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A QUITE NEW APPROACH TO THE ASYMPTOTIC STABILITY THEORY: DISCRETE DESCRIPTIVE TIME DELAYED SYSTEM

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Abstract. This paper gives sufficient conditions for the stability of linear singular discrete delay systems of the form $E\mathbf{x}(k+1) = A_0\mathbf{x}(k) + A_1\mathbf{x}(k-1)$. These new, delay-independent sufficient conditions are derived using approach based on Lyapunov's direct method. A numerical example has been working out to show the applicability of results derived.

Keywords. Singular continuous time delay systems, Lyapunov stability.

1 Introduction

It should be noticed that in some systems we must consider their character of dynamic and static state at the same time. Singular systems (also referred to as degenerate, descriptor, generalized, differential - algebraic systems or semi - state) are those the dynamics of which are governed by a mixture of algebraic and differential equations. Recently many scholars have paid much attention to singular systems and have obtained many good consequences. The complex nature of singular systems causes many difficulties in the analytical and numerical treatment of such systems, particularly when there is a need for their control.

The problem of investigation of time delay systems has been exploited over many years. Time delay is very often encountered in various technical systems, such as electric, pneumatic and hydraulic networks, chemical processes, long transmission lines, etc. The existence of pure time lag, regardless if it is present in the control or/and the state, may cause undesirable system transient response, or even instability. Consequently, the problem of stability analysis for this class of systems has been one of the main interests for many researchers.

In general, the introduction of time delay factors makes the analysis much more complicated.