

FUNDAMENTAL EXISTENCE AND UNIQUENESS OF STOCHASTIC INTEGRO-DIFFERENTIAL EQUATIONS WITH MARKOVIAN SWITCHING

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Abstract. The existence and uniqueness results of solutions of stochastic nonlinear integro-differential equations with Markovian switching is investigated. The method of successive approximations is utilized to establish these results. Some special cases of the established main results are also investigated.

Keywords. Stochastic, integro-differential, Existence, Uniqueness, Markovian, switching.

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1 Introduction

Stochastic functional differential systems appear in many areas of sciences and engineering. Such equations arise in the study of stochastic systems in the presence of hereditary influences on the state variable. For example, stochastic integro-differential systems which covers a large area of system dynamics including reactor dynamics [4, 12, 13], heat transfer by conduction and radiation [11, 14] mathematical modeling of system hysteresis [7, 12] models of transmission of infection of diseases [2] etc. The presence of a stochastic component makes the evolution of the state variable a stochastic process and accounts for intrinsic or external random influences.

One of the fundamental problems in such dynamical systems is to establish sufficient conditions under which it exhibits a unique solution. There are many ways to establish such results, for example, (i) Monotone Iterative Techniques which uses the method of upper and lower solutions [11] used mainly for boundary value problems, (ii) topological methods which use one of the fixed point theorems such as Schauder-Tychonoff's [5], and (iii) construction methods such as the Picard's successive approximations [1, 3, 6, 8, 9, 10, 15] in which one has to show the convergence of the approximation process to the original solution.