Inverse Scattering for Planar Cracks via Nonlinear Integral Equations

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Abstract

We present a Newton-type method for reconstructing planar sound-soft or perfectly conducting cracks from far-field measurements for one time-harmonic scattered with plane wave incidence. Our approach arises from a method suggested by Kress and Rundell [2] for the inverse boundary value problem for the Laplace equation. It was extended to inverse scattering problems for sound-soft obstacles [1] and for sound-hard cracks [3]. In both cases it was shown that the method gives accurate reconstructions with reasonable stability against noisy data. The approach is based on a pair of nonlinear and ill-posed integral equations for the unknown boundary. The integral equations are solved by linearization, i.e., by regularized Newton iterations. Numerical reconstructions illustrate the feasibility of the method.

References

[1] O. Ivanyshyn and R. Kress. Nonlinear integral equations in inverse obstacle scattering. *Mathematical Methods in Scattering Theory and Biomedical Engineering (Fotiatis, Massalas, eds)*, pages 39–50, 2006.

[2] R. Kress and W. Rundell. Nonlinear integral equations and the iterative solution for an inverse boundary value problem. *Inverse Problems*, 21(4):1207–1223, 2005.

[3] K.-M. Lee. Inverse scattering via nonlinear integral equations for a Neumann crack. *Inverse Problems*, 22(6), 2006.