Global uniqueness for a non-overdetermined inverse conductivity problem in unbounded domains

Michael V. Klibanov and Alexandre Timonov

Preprint no. 2004-01

Abstract

In this paper we show that sufficiently smooth coefficients of the elliptic operator $\nabla_x \cdot \sigma(x')\nabla_x - c(x'),\ x \in R^3,\ x' \in R^2$ can be uniquely determined from the Cauchy data given on a strip in the plane $\{x_3 = 0\}$. This is an extension of Tikhonov's formulation of the one-dimensional inverse problem of electric prospecting to two dimensions. In this formulation, the number of variables in the Cauchy data equals the number of variables in unknown coefficients. This is referred to the concept of non-overdeterminacy. Unlike the Dirichlet-to-Neumann map defined on the entire boundary of a bounded domain, the position of a pointlike electrode injecting electric currents into a domain is assumed to be fixed, and such a domain is assumed to be unbounded. The method of Carleman estimates combined with both the direct Fourier and inverse Laplace transforms is adopted to establish the global uniqueness theorem. Also, we establish the global uniqueness result for a corresponding inverse source problem arising in gravimetry prospecting.

2000 AMS Subject Classifications: 35R30, 35J45

Key words and phrases: inverse conductivity problem, unbounded domain, non-overdeterminacy, Carleman estimates, global uniqueness

This preprint is also downloadable from:

`http://www.math.uncc.edu/people/research/mklibanv.php3`

Department of Mathematics, UNC Charlotte, Charlotte, NC 28223