Tomographic inversion using $\ell_1$-norm regularization of wavelet coefficients

I. Loris (1), G. Nolet (2), I. Daubechies (3), F. A. Dahlen (2)

(1) Dienst Theoretische Natuurkunde, Vrije Universiteit Brussel (igloris@vub.ac.be),
(2) Department of Geosciences, Princeton University,
(3) Program in Applied and Computational Mathematics, Princeton University

We propose the use of $\ell_1$ regularization in a wavelet basis for the solution of linearized seismic tomography problems $\mathbf{A} \mathbf{m} = \mathbf{d}$, allowing for the possibility of sharp discontinuities superimposed on a smoothly varying background. An iterative method is used to find a sparse solution $\mathbf{m}$ that contains no more fine-scale structure than is necessary to fit the data $\mathbf{d}$ to within its assigned errors.