Strong Approximation for Highly Nonlinear Stochastic Functional Differential Equations with Distributed Delays

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Abstract: We introduce a class of stochastic functional differential equation with distributed delays given by

$$dX(t) = b\left(X(t), \int_0^t H(t,s,X(s-\tau))ds\right)dt + \sigma\left(X(t), \int_0^t G(t,s,X(s-\tau))ds\right)dW(t),$$

with initial data $X(s) = \xi(s),\ s \in [-\tau, 0]$, where τ is a fixed positive constant, $W = (W_t)_{t\geq 0}$ is a standard m-dimensional Brownian motion. Under the assumption that b and σ are super-linear growth and Hölder continuous with respect to the delay components, we show that these equations still have a unique strong solution and establish the strong rate of convergence for their Euler-Maruyama approximation. Our finding partly extends some recent results of Bao-Yuan (*Proc. Amer. Math. Soc.*, 141, no. 9, 3231–3242 (2013)) and Mao-Sabanis (*J. Comput. Appl. Math.*, 151, no. 1, 215–227 (2003)).

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