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Single-Crystal Kerfless 2D Array Transducer for Volumetric Medical Imaging: Theoretical Study

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Abstract : The aim of this work is to present a theoretical analysis of a 2D ultrasound transducer comprised of crossed arrays of metal strips placed on both sides of thin piezoelectric layer (a). Such a structure is capable of electronic beam-steering of generated wave beam both in elevation and azimuth. In this paper, a semi-analytical model of the considered transducer is developed. It is based on generalization of the well-known BIS-expansion method. Specifically, applying the electrostatic approximation, the electric field components on the surface of the layer are expanded into fast converging series of double periodic spatial harmonics with corresponding amplitudes represented by the properly chosen Legendre polynomials. The problem is reduced to numerical solving of certain system of linear equations for unknown expansion coefficients.

Keywords : beamforming, transducer array, BIS-expansion, piezoelectric layer
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