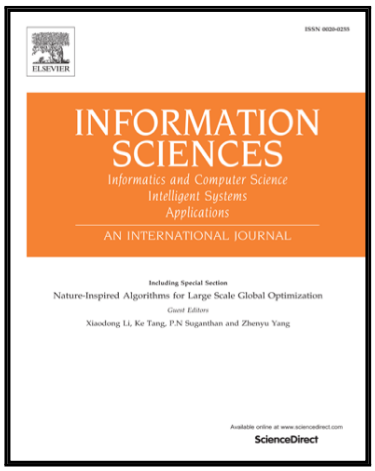

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PII: S0020-0255(17)30620-5
DOI: 10.1016/j.ins.2017.08.057
Reference: INS 13061

To appear in: *Information Sciences*

Received date: 22 March 2017
Revised date: 17 June 2017
Accepted date: 11 August 2017

Please cite this article as: An-Yang Lu, Guang-Hong Yang, Event-triggered secure observer-based control for cyber-physical systems under adversarial attacks, *Information Sciences* (2017), doi: 10.1016/j.ins.2017.08.057

Event-triggered secure observer-based control for cyber-physical systems under adversarial attacks

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Abstract

This paper investigates the problem of event-triggered secure observer-based control for continuous-time cyber-physical systems (CPSs) under actuator and sensor attacks. Under event-triggered scheme, the original plant is augmented into a discrete-time system, where the states and attacks are assembled into the state vector of the new system. Then, based on the augmented system, a discrete-time secure observer is presented to estimate the states and attacks. Besides, a novel secure observer-based controller, where the actuator attack estimations are utilized to neutralize the actuator attacks, is proposed. A cone complementarity linearization (CCL) algorithm is provided to co-design the desired observer and controller. It is shown that using the proposed secure observer-based controller, the states of the original plant converge to a small neighborhood of the origin despite attacks. Finally, an illustrative example is given to show the effectiveness of the proposed methods.

Keywords: Cyber-physical systems, actuator and sensor attacks, event-triggered scheme, secure observer-based controller

1. Introduction

Nowadays, cyber-physical systems (CPSs), which tightly integrate computation, networking, and physical processes, have attracted much attention of the scientific community. While the integration does not mean the simple convergence of the physical world and the cyber space, but the deep interaction of all the physical and cyber components, CPSs need to guarantee the execution of multiple control policies and communications with sensors and actuators at a suitable rate and optimize the performance of control, security and management function, e.g. power systems [13] and deep sea exploiting systems [36]. For the immense

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