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(Research Article)
Using the eigenvalues of the sound equation to determine the properties of materials

M. Tariverdi, A. Ebrahimzadeh*, B. Zakeri
Babol University of Technology, Department of Electrical-Computer Engineering

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Abstract

In this article, the eigenvalues of the sound equation are used to determine the refractive index of the objects. This refractive index helps to extract the acoustic components of the material such as the speed of sound in the material. This will help in identifying targets, especially in the field of signal processing. For this purpose, a method has been extracted that can be used to establish a relation between the eigenvalues and refractive index, which is the main goal of this article. In order to find this relation, it is necessary to obtain appropriate basis vectors for the space of problem, so that the eigenvectors can be expanded in terms of these bases. Therefore, in this article, the eigenvectors of the fourth-order elliptic operator are used as independent bases for the Sobolov space, with the help of which the nonlinear eigenvalue problem becomes a matrix relation that can be easily implemented. Finally, the proposed method is applied to several objects with different refractive indices and the results are compared with the dual space method, which shows that the proposed method has less error in reconstructing the refractive index. As the refractive index value increases, the error is also reduced.

Keywords: Eigenvalues, Eigenvectors, Acoustic refractive index, Inverse scattering problem.

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* Corresponding author E-mail: abrahamzadeh@gmail.com

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