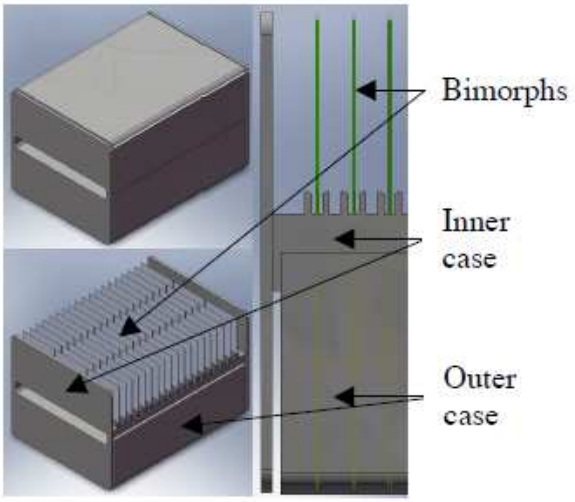
PORTABLE PIEZO CHARGING

R.M.FAIN, P.K.WRIGHT

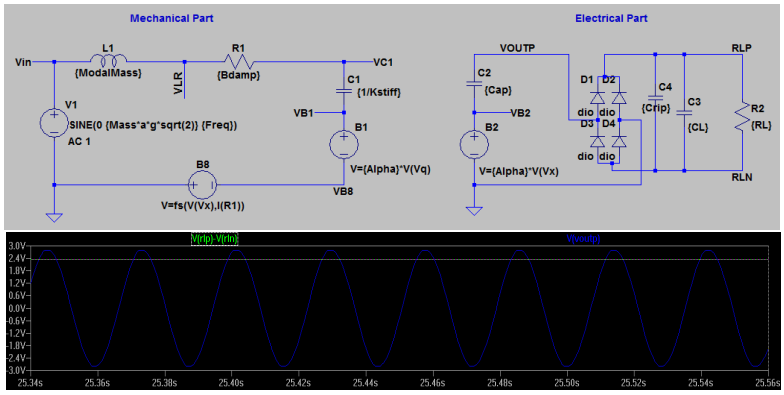
Vision

This project concerns the development of an electronics case which harvests wasted vibrational energy to charge a portable electronics device. By using actual data input from likely environments, a simulation model will be used to show the conditions under which sufficient power generation is provided. The resulting battery charging system could greatly reduce the need for use of AC adapters, increasing user flexibility and energy saving potential. It could also extend the life of the device's batteries, reducing landfill and the expensive recycling of materials. Specifically, a laptop case and its charging system are the working foci here.



Interactive SolidWorks Design

Simulation Spice Model and Signal Output



Research Questions

With respect to charging electronics devices piezoelectrically:

- Is it possible within reasonable case weights and external dimensions?
- Will more efficient single unit generator designs be necessary?
- Will the benefits and enhanced usability outweigh the long term cost of manufacturing?
- Could this goal be achieved with other piezoelectric materials as well?

Methods

Although a more compact, optimized design of the charging case will likely use microfabricated arrays of piezoelectrics in future iterations, macroscale bimorph generators are first being used for proof of concept and to verify a model simulation. The power output of a single-unit piezoelectric bimorph was measured by activation both at and off resonance. Then the model was run under the same acceleration profile and the results compared. Once the model is fine tuned, acceleration data from real-world environments will then be used as input to the simulation, to estimate the response of a larger array of single-unit bimorph generators.

Findings

Preliminary simulations are approximately 5% lower than the measured voltage across the bimorph, and 13% lower than the measured voltage across the battery, when measured off resonance.

(35.5Hz/1.3g/1.25mm)	Max Voltage (V):
MEASURED	
V piezo	2.96
V battery	2.74
SIMULATED	
V piezo	2.82
V battery	2.38

The V_{oc} was approximately 20V and the I_{sc} 50mA for the same bimorph at resonance.