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Investigation of coupled piezoelectric and multiple electromagnetic hybrid vibration energy harvester

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Abstract: Vibrational energy harvesting used for powering small electronic components has received more attention in the recent years for various applications. A lot of early research on vibrational energy harvesting was on linear, single frequency based resonance harvesting devices. These harvesters give maximum power only at the resonance and the efficiency drops drastically as the excitation frequency moves away from resonance. In reality, the ambient vibration sources are random in nature. Hence, considering realistic application, narrowband linear systems are inefficient. To overcome this drawback, the present work proposes a hybrid transduction based vibration energy harvester for achieving sufficient power across wide band of frequencies. In the present work, a cantilever beam with an unimorphed macro fibre composite patch is used to harvest piezoelectric energy and a spring-magnet mass system moving within a solenoid hung in different places of the cantilever is used to harvest electromagnetic energy out of motion in a magnetic field. The present study analyzes the implications of the number of electromagnetic units on the total harvested power of the hybrid system and the saturation trends for various energy levels have been reported. Comparison studies have also been made to show the increase in the order of power bandwidth obtained in a hybrid system with reference to its standalone counterparts.

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