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Summary: In this paper, we use a novel technique to solve the nonlinear fractional Volterra-Fredholm integro-differential equations (FVFIDEs). To this end, the Legendre wavelets are used in conjunction with the quadrature rule for converting the problem into a linear or nonlinear system of algebraic equations, which can be easily solved by applying mathematical programming techniques. Only a small number of Legendre wavelets are needed to obtain a satisfactory result. Better accuracies are also achieved within the method by increasing the number of polynomials. Furthermore, the existence and uniqueness of the solution are proved by preparing some theorems and lemmas. Also, error estimation and convergence analyses are given for the considered problem and the method. Moreover, some examples are presented and their results are compared to the results of Chebyshev wavelet, Nyström, and Newton-Kantorovitch methods to show the capability and validity of this scheme.

MSC:
47G20 Integro-differential operators
65T60 Numerical methods for wavelets
34A08 Fractional ordinary differential equations

Keywords:
Legendre wavelet; Gaussian quadrature; operational matrix; fractional Volterra-Fredholm integro-differential equations

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References:

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