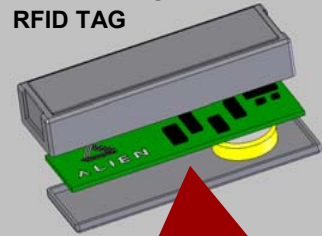
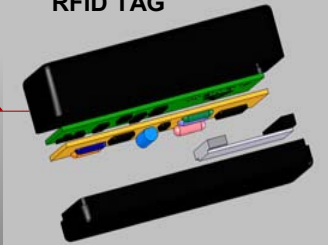


A MATLAB Program to Aid in Resonator Design and an Experiment in Powering a Semi-Active RFID tag

BATTERY POWERED
RFID TAG



VIBRATION POWERED
RFID TAG



Methods

Modeling

- An end-to-end design flow using MATLAB
- Detailed graphical and tabular outputs of electrical and mechanical behavior results from an input of source vibration characteristics, volumetric constraints, and material properties
- Versatile program which is capable of analyzing various beam composites and configurations

Teeny Temp

- Design and fabrication of a piezoelectric power generator and power conditioning circuit which will power an Alien battery-assisted passive RFID tag
- Analysis of system characteristics as compared to earlier experiment in powering a Crossbow Mica2Dot Mote

Vision

To scavenge energy from ambient vibrations to power nodes of a wireless sensor network. In order to realize this vision, a systematic approach to piezoelectric power generator design must be developed. Furthermore, experiments have shown that the Crossbow Mica2Dot Mote is not a feasible load application for energy scavenging due to relatively large power demands. A better load solution needs to be found.

Research

Questions

- Given a vibration source and load application, what is the optimal resonator design for scavenging energy and powering the load?
- Can a piezoelectric power generator effectively power a battery-assisted passive RFID tag?
- If so, how do the results compare to powering a Crossbow Mica2Dot Mote?

Findings

- A MATLAB program was built to analyze various resonator designs in order to find the optimum for a given vibration source and load characteristics. Results showed voltage, current, power, stress, and displacement characteristics for various designs.
- An experiment in powering an RFID tag with onboard temperature sensor proved successful
 - 8mW of power was needed for the reader to reliably read the tag; cycle time to charge the capacitors was 1 minute with a modest vibration source
 - compared to the mote, this experiment saw a 88% decrease in power consumption and 90% decrease in cycle time

Beam w/ HeavyMass of 0.05kg to Achieve Frequency of 200Hz

