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Reflection Tomographic Imaging with Applications to Circular SAS.

ABSTRACT - Masterthesis

Computed tomography is a technique of producing a two-dimensional cross-sectional view of a three-dimensional object by digital signal processing of many one-dimensional views or projections taken at different angles. By processing all the projections received for all possible angles, an image is reconstructed that represents the two-dimensional spatial distribution of the object's acoustic reflectivity function when projected on the imaging plane. In acoustic reflection tomography, the object is struck by acoustic waves and then the backscattered signal provides the projection information for a given angle. The shape of the reflector is reconstructed by applying standard backprojection, Radon transform inversion (using both convolution and filtered backprojections), and direct Fourier inversion to simulated projection data. The relative merits of the various reconstruction algorithms are assessed and the resulting shape and resolutions are compared. For bandpass sonar data, however, the wave number components of the acoustic reflectivity function that are outside the passband are absent. This leads to the consideration of image reconstruction for bandpass data. The number of industrial applications of Computed Tomography (CT) is large and rapidly increasing.

Tomographic images are generally formed by illuminating an object with some form of energy (x- rays, microwaves, or ultrasound) and by measuring the energy that passes through the object to the other side and cast on a receiver or reflected by the object and cast on a receiver placed at the location of the transmitter itself. The amplitude or the time of arrival of the received signal can be measured and an estimate is then formed of a line integral of the object’s attenuation coefficient or refractive index. Even when the energy doesn’t travel in a straight line it is often possible to use either algebraic techniques or diffraction tomography to form an image which is outside the scope of my research.