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Some novel numerical techniques for an inverse problem of the multi-term time fractional partial differential equation

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Abstract

In this paper, an inverse problem to identify parameters for the multi-term time fractional partial differential equation with Caputo fractional derivative is considered. The numerical solution of the direct problem is obtained by the modified fractional predictor-corrector method, while the inverse problem is conducted by the modified hybrid Nelder-Mead simplex search and particle swarm optimization (MH-NMSS-PSO) algorithm, which is expanded to estimate parameters for fractional differential equations. To verify the efficiency and accuracy of the proposed methods, three numerical examples with experimental data are conducted. Furthermore, in order to improve the practical significance of the research on inverse problems, the predictive value of parameter estimation is also testified. This paper provides effective numerical methods for parameter estimation in practical applications involving multi-term time fractional constitutive equations.

Keywords: Inverse problem, Multi-term time fractional partial differential equation, modified fractional predictor-corrector method, MH-NMSS-PSO algorithm, Experimental data, Numerical method
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