

Modeling, Simulation, and Optimization of Piezoelectric Bimorph for Broadband Energy Harvesting

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Abstract

Vibration energy harvesting has become an increasingly interesting technology as it offers on-board energy harvesting solutions to small scale sensors and devices. Piezoelectric effect converts mechanical strain into voltage or charge that can be stored and supplied for auxiliary sensor systems. However, the main challenge remains - how to tune the harvester to mechanical resonance of the device in order to capture high magnitude of energy. In this research, we try to address this issue by designing a broadband energy harvesting device that can work at multiple frequencies by modifying the geometrical parameters of the system. We use the COMSOL Multiphysics® software to design, simulate and analyze the voltage and power characteristics under applied mechanical vibrations of a piezoelectric cantilever beam connected in a series bimorph configuration. Authors believe that this multi-harvester device can address the aforementioned challenge of off-resonance drop in power and can provide a true broadband energy harvesting solution for a sensor system.