Analytical technique and diverse chaos-identifying tools for the time fractional symmetric regularized long wave equation: extended analysis

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The nonlinear conformable time-fractional symmetric regularized long wave (SRLW) equation is important in physics because it captures memory effects in fluid flow and describes how weakly nonlinear pulses evolve in optical fibers. This work solves the SRLW problem using the \documentclass[12pt]{minimal} \usepackage{amsmath} \usepackage{wasysym} \usepackage{amsfonts} \usepackage{amssymb} \usepackage{amsbsy} \usepackage{mathrsfs} \usepackage{upgreek} \setlength{\oddsidemargin}{-69pt} \begin{document}$$\:\left(\frac{{G}^{\prime\:}}{{G}^{2}}\right)$$\end{document} -expansion technique and obtain diverse exact solutions, such as breather waves, kinky breathers, double kinks, local breathers with kink waves, local breathers with lump waves, and local breathers with dark-bright solitons. Then, the three-dimensional representations, along with their density plots for the real, imaginary, and absolute value parts of these solutions are displayed. We also detect the system's chaotic nature using various chaos-identifying tools, such as strange attractors, return maps, Lyapunov exponents, and others. The findings demonstrate the usefulness of the mentioned method as a mathematical tool for resolving nonlinear conformable time-fractional problems that arise in various mathematical fields.

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