MEMS-Based Waste Vibrational Energy Harvester

ABSTRACT

The piezoelectric effect is a phenomenon where strain on a piezoelectric crystal structure causes potential difference at its ends. By merging piezoelectric materials and microelectromechanical systems (MEMS), mechanical vibration could cause the necessary displacement in MEMS to create a potential difference that could be used to power electronic devices. Developing new sustainable energy sources and using energy more efficiently is at the forefront of several research initiatives and is a clear priority for the Department of the Navy’s strategic planning. This thesis aims to design a vibrational energy harvesting MEMS device to harness vibrational waste energy with the goal of producing power for naval applications. The development and widespread use of vibrational harvesting MEMS would aid the effort to meet each of these goals in the Department of the Navy. Any shore based, seagoing, or expeditionary mechanical platform could serve as a kinetic energy source for vibration energy harvesting MEMS. This thesis investigates the physics, materials, design, optimization, and microfabrication process in the creation of such a device. Time-dependent finite element models for two designs have been developed, simulating electrical power output. Microfabrication processes for the designs have also been developed.

INFORMATION

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School: Graduate School of Engineering and Applied Sciences
Department: Applied Physics

INVOLVED MEMBERS

NPS Students: LT Daniel Hogue, USN, LTJG Sarah Gregory, USN
E2O POC/Lead: Major Brandon Newell
Primary Advisor: Prof Dragoslav Grbovic
Co-Advisor: N/A
Second Reader: Prof Gamani Karunasiri
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