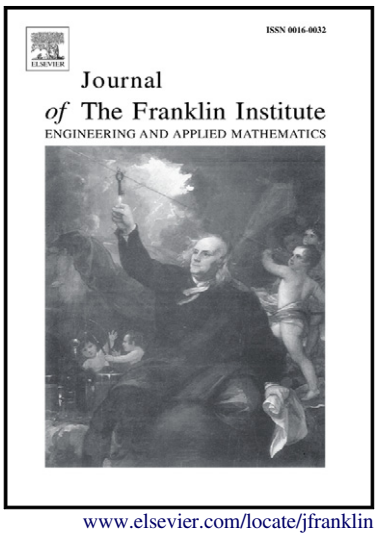

www.elsevier.com/locate/jfranklin

Event-Triggered Distributed State Estimation with Randomly Occurring Uncertainties and Nonlinearities over Sensor Networks: A Delay-Fractioning Approach

Jun Hu, Zidong Wang, Jinling Liang, Hongli Dong

PII: S0016-0032(14)00353-6
DOI: http://dx.doi.org/10.1016/j.jfranklin.2014.12.006
Reference: FI2187

To appear in: *Journal of the Franklin Institute*

Received date: 1 October 2014
Revised date: 1 November 2014
Accepted date: 5 December 2014

Cite this article as: Jun Hu, Zidong Wang, Jinling Liang, Hongli Dong, Event-Triggered Distributed State Estimation with Randomly Occurring Uncertainties and Nonlinearities over Sensor Networks: A Delay-Fractioning Approach, *Journal of the Franklin Institute,* http://dx.doi.org/10.1016/j.jfranklin.2014.12.006

Event-Triggered Distributed State Estimation with Randomly Occurring Uncertainties and Nonlinearities over Sensor Networks: A Delay-Fractioning Approach

Jun Hu[a,b,c], Zidong Wang[d,e], Jinling Liang[a,e,*] and Hongli Dong[f]

***Abstract*—This paper is concerned with the problem of event-triggered distributed state estimation for a class of discrete nonlinear stochastic systems with time-varying delays, randomly occurring uncertainties and randomly occurring nonlinearities. Both the uncertainties and nonlinearities enter into the system in a random way characterized by random variables obeying the Bernoulli distribution. An event-triggered scheme is introduced to reduce the number of excessive executions of the signal transmissions. The aim of this paper is to design a distributed state estimator such that the estimation error dynamics is asymptotically mean-square stable. By constructing a Lyapunov-Krasovskii functional and employing the delay-fractioning approach, sufficient conditions are established to guarantee the desired performance requirements and then the explicit form of the distributed estimator gains is parameterized. An illustrative example is finally provided to demonstrate the effectiveness of the developed distributed state estimation scheme with the event-triggered communication mechanism.**

***Index Terms*—Sensor networks, distributed state estimation, randomly occurring uncertainties, randomly occurring nonlinearities, time-varying delay.**

This work was supported in part by the National Natural Science Foundation of China under Grants 61329301, 61134009, 11301118, 61174136 and 61374127, the China Postdoctoral Science Foundation under Grant 2014M560376, Jiangsu Planned Projects for Postdoctoral Research Funds under Grant 1402004A, and the Alexander von Humboldt Foundation of Germany.

[a] Department of Mathematics, Southeast University, Nanjing 210096, China.

[b] Department of Applied Mathematics, Harbin University of Science and Technology, Harbin 150080, China.

[c] Department of Electrical and Computer Engineering, University of Kaiserslautern, Kaiserslautern 67663, Germany.

[d] Department of Computer Science, Brunel University, Uxbridge, Middlesex, UB8 3PH, United Kingdom.

[e] Communication Systems and Networks (CSN) Research Group, Faculty of Engineering, King Abdulaziz University, Jeddah 21589, Saudi Arabia.

[f] College of Electrical and Information Engineering, Northeast Petroleum University, Daqing 163318, China.

[*] Corresponding author. E-mail: jinlliang@gmail.com

I. Introduction

A sensor network is composed of a group of sensor nodes equipped with the communication infrastructure monitoring and collecting information at diverse locations [26]. During the past decade, the sensor networks have received an increasing research interest due to their successful applications in a variety of domains such as industrial automation, traffic and environmental monitoring, medical device monitoring, and wireless networks etc [6], [24], [31]. In terms of theoretical research, considerable effort has been devoted to the synchronization, estimation and filtering problems over sensor networks [7], [32], [34]. To be specific, the design of the centralized time-varying Kalman filtering has been studied in [30] over a wireless sensor network with correlated fading channels, where the stochastic stability of the developed filtering algorithm has been