

(PM-1-7) Young's Modulus for a Metallic Rod

Aim of experiment

Determination of Young's modulus for a metallic rod.

Apparatus

A Metal Bar Supported on Two Knife Edges, Strain Gauge, a Set of Loads, Scale Bar Fixed at the Middle of the Rod.

Theory of experiment

When a load of mass m is hung in the middle of a metal rod of length L , width b and thickness d , the middle part of the rod will strain in the down vertical direction, say -y- direction.



Figure 1. Set up of the experiment

The strain, y is dependent on the material and its shape according to the following relation:

$$y = \frac{mg}{4} \frac{L^3}{Y b d^3} = \frac{m}{Y} \frac{gL^3}{4 b d^3}$$

where Y is Young's modulus of the material. It is a material constant, which does not depend on shape.

The relation between m and y is a straight line passing through the origin, with a *slope* = $\frac{g}{4} \frac{L^3}{y_h d^3}$

Since g , L , b , and d can be measured, Y can be calculated.

Procedures

1. Measure the length L , the width b , and thickness d of the rod
2. Fix the scale pan at the mid point from the rod and find the zero reading of the gauge.
3. Measure the bent distance, y_o for different masses, m .
4. Repeat the above step three times and draw the relation between m and y_{av}

Results

Rod length L =m

Rod thickness $d = \dots\dots\dots m$

Rod width b =m

[illegible]

Slope of the straight line =kg/m
Young's modulus =N/m²