

Reconstruction algorithms in time domain sonic imaging

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Sonic imaging plays an important role in medical radiology, nondestructive testing and seismic exploration. Most of the work in this field is done by linearization. In this talk we deal with iterative methods for the fully nonlinear problem - full waveform inversion in the jargon of exploration geophysics. We start with a survey on the results obtained by linearization. For the fully nonlinear problem we describe in detail the Kaczmarz method in the time domain. It turns out that Kaczmarz's method, whose linear version is widely used in X-ray tomography, can be viewed in a very intuitive way as consecutive time reversal. We show by numerical examples that Kaczmarz easily solves the standard problems, such as transmission tomography and reflection imaging with broadband data. To speed up the convergence we discuss novel techniques based on wavefront synthesis, plane wave stacking and source encoding.