Rotational piezoelectric energy harvester for wearable devices

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Abstract

Electronic devices are mostly powered externally via batteries. The dependency on the recharging process limits the usage of these devices to work in a specified period of time. This research work highlights the capability of a piezoelectric energy harvester to generate sufficient electricity to power up electronic devices by using low frequency vibrations alone, without relying on external power supplies. In general human motions consists of low frequency vibrations, therefore the capability to power up electronic devices using low frequency vibrations will also eventually become useful to power up wearable devices. Simulations were conducted using COMSOL Multiphysics (R) to identify the dimensions of a piezoelectric beam which will produce the optimum level of voltage output. A specially fabricated rotational piezoelectric energy harvester prototype that consists of a 40 mm piezoelectric bimorph beam that rotates with the aid of a rotor and aluminum proof-mass was developed together with a corresponding Arduino Uno based data logger. With a given input frequency of 18 Hz, the maximum voltage output that could be generated was recorded at 0.024 V. This research high-lights the optimistic possibility that clean energy could be generated and utilized in powering various applications without depending on external power supplies.

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