An inverse problem for the heat equation with Caputo fractional derivative

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In this paper we consider an anomalous diffusion equation with nonlocal integral boundary conditions. An inverse determination problem of the temperature distribution and the source term is considered. The inverse problem is to be well-posed in the sense of Hadamard whenever an overdetermination condition of the final temperature is given.

The purpose of this contribution is to study an inverse problem for the anomalous diffusion equation (see [1])

$$\mathcal{D}^{\beta}_{0+,t}u(x,t) + \mathcal{D}^{\alpha}_{a+,x}\mathcal{D}^{\alpha}_{b-,x}u(x,t) = f(x)$$

where $0 < \beta \leq 1, 1/2 < \alpha < 1, (t,x) \in (0,+\infty) \times [a,b]$. The problem of determination of temperature at interior points of a region when the initial and boundary conditions along with diffusion source term are specified are known as direct diffusion conduction problems. In many physical problems, determination of coefficients or right hand side (the source term, in case of the diffusion equation) in a differential equation from some available information is required; these problems are known as inverse problems.

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Keywords: fractional differential equation, inverse problem

References:

[1] Uchaikin V.V., 2013. Fractional Derivatives for Physicists and Engineers. V. 1, Background and Theory. V. 2, Application. Springer. V. 4, No. 3, P.332-339.

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Spectral geometry: eigenvalue and norm inequalities

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In this talk, we discuss some geometric eigenvalue and norm inequalities for the logarithmic potential and Riesz potential type operators. In this case, the main reason why the results are useful, beyond the intrinsic interest of geometric extremum problems, is that they produce a priori bounds for spectral invariants of operators on arbitrary domains. We demonstrate these in explicit examples. We also discuss nonlinear analogues of these problems related to the multidimensional MEMS type problems. This talk is based on our joint papers with Kalmenov T.Sh., Kassymov A., Rozenblum G., Ruzhansky M., Sadybekov M. and Wei D. [1]-[6].

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