INVERSE KERNELS FOR THE TIME FRACTIONAL INVERSE HEAT CONDUCTION PROBLEM

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Abstract

The main purpose of this paper is to introduce the four inverse kernels associated with the time fractional inverse heat conduction problem (TFIHCP). The aim is twofold: to investigate the inverse kernels attempting to get more insight into the characteristics and properties of the TFIHCP and also to explore the possibility of using the inverse kernels for the approximate numerical solution of the TFIHCP.

We introduce a family of inverse kernels that depend on the order of the partial time derivative, the time sample step size, the amount of regularization, and the width of the finite slab.

We review the notion of fractional derivatives and define the time fractional diffusion equation to which the TFIHCP applies. The regularization of the TFIHCP and the description of a space marching finite difference algorithm for its numerical solution are investigated.

Several properties of the inverse kernels are stated, and the influence of the asymptotic time behavior of the inverse kernels on their numerical implementation for the solution of the TFIHCP is discussed.

We conclude that, under certain conditions, the inverse kernels can be used to obtain approximate stable solutions for the TFIHCP with a minimum of computations. Numerous numerical examples are provided.