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Micro vibration energy harvesters for low frequency operation

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Self-powering of wireless sensors and wireless micro devices attract the attention of many researches nowadays. Problems associated with chemical batteries such as limited life time and minimization restrictions can be solved using the approach of energy harvesting. Various ambient energy sources such as vibration, thermal, light, wind, etc., could be harvested and converted into electrical energy. However, vibration energy harvesting is more convenient for important kinds of applications such as machine condition monitoring, where sensors are placed in a deep dark place and human body-powered devices whether they are wearable or implantable. Some problems arise when dealing with human motion energy harvesting. Human body provides a kind of unsteady low frequency vibrations which are difficult to match by most common resonant harvesters. Instead, a way of non-resonant low frequency energy harvesting should be used. In this speech, a micro electromagnetic non-resonant energy harvester based on free/impact motion will be presented. Free relative motion is allowed between tube-carrying an electrical coil directly connected to the vibration source and a permanent magnet inside. Impacts appear between the magnet and two hard end stops. Free motion enhances power harvesting at low frequency, while combined free/impact motion results in a non-resonant behavior in which the output power increases with input amplitude and/or frequency. In addition, the harvester has a simple construction which allows fabrication with small sizes. Hence, the harvester can be well suited for small size applications encountered variable large amplitude – low frequency vibrations such as human powered devices.

Biography

Ahmed Haroun has completed his PhD from University of Tokyo in Mechanical Engineering. He is currently a Post-doctoral research fellow at National University of Singapore (NUS) and holding the position of Lecturer Assistant at Cairo University. His research interests include energy harvesting for implantable and wearable devices; MEMS-based energy harvesting; MEMS sensors and actuators, Implantable bio-MEMS; Vibration energy harvesting and Dynamics of multi-body systems.

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