



# Robust fault tolerant tracking controller design for a VTOL aircraft

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Received 1 April 2012; accepted 22 September 2012

Available online 3 October 2012

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## Abstract

This paper deals with the fault tolerant control (FTC) design for a Vertical Takeoff and Landing (VTOL) aircraft subject to external disturbances and actuator faults. The aim is to synthesize a fault tolerant controller ensuring trajectory tracking for the nonlinear uncertain system represented by a Takagi–Sugeno (T–S) model. In order to design the FTC law, a proportional integral observer (PIO) is adopted which estimate both of the faults and the faulty system states. Based on the Lyapunov theory and  $\mathcal{L}_2$  optimization, the trajectory tracking performance and the stability of the closed loop system are analyzed. Sufficient conditions are obtained in terms of linear matrix inequalities (LMI). Simulation results show that the proposed controller is robust with respect to uncertainties on the mechanical parameters that characterize the model and secures global convergence.

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## 1. Introduction

In the last three decades, the need for increased flight safety and aircraft reliability has been and will continue to be an important issue in commercial aviation industry. All pilots undergo widespread training to help them to be able to react to unexpected difficulties that may occur during a flight in uncertain conditions. Furthermore, advanced fault-tolerant

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