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Topological Sensitivity Analysis for Reconstruction of the Inverse Source Problem from Boundary Measurement

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Abstract : In this paper, we consider a geometric inverse source problem for the heat equation with Dirichlet and Neumann boundary data. We will reconstruct the exact form of the unknown source term from additional boundary conditions. Our motivation is to detect the location, the size and the shape of source support. We present a one-shot algorithm based on the Kohn-Vogelius formulation and the topological gradient method. The geometric inverse source problem is formulated as a topology optimization one. A topological sensitivity analysis is derived from a source function. Then, we present a non-iterative numerical method for the geometric reconstruction of the source term with unknown support using a level curve of the topological gradient. Finally, we give several examples to show the viability of our presented method.

Keywords : geometric inverse source problem, heat equation, topological optimization, topological sensitivity, Kohn-Vogelius formulation
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