

Increasing the bandwidth of the width-split piezoelectric energy harvester

Abstract

A new method to maximize the output power of a piezoelectric energy harvesting system has been previously proposed by the authors. This can be achieved by reducing the mechanical damping through folding a given piezoelectric material equally and splitting it into smaller width. Experimental results have shown that the power harvested increases when the number of fold increases but with the trade off the optimal operating frequency range, which is referred as the bandwidth. This paper aims to improve the bandwidth by modifying the natural frequency of each split piezoelectric material and connecting them in parallel. Experimental results show that the bandwidth increases as the difference between the natural frequency of the reduced-width piezoelectric materials increases. Although these results are with trade off in reducing output power gain, the gain in the bandwidth per unit output power reduction is still increasing. This shows that the maximum output power of the harvesting system can be ensured with the width-splitting method and the bandwidth of the output can be widened by increasing the difference between the natural frequencies of the participating piezoelectric elements. This maximization method with wideband feature can be implemented at microscopic stage to be incorporated in the microelectronics devices such as MEMS.