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STABILITY CONDITIONS OF UNCERTAIN DYNAMICAL NETWORKS WITH DELAYS

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Abstract. In this paper, we derive some sufficient conditions for asymptotic stability of uncertain dynamical networks with constant and time-varying delays. The Lyapunov-Krasovskii stability theory for functional differential equations, the linear matrix inequality (LMI) approach and the delay differential inequality are employed to investigate delay-dependent and delay-independent of these networks. Especially, for the case of constant time delays, the stability criteria adapt to genetic regulatory networks [23]. Finally, to test the theory, a example is given to demonstrate the effectiveness of the obtained results.

Keywords. complex network; constant and time-varying delays; Lyapunov- Krasovskii stability theory; linear matrix inequality; delay differential inequality; asymptotically stable.

AMS (MOS) subject classification: 65L20, 65L07

1 Introduction

Recently, complex networks have been a subject of considerable interest within the science and technology communities [1-12]. However, most of the networks in the existing literature do not involve any time-delays. As a matter of fact, time delays exist commonly in the real applications. It is a key factor that affects the stability of the networks. The switch problem of the stability of the networks will come forth as time-delays become de novo. During the last decades, considerable attention has been devoted to the problem of stability analysis and controller design for time-delay systems. Especially, in accordance with the advance of robust control theory, a number of robust stabilization methods have been proposed for time-delay systems.

The existing robust stabilization results for time-delay systems can be classified into two types: delay-independent stabilization [13-15] and delay-dependent stabilization [16-18]. The delay-independent stabilization provides a controller which can stabilize a system irrespective of the size of the delay. On the other hand, the delay-dependent stabilization is concerned with the size of the delay. While the delay-independent stabilization has been extensively studied by many researchers for the last decades, the study for the delay-dependent stabilization is relatively new and still under progress [19-23].