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2D-ultrasonic tomography using first-order Born and canonical approximations

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This paper deals with the two-dimensional image reconstruction of an elastic tubes using ultrasonic tomographic method based on first-Born approximation and a canonical approximations. The latter improvement makes it possible to extend the scope of tomography from lower impedance contrast media to higher impedance contrast situations, even when the ultrasonic propagation is greatly perturbed by the difference in acoustic impedance between the scatterer and the surrounding medium. The strategy used to solve this problem was based on comparisons between the experimental diffracted field and the canonical solution approached as a forward problem. The algorithm adopted, using the analytical solution to the local forward problem and an iterative process to recover the unknowns, is fast enough to yield real-time information about the shape. A single frequency does not suffice to determine the real solution as the global minimum of the cost function, and the inversion is improved by using all the frequencies present in the broadband of the transducers. The method presented is robust and is not perturbed by the experimental measurements or small errors in the material properties. The results are most promising. This method gives an image with an error, which is lower than the wavelength.