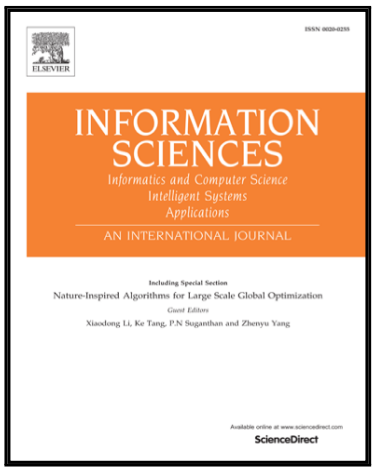

Event-triggered dynamic output feedback control for networked control systems with probabilistic nonlinearities

Zhou Gu, Zhao Huan, Dong Yue, Fan Yang

PII: S0020-0255(18)30362-1
DOI: 10.1016/j.ins.2018.05.007
Reference: INS 13635

To appear in: *Information Sciences*

Received date: 14 January 2018
Revised date: 23 April 2018
Accepted date: 2 May 2018

Please cite this article as: Zhou Gu, Zhao Huan, Dong Yue, Fan Yang, Event-triggered dynamic output feedback control for networked control systems with probabilistic nonlinearities, *Information Sciences* (2018), doi: 10.1016/j.ins.2018.05.007

Event-triggered dynamic output feedback control for networked control systems with probabilistic nonlinearities

Zhou Gu[a,*], Zhao Huan[a], Dong Yue[b], Fan Yang[a]

[a] College of Mechanical & Electronic Engineering, Nanjing Forestry University, Nanjing, 210037, China
[b] The Institute of Advanced Technology, Nanjing University of Posts and Telecommunications, Nanjing 210023, China

Abstract

This paper investigates the problem of dynamic output feedback control for networked nonlinear systems. A novel event-triggered mechanism (ETM) is proposed, in which a new event-triggering condition is introduced. Compared with some existing ETMs, the proposed ETM has at least three merits: i) The data-releasing rate can be further decreased, leading to a reduction of network loads; ii) During the time when the system is disturbed by external signals, this ETM can release more sampled data to the controller so that some better closed-loop performance can be achieved; and iii) Wrong decision-making on data-releasing can be avoided due to a new definition of the related error. By employing the Lyapunov-Krasovskii functional method, sufficient conditions are derived to design both controller gains and ETM parameters. An example with four cases is given to show the effectiveness and superiority of the proposed method.

Keywords: Event-triggered mechanism; Dynamic output feedback control; Probabilistic nonlinearities

1. Introduction

Over the last few decades, event-triggered mechanisms (ETMs) for networked control systems (NCSs) have received increasing interest of researchers [1, 19, 26, 34]. Different from the conventional time-triggered mechanism, data-releasing under an ETM is dependent on a predefined event-triggering condition rather than on the lapse of a fixed time period [4, 15, 33, 35]. In this situation, a large amount of redundant sampled data occupying the network resources, such as networked bandwidth, computation and energy resources of battery-based devices, can be discarded. Therefore, under an ETM, much better performance is expected for an NCS under study since the quality of network communication can be improved significantly [11, 17, 24, 27, 40, 44].

The data-releasing device receives a command from the ETM to execute the communication task. The efficiency of data-transmission can be enhanced since this implementation is based on a certain need of the control system. Therefore, the ETM may be regarded as an alternative to the traditional time-triggered mechanism. Considerable efforts have been devoted to ETMs recently. In [6, 28], the authors proposed an ETM by two steps: the first step is to design a controller for the NCSs under an assumption that the communication network is ideal (no delay and no packet dropouts), and the second step is to design an event-triggered condition under the pre-designed controller. There are two demerits if this two-step scheme works: One is called Zeno behaviour, which may result in infinite events generated by the ETM; and the other is that the controller should be known before the ETM is designed. Nevertheless, this scheme provides a good idea to improve the quality of an NCS. In [17], a discrete event-triggered scheme (DETS) is developed, which depends on the discrete sampled data rather than the real-time signal. Thus, the inter-event time is larger than one sampled period at least, resulting in an avoidance of Zeno behaviour [42]. Moreover, the closed-loop system under a DETS can be modeled as a time-delay system, based on which the parameters of the DETS and the controller gains can be co-designed in terms of linear matrix inequalities. Consequently, A DETS

*Corresponding author
Email address: gzh1808@163.com (Zhou Gu)