On the Construction of Nonscattering Fields

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Abstract

There are many methods for identifying the shape and location of scatterers from far field data. We take the view that the connections between algorithms are more illuminating than their differences, particularly with regard to the Linear Sampling and Factorization Methods, the Point Source Method and the MUSIC algorithm. Using the first two techniques we show that, for a scatterer with Dirichlet boundary conditions, there is a nontrivial incident field that does not generate a scattered field. This incident field, written as an expansion of eigenfunctions of the far field operator, is used in the MUSIC algorithm to image the shape and location of the obstacle as those points z where the incident field is orthogonal to the far field pattern due to a point source located at z . This has two intriguing applications, one for inverse scattering and the other for signal design. Numerical examples demonstrate these ideas.