

Recovering the reaction coefficient for two dimensional time fractional diffusion equations

Xiaoyan Song* Guanghui Zheng[†] Lijian Jiang[‡]

ABSTRACT

In this paper, we present an inverse problem of recovering the reaction coefficient for time fractional diffusion equations in two dimensional spaces by using boundary Neumann data. It is proved that the forward operator is continuously Fréchet differentiable. This can ascertain whether the forward model is robust with regard to different parameters, and is also necessary for using Levenberg-Marquardt(L-M) algorithm to solve the minimization problem. Because the inverse problem is often ill-posed, regularization strategies are imposed on the least fit-to-data functional to overcome the stability issue. There may exist various kinds of functions to reconstruct. It is crucial to choose a suitable regularization method. We present a multi-parameter regularization L^2+BV method for the inverse problem. A few numerical examples are presented for the inverse problem in time fractional diffusion equations to confirm the theoretic analysis and the efficacy of the different regularization methods.

keywords: time fractional diffusion equation, reaction inversion, L^2+BV regularization

*College of Mathematics and Econometrics, Hunan University, Changsha 410082, China. Email: xiaoyansong@hnu.edu.cn

[†]College of Mathematics and Econometrics, Hunan University, Changsha 410082, China. Email: zhgh1980@163.com

[‡]Institute of Mathematics, Hunan University, Changsha 410082, China. Email: ljjiang@hnu.edu.cn.
Corresponding author