

## Exercise 105: YOUNG'S MODULUS

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Keywords: Young's modulus; micrometer; linear regression.

The exercise aims at determining Young's modulus of solid rods.

### Measurements:

1. Determine width ( $b$ ) and height ( $h$ ) of the rod (do the measurement at least three times).
2. Determine systematic error of the measurements.
3. Measure the distance  $l$  between the rod's supports.
4. Assume the mass of the weights  $m=50\text{ g}$  with the systematic error of  $1\text{ g}$ .
5. Align the rod on the supports so that the sensor points at its center.
6. Turn on the sensor and reset it to zero.
7. Increase the weight of the rod by adding weights. Each time measure the rod's deflection  $s$  and its systematic error.
8. Repeat the measurements while decreasing weight.
9. Repeat the experiment for the remaining rods.

### Report:

1. Calculate the force acting on the rod.
2. For each rod, plot the deflection as a function of the force:  $s=f(F)$ .
3. Determine the slope coefficients (linear regression).
4. Calculate the Young modulus  $E$  from the relation:  $a=\frac{l^3}{4Ebh^3}$ .
5. Summarise the results. Try to find the corresponding values in the literature.