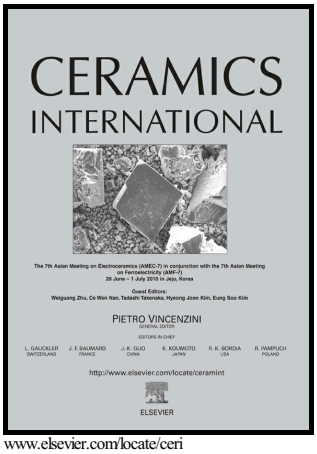

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The Design and Analysis for Low-Frequency Piezoelectric Cymbal Transducers

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Abstract

Piezoelectric cymbal transducers (PCT) have been widely used in energy harvesting. Previous researches recommend PCTs with symmetric geometry to avoid the disadvantages, such as failure of the epoxy layers due to the high frequency loads. In the current study, the applicability of the asymmetric cymbal transducer for low frequency is evaluated by finite element method. Three types of transducers are compared, including Type I, which is the conventional transducer, Type II with the apexes of the top and bottom cymbals shifted in the same directions, and Type III with the apexes shifted in the opposite direction. The results show that the optimized Type II and III transducers improve power output by 7.1 % and 15.9 %, respectively, compared with Type I. Moreover, a numerical method is proposed to decompose the strain states of the piezoelectric disc into the superposition of sets of the strain state basis of the radial resonance modal shapes. The results reveal the relationship between the resonant modal shapes and the increase of the power output. A new design of PCT is proposed. The current work provides design guideline for the