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Inverse problems for elliptic PDEs, analysis and applications

Lipschitz stability for the inverse conductivity problem for a conformal class of anisotropic conductivities

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Abstract:
We discuss the stability issue for the inverse conductivity problem. We focus on a particular a priori choice of the *anisotropic* conductivity $\sigma(x)$, namely given a *known* matrix valued function $A(x)$ we have that

$$\sigma(x) = \gamma(x)A(x)$$

with $\gamma(x) = \sum_{i=1}^{N} \gamma_i \chi_{D_i}$ where each subdomain of Ω, D_i, $i = 1, \dots, N$ is *given* and each number γ_i is *unknown*. We prove that under such an a priori hypothesis the dependence of the conductivity σ upon the local Dirichlet to Neumann map is continuous with a *Lipschitz* modulus of continuity [2]. Our approach relies on the well established method of singular solutions, more precisely we combine quantitative unique continuation arguments and original asymptotic estimates for the underlying Green function.
From a medical imaging point of view, each D_j may represent the area occupied by different tissues or organs and one can think that the geometrical configuration of each D_j is given by means of other imaging techniques such as MRI for example. Since most tissues in the human body are anisotropic, we have extended the previous Lipschitz stability result obtained in [1] for the piecewise constant isotropic case.

References

[1] G. Alessandrini, S. Vessella, Lipschitz stability for the inverse conductivity problem, Advances in Applied Mathematics, 35 207-241 (2005).

[2] R. Gaburro, E. Sincich, Lipschitz stability for the inverse conductivity problem for a conformal class of anisotropic conductivities, Inverse Problems 31 015008 (2015).