Experiment 2: Determination of the Spring Constant (Hooke’s Law)

Purpose

This experiment is performed to determine the spring constant with mass-spring system.

References


Safety First

Do not overload the spring. This causes deformation.

Equipments

1. Spring with hook
2. Hanger
3. Rod
4. Ruler
5. Adjustable slotted masses

Pre-Lab Questions

1. What differs one spring from another?
2. Does a spring produce the same amount of force when it is compressed or decompressed for equal distances?

Introduction and Theory

Hooke's Law states that the restoring force of a spring is directly proportional to a small displacement in the spring. In equation form, we write

\[ F = -kx \]

where \( x \) is the amount of the displacement. The \( k \) is proportionality constant (spring constant) and it has a specific value for each spring.

Experimental Procedure

The equilibrium can be expressed as \( F = kx \) where \( F = W \), where \( W \) is the weight of the added mass. Weight is mass times the acceleration of gravity or \( W = mg \) where \( g \) is about 9.81 m/s\(^2\). Using this relationship weights are computed for the masses in the table above.
Data Collection and Calculations

<table>
<thead>
<tr>
<th>m (kg)</th>
<th>F (N)</th>
<th>X (mm)</th>
<th>X (m)</th>
<th>k (N/m)</th>
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Then determine \( k_{\text{AVERAGE}} \).

From the above data, the below graph is plotted and determine the k value from it. Compare this value with that obtained from the table.

Your Conclusion

\[
k = \frac{98000 \text{ dynes}}{4 \text{ cm}} = 24500 \text{ dynes/cm}.\]