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FINITE-TIME CONTROL OF LINEAR STOCHASTIC SYSTEMS

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Abstract. *In this paper, finite-time control problems for stochastic systems governed by Itô-type stochastic differential equations are considered. The main results provided are sufficient conditions for finite-time stochastic robust stabilization via state feedback. These conditions are eventually reduced to feasibility problems of linear matrix inequalities. One detailed example is presented to illustrate the validity of our developed theory.*
Keywords: Finite-time stochastic stability, Stochastic systems, Linear matrix inequality, State feedback

1. **Introduction.** Stochastic control, especially for the systems governed by Itô-type stochastic differential equations, has become a popular research field of modern control theory due to its great many applications in signal processing, mathematical finance and population modeling [11]. The conventional stochastic stability reflects the asymptotic behavior over an infinite horizon interval [9], which has been adopted in the robust H_∞ control of stochastic Itô systems, e.g, see [4, 5, 7, 13]. Because for infinite horizon stochastic H_∞ control and filtering design, internal stability is required, which is often defined by means of asymptotic stochastic stability. As known for us, the conventional stochastic stability has been studied extensively by many researchers, we refer the reader to the monographs [1, 12, 9, 10]. However, in many practical applications such as in the presence of saturation, large state value is not admissible over a fixed finite-time interval. In these cases, one cares more about the finite-time behavior of the system than its asymptotic stability [2, 3, 6]. Hence, it is reasonable to define the finite-time stability (FTS) of a dynamic system, which means that the system state remains within a prescribed bound over a finite-time interval when the initial state satisfies some given conditions. [6] first defined FTS or short-time stability for linear deterministic systems. Recently, [2] further introduced the concept of finite-time boundedness (FTB), where not only the initial state, but also the external constant disturbance is considered, and a sufficient condition for FTB was obtained. Soon after [2], the finite-time stabilization of linear deterministic systems via a dynamic output feedback control law was discussed in [3], which requires us to find a feedback controller such that the closed-loop system is finite-time stable. [8] generalized the results of [2] to linear singular uncertain systems.

In this paper, we extend the results of [2] on finite-time state feedback stabilization of linear deterministic systems to stochastic Itô systems with the control input u and