Group Members:

Engineering Experimentation

LAB-04, D12

Vibration Measurements

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# ABSTRACT

{In this portion of the document, include a very brief outline of the key points of the experiment and the procedures your team followed. Often, the Abstract section is written after the experiment has been completed and most of the document has been written. In this way, the team can synthesize a much longer description down to the key points. It is not necessary to include calculations or the names of the equipment in the Abstract portion of the report. It is best to only include the highlights of the work, in clear general statements. }

# DESCRIPTION

## {The background and description section of any report are usually the longest portions of the document, for this section contains all the descriptive details of the experiment. Fill in all the areas below. But continue beyond these few headings. This is where background information gained in lectures and in research will come in. This is also where note taking and documenting your work will come in. Record all you do during the experiment. do not include things here like the complete step-by-step construction of the VI, that sort of material belongs in the appendix, as do other long lists, etc.}

## PURPOSE OF THE EXPERIMENT

## EXPERIMENTAL PROCEDURES

## KEY EQUATIONS

## ANALYSIS

1. Determine the vibration amplitude, velocity, and acceleration (in various units of measure. Provide the results in units of Hz, circular frequency, log decrement, and percent of critical damping). Tables of results giving the maximum acceleration, velocity, and displacement of the cantilever using the data from the test. Give your answers for acceleration, velocity and displacement in both English (use inches or mils) and SI units (millimeters). In addition, report maximum acceleration in units of g’s. Finally, specify the values in terms of RMS, peak, and peak-to-peak (1 mil = 0.001 inches).
2. Determine natural frequencies.
3. Measure and express damping characteristics as logarithmic decrement and percentage of critical damping.

1. Compare measurements with analytical and/or computational models of a cantilever.
2. Table providing summary of the modal parameters and elastic material properties obtained with each motion transducer. In the same table, also provide analytical and/or computational results. Make sure to indicate percentage differences.
3. Determine elastic modulus of a cantilever via vibration measurements.

## UNCERTAINTY ANALYSYS

1. Uncertainty analyses on the determined modal parameters and measured material properties. Make sure to identify uncertainty parameters in order of importance.

## EQUIPMENT LIST

* National Instruments USB-6229 DAQ
* 2310 Signal Conditioner
* Electrical Connector Plate
* Strain Gage
* Accelerometer

# RESULTS & CONCLUSIONS

{This portion of the document should include everything in terms of data and results which you and your team have learned throughout the experiment. Include any MS Excel tables, or similar arrays of data as long as they are condensed. Extensive arrays or tables of data can be placed in the Appendix section.

Any good results section should include more than mere lists, this section should also include a thorough analysis of the data. For instance, typical questions might how accurate is the data? What are the sources of error in this experiment? Or, how confident are you in the outcome? If the experiment requires groups to calibrate an instrument, then data will likely include a straight line and curve fitting. In that case, a regression analysis would be necessary. What sort of confidence do you have that a line through the data is really straight and fits through the points?

Your conclusion should state whether you believe that the expected results were achieved and how confident you are in the results.}

# **references**

{Any sources used during the experiment should be listed here. This includes text books or instructional books on LabView, or material provided by a supplier’s web site, or third party web sites. Cut and past the URL for any sites used during the course of the experiment. See the example, below, which was written in MS Word’s “citations & bibliography” section under “references.” }

(Vishay Measurement Group, n.d.)

All About Circuits, n.d. *Ohmmeter usage, Volume VI - Experiments » BASIC CONCEPTS AND TEST EQUIPMENT.* [Online] Available at: http://www.allaboutcircuits.com/vol\_6/chpt\_2/2.html

Bishop, R. H., 2007. *LabView 8 Student Edition.* Upper Saddle River(NJ): Pearson Prentice Hall.

# APPENDIX

{Any information, photos, drawings, sketches, data, lists, tables, etc., which are too long for insertion in the regular areas above, should be included here. This means anything that interrupts the natural flow of the document or narrative. This would include numerous detail drawings of some equipment, extensive lists of numerical results, large-scale images, etc.}

## DATA

## PHOTOGRAPHS

{Students should use their cell phone cameras or other imaging devices to capture and document everything you do in the lab. }



Figure 1. National Instruments DAQ Box.

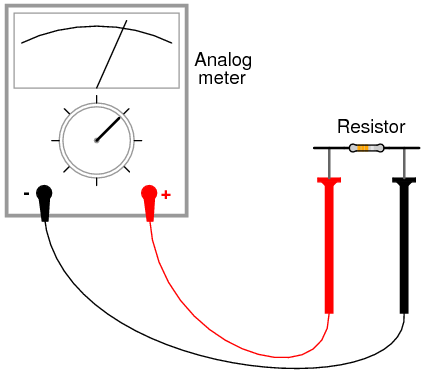


Figure 2. Simple schematic of a multimeter measuring a resistor.

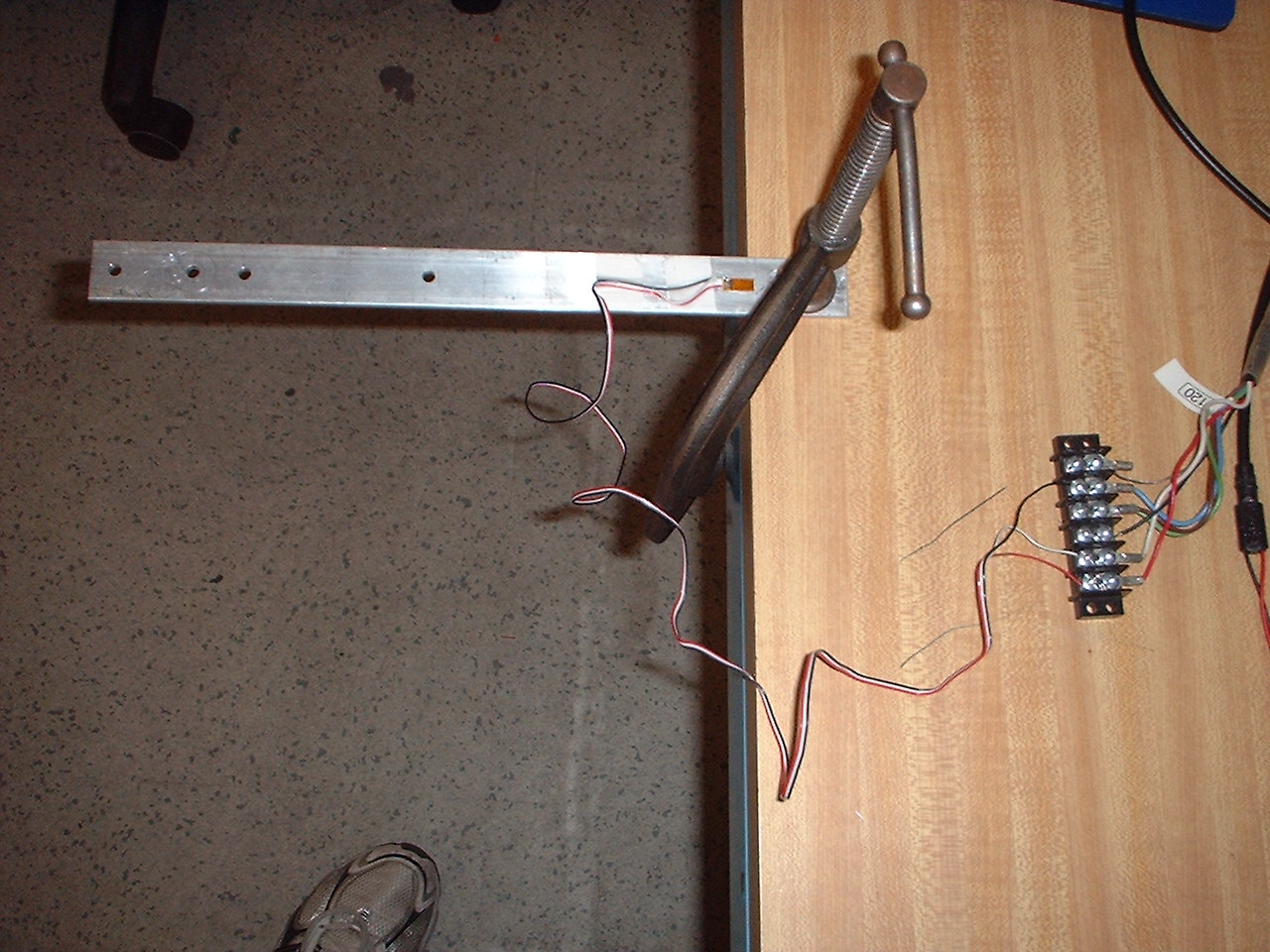


Figure 3. Clamping of the cantilever beam onto the bench top.

## C:\Documents and Settings\ssharma\Desktop\Final Pics\DSCN1797.JPG

Figure 4. Close up of the cantilever beam clamped properly to the work bench. note position of the strain gage.

## SKETCHES & DRAWINGS

## LABVIEW PROGRAMMING

# SAFETY REQUIREMENTS

**WORCESTER POLYTECHNIC INSTITUTE**

**MECHANICAL ENGINEERING DEPARTMENT**

**Room: HL-031**

Safety Note: Engineering Experimentation, ME-3901, D-Term 2012

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**(To be signed and given to TA or Instructor before using Laboratory)**

We have added a “user ID card access” key to the lab. Your ID will be programmed to give you access to the lab throughout the term 24hrs per day. You must follow the security procedures of the lab.

In ADDITION to all safety procedures required by WPI, the ME3901 lab requires:

1. **You cannot be alone in the room after normal business hours** – a second person is required in the event of an accident or hazard.

THIS REQUIRES THAT 2 PEOPLE ENTER THEIR ID CARDS FOR ACCESS. IF ONE PERSON ENTERS THEIR CARD, THE DOOR WILL OPEN. HOWEVER, IF A SECOND ENTRY IS NOT RECORDED, THEN WE CONSIDER THAT YOU HAVE ENTERED ALONE - WHICH VIOLATES OUR SAFETY REQUIREMENT.

1. You must use your ID card for access during all hours other than weekdays between 8-5. Even if the door is opened by another, you must pass your ID card through the door lock.
2. Any missing or broken equipment must be reported immediately. Email to the TA’s: Ivo Dobrev and Peter White or Prof. Furlong <cfurlong@wpi.edu> or Prof. Scarpino <cscarpino@wpi.edu>
3. ***The lab is used by several groups. Each student must maintain a clean environment and not leave “experiments in progress” unless it has been cleared by an instructor*.**

I understand and agree to abide by the safety procedures outlined by WPI and the ME3901 Laboratory.

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Student name (printed) (signature) (ID Number) Date

(WPI Copy)