An Analytical Numerical Method for Solving Fuzzy Fractional Volterra Integro-Differential Equations

Abstract: The modeling of fuzzy fractional integro-differential equations is a very significant matter in engineering and applied sciences. This paper presents a novel treatment algorithm based on utilizing the fractional residual power series (FRPS) method to study and interpret the approximated solutions for a class of fuzzy fractional Volterra integro-differential equations of order $0 < \beta \leq 1$ which are subject to appropriate symmetric triangular fuzzy conditions under strongly generalized differentiability. The proposed algorithm relies upon the residual error concept and on the formula of generalized Taylor. The FRPS algorithm provides approximated solutions in parametric form with rapidly convergent fractional power series without linearization, limitation on the problem's nature, and sort of classification or perturbation. The fuzzy fractional derivatives are described via the Caputo fuzzy H-differentiable. The ability, effectiveness, and simplicity of the proposed technique are demonstrated by testing two applications. Graphical and numerical results reveal the symmetry between the lower and upper r-cut representations of the fuzzy solution and satisfy the convex symmetric triangular fuzzy number. Notably, the symmetric fuzzy solutions on a focus of their core and support refer to a sense of proportion, harmony, and balance. The obtained results reveal that the FRPS scheme is simple, straightforward, accurate and convenient to solve different forms of fuzzy fractional differential equations.

Keywords: fuzzy fractional Volterra integro-differential equations; Caputo fractional derivative; fractional residual power series.

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