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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

Fault-tolerant control merges several disciplines into a framework with common goals. The fault-tolerant properties are obtained through on-line fault detection and isolation, automatic condition assessment and calculation of appropriate remedial actions. The final step is activation of the necessary actions through software.Â This paper presents an actuator fault compensation approach for a class of Linear Parameter-Varying (LPV) systems with noisy measurements. The proposed method is based on interval estimation assuming that the fault vector and the external disturbances are unknown but bounded. The main idea consists in designing a control law, based on a linear state feedback, to guarantee closed-loop stability. Designing a Fault-Tolerant Network Using Netra CP3x40 Switches. Designing a Fault-Tolerant Network. This document provides guidelines for designing a fault-tolerant network using Netra CP3140 switches and Netra CP3240 switches. This document contains the following topics: ATCA Network Overview.Â Independent of the software used to increase availability, a system should be redundantly cabled, preferably at both the board level and the link level. ATCA uses a dual-star topology for backplane connections. So, inside the ATCA shelf every node (anything that is a network endpoint) is connected to both switch blades. Abstractâ€” The problem of fault-tolerant control allocation for a class of overactuated nonlinear systems is considered. The construction extends to the nonlinear case some results obtained previously in the linear systems framework. The proposed scheme consists of three main steps: fault detec-tion/approximation using a nonlinear observer, fault isolation through a bank of unknown input observers with a resetting policy to reduce the effects of nonlinearities and control reconguration based on reduced order allocation. I. INTRODUCTION. The main objective of control allocation is to determine h... J. Wang, â€œH fault-tolerant controller design for networked control systems with time-varying actuator faultsâ€ International Journal of Innovative Comput- ing, Information and control, 11(4), 1471-1481, 2015. H. Azmi, M. J. Khosrowjerdi, â€œRobust adaptive fault tolerant control for a class of lipschitz nonlinear systems with actuator failure and distur- bancesâ€ Journal of Systems and Control Engineering, 230(1), 13-22, 2015. https://doi.org/10.1177/0959651815606628.Â T. Takagi, M. Sugeno, â€œFuzzy identification of systems and its applications to modeling and controlâ€ IEEE Transactions on Systems, Man and Cybernetics, 15(1), 116-132, 1985. https://doi.org/10.1109/TSMC.1985.6313399. Fault detection fault identification fault tolerant control temperature control. This is a preview of subscription content, log in to check access. Preview.Â In: 1st Workshop on Networked Control System and Fault Tolerant Control conf., France (2005)Google Scholar. 8. Noura, H., Sauter, D., Hamelin, F., Theilliol, D.: Fault tolerant control in dynamic systems: application to a winding machine. IEEE control system magazine , 33-49 (2000) Google Scholar. 9.Â Z.: Design of Knowledge-based Fault Detection and Identification for Dynamical Systems. Master of Science, University of Alberta (2002) Google Scholar. 13. Bolat, E., Erkan, D., PostalcioÄŸlu, K.: Microcontroller Based Temperature Control of Oven Using Different Kinds of Autotuning PID Methods.