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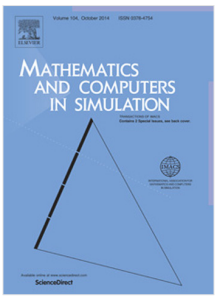

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The method of simplified Tikhonov regularization for a time-fractional inverse diffusion problem *

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Abstract In this paper, we consider a time-fractional inverse diffusion problem, where the data are given at $x = 1$ and the solution is required in the interval $0 < x < 1$. This problem is typically ill-posed, i.e., the solution (if it exists) does not depend continuously on the data. The simplified Tikhonov regularization method is proposed to solve this problem. An *a priori* error estimate between the exact solution and its regularized approximation is obtained. Moreover, a new *a posteriori* parameter choice rule is proposed and the Hölder type error estimate is also obtained. Some different type examples are presented to demonstrate the feasibility and efficiency of the proposed method.

keywords: Time-fractional inverse diffusion problem; Simplified Tikhonov method; *A posteriori* parameter choice; Error estimate

1 Introduction

Partial differential equations with fractional order arose from the studies of continuous random walk [1], Levy motion [4], and high-frequency financial data [17]. Among these studies the modeling of advection and dispersion phenomena in groundwater hydrology to simulate the transport of passive tracers carried by fluid flow in a porous medium resulted in a partial differential equation with fractional order [2]. In general, fluid flow and diffusion phenomena are governed by a fractional advection-dispersion equation. If the initial concentration distribution and boundary conditions are given, a complete recovery of the unknown solution is attainable from solving a well-posed forward problem [12]. However, in some practical problems, the boundary data can only be measured

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