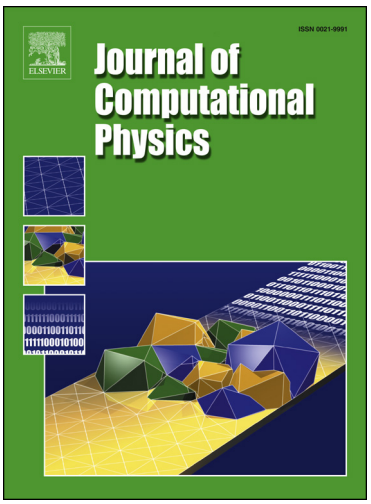
Accepted Manuscript



Acoustic imaging of layered media

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PII: S0021-9991(18)30431-5
DOI: https://doi.org/10.1016/j.jcp.2018.06.053
Reference: YJCPH 8102

To appear in: *Journal of Computational Physics*

Received date: 8 February 2018
Revised date: 20 June 2018
Accepted date: 20 June 2018

Please cite this article in press as: P.C. Gibson, Acoustic imaging of layered media, *J. Comput. Phys.* (2018), https://doi.org/10.1016/j.jcp.2018.06.053

Acoustic imaging of layered media

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June 15, 2018

Abstract

This paper presents the echoes-to-impedance transform, a nonlinear transform designed for acoustic imaging of layered media—for example, sedimentary geological formations, biological tissue such as skin, or laminated structures in the built environment. 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 prepreprocessing. 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.

MSC 35L05, 35R05, 35R30, 47C05; Keywords: one dimensional wave equation, impedance inversion, inverse problems, orthogonal polynomials

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