

MEMS energy harvesters based on silicon and PZT thickfilm technology for wireless sensor systems

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In recent years, the concept of energy harvesting has attracted much attention. The basic idea is to scavenge or harvest energy from the ambient surroundings of a device, convert it into electrical energy and use it to power a device, typically a wireless sensor system. The energy harvester can thus be seen as a small local power plant which uses otherwise wasted energy in the form of vibrations, temperature differences etc. which are abundant in most systems. By creating energy harvesters of the same size as modern batteries, the technology therefore has the fascinating future prospect of making batteries redundant. This is therefore a green technology that can be integrated in a wide range of systems, making it highly interesting.

During two bachelor projects, several contributions to the development of vibrational energy harvesters have been made. A theoretical model have been developed which is capable of predicting the power output of vibrational energy harvesters based on cantilevers operated at resonance. This makes it possible to investigate the designs that yields the maximum power output. In addition to this, a range of different cantilevered energy harvesters have been designed and fabricated using cleanroom processing and screen printing techniques. This combination have made it possible to produce novel designs with cantilevers made of silicon and PZT or cantilevers made solely of PZT, thereby demonstrating different methods of harvesting the maximum amount of energy from ambient vibrations. The use of silicon technology facilitates the future integration of external electrical circuits in the design and makes it possible to fabricate a whole system consisting of both the energy harvester and the corresponding sensor system in the same process flow, thus making the production easier, faster and cheaper.

In the presentation results obtained with real energy harvesters designed and fabricated during the two bachelor projects will be presented and the prospects of energy harvesting will be discussed.