Contribution ID: **16** Type: **Talk**

Efficient Regularization and Numerical Reconstruction Methods for Inverse Source Problems in Generalized Diffusion Equation

Tuesday, 21 January 2025 16:00 (20 minutes)

We address two inverse source problems when determining a space-dependent source term and a time-dependent coefficient for a two-dimensional generalized diffusion equation. These problems are ill-posed in the Hadamard sense, where small perturbations in the data can lead to uncontrolled variations in the solution. From a analytic viewpoint we provide existence and uniqueness results for the solutions of these problems under appropriate over-specified and regularity conditions. From a computational viewpoint, we use a quasi-boundary value regularization to reconstruct the underlying approximate source term. In the reconstruction, by employing a finite difference discretization of the regularized problem, we encounter a two-by-two (structured) block linear system. We propose efficient (preconditioned) Krylov solvers and we present numerical experiments to demonstrate the effectiveness of our method.

1. A. Ilyas, S. A. Malik, Direct and some inverse problems for a generalized diffusion equation with variable coefficients, *Computational and Applied Mathematics*, **43**(6), (2024), 364 pp.
2. H.-K. Pang, H.-H. Qin, S. Ni, Sine transform based preconditioning for an inverse source problem of time-space fractional diffusion equations. *Journal of Scientific Computing*, **100**(3), Paper No. 74,(2024), 32 pp.
3. C. Garoni, S. Serra-Capizzano, Generalized locally Toeplitz sequenecs: theory and applications, Vol. II, Springer, Cham, 2018.
4. A. Ilyas, S. Serra-Capizzano, Inverse Source Problems for Identifying Time and Space-Dependent Coefficients in a 2D Generalized Diffusion Equation, preprint 2024.

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