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NEW LYAPUNOV CONDITIONS FOR FINITE-TIME STABILITY OF LINEAR TIME-VARYING SYSTEMS

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Abstract. This paper considers the finite-time stability problem of continuous-time linear time-varying systems. Some novel sufficient conditions to ensure finite-time stability of the system under consideration are derived based on the comparison principle. Besides, to the purpose of computational efficiency, new finite-time stability conditions including differential linear matrix inequalities are established by use of a quadratic Lyapunov-like function and an appropriate comparison system. Finally, these numerically tractable conditions are illustrated by a given numerical example.

Keywords. finite-time control, finite-time stability, linear systems, Lyapunov functions, stability.

AMS (MOS) subject classification: 34D20 .

1 Introduction

In recent years, finite-time stability and control have attracted increasing interest due to their theoretical and practical importance [14, 1, 11]. The notion of finite-time stability is to restrain the system evolution for given initial and trajectory domains during a preassigned time interval. Early works on finite-time stability can be found in those papers such as [8, 9]. Practical applications of finite-time stability include synchronization [16, 17], switched systems [18] and fight coordination control [15].

So far, many researchers have investigated a variety of research problems related to finite-time stability. Amato et al. [2] have solved finite-time stability and design problems for continuous-time linear time-varying systems and devised necessary and sufficient conditions, which are applied to state and output feedback design. Ambrosino et al. [4] have studied the finite-time stability problem for state-dependent impulsive dynamical linear systems and