FICTITIOUS DOMAIN DECOMPOSITION TECHNIQUE FOR RECOVERING MISSING BOUNDARY DATA: GROUNDWATER FLOW EQUATION

A. BEN BBDA[*], J. ERHEL[†] and S. KHALFALLAH[*†]

[*] LAMSIN – ENIT – TUNISIA
e-mail: amel.benabda@enit.rnu.tn

[†] SAGE – IRISA – RENNES
e-mail: jocelyne.erhel@irisa.fr sinda.khalfallah@irisa.fr

Summary. In this paper, we consider an inverse problem known as missing boundary data recovering. We assume that a transient groundwater model is given in a computational domain with overspecified data on a part of the boundary and missing data on the other part. Classical approaches use a least-squares formulation which requires some regularization tool to solve this ill-posed problem. Here, we consider an approach based on an energy norm defined from two well-posed problems, which appears to be self-regularizing [2, 1]. There are several ways to minimize the energy norm. We follow the method introduced in [4] for the steady-state case, whereas we consider here a transient case. The idea is to write the first-order optimality conditions as an interfacial problem [3]. At each time step, we apply a preconditioned iterative gradient algorithm, which appears to be very efficient. Numerical experiments illustrate the robustness of the method, even for a noisy singular test case.

References.

[1] S. Andrieux and T. Nouri Baranger; Energy methods for Cauchy problems of evolutions equations. Journal of Physics: Conference series (2008) 135, 012007.

[2] S. Andrieux, T. Baranger and A. Ben Abda, Solving Cauchy problems by minimizing an energy-like functional, Inverse Problems, 22 (2006), 115133

[3] F. Ben Belgacem and H. El Fekih; On Cauchy problem: I. A variational Steklov-Poincaré theory. Inverse Problems 21 (2005) 1915-1936.

[4] D.N. Hao and D. Lesnic, The Cauchy problem for Laplace's equation via the conjugate gradient method, IMA Journal of Applied Mathematics, 65 (2000), 199217.