The performance of stochastic Taylor methods and derivative-free method to approximate the solutions of stochastic delay differential equations

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ABSTRACT
This paper is devoted to investigate the performance of stochastic Taylor methods and derivative-free method to approximate the solutions of stochastic delay differential equations (SDDEs) in population dynamics. The corresponding deterministic models of population dynamics follow the generalised of Verhults laws. Stochastic Taylor methods for SDDEs are developed by truncating the stochastic Taylor series expansion with time delay at certain order. As the order increasing, the method is proving theoretically will provide better solutions for SDDEs. However, the difficulty arises in implementing the stochastic Taylor methods as one needs to find the partial derivative of drift and diffusion functions. It is then natural to look for derivative-free method. This paper demonstrates the performance of the existing stochastic Taylor methods of Euler Maruyama and Milstein scheme and the derivative-free method of 1.0 order of convergence in approximating the solutions of SDDEs models under Verhutls laws. Numerical experiments are conducted to demonstrate the performance of the corresponding methods in approximating the solutions of SDDEs.

KEYWORDS
Taylor methods; Stochastic delay; SDDEs

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