An Euler-Maruyama Method and Its Fast Implementation for Multi-Term Fractional Stochastic Differential Equations

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Abstract

In this paper, we derive an Euler-Maruyama (EM) method for a class of multi-term fractional stochastic nonlinear differential equations, and prove its strong convergence. The strong convergence order of this EM method is $\min\{\alpha_{m}-0.5,~\alpha_{m}-\alpha_{m-1}\}$, where $\{\alpha_{i}\}_{i=1}^{m}$ is the order of Caputo fractional derivative satisfying that $1>\alpha_{m}>\alpha_{m-1}>\cdots>\alpha_{2}>\alpha_{1}>0$, $\alpha_{m}>0.5$, and $\alpha_{m}+\alpha_{m-1}>1$. Then, a fast implementation of this proposed EM method is also presented based on the sum-of-exponentials approximation technique. Finally, some numerical experiments are given to verify the theoretical results and computational efficiency of our EM method.

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