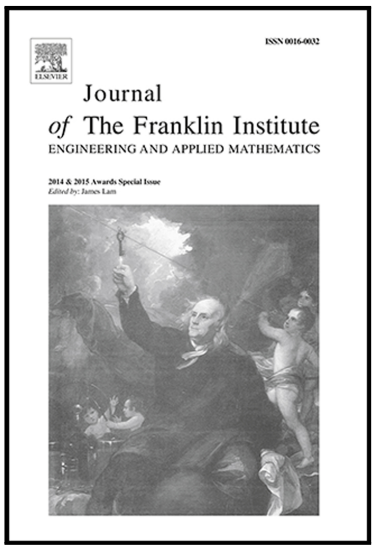

Finite-time outer-synchronization for complex networks with Markov jump topology via hybrid control and its application to image encryption

Suying Sheng , Xiaomei Zhang , Guoping Lu

PII: S0016-0032(18)30427-7
DOI: 10.1016/j.jfranklin.2017.12.041
Reference: FI 3519

To appear in: *Journal of the Franklin Institute*

Received date: 26 March 2017
Revised date: 15 October 2017
Accepted date: 11 December 2017

Please cite this article as: Suying Sheng , Xiaomei Zhang , Guoping Lu , Finite-time outer-synchronization for complex networks with Markov jump topology via hybrid control and its application to image encryption, *Journal of the Franklin Institute* (2018), doi: 10.1016/j.jfranklin.2017.12.041

Finite-time outer-synchronization for complex networks with Markov jump topology via hybrid control and its application to image encryption[1]

Suying Sheng[a], Xiaomei Zhang[a,b,2], Guoping Lu[b]

[a] *School of Electronics and Information, Nantong University, Nantong 226019, China*
[b] *The Institute of System Science, Nantong University, Nantong 226019, China*

Abstract

This paper investigates the problem of finite-time outer-synchronization for discrete-time complex networks with Markov jump topology in the presence of communication delays and possible information losses and application to image encryption. A hybrid control, which is subject to both stochastic jumps and deterministic switches, is proposed to realize finite-time and stochastic outer-synchronization for the concerned networks. By utilizing a stochastic Lyapunov functional combined with the average dwell-time method, sufficient conditions are found such that the synchronization error dynamical system is stochastically stable in finite-time. Two numerical examples are presented to illustrate the effectiveness of the proposed method. Finally, the complex network consists of four coupled Lorenz systems are utilized to generate chaotic sequences and a new chaotic image cryptosystem is constructed to transmit encrypted images based on the synchronized drive-response complex networks. Experiments are conducted by using numerical simulation, and the security is analyzed in terms of key space, key sensitivity, histogram distributions, correlation coefficients, information entropy and differential attack measures. The experimental results show that the proposed chaotic image cryptosystem has the advantages of high security against some classical attacks.

[1] This work was supported in part by National Natural Science Foundation of China under Grants 61174065, 61374061 and 61573201, Project of Flagship-Major Construction of Jiangsu Higher Education Institutions of China (PPZY2015B135), and Postgraduate Research & Practice Innovation Program of Jiangsu Province (KYCX17_1915).

[2] Corresponding author.
E-mail address: zhang.xm@ntu.edu.cn