

**ME 391: Measurements and Instrumentation Laboratory**  
**Experiment Title: SM – Strain Measurement**

**1. Purpose**

The student will learn the basic operating principles of strain gauges and the use of the Wheatstone bridge for accurate strain measurement. The experiment uses a cantilever beam (with gauges already attached) and the student will measure and calculate the axial and transverse strains as well as the deflection in the beam. Young's modulus and Poisson's ratio for the beam material will be calculated using experimental data. The student will also gain experience in collecting experimental data via a USB interface.

**2. Learning Objectives**

- a. Become familiar with the operation of resistive strain gauges.
- b. Understand the use of the Wheatstone bridge.
- c. Measure and calculate the surface strains and deflection of a cantilever beam, given the dimensions and material of the cantilever and the location of the strain gauges.
- d. Connect a strain gauge readout box for quarter-bridge and half-bridge configurations.
- e. Calculate Young's Modulus and Poisson's ratio from experimental data.
- f. Use an oscilloscope for dynamic strain measurements.
- g. Measure resonant frequency and compare to theoretical results.

**3. References**

Beckwith, *Mechanical Measurements*, 6th ed., Pearson/Prentice Hall, 2007  
*Student Manual for Strain Technology*, Bulletin 309D, Vishay Measurement Group, Inc.

**4. Equipment**

|                                |                            |                           |
|--------------------------------|----------------------------|---------------------------|
| Cantilever Beam Apparatus      | Vishay P3 Strain Gauge Box | Caliper                   |
| Oscilloscope                   | Dial indicator             | Flat beam (Alum. 6061-T6) |
| Set of weights                 | Ruler                      | BNC cable                 |
| Strain gauges attached to beam | Scale                      | USB cable                 |
| 2 jumper wires for P3          |                            |                           |

# Sm Experimental Method I M T B

**S. D. Probert, J. P. Marsden, T. W.  
Holmes**



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**Sm-1** Hands-On Labs, 2007-02      **Experimental Method and Measurement** S. D. Probert, J. P. Marsden, T. W. Holmes, 1971

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