Functionally Graded MEMS Piezoelectric Energy Harvester with Magnetic Tip Mass

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Abstract : Role of piezoelectric energy harvesters has gained interest in supplying power for micro devices such as health monitoring sensors. In this study, in order to enhance the piezoelectric energy harvesting in capturing energy from broader range of excitation and to improve the mechanical and electrical responses, bimorph piezoelectric energy harvester beam with magnetic mass attached at the end is presented. In view of overcoming the brittleness of piezo-ceramics, functionally graded piezoelectric layers comprising of both piezo-ceramic and piezo-polymer is employed. The nonlinear equations of motions are derived using energy method and then solved analytically using perturbation scheme. The frequency responses of the forced vibration case are obtained for the near resonance case. The nonlinear dynamic responses of the MEMS scaled functionally graded piezoelectric energy harvester in this paper may be utilized in different design scenarios to increase the efficiency of the harvester.

Keywords : energy harvesting, functionally graded piezoelectric material, magnetic force, MEMS (micro-electro-mechanical systems) piezoelectric, perturbation method

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