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Acoustic imaging of layered media

We present a recent solution to the inverse medium problem in one dimension. The echoes-to-impedance transform is a nonlinear transform designed for acoustic imaging of layered media. The transform converts time domain digital reflection data directly into impedance as a function of spatial location, using minimal prior information about the source wavelet and no pre-preprocessing. It is simple, fast, and, according to numerical experiments, highly accurate. More than this, physical structure is superresolved at a finer scale than that of the source wavelet. The derivation of the echoes-to-impedance transform stems from a recently developed numerical method for wave propagation in one dimension in conjunction with the theory of orthogonal polynomials on the unit circle.