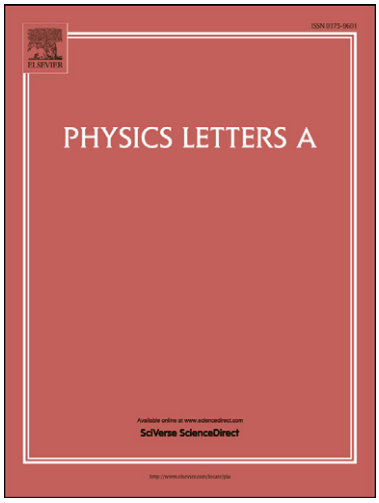

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Impulsive generalized function synchronization of complex dynamical networks

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Abstract

This paper investigates generalized function synchronization of continuous and discrete complex networks by impulsive control. By constructing the reasonable corresponding impulsively controlled response networks, some criteria and corollaries are derived for the generalized function synchronization between the impulsively controlled complex networks, continuous and discrete networks are both included. Furthermore, the generalized linear synchronization and nonlinear synchronization are respectively illustrated by several examples. All the numerical simulations demonstrate the correctness of the theoretical results.

PACS numbers: 05.45.-a, 05.45.Xt

Keywords: Complex network, generalized function synchronization, impulsive control, continuous, discrete

1 Introduction

Complex networks widely exist in our life, from Internet to World Wide Web (WWW), from linguistic networks to social networks, from food webs to metabolic networks and so forth. They are receiving more and more attention from various fields of science and engineering, including mathematics, physics, ecology science and social science [1, 2].

Synchronization, as a coherent behavior, it happens within a complex network also between different complex networks, has been wildly studied in recent years. In the early, people mainly focused on the synchronization within a complex network, which is called "inner synchronization", and derived a lot of important results [3–12]. In reality, synchronization between two or more networks is more practical. For example, predator-prey interactions network, the relationship between the network of predators and that of preys is of importance in maintaining balance among different animal species finally. So this kind of synchronization is also meaningful and important, which is called "outer synchronization" [13]. At the same time, many kinds of control methods, including adaptive synchronization [14-16], pinning control [17,18] and impulsive control [19–21], have been applied to solve the above problem.

However, most of the above mentioned works mainly focused on the complete synchronization(CS). CS means that the coupled systems remain in step with each other in the course of time, it is not able to describe many synchronization phenomena in secure communication, encryption, automatic control and biological systems. Hence, a various of different synchronization definition were proposed in the last few years, such as phase synchronization[11,12], lag synchronization(LS)[16,18,21], projective synchronization(PS)[21–23], function projective synchronization(FPS)[24–26] and generalized function synchronization(GFS)[27-32] and so on. Among these definitions, GFS is the most general and received more attention in recent years. Zhang *et.al* realized the FPS between the drive-response dynamical networks by design feedback controllers [24], Wu *et.al* studied the PS between two different general complex

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