The Kohn-Vogelius method for the identification of singular parameters

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Abstract

In this talk, we present the Kohn-Vogelius method for solving some inverse problems of the identification of singular parameters from boundary measurements in elliptic partial differential equations. The method consists to transform the corresponding inverse problem into an optimization one by constructing a cost functional J modeling the energy gap between the solution of the "Neumann" direct problem and a "Dirichlet" problem evaluated using the measured data f given on some accessible part Γ_1 of the domain boundary.

In the case of discontinuous unknown parameters, it is well known that the differentiability of the state variables with respect to the discontinuity points of the parameters is not guaranteed (see [1] for an example case). We shall provide an abstract framework guaranteeing the differentiability of the Kohn-Vogelius cost functional with respect to the discontinuity points of the unknown parameters although the state may not be differentiable. As an application we retrieve the results obtained by S. Chaabane, I. Feki and N. Mars [1] for the reconstruction of a piecewise constant Robin parameter in the case of the Laplace operator and those of S. Chaabane, B. Charfi and H. Haddar [2] for the differentiability of the Kohn-Vogelius function with respect to the discontinuity points of the parameters in a second order impedance boundary operator.

This presentation is dedicated to Professor M. Jaoua on the occasion of his 70th birthday.

References

[1] S. Chaabane, I. Feki, N. Mars, *Numerical reconstruction of a piecewise constant Robin parameter in the two-or three-dimensional case*, Inverse Problems, **28 (6)**, (2012).

[2] S. Chaabane, B. Charfi, H. Haddar. *Reconstruction of discontinuous parameters in a second order impedance boundary operator,* Inverse Problems, **32 (10)**, (2016).