Thickness Optimization of a Piezoelectric Converter for Energy Harvesting

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Keywords: PZT thick film, Energy harvesting, Modelling.

ABSTRACT

In sensors and automation field, wireless sensor nodes are usually powered with batteries. This implies several problems and costs for replacing, recharging or disposing the batteries. The retriving of unused environmental energy from mechanical vibrations is a promising solution for powering sensor nodes, realizing an autonomous sensor system. The most studied mechanical energy converters are based on the direct piezoelectric effect and they are made with thick-film and MEMS technologies [1-2]. In order to improve the power conversion, geometry and dimensions of piezoelectric converters should be optimized. In this context the use of FEM simulation [3] is a powerful tool in predicting and optimizing the expected behavior of different structures. In this study a 3D piezoelectric unimorph cantilever has been considered, as reported in figure 1. The device is made by a stainless steel substrate with a piezoelectric layer on the top, poled along thickness-direction. The lenght of the structure is 27 mm and the width is 3 mm, while the thickness of the substrate is 200 µm. A sinusoidal vertical acceleration, with a magnitude of 0.1 *g* and a frequency of 10 Hz, has been applied to the device and, using the moving mesh application mode in COMSOL, the piezoelectric layer thickness has been varied in order to maximize output electrical energy.

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