EXPERIMENT 4
HOOKE'S LAW

1. Objectives

The main objective of this experiment is to show Hooke's Law of spring, calculate the total energy absorbing in the spring.

2. Equipment

Tripod Base
Barrel Base
Support Rod, square, l=1000mm
Right Angle Clamp
Cursor, 1 pair
Weight Holder f. Slotted Weights
Slotted Weight, 10g, black
Slotted Weight, 10g, silver bronze
Slotted Weight, 50g, black
Slotted Weight, 50g, silver bronze
Helical Spring 3 N/m
Helical Spring 20 N/m
Silk Thread, 200m
Meter Scale demo l=1000mm
Holding Pin
Square section rubber strip, l 10m

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Figure 4.1 Experimental set up

3. Theory

Measuring the stretching produced by different loads, added to the spring, tests the elasticity of a spring. When a spring is stretched by an applied force, a restoring force is produced. Due to the restoring force, simple harmonic motion is caused in a straight line in which the acceleration and the restoring force are directly proportional to the displacement of the vibrating load from the equilibrium position. The relation between the force F and displacement x is $F = -kx$. The force is opposite in direction to the displacement. The constant k is known as the force constant of the spring. This is the force, expressed in Newton, which will produce an elongation of one meter in the spring. The equation of energy of the spring is shown below.

$$dW = Fdx \tag{4.1}$$

And if we integrate the Eq. 4.1 the equation of the potential energy of the spring is shown below

$$W = \Delta PE = -\frac{1}{2}k(x_1^2 - x_0^2) \tag{4.2}$$

4. Experimental Procedure and Calculations

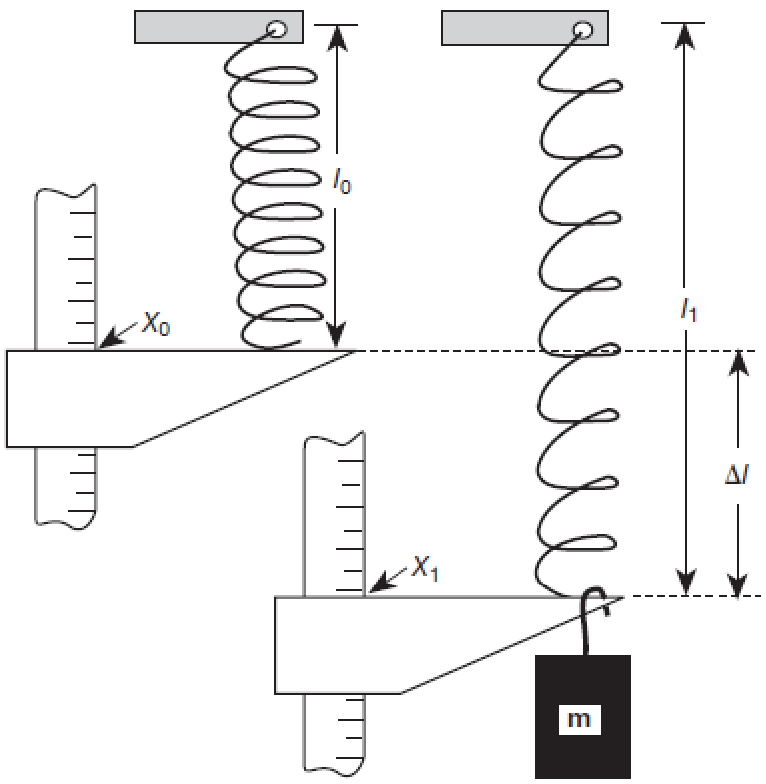

Figure 4.2 By adding the mass, the spring reaction

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1. Set up the spring as figure 4.2

2.Measure the length of each spring

L_{thin} =…………… L_{thick} =………………

3. Hang a m_1 on first spring and record the elongation.

4. Repeat the step 3 for different masses.(m_2, m_3)

5. Repeat the steps 4 and 5 for second spring.

6. Calculate the applied force for different masses and spring.

7. Calculate k using ${}^{F_i}/_{\Delta L_i}$ and k_{avg} for each spring.

For thin spring: $k_{avg} =$ … … ...

For thick spring: $k_{avg} =$ … … ..

Spring	Mass(kg)	Length of the spring(m)	Elongation (m)	Force (m * g)	k = ${}^{F_i}/_{\Delta L_i}$ (kg*g / m)	k $_{av}$
Thin	0,12					
Thin	0,17					
Thin	0,22					
Thick	0,17					
Thick	0.27					
Thick	0.32					

8. Connect the thin and thick springs in series.

9. Measure the extension ΔL =………….. caused by a 0.12 kg mass compute the equivalent value of k_{eq} from $k_{eq} = \frac{F}{\Delta L}$

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By means of the formula $\frac{1}{k_{eq}} = \frac{1}{k_1} + \frac{1}{k_2}$ or $k_{eq} = \frac{k_1\,k_2}{k_1+k_2}$

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10. Connect the first and second springs in paralel.

Measure the extension ΔL =………….. caused by a 0.17 kg mass compute the equivalent value of k_{eq} from $k_{eq} = \frac{F}{\Delta L}$

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By means of the formula $k_{eq} = k_1 + k_2$

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3. **Results and Discussion:** *Discuss the results*