Determination of complex obstacles from scattering data.

Mourad Sini *

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Abstract

The scattering by an obstacle $D \subset R^n$ with mixed boundary conditions can be considered as a prototype model for the radar detection of complex obstacles with coated and non-coated parts of its boundary. The complex obstacle is characterized by its shape, the type of boundary conditions imposed on the its surface and the boundary values of the impedance coefficient.

In this talk, we are concerned with the identification of these complex obstacles from the scattering data for the acoustic problem. We present the following results:

- We construct some indicator functions for this inverse problem using the far-field pattern directly, without the necessity to transform the far-field to the near field. Based on the careful singularity analysis, we establish point-wise formulas which can be used to reconstruct the shape of the obstacle and give explicitly the values of the surface impedance as a function of the far fields. In addition, these formulas enable us to distinguish and recognize the coated and the non-coated parts of the obstacle. This analysis is given for arbitrary dimension n.
- In the 2D case, we give numerical tests based on these formulas which show that both the boundary shape and the surface impedance in the coated part of boundary can be reconstructed accurately. Our reconstruction scheme reveals that the coated part of the obstacle is less visible than the non-coated one, which corresponds to the physical fact that the coated boundary absorbs some part of the scattered wave. This is known as the *coating effect*. This is of importance in the design of non-detectable obstacles.
- The stability issue for the complex obstacles will be also treated.

*RICAM, Altenbergerstrasse 69, A 40-40, Linz, Austria. Email: mourad.sini@oeaw.ac.at