Accepted Manuscript

Extended dissipative synchronization of complex dynamical networks with additive time-varying delay and discrete-time information

M. Syed Ali, J. Yogambigai

PII: S0377-0427(18)30355-8
DOI: https://doi.org/10.1016/j.cam.2018.06.003
Reference: CAM 11733

To appear in: *Journal of Computational and Applied Mathematics*

Received date : 14 September 2017
Revised date : 28 May 2018

Please cite this article as: M. Syed Ali, J. Yogambigai, Extended dissipative synchronization of complex dynamical networks with additive time-varying delay and discrete-time information, *Journal of Computational and Applied Mathematics* (2018), https://doi.org/10.1016/j.cam.2018.06.003

Extended dissipative synchronization of complex dynamical networks with additive time-varying delay and discrete-time information

M. Syed Ali [1], J.Yogambigai
Department of Mathematics
Thiruvalluvar University
Serkkadu,Vellore - 632 106, Tamilnadu, India.

Abstract: The problem of extended dissipativity analysis of complex dynamical networks with additive time-varying delay and discrete time information is considered in this article. By utilizing the Lyapunov functional method, Jensen's inequality and free-weighting matrix analysis techniques, we establish sufficient criterion such that the complex dynamical networks is synchronized in the sense of extended dissipative. Further, we consider the extended dissipativity analysis problem, which contains the H_∞ performance, passivity performance, dissipativity performance and $L_2 - L_\infty$ performance in a unified framework. The derived criteria are expressed in terms of linear matrix inequalities that can be easily checked by using the standard numerical softwares. Illustrative examples are presented to demonstrate the effectiveness and usefulness of the proposed results.

Key Words: Extended dissipative; Complex dynamical networks; Discrete-time information; Synchronization; Linear Matrix Inequality; Additive time-varying delay.

1. Introduction

Many phenomena in nature can be modeled as coupled networks, such as brain structures, protein-protein interactions, social interactions, disease transmission networks, Internet, metabolic networks, aviation networks, electricity distribution networks, and so forth [1]–[8]. Recently, since the discovery of small-world networks [9] and scale-free networks [10], complex networks become a focus point of research which has attracted increasing attention from various fields of science and engineering. Time delays area unit ineluctably gift as a result of the finite switching speeds of the amplifiers and also the inherent communication time of interconnected neurons, and its existence can have an effect on the stability of a framework by making oscillating and instability characteristics [11, 14]. Also, the network couplings often give rise to delays in biological neural networks, communication networks, and electrical power grids. Therefore, the synchronization analysis of complex dynamical frameworks with delays has received attention (see [15]–[20] and the references therein).

Synchronization processes are ubiquitous in our lives, which play an important role such as synchronous communication, signal synchronization, firefly bioluminescence synchronization in biology, geostationary satellite, synchronous motor, database synchronization and so forth. Until now, there have been very rich results concerning the synchronization design of time-delayed complex networks, such as [21]–[26] to name a few. In particular, the control and synchronization of complex network becomes a hot topic, which attracts many researchers from the nonlinear dynamics and control community [27]–[31]. Therefore, its of sensible importance to review the control effects on the synchronization criteria of complex dynamical frameworks with additive time-varying, some results associated with this downside are published in [32, 33].

On another analysis front, the dissipativity issue for a spread of sensible systems are attracting invigorating attention for several years [34]. For instance, the dissipativity issue of the delayed complex dynamical frameworks was considered in [35]. Regardless, to the best of our understanding, there are no reports on the extended dissipativity analysis of complex dynamical networks with additive time-varying delay and discrete-time information. Pushed by the above talk and to fill this gap, we try to perform an extended dissipativity analysis of conceded complex dynamical framework with additive

[1] *Corresponding author, E-mail address:* syedgru@gmail.com (M. Syed Ali),yogambigaij@gmail.com(J.Yogambigai)