

SYNCHRONIZATION CONTROL OF UNITED COMPLEX DYNAMICAL NETWORKS WITH MULTI-LINKS

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ABSTRACT. *Based on a method of network split according to the different nature of time-delay, the synchronization of the united directed and undirected complex networks with multi-links is further investigated in this paper. Via the theory of Lyapunov stability combined with linear matrix inequalities (LMIs) technique, the method of decomposing the coefficient matrices of the delay items and the method of the free-weighting matrix, the delay-dependent synchronization stability criterion which is less conservative is derived in the form of linear matrix inequalities. The linear and adaptive feedback synchronization controllers for the known and unknown coupling coefficients are designed, respectively. Two numerical examples of the united undirected and directed complex networks with multi-links are given to demonstrate the effectiveness of the control strategies.*

Keywords: United complex networks with multi-links, Synchronization, Network split, Linear matrix inequality, Adaptive control

1. Introduction. Recently, the study of various complex networks has attracted increasing attentions from researchers in various fields of physics, mathematics, engineering, biology and sociology [1,4,10,11,16]. A complex network is composed of a large set of interconnected nodes, where the nodes and connections can represent everything. Complex networks have applications in almost all the fields in the real world [10,11].

Most of the researches of complex dynamical networks are aimed at complex dynamical networks with single link [1,4,11-14,17]. The researches of united complex dynamical networks with multi-links are relatively few [15]. However, there are a lot of united complex dynamical networks with multi-links (i.e., more than one edge connecting two nodes) consisted of sub-networks with different natures in the real-world [15], such as human connection networks, transportation networks, communications networks, etc. For example, people can connect each other by mail, telephone, MSN, e-mail, and so on. So human connection network is a united complex dynamical network with multi-links. The unity of complex dynamical network is a synthetical and complicated process. There must be a lot of different characteristics between united complex dynamical networks with multi-links and complex dynamical networks with single link. Therefore, the united complex dynamical networks with multi-links need to be modeled.

When we deal with the united complex dynamical networks with multi-links, one of the simplest way is that we can combine the sides with different natures to one side. Nevertheless, some sides can't be combined simply, such as human connection networks,