A new method for the data completion problem and application to obstacle detection

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Author(s) Caubet, Fabien; Dambrine, Marc; Harbrecht, Helmut
Author(s) at UniBasel Harbrecht, Helmut ;
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The present article is devoted to the study of two well-known inverse problems, that is, the data completion problem and the inverse obstacle problem. The general idea is to reconstruct some boundary conditions and/or to identify an obstacle or void of different conductivity which is contained in a domain, from measurements of voltage and currents on the outer boundary of the domain. We focus here on Laplace's equation. First, we use a penalized Kohn-Vogelius functional in order to numerically solve the data completion problem, which consists in recovering some boundary conditions from partial Cauchy data. The functional to be minimized is quadratic, hence we compute its minimum by solving the linearized equation. Second, we propose to build an iterative method for the inverse obstacle problem based on the combination of the previously mentioned data completion subproblem and the so-called trial method. The underlying boundary value problems are efficiently computed by means of boundary integral equations and several numerical simulations show the applicability and feasibility of our new approach. For the numerical simulations, we focus on star-shaped domains in the two-dimensional case.
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