COMPUTATION OF INTERIOR EIGENVALUES FROM THE SCATTERING DATA

FIORALBA CAKONI

Abstract. In the recent years new spectral imaging methods have been introduced for solving the inverse scattering problem [3]. These methods make use interior eigenvalue problems defined on the support of the scatterer, which arise from the study of injectivity of the relative scattering operator. In the case of the scattering by an impenetrable obstacle with Dirichlet or Robin boundary condition this is merely the Dirichlet or Robin eigenvalue problem for a symmetric elliptic operator [1]. A more intriguing situation arises in the scattering by an inhomogeneous medium, where a non-selfadjoint eigenvalue problems arises, known as the transmission eigenvalue problem [2]. The interior eigenvalues contain information about the geometry and/or constitutive material properties of the scatterer that can be used in the imaging. In this presentation we show how to determine the interior eigenvalues associated with a particular scattering problem from measured scattering data. The numerical algorithm is based on the lack of injectivity of the relative scattering operator at an interior eigenvalues, which in the literature is often referred to as inside-outside duality in scattering theory.

Keywords: scattering operator, inverse scattering theory, inside outside duality, transmission eigenvalues, interior eigenvalues

Mathematics Subject Classifications (2010): 35R30; 35J25; 35P25; 35P05

References

[1] F. Cakoni, D. Colton, and H. Haddar. On the determination of Dirichlet or transmission eigenvalues from far field data *C. R. Math. Acad. Sci. Paris*, 348: 379-383, 2010.

[2] F. Cakoni, D. Colton, and H. Haddar. Transmission Eigenvalues *AMS Notices*, 68 no 9:1499-1510, 2008.

[3] F. Cakoni, D. Colton, and H. Haddar. *Inverse Scattering Theory and Transmission Eigenvalues*, volume 98 *CBMS-NSF*. SIAM Publications, 2023.

DeRutgers University, New Brunswick, USA
Email address: fc292@math.rutgers.edu