A combination of Kohn-Vogelius and DDM methods for a geometrical inverse problem

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Abstract

We consider the geometrical inverse problem of identifying the discontinuity curve of an electrical conductivity in a bounded domain Ω of $\mathbb{R}^2$ from Cauchy data on $\partial\Omega$. We formulate the inverse problem as the minimization of a Kohn-Vogelius cost functional. We then employ a gradient descent method combined with a domain decomposition method to solve the direct problem. Our goal is to study the relevance and convergence of alternate descent schemes where only partial steps of the domain decomposition method are performed at each gradient descent. We study in particular the case of the so called one-shot method where one step of the DDM is used. We shall also discuss the numerical scheme associated with this method and in particular the ambiguity in defining the update for the gradient of the cost functional when the domain decomposition respect the jump of the conductivity. We finally illustrate our theoretical findings and the performance of the inversion scheme with some numerical experiments.