaged and/or there may have been inaccuracies in the measurements, however the line fits the data points very well due to there being no significant outliers. The data points also have a relatively consistent k value of k = 12.25 N/m(I have rounded the spring constant to two decimal places due to not knowing the measuring instrument and therefore not knowing the margin of error ). this value was found by using F = kx.

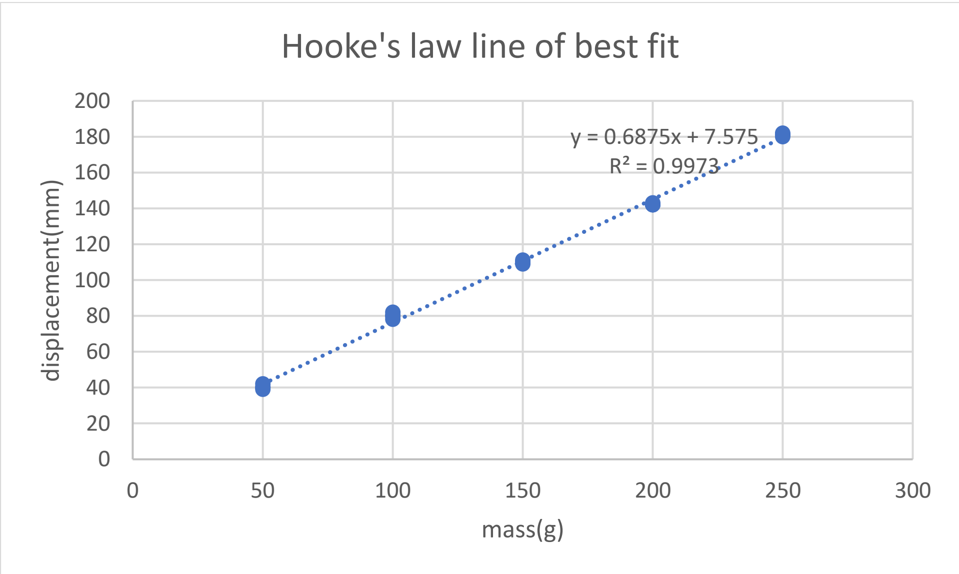



fig 4

In conclusion; the spring constant was found by using the formula F = kx, this experiment was also able to verify Hooke's law as observable in *fig 3*, and so despite Hooke's law being 360 years old 27 years older than Isaac Newton's law of universal gravity it still holds up.

The data provided was not collected by Kip Minifie.

Fig1 source https://scripts.mit.edu/~srayyan/PERwiki/index.php?title=Module_2_--_Hooke%27s_Law_for_Elastic_Restoring_Force