On the convergence of the no response test

Roland Potthast

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r.w.e.potthast@reading.ac.uk

Abstract

The no response test is a new scheme in inverse problems for partial differential equations which was recently proposed by Luke and the author in the framework of inverse acoustic scattering problems. The main idea of the scheme is to construct special probing waves which are small on some test domain. Then, the response for these waves is constructed. If the response is small, the unknown object is assumed to be a subset of the test domain. The response is constructed from *one*, *several* or *many* particular solution of the problem under consideration.

We investigate the *convergence* of the no response test for the reconstruction information about inclusions D from the Cauchy values of solutions to the Helmholtz equation on an outer surface $\partial\Omega$ with $\overline{D} \subset \Omega$. We show that the one-wave no response test provides a criterion to test the analytic extensibility of a field. In particular, we investigate the construction of approximations for the set of singular points $N(u)$ of the total fields u from one given pair of Cauchy data. Thus, the no response test solves a particular version of the classical *Cauchy problem*. Also, if an infinite number of fields is given, we prove that a *multi-field version* of the no response test reconstructs the unknown inclusion D.