

Innovative Applications of Piezoelectric Generators: Analyzing Efficacy and Feasibility

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Abstract

The objective of the study was to test and collect data on novel application areas of piezoelectric materials to determine their overall efficacy and efficiency for the transfer from mechanical to electrical energy. Efficacy was determined by the magnitude of the voltage as well as the electrical current being produced, in relation to the magnitude and frequency of the vibrations being applied. Analysis of quantitative data enabled calculation of the efficacy of the conversion and ultimately showed whether the piezoelectric materials can be an effective way to recycle energy lost to vibrations in modern machinery and infrastructure, and an alternative energy generation practice.

The voltage output of each piezoelectric ceramic was tested using two methods of excitation: vibrations, and pressure. The ceramics were attached to the external surfaces of the machinery used for testing, which include single-room AC unit, building AC unit, washing machine and dryer. Based on the qualitative observations of the machinery and the data collected, the potential and direction of further testing was determined.

Based on the data collected piezoelectric materials tested produced higher voltage outputs when tested on larger machinery and when placed closer to the motor or source of the vibrations. On the other hand, the voltages recorded together with the current produced from the experiments was found to be lower than initially expected, thus rendering the use of crystals inefficient in terms of passively harvesting energy from vibrations. The data collected also only includes single ceramic applications. The ceramics tested can produce voltage from vibrations. The voltages produced are low, but it can be increased connecting large numbers of ceramics in stacks or in series. Piezoelectric ceramics have the potential to be applied in modern machinery that produces large enough vibrations. Further testing will be required to find the efficiency and confirm if this application is cost effective

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Bio



Name: David J. Berube

Age: 21

Year: Senior undergraduate

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Grew up in Colchester Connecticut

Academic interests: I am interested in Robotics, signal analysis and sustainable energy

Campus involvement: I am the President of Anime Club , in the Robotics Club as well as Math and Physics Club