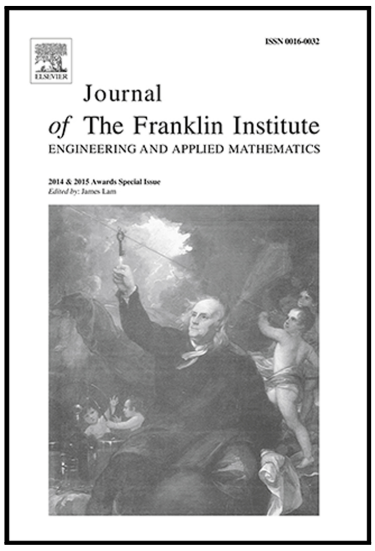

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Abstract

This paper focuses on the filtering problem for nonlinear networked systems with event-triggered data transmission and correlated noises. An event-triggered data transmission mechanism is introduced to reduce excessive measurements transmitted over a bandwidth-constrained network. Considering that process noise and measurement noise are one-step cross-correlated, an UKF-based filtering algorithm which depends on correlation parameter and trigger threshold is presented. Then sufficient conditions are established to ensure stability of the designed filter, where a critical value of the correlation parameter exists. Finally, the effectiveness of the proposed filtering algorithm is demonstrated by comparative simulations.

Keywords Event-triggered transmission mechanism, unscented Kalman filter, cross-correlated noises, nonlinear systems.

I. Introduction

With the development of network technology, an increasing attention has been paid to the research of networked control systems (NCSs) [1]-[5], especially wireless sensor networks systems (WSNs) that have been applied in environmental monitoring, intelligent buildings, transportation systems, national defense, etc. Moreover, the research on nonlinear filtering problem for NCSs has become a hotspot. In a NCS, due to limited computing, communication resources and network bandwidth, it is necessary to reduce communication rate from sensor to filter with a guaranteed estimation performance. So many filtering schemes with different event-triggered data transmission mechanisms are presented in recent years [6]-[17]. A variance-based event-triggered transmission mechanism is used in [7], with that a modified Riccati equation is derived based on Kalman filter. In [8], a maximum likelihood state estimator is designed based on an innovation-based scheduler which is integrated to a sensor. Under a commonly-accepted Gaussian assumption, state estimation based on the information from multiple sensors that provide their measurement updates according to separate event-triggering conditions is considered in [9]. With a similar assumption condition, [10] derives a minimum mean-square error (MMSE) estimator with innovation-based sensor scheduler. To preserve the Gaussianity of system state, a stochastic event-triggered sensor schedule is proposed in [11] and [12]. In the case of nonlinear systems, Sun *et al.* [13] investigate an H_∞ filtering problem for nonlinear networked systems by combining with the send-on-delta event-triggered scheme and a signal quantization strategy. With similar event-triggered scheme, two robust filters for nonlinear systems with missing measurements are design in [14] and [15], respectively. At the same time, the event-triggered filtering schemes have been successfully applied in some engineering systems [16]-[17]. However, there have been not many researches on unscented Kalman filter (UKF) based on event-triggered data transmission mechanism, which constitutes one motivation of this literature.

The aforementioned literatures assume that both the process noise and measurement noise are uncorrelated. However, performance of the filters will be seriously deteriorated when correlated noises appear in the actual systems. Thus the problem of state estimation with correlated noises has received wide attention in NCSs [18]-[30]. In [18], a design of optimal state estimator for linear systems with cross-correlated noises is concerned. Moreover, considering sudden environment changes, recursive filtering algorithms with the autocorrelated and cross-correlated noises are given for uncertain systems in [19] and [20]. Aiming at the problems of the networked systems, [21] and [22] consider the problem of autocorrelated noises and cross-correlated noises for linear systems with packet dropouts, respectively. As for the research of nonlinear filtering with correlated noises, there exists two frameworks available to solve this problem including the Gaussian approximation recursive filter (GASF) framework [25] and the

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