TIME FRACTIONAL INVERSE HEAT CONDUCTION PROBLEM

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Abstract

Time fractional diffusion equations (TFDE) arise by replacing the standard time partial derivative in the diffusion equation with a time fractional partial derivative, attempting to generalize the classical Fick (or Fourier) law to describe phenomena with long memory where the rate of diffusion might be inconsistent with the classical Brownian motion model.

The main purpose of this paper is to introduce and analyze a stable space marching numerical method for the approximate solution of the Time Fractional Inverse Heat Conduction Problem (TFIHCP).

We review the most common definitions of fractional derivatives, their interpretation as ill-posed problems and the necessity of regularization when the data is not known exactly. After a brief classification of different types of fractional diffusion equations, we concentrate on time fractional diffusion equations and the data acquisition procedure for TFIHCP. A new space marching mollification algorithm for the numerical solution of the TFIHCP is developed and a proof of formal convergence is provided. Numerical examples of interest are presented.