Active fault detection and isolation of discrete-time linear time-varying systems: a set-membership approach - DTU Orbit (18/12/2018)

Active fault detection and isolation (AFDI) is used for detection and isolation of faults that are hidden in the normal operation because of a low excitation signal or due to the regulatory actions of the controller. In this paper, a new AFDI method based on set-membership approaches is proposed. In set-membership approaches, instead of a point-wise estimation of the states, a set-valued estimation of them is computed. If this set becomes empty the given model of the system is not consistent with the measurements. Therefore, the model is falsified. When more than one model of the system remains un-falsified, the AFDI method is used to generate an auxiliary signal that is injected into the system for detection and isolation of faults that remain otherwise hidden or non-isolated using passive FDI (PFDI) methods. Having the set-valued estimation of the states for each model, the proposed AFDI method finds an optimal input signal that guarantees FDI in a finite time horizon. The input signal is updated at each iteration in a decreasing receding horizon manner based on the set-valued estimation of the current states and un-falsified models at the current sample time. The problem is solved by a number of linear and quadratic programming problems, which result in a computationally efficient algorithm. The method is tested on a numerical example as well as on the pitch actuator of a benchmark wind turbine.

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