

عنوان مقاله:

Optimal Robust Control Based on State-Dependent Differential Riccati Equation with Application on Ducted Fan Aircraft

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خلاصه مقاله:

In this paper, optimal robust controllers are developed for tracking control of a ducted fan engine of a thrust-vectoring aircraft in the presence of external disturbances. First, by applying a nonlinear regulator based on the state-dependent differential Riccati equation (SDDRE) approach, an optimal control law is designed that is not robust against external disturbances. The second design, a VSC (variable structure control) with an NTV (nonlinear time-varying) sliding sector, is proposed. The sliding sector is a subset of the state space which is obtained by the SDDRE. As the final design, to guarantee the system's robustness against external disturbances and achieve optimal performance, a robust optimal sliding mode controller based on SDDRE (ROSMC) is designed, which integrates the sliding mode control (SMC) theory with the SDDRE approach. For each design, the global asymptotic stability is proved using the Lyapunov stability theorem. Also, the SDDRE is solved by a change of variable and converting it to a differential Lyapunov equation (DLE). Numerical simulations are presented considering different types of external disturbances and several scenarios. Simulation results show that ROSMC has stronger robustness and demonstrates optimal performance compared to SDDRE and VSC designs.

کلمات کلیدی:

Optimal, State-dependent differential Riccati equation (SDDRE), Variable structure control (VSC), sliding mode, Ducted fan engine

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