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FAULT IDENTIFICATION AND FAULT-TOLERANT CONTROL FOR A CLASS OF NETWORKED CONTROL SYSTEMS

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Abstract. *In this paper, diagnosis of actuator/component faults for a class of networked control systems using adaptive observer techniques is investigated. At first, linear networked control systems are considered. Under certain conditions, a stable adaptive fault diagnosis observer is proposed. Then based on the fault estimation information, a fault tolerant controller is designed to recover the system performance. An extension to a class of nonlinear systems is also made. Finally, simulation results verify the efficiency of the proposed method.*

Keywords: Fault diagnosis, Adaptive observer, Fault-tolerant control, Networked control systems, Nonlinear systems

1. **Introduction.** Networked control systems (NCSs), due to their advantages, are applicable to many fields ranging from DC motors, advanced aircraft, spacecraft automotive, and manufacturing process. The stabilizing problem of linear NCSs has attracted much attention during recent years, for example [1, 3]. But, only a few papers have considered nonlinear NCSs, such as [4]-[6].

Faults may lead to unacceptable system behaviors. Fault diagnosis (FD) is aimed at detecting, isolating and estimating the faults, while fault tolerant control (FTC) is aimed at guaranteeing the system goal to be achieved in spite of faults. For some representative work on this general topic, to name a few, we refer the readers to [7]-[11] and the references therein. Compared with fault detection, fault diagnosis/identification is not an easy task. Recently, there are also some results in the fault detection for linear NCSs, in which the faults are not only those (e.g. data missing) caused by the NCSs, but also the controlled plant faults (e.g. actuator/component faults), see [12, 13]. Very little work has been done about FTC for linear NCSs, where the passive FTC methods are mainly used, i.e., implementing control algorithms that are robust to faults.

The novelty of this paper is that we propose a fault estimation method to provide the fault shape, which is very important for fault accommodation. Based on it, an active FTC approach is presented, which in general can make the system have better performance under both the healthy and faulty conditions, compared with the passive FTC method. Furthermore, the proposed approach is extended to a kind of nonlinear NCSs.

The rest of this paper is organized as follows. Section 2 describes a class of linear NCSs and introduces some preliminaries. Under certain conditions, an adaptive diagnostic