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The numerical solution of the acoustic wave scattering from penetrable obstacles by a Least-squares method

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Abstract

This paper documents a numerical method for a two dimensional time-harmonic wave scattering problem by penetrable obstacles. The Fourier-Bessel function combining a multipole expansion is used to give an approximation of the scattering field. This method is based on the least-squares technique. Especially, we find a simple function to control the errors, and then give the theoretical results of the presented method. The continuity across the element boundaries is enforced by minimizing a simple quadratic functional. This method does not need to truncate the domain and could obtain high accuracy by increasing the number of basis functions with even coarse mesh. At last, we give some examples to illustrate the effectiveness of the approach including the solution domain being multiple or even multi-connected.

Keywords:
penetrable obstacle scattering, least-squares technique, Fourier-Bessel function, multipole expansion

1. Introduction

In this paper, we consider the acoustic scattering problem by penetrable obstacles. The acoustic wave scattering problem is very important in a wide range of areas such as noise prediction, antenna design, radar and sonar modeling, geophysical exploration, medical imaging. The background may

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