Vibration Energy Harvesting – Biomedical Application

Mechanical Engineering
Research Project Sponsored by Edison International
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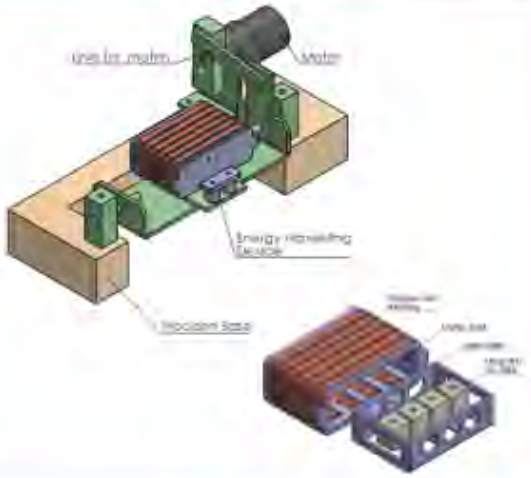
Abstract

Vibration energy harvesting is considered a promising alternative approach to power wireless low power microelectronic devices. This project mainly focuses on a small wearable electromagnetic transduction mechanism for energy harvesting. The harvested energy may potentially be used to charge the hand wearable device, such as an electronic watch or health monitoring device. This project is completed in collaboration with research related to a wearable biomedical wrist tremor reduction device. This energy harvesting project will investigate the potential to harvest energy from wrist tremors in a wearable device. The tremor vibrations are simulated by oscillating rotary movement, which externally excites a set of magnets to oscillate through a set of coils, inducing current in the coils. The voltage readings from the harvested vibration energy are recorded, and adjustments to optimize the vibration and create more efficient wearable design may be made.

Application

Applications for vibration energy harvesting are numerous. This project focuses on investigating the potential for harvesting energy from a small, wearable device. The device simulates wrist tremor movement through rotary motion. The apparatus oscillates back and forth through a range of 60 degrees. This movement causes magnets to oscillate through a set of coils. As described by Faraday's Law, this induces current in the coils, which is recorded using a multimeter.

Design



Current Apparatus

Results

One shell is wound with a single coil of 300 turns. Another shell is wound with six individual coils with 50 turns each. The copper wire is gauge is 26.

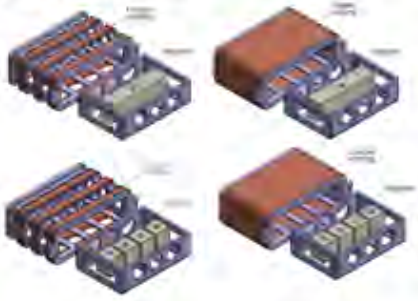
Two magnet orientations were used. The first has four small magnets of size 0.5"X0.5"X0.5" stacked together, and the second has one single magnet of size 2"X0.5"X0.5". The Magnets are fixed on the linear guide in inside the shell to achieve linear motion.

The device is tested at a frequency of 4.5Hz to represent the general tremor range.

- Individual coils output in 6 coil shell with 4 stacked magnets-**10mV**
- Individual coils output in 6 coil shell with single magnet-**50mV**
- Single coil shell output with 4 stacked magnets-**15mV**
- Single coil shell output with single magnet-**100mV**

Future Work

Future work will include testing the apparatus with various numbers of coils, as well as two different sets of magnets – four cube magnets in a row, or a single rectangular magnet across the same space. The effect of each of these variations on the amount of energy harvested will be investigated and recorded.



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