Accepted Manuscript

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PII: S0377-0427(17)30584-8
DOI: https://doi.org/10.1016/j.cam.2017.11.024
Reference: CAM 11396

To appear in: *Journal of Computational and Applied Mathematics*

Received date : 17 January 2017
Revised date : 17 November 2017

Please cite this article as: G. Lan, F. Xia, Strong convergence rates of modified truncated EM method for stochastic differential equations, *Journal of Computational and Applied Mathematics* (2017), https://doi.org/10.1016/j.cam.2017.11.024

Strong convergence rates of modified truncated EM method for stochastic differential equations *

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Abstract

Motivated by truncated Euler-Maruyama (EM) method introduced by Mao (2015), a new explicit numerical method named modified truncated Euler-Maruyama method is developed in this paper. Strong convergence rates of the given numerical scheme to the exact solutions to stochastic differential equations are investigated under given conditions in this paper. Compared with truncated EM method, the given numerical simulation strongly converges to the exact solution at fixed time T and over a time interval $[0, T]$ under weaker sufficient conditions. Meanwhile, the convergence rates are also obtained for both cases. Two examples are provided to support our conclusions.

MSC 2010: 60H10, 65C30, 65L20.

Key words: stochastic differential equations, local Lipschitz condition, modified truncated Euler-Maruyama method, strong convergence rate.

1 Introduction

Numerical methods for stochastic differential equations (SDEs) have been playing more and more important roles because most equations can not be solved explicitly. In general, there are two kinds of numerical methods, the one is explicit and the other is implicit. The most commonly used explicit numerical method is the well known Euler-Maruyama (EM) method. There are a lot of literature concerning with this method, e.g., [15, 16, 7, 12, 2]. However, as mentioned in [10], most of the existing strong convergence theory for numerical methods requires the coefficients of the SDEs to be globally Lipschitz continuous(see e.g. [7, 12]). In 2002, Higham et al. [3] studied the strong convergence for numerical approximations under local Lipschitz condition for the first time plus the bounded condition on the pth moments of both exact and numerical solutions to the underlying SDE. Recently, Hutzenthaler et al. [4] proved, for a large class of SDEs with superlinearly growing coefficient functions, that both the distance in the strong L^p-sense and the distance between the pth absolute moments

*Supported by Natural Science Foundation of China (NSFC 11601025).
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