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Applied Actuator Fault Accommodation in Flight Control Systems Using Fault Reconstruction Based FDD and SMC Reconfiguration

Authors : A. Ghodbane, M. Saad, J. F. Boland, C. Thibeault

Abstract : Historically, actuators' redundancy was used to deal with faults occurring suddenly in flight systems. This technique was generally expensive, time consuming and involves increased weight and space in the system. Therefore, nowadays, the on-line fault diagnosis of actuators and accommodation plays a major role in the design of avionic systems. These approaches, known as Fault Tolerant Flight Control systems (FTFCs) are able to adapt to such sudden faults while keeping avionics systems lighter and less expensive. In this paper, a (FTFC) system based on the Geometric Approach and a Reconfigurable Flight Control (RFC) are presented. The Geometric approach is used for cosmic ray fault reconstruction, while Sliding Mode Control (SMC) based on Lyapunov stability theory is designed for the reconfiguration of the controller in order to compensate the fault effect. Matlab®/Simulink® simulations are performed to illustrate the effectiveness and robustness of the proposed flight control system against actuators' faulty signal caused by cosmic rays. The results demonstrate the successful real-time implementation of the proposed FTFC system on a non-linear 6 DOF aircraft model.

Keywords : actuators' faults, fault detection and diagnosis, fault tolerant flight control, sliding mode control, geometric approach for fault reconstruction, Lyapunov stability
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