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STABILITY AND STABILIZATION OF LARGE-SCALE STOCHASTIC IMPULSIVE SYSTEMS WITH TIME DELAY

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Abstract. In this paper, we address a general class of nonlinear large-scale stochastic impulsive systems with time delay. The stochastic perturbation is modelled by a Wiener (or Brownian motion) process, the impulsive effects are of a fixed-time type, and the time delay is finite. The objective is to develop different sets of sufficient conditions to guarantee some stability properties and stabilization by impulsive effects using the classical Lyapunov technique and comparison principle. It has been shown that if a continuous system is stable, impulses should not be applied frequently, and if a continuous system is unstable, helpful impulsive effects can contribute to stabilize the system and they should be applied frequently to compensate the growth of unstable states of the systems. Some special cases of these results are derived, and application to an automatic control system are presented to enhance the theoretical results.

Keywords. Nonlinear large-scale systems, stochastic systems, impulsive effects, time delay, stability, Lyapunov-Razumikhin method, comparison principle. .

1 Introduction

In the last few decades, technology has produced a new generation of high-dimensional, structurally sophisticated dynamical systems, which are known as *large-scale dynamical systems*. Typically, a large-scale system is described by a large number of variables, nonlinearities and uncertainties. Nowadays, large-scale systems, as a tool, have been used to model numerous processes in many different fields in science and engineering, such as large electric power network systems, control systems, aerospace systems, solar systems, nuclear reactors, chemistry, biology, and ecology systems.