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Title: FINITE ELEMENT SIMULATION OF MEMS PIEZOELECTRIC ENERGY SCAVENGER BASED ON PZT THIN FILM

Author(s): Ralib, AAM (Ralib, Aliza Aini Md); Zulfakher, NWA (Zulfakher, Nur Wafa Asyiqin); Ab Rahim, R (Ab Rahim, Rosminazuin); Za'bah, NF (Za'bah, Nor Farahidah); Hanif, NHHM (Hanif, Noor Hazrin Hany Mohamad)

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Abstract: Vibration energy harvesting has been progressively developed in the advancement of technology and widely used by a lot of researchers around the world. There is a very high demand for energy scavenging around the world due to it being cheaper in price, possibly miniaturized within a system, long lasting, and environmentally friendly. The conventional battery is hazardous to the environment and has a shorter operating lifespan. Therefore, ambient vibration energy serves as an alternative that can replace the battery because it can be integrated and compatible to micro-electromechanical systems. This paper presents the design and analysis of a MEMS piezoelectric energy harvester, which is a vibration energy harvesting type. The energy harvester was formed using Lead Zicronate Titanate (PZT-5A) as the piezoelectric thin film, silicon as the substrate layer and structural steel as the electrode layer. The resonance frequency will provide the maximum output power, maximum output voltage and maximum displacement of vibration. The operating mode also plays an important role to generate larger output voltage with less displacement of cantilever. Some designs also have been studied by varying height and length of piezoelectric materials. Hence, this project will demonstrate the simulation of a MEMS piezoelectric device for a low power electronic performance. Simulation results show PZT-5A piezoelectric energy with a length of 31 mm and height of 0.16 mm generates maximum output voltage of 7.435 V and maximum output power of 2.30 mW at the resonance frequency of 40 Hz.

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Addresses: [Ralib, Aliza Aini Md; Zulfakher, Nur Wafa Asyiqin] Int Islamic Univ Malaysia, Dept Elect & Comp Engn, POB 10, Kuala Lumpur 50728, Malaysia. [Hanif, Noor Hazrin Hany Mohamad] Int Islamic Univ Malaysia, Dept Mechatron Engn, POB 10, Kuala Lumpur 50728, Malaysia.

Reprint Address: Ralib, AAM (reprint author), Int Islamic Univ Malaysia, Dept Elect & Comp Engn, POB 10, Kuala Lumpur 50728, Malaysia.

E-mail Addresses: alizaaini@iium.edu.my

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