Numerical computation of fractional Fredholm integrodifferential equation of order 2β arising in natural sciences

Abstract: This article investigates the approximate solutions to a class of fractional linear Fredholm integro-differential equations arising in physical phenomena based upon the use of an effective treatment technique, called the residual power series (RPS) technique. This approach relies on the generalized Taylor formula as well as the residual error function under the sense of Caputo, with the aim of deriving a supportive analytical solution in the form of a rapidly convergent fractional power series with easily computable components. The RPS algorithm is easy to implement without linearization, limitations or restrictions on the problem's nature and the number of grid points. To justify the efficiency and accuracy of the proposed technique, an illustrative example is given. The results obtained indicate that the algorithm is simple, accurate, and powerful to solve such equations.

Keywords: Fractional Fredholm integrodifferential equation, Caputo fractional derivative, Residual power series method, Generalized Taylor formula.

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