Robust Stability Analysis for a Class of Uncertain Discrete Descriptor
Systems with Multiple Time Delays

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Abstract

Descriptor systems have been found in many practical applications, for example, network analysis, engineering systems, mechanical systems, time-series analysis, economics, and singularly perturbed systems. On the other hand, it is well known that the time-delay phenomena and parametric uncertainties always exist in various engineering systems, which frequently cause the instability of the systems. Consequently, it is very crucial to take time delay factors and parametric uncertainties into consideration in the applications of descriptor systems. In this paper, a robust stability problem for a class of uncertain discrete descriptor systems with multiple time delays is investigated. The systems considered in this paper are much more general than those presented in other papers in recent literature. To the authors’ knowledge, the robust stability problem of uncertain discrete descriptor systems with multiple time delays has not yet been well explored. A delay-dependent criterion is first proposed to guarantee that the uncertain discrete time-delay descriptor system subject to structured perturbations is proper. A robust delay-dependent stability criterion is then presented to ensure the asymptotic stability of the uncertain discrete time-delay descriptor system. It can be seen that the robust stability criterion proposed in this paper is less conservative than those presented in recent research. Furthermore, a delay-dependent criterion is derived to guarantee that the system is regular, impulse-free, and asymptotically stable. Finally, two numerical examples are provided to illustrate that our main results.