Increasing the Output from Piezoelectric Energy Harvester Using Width-Split Method with Verification

Abstract

This paper proposes a new scheme for piezoelectric energy harvesting maximization. The proposed enhancement relies on a new topology of splitting a specified dimension piezo composite bender into beams with smaller width and, therefore, higher quality factor (or Q factor). The increase of Q factor allows a much more effective energy conversion process. It is shown that the proposed method, based on single splitting, increases the harvested power by a factor of up to √6, and up to √7.62 for two even-splitting compared to with no splitting. The wideband operation is accomplished by using different resonating benders in such a way that individual benders are each tuned to a different resonance frequency. Taking the configuration of single even-splitting as an example, the power output of the prototype was 39 μW at 27.2 Hz with 8 Hz bandwidth under 2 mm peak-to-peak input displacement and 3 Hz variation in resonant frequency. This corresponds to more than 2 times of power output with no splitting as well as about 23% increase in bandwidth. Such power output is sufficient to power up electronics devices such as a "2 AA dry cells-powered" digital clock with the wider range operating frequency.