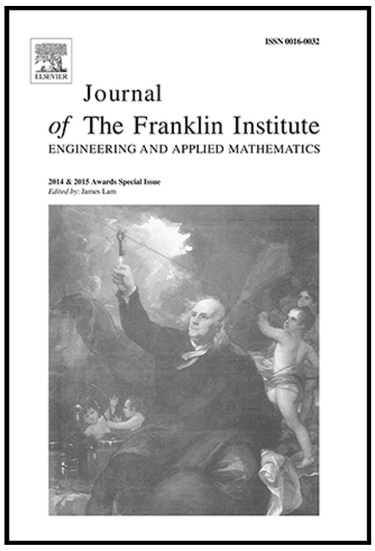

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Fixed-time stability and stabilization of impulsive dynamical systems

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Abstract

This paper mainly tends to consider the fixed-time stability behavior for impulsive dynamical systems. An efficient theorem is established to construct an impulsive comparison system. By means of inequality analysis method, certain average impulsive interval and Lyapunov function, some sufficient conditions are given to ensure the fixed-time stability of impulsive dynamical systems. Moreover, as an important application, the fixed-time stabilization of a class of coupled impulsive neural networks is proposed. By designing a discontinuous control law, several new criteria are obtained to guarantee the fixed-time stabilization of the coupled impulsive neural networks. Finally, two numerical simulations are provided to illustrate the validity of the theoretical analysis.

Keywords: Impulsive dynamical systems; Fixed-time stability; Stabilization; Comparison system; Average impulsive interval.

1. Introduction

Impulsive dynamical systems are a special class of hybrid systems, where dynamical systems involve the continuous time systems and the discrete-time systems (i.e., impulse state jumping function). Impulsive dynamical systems have been studied extensively in the early literature [1–17], because of many practical applications such as in neural networks [1, 3, 5, 7], linear or nonlinear dynamical systems [2–4, 8, 10, 12, 13, 16, 17], multi-agent systems [6], stability of bouncing ball systems [9], and some couple complex networks [11, 15].

As is well known, the finite-time stability is quite different from the Lyapunov asymptotic stability. A system can be finite-time stable but not Lyapunov asymptotically stable vice versa. Finite-time stability can be divided into two types. The one can be defined as that the system