MEMS FOR VIBRATION ENERGY HARVESTING

Microsystem for harvesting vibration energy at low mechanical frequencies

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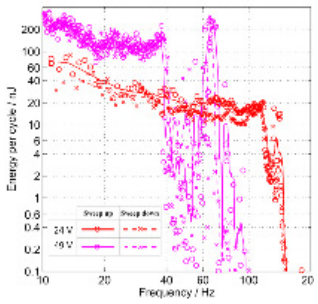
PRESENTATION

For embedded systems, battery liftetime is often a critical issue and finding ways to increase it could provide major benefits. For example, improving the battery lifetime of pacemakers would postpone the chirurgical operation needed to replace the battery, while for smart clothes, tackling the battery issue would open a wide range of new applications. When the embedded system is a wearable one, it is possible to harvest the mechanical energy due to human movements and convert it into electrical energy. But mechanical energy harvesters work efficiently only at a given mechanical frequency which is linked to their size. So when it comes to designing a miniature energy harvester, the mechanical frequency generally exceeds 100 Hz, far beyond the spread of human movements.
Our MEMS electrostatic harvester has an internal structure designed to provide electrical power efficiently at low and wideband frequencies, making it suitable for wearable devices.



Vibration energy Harvesting - MEMS -
Low frequency operation - Electrostatic transducer

COMPETITIVE ADVANTAGES

- Microsized system (actual prototype is 10 mm x10 mm x3 mm)
- Versatile solution for harvesting energy from human movements (Hz or tens of Hz) to higher frequencies (hundreds of Hz)
- Important power density for a microsystem operating at low frequency (10 microW/cm3 at 10 Hz in most recent prototypes, conversion efficiency ~60%)

INTELLECTUAL PROPERTY

International patent application

PUBLICATIONS

Y. Lu et al, IEEE Antennas and Wireless Propagation Letter, vol. 16, pp. 1832 – 1835, 2017
Y. Lu et al, Journal of Micromechanics and Microengineering, Vol. 26, no 12, 2016
Y. Lu et al, AIP Applied Physics Letters 107, 253902, 2015

APPLICATIONS

- Improving performances of semi-passive RFID tags
- Improving battery lifetime of microsystems (healthcare devices)
- Energy supply of autonomous wireless sensors for transportation, inventory, surveillance, military and industrial monitoring

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DEVELOPMENT PHASE

- ☑ Improved design to reach conversion efficiency of 80%
- ☑ Self-biased conditioning circuit
- ☑ Application to semi-passive RFID