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Abstract

REFLECTED STOCHASTIC DIFFERENTIAL EQUATIONS WITH A RANDOM AND MOVING BOUNDARY

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In this thesis we study a special case of reflected stochastic differential equations which the reflecting boundary is random and moving with respect to time t. Our main work are divided into two parts. The first part deals with the existence and uniqueness of solutions for the reflected stochastic differential equations which are mentioned above. The second part studies a numerical scheme for the solutions of reflected stochastic differential equations with random and moving boundary, and the relative convergent rate of these solutions.

This thesis is organized as follows. In Chapter one we give a brief history and a review of the existence and uniqueness of stochastic differential equations, the definition of reflected stochastic differential equations and four main methods to solve the reflected stochastic differential equations, i.e. 1. Classical iterative approach based on the Skorohod problem; 2. Approach based on stochastic variational inequalities; 3. Functional method; 4. Approximations based on numerical schemes. Chapter two gives the Skorohod lemma for the reflected stochastic differential equations, which is our main tool in the proof of the existence and uniqueness for the solutions. Simultaneously, we demonstrate an estimation for the continuity of solutions. In Chapter three we consider the Skorohod problem of discontinuous functions and an iterative scheme for the numerical solutions of reflected stochastic differential equations with random and moving boundary, this scheme is developed from the Euler-Peano scheme. Finally, we give the convergence of solutions for this scheme. In the last part, the Appendix contains some definitions and other technical lemmas used in the proofs.