

Transmission Eigenvalues and Inverse Scattering Theory

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The transmission eigenvalue problem is a new class of non-selfadjoint eigenvalue problems for partial differential equations that first appeared in inverse scattering theory. This problem can be viewed as the dual of the well known "cloaking" problem where now, for a given inhomogeneous medium, one seeks an incident field for which the inhomogeneous medium is invisible, i.e. there is no scattered field. It can be shown that this can occur for at most a discrete set of values of the wave number and such values are called transmission eigenvalues. It has only recently been shown that for a non-absorbing medium real transmission eigenvalues exist and that these eigenvalues can be determined from a knowledge of the far field pattern of the scattered wave. Through the derivation of Faber-Krahn type inequalities for transmission eigenvalues one can obtain estimates for the index of refraction of the medium, thus opening up new possibilities for non-destructive testing using either acoustic or electromagnetic waves. Such applications are currently being investigated at Wright Patterson Air Force base in Dayton, Ohio.

This talk will provide a brief survey of the above results as well as the formulation of open problems whose solution is necessary for further progress.