Energy harvesting from ambient mechanical vibrations and electromagnetic radiations based on MEMS and NEMS devices

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Microelectromechanical systems (MEMS) have demonstrated to be a suitable technology to implement the transducer element of energy harvesting devices at the micrometer scale. This is so especially when mechanical vibration sources are involved. However, MEMS based realizations of vibration energy harvesters (VEH) have to overcome several intrinsic limitations related to the mismatch between their natural resonance frequency with the characteristic frequency of the vibration source, as well as those related to the low energy that a microsystem can extract from the ambient.

In this talk we are going to show some strategies that are oriented to treat such limitations. From one hand we are going to present a non-linear vibration energy harvester (NLVEH) implemented on an AFM triangular cantilever. Bistable non-linearity is induced by means of one electret locally charged at the free end of the AFM cantilever and another at a closely placed counter electrode[1]. Experimental results show (figure 1) that an accurate control of the distance between the cantilever and the counter electrode (d), allows optimizing the rms value of the cantilever deflection when the system is excited with a certain intensity of pink noise.

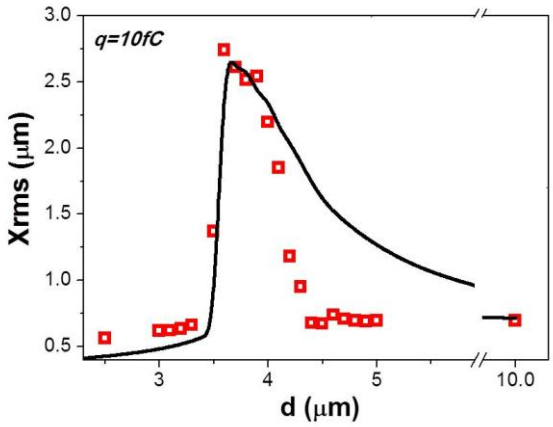

Figure 1: Experimental (symbols) and simulated (lines) results for the rms value of the AFM cantilever deflexion as a function of cantilever – counter electrode distance, d. The intensity of the excitation noise is Frms=4nN.

On the other hand, proof of concept devices of micro-opto-electromechanical systems (MOEMS) based energy harvesters, which have been designed to extract energy from electromagnetic radiation sources in the radiofrequency (RF) range and in the IR optical range, will be also presented.

[1] M. López-Suárez, J. Agustí, F. Torres, R. Rurali, G. Abadal. "*Inducing bistability with local electret technology in a microcantilever based non-linear vibration energy harvester*", To be published in Appl. Phys. Lett. (2013).