Analytical Solutions of a Nonlinear Stochastic-Fractional Equation

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In this study, Stochastic-Fractional Drinfel'd-Sokolov-Wilson (SFDSW) equation is considered given as [1]:

$$d\psi + \left(\alpha_1 \varphi T_x^\omega \varphi\right) dt = \rho \psi d\eta, \tag{1}$$

$$d\varphi + \left(\alpha_2 T_{xxx}^\omega \varphi + \alpha_3 \psi T_x^\omega \varphi + \alpha_4 \varphi T_x^\omega \psi\right) dt = \rho \varphi d\eta, \tag{2}$$

where $\psi = \psi\left(x,t\right), \varphi = \varphi\left(x,t\right)$ are real stochastic functions, $\eta = \eta\left(t\right)$ is the standart Brownian motion, ρ is a noise intensity, α_i for $i = \overline{1,4}$ are nonzero real constants and T^ω is conformable derivative of order ω for $0 < \omega < 1$.

The aim of this study is to obtain the analytical solutions of (1)-(2) via unified solver technique [2] Before starting the solution process, some definitions and basic properties of implemented method is given [1].

1. Alsallami S. A. M., Rizvi S.T.R, Seadawy A. R. Study of Stochastic-Fractional Drinfel'd-Sokolov-Wilson Equation for M-Shaped Rational, Homoclinic Breather, Periodic and Kink-Cross Rational Solutions, Mathematics, 2023, 11, 1504.
2. Abdelrahman M. A. E., Hassan S. Z. et al., Fundamental solutions for the conformable time fractional Phi-4 and space-time fractional simplified MCH equations, AIMS Mathematics, 2021, 6.