Resilient Event-based Control for Nonlinear Cyber-Physical Systems under Intermittent Deception Attacks

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Abstract

We address the resilient event-based control of nonlinear cyber-physical systems subject to deception attacks. In particular, an improved Takagi–Sugeno (T-S) fuzzy model is employed to solve the mismatch problem between the fuzzy system and fuzzy controllers. From the attacker's point of view, we construct a novel queuing model to depict the intermittent behaviors of deception attacks. Then, a resilient event-based communication scheme is proposed, which is dynamically switched with different attack modes. The idea is to appropriately reduce the number of triggers according to the severity level of attacks, which can further save network resources. By using piecewise Lyapunov functional methods, we find a solution to the co-design of fuzzy controllers and event-triggering parameters while the concerned system is guaranteed to be exponentially stable. Finally, we apply the proposed approaches to a mass–spring–damping system, where the effectiveness is well verified.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures

Figure 1

System plant

Figure 2

Time sequence for intermittent deception attacks

Figure 3

Time sequence for intermittent deception attacks

Figure 4

Deception attack signal

Figure 5

State responses and Releasing period

Figure 6

Response of the control input

Figure 7

State responses and Releasing period

Figure 8

State responses and Releasing period