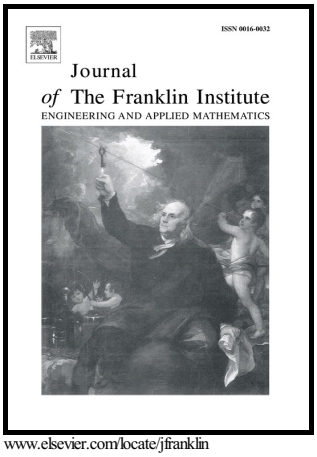

www.elsevier.com/locate/jfranklin

Finite-Time Synchronization of Cyclic Switched Complex Networks under Feedback Control

Guang He, Jian-an Fang, Zhen Li

PII: S0016-0032(16)30376-3
DOI: http://dx.doi.org/10.1016/j.jfranklin.2016.10.016
Reference: FI2759

To appear in: *Journal of the Franklin Institute*

Received date: 19 September 2016
Accepted date: 10 October 2016

Cite this article as: Guang He, Jian-an Fang and Zhen Li, Finite-Tim Synchronization of Cyclic Switched Complex Networks under Feedbac Control, *Journal of the Franklin Institute* http://dx.doi.org/10.1016/j.jfranklin.2016.10.016

Finite-Time Synchronization of Cyclic Switched Complex Networks under Feedback Control ☆

Guang He[a,*], Jian-an Fang[b], Zhen Li[b]

[a] *Department of Mathematics, Anhui Polytechnic University, Anhui 241000, PR China*
[b] *College of Information Science and Technology, Donghua University, Shanghai 201620, PR China*

Abstract

In this paper, the global finite-time synchronization between two cyclic switched complex dynamical networks is investigated via feedback control. Based on the cyclic dwell time approach, finite-time stability theorem and some inequality techniques, several sufficient criteria are proposed to ensure finite-time synchronization for a class of cyclic switched complex networks (CSCNs) with and without coupling delay. The obtained criteria not only provide a feasible approach to design state feedback controllers but also fully reveal the trade-off among the cyclic dwell time, the finite convergence time and the initial state. Finally, numerical simulations are given to illustrate the effectiveness of the proposed results.

Keywords: cyclic switched complex networks, finite-time synchronization, cyclic dwell time, feedback control,

1. INTRODUCTION

During the past few decades, complex networks which consist of interacting dynamical entities with an interplay between dynamical states and interaction patterns have been extensively investigated [1, 2, 3, 4]. Complex networks have found many applications in various fields such as genetics regulatory networks, communication networks, social networks, neuronal networks, and Internet [5, 6, 7]. Complex networks can exhibit many interesting phenomena, such as spatio-temporal chaos, synchronization, spiral waves, self-organization [8, 9]. As the major collective behavior of complex networks, synchronization is one of the key issues that have been extensively investigated [10, 11, 12, 13, 14, 15].

As is known to all, in network environment, the dynamical behavior of each node may present switching phenomenon due to unexpected external or internal effects [16]. Moreover, link failure and new link creation may happen at times, then the switching between different topologies is inevitable [17]. Hence, it is important to consider both the node and topology switching effects when modeling real-world dynamical networks. Recently, stability and synchronization problems of switched complex networks have gained much attention [2, 6, 13, 18, 19, 20]. Various methods have sprung out to deal with stability and synchronization of switched systems, such as the average dwell time approach [12, 21], the mode-dependent average dwell time approach [22] and the multiple Lyapunov function technique [21, 23]. In various constrained switched systems, cyclic switched systems are an important class of switched systems, in which the switching index sequence is cyclic and the switching time sequence is possibly with pre-assigned duration intervals [19, 24]. In some engineering applications, the order of the activated modes is pre-assigned and the switching cannot be arbitrarily designed, e.g., automotive control with cyclic gear transition [24], circuits with cyclic switching

☆The Common Scientific Research of Anhui Province Higher Education(TSKJ2016B10), The Natural Science Foundation of China (11401005), the Anhui Excellent Youth Fund (2013SQRL033ZD), the Natural Science Foundation of Anhui Province (1408085QA09) and the Fundamental Research Funds for the Central Universities (CUSF-DH-D-2015055).

*Corresponding author
Email addresses: hg-1211ok@163.com (Guang He), jafang@dhu.edu.cn (Jian-an Fang), lzqz12@hotmail.com (Zhen Li)