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Resilient Output Feedback Control of Cyberphysical Systems

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Cyber-physical system architectures are being used in many different applications such as power systems, transportation systems, process control systems, large-scale manufacturing systems, ecological systems, and health-care systems. Many of these applications involve safetycritical systems, and hence, any failures or cyber attacks can cause catastrophic damage to the physical system being controlled resulting in drastic societal ramifications. Due to the open communication and computation platform architectures of CPS, one of th most important challenges in these systems is their vulnerability to malicious cyber attacks. Cyber attacks can severely compromise system stability, performance, and integrity. In particular, malicious attacks in feedback control systems can compromise sensor measurements as well as actuator commands to severely degrade closed-loop system performance and integrity. Cyber attacks are continuously becoming more sophisticated and intelligent, and hence, it is vital to develop algorithms that can suppress their effects on cyber-physical systems.In this paper, an output feedback adaptive control architecture is presented to suppress or counteract the effect of false data injection actuator attacks in linear systems, where it is assumed that the attacker is capable of maliciously manipulating the controller commands to the actuators. In particular, the proposed controller is composed of two components, namely anominal controller and an additive corrective signal. It is assumed that the nominal controller has been already designed and implemented to achieve a desired closed-loop nominal performance. Using the nominal controller, an additive adaptive corrective signal is designed and added to the output of the nominal controller in order to suppress the effect of the actuator attacks. Thus, in the proposed control architecture, there is no need to redesign the nominal controller; only the adaptive corrective signal is designed using the available information from the nominal controller and the system.

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