

**University of California at Berkeley
College of Engineering
Mechanical Engineering Department**

ME138/238, Spring 2018

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Lab #1

Assigned: January 23, 2018; Due: February 20 (Tuesday)

Lab 1: Design, Fabrication & Assembly of a Mechanical Energy Harvester

In this lab, we are going to conduct experiments to make a mechanical energy harvester to convert mechanical energy to electrical outputs. You will need to design the structure, select the materials, assemble the components and conduct experiments to record the electrical energy production results. After the completion of the design and fabrication process, you will need to make electrical connections and test the energy harvesters in different mechanical vibration/motion environments. Please read through paper #1 carefully as lab #1 is based on the same process. Specifically,

- (1) Go to 1113 Etcheverry at the time you are assigned and the GSI will show a demonstration of a finished mechanical energy harvester. You should ask the GSI on the specific dimensions, thickness ... of the device.
- (2) Under the guidance of the GSI, please place the piezoelectret material under the setup and conduct the Corona discharging process similar to paper #1. Please measure the surface potential right after the process and every few days before the report is due to observe the charge neutralization process.
- (3) After the charging process, please assemble/connect your own energy harvester system (you should have your own specific design before the lab). The assembly process may require bonding and selection of different materials as described in paper #1 or other ways before the charging process.
- (4) Measure the response of electrical outputs from your energy harvester (such as Voltage, Current) under different mechanical inputs.
- (5) If you change the resistor setup under the close-loop electrical connection, can you identify the optimal resistor value for highest output power?
- (6) Please connect your energy harvester to power an LED.
- (7) We will conduct a quick competition in class by using a relatively fixed mechanical inputs (your own hands to power your energy harvester with a frequency of 1 Hz) and see which one has the highest energy output.
- (8) Write an individual report about this lab, including experiment results, discussions and other observations.

For Graduate Students:

- (9) Conduct analytical and/or numerical simulations to study the design optimization of your energy harvester, including optimized dimensions with possible validations from experimental results.
- (10) Expand your energy harvester to harsh environments (such as water) and discuss possible things to prevent the damages of the device with possible experimental validations.
- (11) Instead of energy harvester, can your device be turned into an actuator?