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STABILIZATION OF STOCHASTIC SYSTEMS WITH PARTIALLY KNOWN TRANSITION JUMPS RATES

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Abstract. *This paper considers the control of the class of continuous-time linear Markov jump systems with Wiener process and partial information on the transition jump rates. An external disturbance is supposed to act on the dynamics. The stochastic stability and stochastic stabilization problems of this class of systems are tackled. The H_∞ state feedback controller is designed to stabilize the system and at the same time assure the rejection of the external disturbance with a desired level. Sufficient conditions that consider only the known bounds on the transition jump rates are developed either for stability or stabilization. A design procedure for the controller which guarantees that the dynamics of the system will be stochastically stable is proposed. It is shown that the addressed problems can be solved if the corresponding developed convex optimization problems are feasible. A numerical example is employed to show the usefulness of the proposed results.*
Keywords: Markov jump systems, Continuous-time linear systems, Linear matrix inequality, Stochastic stability, Unknown jump rates, State feedback controller H_∞ control

1. **Introduction.** Continuous-time stochastic Models, compared to deterministic ones, are more powerful to describe the behavior of many practical systems. The ones of Markov jump system with Wiener process are more appropriate to describe systems with random abrupt changes in their dynamics with external disturbance with some known statistical properties. This class of systems has been a hot topic of research and has attracted a lot of researchers from control and mathematics communities. Most of the problems have been tackled and interesting results on stability, stabilization, H_∞ control, filtering, guaranteed cost, etc. have been reported in the literature and for more details on these subject we refer the reader to [3] and the references therein. More specifically the stochastic stability and stabilization using different types of controllers have been tackled and interesting results have been reported in the literature among these results we quote those in [3,10-13] and the references therein. The H_2 control, the H_∞ control and the H_∞ filtering problems have been also addressed. For more details on these problems we quote the work in [3,8,15] and the references therein.

Most of the results reported in the literature on the class of Markov jump systems with Wiener process assume the complete access to the transition jump rates which makes them inappropriate in some cases when these jumps rates are not available. This is the case for many practical systems and even to obtain the jump rates, it may take more time and can be more costly.