Convergence and stability of the split-step theta method for stochastic differential equations with piecewise continuous arguments

Y.L. Lu, M.H. Song, M.Z. Liu

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Highlights

1. The split-step theta (SST) method is implemented to stochastic differential equations with piecewise continuous arguments (SDEPCAs) in which both the drift and the diffusion coefficients do not satisfy the global Lipschitz and linear growth conditions, especially the diffusion coefficients are highly non-linear growing.
2. The strong convergence of SST method with $\theta \in [1/2,1]$ is proved under the local Lipschitz, monotone and one-sided Lipschitz conditions.
3. It is obtained that the SST method with $\theta \in (1/2,1]$ preserves the exponentially mean square stability of SDEPCAs under the monotone condition and some condition on the step-size.
4. It is also obtained that the SST method with $\theta \in (1/2+1/2\sqrt{\lambda_2/\lambda_1},1]$ preserves the exponentially mean square stability for all step-size ($0<\lambda_2<\lambda_1$).