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Exact Solution of Fractional-order Soliton Dynamics in the space-time fractional Westervelt Equation

Communication Info

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Abstract

This study investigates the space-time fractional form of the third-order nonlinear Westervelt equation, a fundamental model for high-intensity ultrasound wave propagation. Analysis of the analytical solutions comes from combining the Bäcklund transformation and generalized Riccati-Bernoulli sub- ODE Method. The rational and trigonometric together with hyperbolic solutions provide fundamental knowledge about wave dynamics inside the fractional model equations. The kink-type solutions are illustrated in both 3D and 2D representations. The 3D visualizations show integer-order shifts but the 2D formats show how the fractional parameter affects wave patterns to compare their behavioral changes. These solutions advance our understanding of fractional acoustic models because they present viable potential applications in acoustic tomography and nonlinear wave analysis.

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