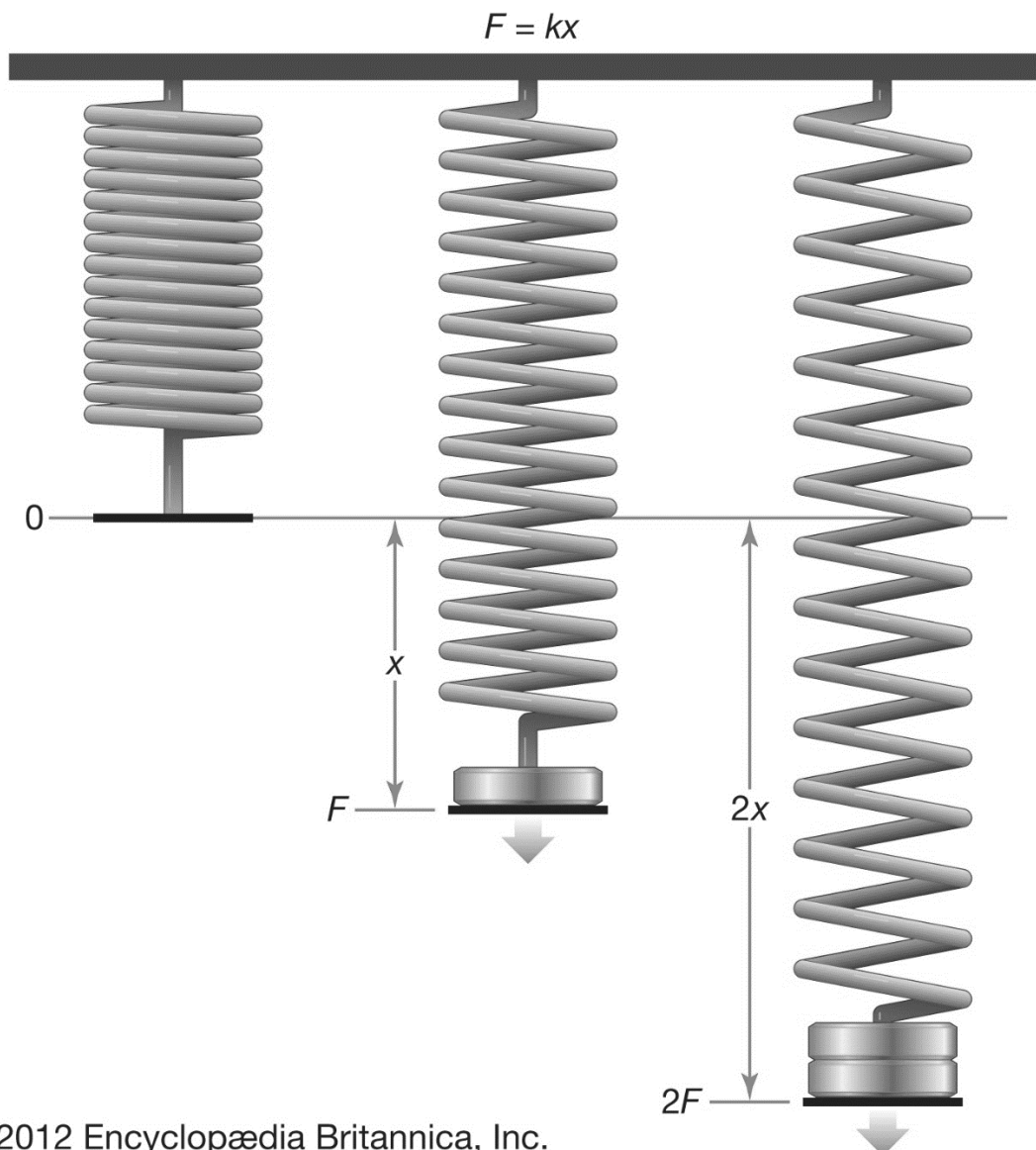


Verification of Hooke's law

Introduction

Hooke's law, according to Encyclopædia Britannica[®], states that for relatively small deformations of an object, the displacement or size of the deformation (x) is directly proportional to the deforming force or load (F), as shown in Figure 1.



© 2012 Encyclopædia Britannica, Inc.

Figure 1: illustration of Hooke's Law (after Encyclopædia Britannica[®])

Purpose

To verify Hooke's Law.

Apparatus

1. Spiral spring,
2. Set of lab weights of various masses,
3. Meter scale,
4. Hanger, and
5. Stand and clamp.

Theory

The linear relationship between the applied force, F , and the elongation of the spring, x , can be given as:

$$F = kx \quad \text{Equation 1}$$

where k is the spring constant.

Equation 1 can be graphically represented as a straight line and it is illustrated in Figure 2.

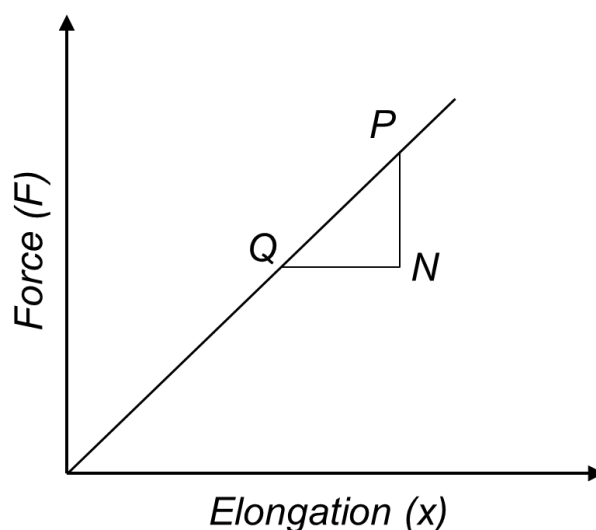


Figure 2: plot of the force F vs. elongation x

Basically, the slope of the straight line shown in Figure 2 is the spring constant (refer to Equation 1). It can simply be calculated from the vertices of two convenient and well separated points on the line (say P and Q) as:

$$\text{slope} = k = \frac{\overline{PN}}{\overline{QN}} \quad \text{Equation 2}$$

Procedure

1. Suspend the spring vertically,
2. Clamp the scale vertically, close to the spring,
3. Attach the hanger to the lower end of the hanging spring,
4. Record the position of the lower end of the mass hanger,
5. Hang a weight from the spring using the hanger and wait for the spring to come to rest,
6. Record the final position of the lower end of mass hanger,
7. Repeat 5 and 6 above until at least 7 recordings are made,
8. Remove a weight from the hanger and wait for the spring to come to rest,
9. Record the final position of the lower end of mass hanger,
10. Repeat 8 and 9 above until at least 7 recordings are made, i.e. reverse 5 and 6 above.

Questions to guide discussions

1. Why Hooke's law is important in civil engineering?
2. What other term is used for spring constant?