STABILIZATION OF STOCHASTIC NONLINEAR HYBRID SYSTEMS

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ABSTRACT. *This paper deals with the control of stochastic nonlinear hybrid systems. Under some appropriate assumptions results on stochastic stability and stochastic stabilization are developed. Two state feedback controllers (linear and nonlinear) that stochastically stabilize the class of systems under study are designed. LMI sufficient conditions are developed to compute the gains of these controllers. Numerical examples are provided to show the usefulness of the developed results.*
Keywords: Nonlinear systems, Hybrid systems, Stochastic stability, Stochastic stabilization, Linear matrix inequalities.

1. **Introduction.** In the last two decades, we witnessed an increasing interest for the linear stochastic systems. Many problems like the stability, the stabilizability (using different types of controllers), the H_∞ control, the filtering and their robustness have been addressed and some results have been reported in the literature. The reader is referred to Arnold [1], Benjelloun et al. [2], Boukas [3], Boukas and Hang [4], Boukas and Liu [6], de Souza and Fragoso [8], de Farias et al. [9], Mariton [10], Shi and Boukas [12], Wang et al. [13], Zhang [14] and the references therein. The results that were developed in the literature will be efficient for dynamical linear systems but will fail for nonlinear ones. Therefore an alternate to solve the stochastic stability and the stochastic stabilizability problems for the class of nonlinear dynamical systems is needed.

This paper deals with the class of nonlinear systems with Markovian jump and Wiener process. Our goal here is to study the stochastic stability and the stochastic stabilizability problems. Keeping in mind the tractability of the two problems we are dealing with, some LMIs techniques are developed. To the best of our knowledge, the problems we are considering here have never been considered by researchers before. The linear case of the class of systems we are considering has been considered by Boukas [3].

The rest of this paper is organized as follows. Section 2 establishes sufficient conditions for the class of systems we are treating to be stochastically stable. Section 3 addresses the stabilization problem for a special class of nonlinear stochastic hybrid systems using two stabilizing controllers. In Section 4, numerical examples are provided to show the validness of the proposed results.