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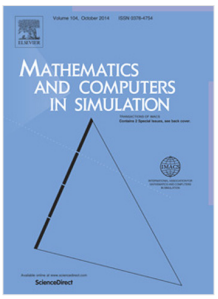

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Exponential stability with respect to part of the variables for a class of nonlinear stochastic systems with Markovian switchings

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Abstract

This paper deals with the exponential stability problem with respect to part of the variables of a class of nonlinear stochastic systems for three classes of Markovian switching processes. The methodologies of stability of stochastic hybrid systems and stability with respect to part of the variables based on Lyapunov methods are combined to find sufficient conditions of the exponential $\mathbf{y}^p$–stability for a class of nonlinear stochastic systems. Moreover, the detailed analysis and criteria of exponential mean square $\mathbf{y}$–stability based on LMI methodology are also given for the case of linear systems.

Keywords: Hybrid system, stochastic system, Lyapunov method, partial stability, Markovian switching.

1 Introduction

As is well known, the stability problem of dynamic systems described by models with uncertain parameters is one of the basic problems in the control theory. Usually these models are described by stochastic differential equations. The main methods for investigating the stability in both deterministic and stochastic models are Lyapunov's Methods [8], [10], [17]. In many large scale systems from it is difficult to find the sufficient conditions of stability and at the same time in real systems we are only interested in the qualitative analysis of some variables. It motivated many researchers to consider stability problems with respect to part of the variables (partial stability). This type of stability is considered in the study of some mechanical holonomic and nonholonomic systems, complex mechanical systems and systems describing the dynamics of controlled solid. A review of these works one can find in Vorotnikov's book [32]. First, it was developed for deterministic models [20], [21],