

NEUTRAL STOCHASTIC DIFFERENTIAL DELAY EQUATIONS WITH LOCALLY MONOTONE COEFFICIENTS

Yanting Ji¹ Qingshuo Song² and Chenggui Yuan³

¹Bryant Zhuhai
Beijing Institute of Technology, Zhuhai, P. R. China

²Department of Mathematics
City University of Hong Kong, Hong Kong, P. R. China

³Department of Mathematics
Swansea University, Swansea, SA2 8PP, U.K.

Abstract. In this paper, we prove the existence and uniqueness of the solution for neutral stochastic differential delay equations with locally monotone coefficients by using numerical approximation. An example is provided to illustrate our theory.

Keywords. stochastic differential delay equations, neutral, locally monotone, Euler scheme.

AMS subject classification: 34K50, 34K40.

1 Introduction

The theory of stochastic functional differential equations (SFDEs) has been developed for a while, for instance [15] provides a systematic presentation for the existence and uniqueness, Markov property, the generator and the regularity of the solutions of SFDEs. [13] presents the estimation of the moment of the solutions, in particular, the Razumikhin theorem was generalized from functional differential equations to SFDEs. For the studies of long-term behaviour of SFDEs, we here only mention [3, 7, 18].

On the other hand, most SFDEs can not be solved explicitly, numerical methods become one of the most powerful tools tackling these problems in the real world practice. There is extensive literature in investigating the strong convergence, weak convergence or sample path convergence of numerical schemes for SFDEs, we here highlight [5, 4, 9, 10, 14], to name a few.

More recently, a class of stochastic differential equations has emerged, which depends on the past and present values but that involves derivatives with delays as well as the function itself. Such equations are called neutral stochastic functional differential equations (NSFDEs). The theory of NSFDEs has recently received a lot of attention. For example, the existence