

Optimization of the Design of Multifrequency Annular Arrays for Very Wide Band Operation

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Abstract:

This paper presents an optimization design strategy for wideband piezoelectric transducers based on a kerfless multifrequency annular array with two elements, made out of a 1-3 connectivity piezo-composite disk. The disk is machined by reducing the thickness within a circular section at the centre of the disk faces, so that two elements are obtained: an inner and thinner disk and an outer ring. They are designed to meet two main criteria: i) both elements present a different resonant frequency, being the inner disk the higher frequency element and ii) the individual frequency bands of the elements overlap to build up an overall frequency response that approximate to the sum of the individual frequency bands. The objective of this research is to determine the optimum configuration of both elements, in particular the relative elevation of the inner disk, so that cross-talk between elements and the appearance of undesired modes is minimized while frequency bandwidth is optimized. Towards this end, the response of different configurations is calculated using a finite element method.