学术报告

报告题目: A new algorithm for approximation of stochastic differential equations via jump processes

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报告摘要: In this talk, we propose a new algorithm for the approximation of the stochastic differential equation in $\mathbb{R}^d$: $dX_t = \sigma(X_t)dB_t + b(X_t)dt$ without the linear growth condition on the coefficients σ, b, which is indispensable for the convergence of the classical Euler-Maruyama algorithm. Our algorithm is the jump process $(X_t^{(\delta)})$ with generator

$$\mathcal{L}^{(\delta)} f(x) := \mathbb{E}\frac{[f(x+\sqrt{\delta s(x)}\sigma(x)\eta) - f(x)]}{\delta s(x)} + \frac{f(x+\delta s_0(x)b(x)) - f(x)}{\delta s_0(x)}$$

where η is some zero mean random vector of the covariance matrix I (as B_1), and $\delta > 0$ is the time-bandwidth and $s_0(x), s(x) > 0$ are two bandwidth-scaling functions chosen according to the growth rate of $b(x)$ and $\sigma(x)$. We prove that $X^{(\delta)} \to X$ in law on $\mathbb{D}([0,T], \mathbb{R}^d)$ under some weak regularity condition (much weaker than the local Lipschitzian condition for the Euler-Maruyama algorithm) and a Lyapunov function condition, surpassing the linear growth condition. We also provide some quantitative estimates of the unknown invariant probability measure μ of (X_t) by means of $\frac{1}{n}\sum_{k=1}^n \frac{1}{T}\int_{T_0}^{T_0+T} g(X_t^{(\delta,k)})dt$ (or another weighted average), where $X^{(\delta,k)}$ are independent copies of $X^{(\delta)}$, generalizing some previous results of Mattingly, Stuart and Tretyakov for the Euler-Maruyama algorithm on the (compact) torus.