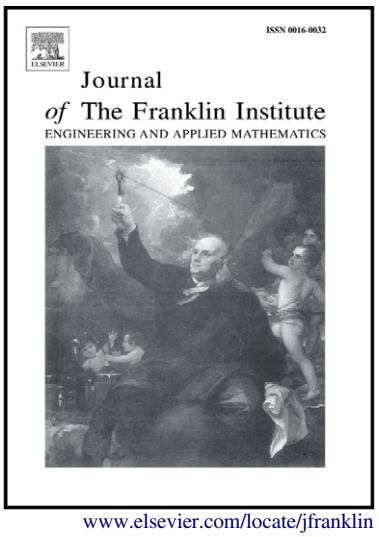

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A Neutral System Approach to Stability of Singular Time-delay Systems*

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Abstract: This paper is concerned with the problem of delay-dependent stability for a class of singular time-delay systems. By representing the singular system as a neutral form, using an augmented Lyapunov-Krasovskii functional and the Wirtinger-based integral inequality method, we obtain a new stability criterion in terms of a linear matrix inequality (LMI). The criterion is applicable for the stability test of both singular time-delay systems and neutral systems with constant time delays. Illustrative examples show the effectiveness and merits of the method.

Keywords: singular systems, neutral systems, stability, time-delay, Wirtinger-based Inequality

1 Introduction

Singular systems (also referred to as descriptor, generalized, differential-algebraic or semi-state systems) arise in a variety of physical systems such as economic systems, power systems and many other systems which can be modeled by dynamic equations and algebraic constraints [1–3]. It is well known that time delay appears in many dynamic systems such as digital control systems, long transmission lines in pneumatic systems, manufacturing processes and remote control systems, which may cause poor performance and even instability [4–8]. Recently, increasing attention has been paid to the study of singular time-delay systems due to the fact that such types of systems can better describe systems than normal ones and have extensive applications in various engineering systems, including flexible arm control of robots, large-scale electric network control and lossless transmission lines [9–18].

Recent study of stability analysis for singular time-delay systems mainly focuses on delay-

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