A state of the Art about Fault Detection and Isolation (FDI) for Fault Tolerant Control (FTC) in onboard systems

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Résumé

Reliability and safety of onboard systems have always been a major concern for aircraft systems designers. The ability to identify as early as possible a fault in such systems can be a critical issue. Fault Detection and Isolation (FDI) capability provides in general a sound basis for introducing Fault Tolerant Control (FTC). Active FTC aims at designing fault tolerant control systems by taking advantage of FDI, while passive FTC pursues the same objective using exclusively robust control techniques. This presentation will concentrate on FDI, leaving aside reconfiguration and other fault tolerant techniques. On-line fault diagnosis has been historically treated via hardware (sensors and actuators) redundancy whose drawbacks are increased costs, additional weight, volume and required power. More recent analytic redundancy approaches have contributed to FDI without facing these limitations. These approaches, termed also model based, takes profit of the analytic relations between the different physical parameters accessible to measurement in order to detect differences symptomatic of failures. More recently model free approaches which use the redundancy and correlations of the data in a hidden manner have also been developed. After presenting the main principles and methods of analytic redundancy based FDI, the applicability of these techniques to onboard systems will be discussed.

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