A new multi-parameter inversion process for elastic diffraction tomography

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Abstract

We consider the problem of elastic diffraction tomography, which consists of reconstructing elastic properties (i.e. mass density and elastic Lamé parameters) of a weakly scattering medium from measurements of scattered waves outside the medium. Elastic diffraction tomography refers to the elastic inverse scattering problem after linearization using a first-order Born approximation. In this paper, we prove the Fourier diffraction theorem, which relates the 2D Fourier transform of scattered waves with the Fourier transform of the scatterer in the 3D spatial Fourier domain. Elastic wave mode separation is performed, which decomposes a wave into four modes. Application of mode separation to the measurement data is the basis of a new multi-parameter inversion process. Finally, we discuss reconstruction with different tomographic setups and with plane wave excitation of different frequencies.