Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **16 (2009)** 807-815
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AN IMPROVED STABILIZATION METHOD FOR TIME DELAY UNCERTAIN SYSTEMS

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Abstract. This note considers delay-dependent/independent robust stability of systems with time-varying structured uncertainties and time-varying delays. By using a matrix decomposition technique and the relationship between the terms in the Leibniz-Newton formula, we establish some new delay-dependent/independent stability criteria which are less conservative than some existing ones. All the results are given in the form of linear matrix inequalities (LMIs) and can be easily tested with efficient algorithms. When getting the maximal allowable upper bound of the time delay, the corresponding optimal matrix decomposition is also obtained at the same time.

Keywords. Robust stability, time-varying delay, structured uncertainty, matrix decomposition, linear matrix inequality.

1 Introduction

Time delay phenomenon abounds in engineering systems, including teleoperation, wireless communication, process control, multi-robot coordination, remote control, and networked control systems. In many cases, time delay is a source of instability [9]. Therefore, the study of time delay systems has been attracting the attention of many researchers. Many of them are devoted to stability criteria for time delay systems (see [1-24] and references therein).

In the literatures, stability results for time delay systems can be classified into two types: delay-independent criteria and delay-dependent criteria. Since delay-dependent criteria make use of the information on the length of delays, they are usually less conservative than delay-independent ones. Hence more and more authors focus on delay-dependent stability of the system. Very recently, improved delay-dependent stability criteria [12, 13, 14, 15, 16, 22] have been derived by using the Lyapunov-Krasovskii theorem and linear matrix inequality (LMI) technique. In [22], some delay-dependent stability conditions for linear time delay systems are established by introducing a new technique. In this method, the Leibniz-Newton formula was employed to illustrate the relationship between the terms in the formula when consid-