Mathematics > Numerical Analysis

The improved split-step backward Euler method for stochastic differential delay equations

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A new, improved split-step backward Euler (SSBE) method is introduced and analyzed for stochastic differential delay equations(SDDEs) with generic variable delay. The method is proved to be convergent in mean-square sense under conditions (Assumption 3.1) that the diffusion coefficient $g(x,y)$ is globally Lipschitz in both x and y, but the drift coefficient $f(x,y)$ satisfies one-sided Lipschitz condition in x and globally Lipschitz in y. Further, exponential mean-square stability of the proposed method is investigated for SDDEs that have a negative one-sided Lipschitz constant. Our results show that the method has the unconditional stability property in the sense that it can well reproduce stability of underlying system, without any restrictions on stepsize h. Numerical experiments and comparisons with existing methods for SDDEs illustrate the computational efficiency of our method.

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