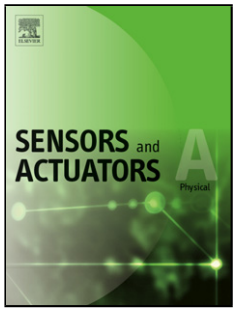

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A Miniaturized Electromagnetic Vibration Energy Harvester using Flux-guided Magnet Stacks for Human-body-induced Motion

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Highlights:

- A human-motion driven miniaturized EM energy harvester using flux-guided magnet stacks.
- Flux-guided magnet stack increases the power density more than three times.
- Capable of driving wearable electronics through efficient power conditioning circuitry.

Abstract

We present a miniaturized electromagnetic energy harvester (EMEH) that uses two flux-guided magnet stacks to harvest energy from common human-body-induced motions such as hand-shaking, walking, and slow running. We designed each magnet stack to increase the flux density within a given size of the harvester component, by guiding the flux lines through soft magnetic material and designed the miniaturized EMEH to up-convert the low-frequency vibration generated by human-body-induced motion to a high-frequency vibration by mechanical impact of a spring-less structure. Our use of a spring-less structure eliminates the challenges of designing a practical and reliable low-frequency (<5 Hz) oscillator. Our low-frequency oscillator couples the human-body-induced vibration to two high-frequency oscillators (electromagnetic transducer elements). Each high-frequency oscillator consists of the analyzed 2-magnet stack and customized helical compression spring. We fabricated a standard AAA battery sized prototype (3.9 cm^3) and tested it with different human activities. We were able to generate a maximum 203 μW, 32 μW, and 78 μW average power from hand-shaking, walking, and slow running motion, respectively. This miniaturized structure