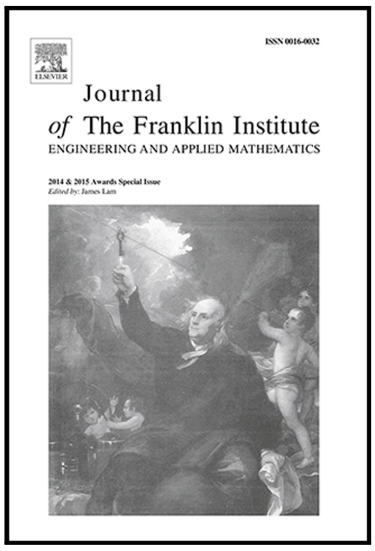

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Novel event-triggered filter design for nonlinear networked control systems

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Abstract

This paper investigates the problem of event-triggered filter design for nonlinear networked control systems (NCSs) in the framework of interval type-2 (IT2) fuzzy systems. A novel IT2 fuzzy filter for ensuring asymptotic stability and H_∞ performance of filtering error system is proposed, where the premise variables are different from those of the fuzzy model. Attention is focused on solving the problem of event-triggered filter design subject to parameter uncertainties, data quantization, and communication delay in a unified frame. It is shown that the proposed event-triggered filter design communication mechanism for IT2 fuzzy NCSs has the advantage of the existing event-triggered approaches to reduce the utilization of limited network resources and provides flexibility in balancing the tracking error and the utilization of network resources. Finally, simulation example is given to validate the advantages of the presented results.

Keywords: Interval type-2 fuzzy systems, nonlinear networked control systems, event-triggered communication mechanism, filter design.

1. Introduction

With rapid advances of network technologies, networked control systems (NCSs) have received increasing attention during the past decades. Compared with traditional point-to-point communication scheme, NCSs have many inherent advantages, such as simple maintenance, and easy installation. Due to these features, some related results have been published, for example [1–6] and references therein. Recently, the Takagi-Sugeno (T-S) fuzzy model proposes an effective scheme for handling the complex nonlinear dynamic [7–13]. Moreover, the filter design problem [14] has been found to be useful in many practical applications. Remarkable filter design approaches for T-S fuzzy NCSs have been published in [15–17]. The authors in [15] studied robust filtering of multichannel nonlinear networked systems. In [16], the filtering scheme for network-based discrete-time fuzzy systems was considered. Distributed filtering for discrete-time fuzzy NCSs with incomplete measurements was considered in [17].

A common assumption in above results is that the communication scheme in the NCSs is generally time-triggered mechanism, under which all of the sampled packets should be transmitted via the network. More recently, to reduce the utilization of limited communication bandwidth, an event-triggered communication approach for NCSs was proposed in [18]. The event-triggered scheme provides an effective way to decide when the measured signals should be transmitted into the network. The authors in [19] considered event-triggered controller design for NCSs subject to quantization and network-induced delays. Different from the continuous event-triggered scheme [20], the authors in

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