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How is mechanical energy conserve in an oscillating spring-mass system?

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Table of Content

Aim	2
Apparatus	2
Method	3
Data	4
Result	6
Bibliography	7

Aim:

The objective of this experiment is to verify the conservation of mechanical energy in an oscillating spring-mass system.

Apparatus:

The material that I need for this experiment shows as follow.

Material: spring mass system (which include different kinds of mass, spring and sticks), sensor.

Theory

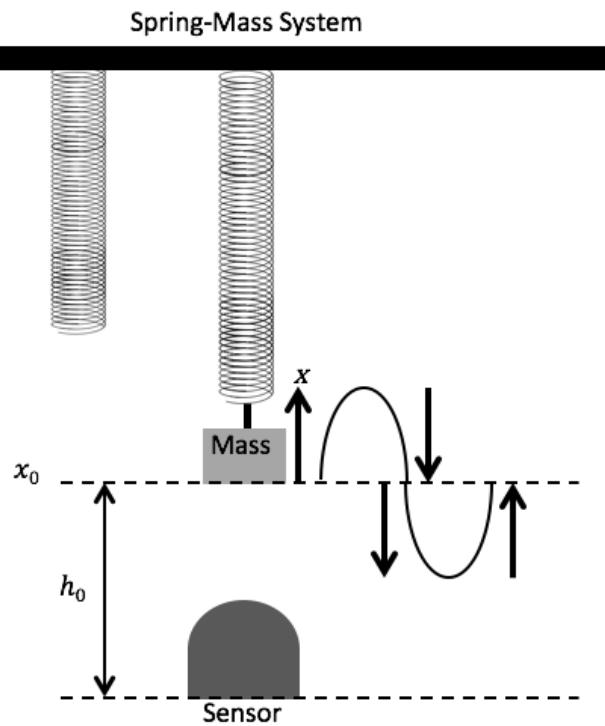
$$E_m = \frac{1}{2}mv^2 + \frac{1}{2}k(x_0 - x)^2 + mgx$$

$$\Rightarrow E_m = \frac{1}{2}mv^2 + \frac{1}{2}k(h - h_0)^2 + \frac{(mg)^2}{2k}$$

$$h_0 = \text{Constant} > 50\text{cm}$$

$$h = \text{Distance measure by Sensor}$$

$$\Rightarrow x = h - h_0$$



Method:

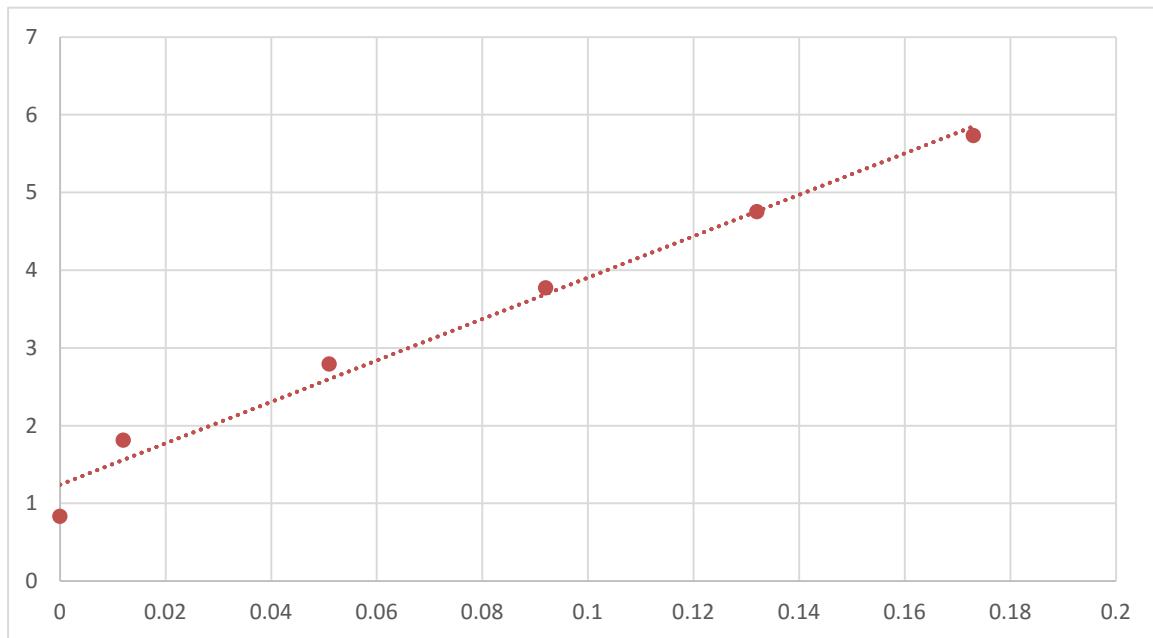
1. Measure the mass of the weight hanger, and record its value. Hang the weight hanger to the spring.
2. Add some mass to the weight hanger to expand the spring.
3. Then get the data from the sensor that connects the computer.
4. To measure the force of different mass that hang to the weight hanger.

Data:

Part 1 – Measure the Spring Constant (k)

Mass of weight hanger = 0.085 kg

Weight (N)	0.833	1.813	2.793	3.773	4.753	5.733
Position (h) (m)	0.641	0.629	0.590	0.549	0.509	0.468
Displacement (m)	0	0.012	0.051	0.092	0.132	0.173



$$y = 26.629x + 1.2414$$

$$k = 26.629 \text{ (N/m)}$$

From the weight-displacement graph we can get the spring constant is 26.629 (N/m)

Part 2 – Verification of conservation of mechanical energy (ME)

Mass of the hanger and weight is 0.335 kg.

Equilibrium position (h_0) is 0.565 m.

$$\text{Displacement} = x = h - h_0$$

$$\text{Velocity} = v$$

$$KE = E_k = \frac{1}{2}mv^2$$

$$PE = E_p = \frac{1}{2}kx^2 + \frac{(mg)^2}{2k}$$

$$ME = KE + PE$$

Point #	Displacement (m)	Velocity (m/s)	KE (J)	PE (J)	ME (J)
1	0.051	-0.017	0.0000484075	0.239306982	0.23936
2	0	-0.405	0.02747419	0.205143627	0.23262
3	-0.046	-0.058	0.00056347	0.232936652	0.2335

ME = 0.23 at each point

Result:

In this lab, I examined the conservation of the mechanical energy using an oscillating spring-mass system. While applying the experiment I did verify the conservation process in the three points precisely in Part 2 and I calculated the mechanical energy by using the data that I collected by the sensor.

Finally, I found out that the mechanical energy will always remain the same in different position point which I can conclude that the mechanical energy will conserve in an oscillating spring-mass system.

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