Title: A novel Jacobi operational matrix for numerical solution of multi-term variable-order fractional differential equations.

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Abstract

In this article, we introduce a numerical technique for solving a class of multi-term variable-order fractional differential equation. The method depends on establishing a shifted Jacobi operational matrix (SJOM) of fractional variable-order derivatives. By using the constructed (SJOM) in combination with the collocation technique, the main problem is reduced to an algebraic system of equations that can be solved numerically. The bound of the error estimate for the suggested method is investigated. Numerical examples are introduced to illustrate the applicability, generality, and accuracy of the proposed technique. Moreover, many physical applications problems that have the multi-term variable-order fractional differential equation formulae such as the damped mechanical oscillator problem and Bagley-Torvik equation can be solved via the presented method. Furthermore, the proposed method will be considered as a generalization of many numerical techniques.