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CALCULATION OF THE NUMBER OF REDUNDANT ACTUATORS FOR TOLERATING ACTUATOR FAULTS

Abstract

Systems such as spacecrafts, aircrafts, etc. which may result in a catastrophic accident due to failures are called safety-critical systems. These systems must satisfy high level of dependability. One of the widely used methods for achieving high level of dependability is adopting redundant hardware that activates as a primary actuator while failure occurs in a primary. In contrast to adopting hardware redundancies, various analytic techniques based on control theory for achieving high reliability have been proposed during the last 30 years. These techniques are defined as fault tolerant control (FTC) techniques. FTC also called reconfiguration is a set of techniques to provide the system with the ability of maintaining the desired performance in case of faults. For tolerating faults, relationship between normal actuators and system states directly affected by faults is very important. In this paper, the reconfiguration criterion that analyzes the relationship between normal actuators and the faulty states is proposed. The proposed criterion provides the reconfiguration possibilities and strategies for tolerating faults. Moreover, the proposed reconfiguration criterion also provides the required minimum number of redundant actuators for tolerating faults. A set of simulation results applied to the spacecraft formation flying demonstrates the efficiency of the proposed method.