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Abstract

In this article, a fractional-order mathematical physics model, advection–dispersion equation (FADE), will be solved numerically through a new approximative technique. Shifted Vieta–Lucas orthogonal polynomials will be considered as the main base for the desired numerical solution. These polynomials are used for transforming the FADE into an ordinary differential equations system (ODES). The nonstandard finite difference method coincidence with the spectral collocation method will be used for converting the ODES into an equivalence system of algebraic equations that can be solved numerically. The Caputo fractional derivative will be used. Moreover, the error analysis and the upper bound of the derived formula error will be investigated. Lastly, the accuracy and efficiency of the proposed method will be demonstrated through some numerical applications.