

Robust adaptive sliding mode control strategy of uncertain nonlinear systems

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Abstract: This paper presents a robust adaptive sliding mode controller scheme as applied to a class of uncertain nonlinear systems with parametric uncertainties and external disturbances. First, a sliding mode control technique is designed. Then, the proposed robust adaptive control schemes are applied to estimate the parametric uncertainties and the upper bound value of the external disturbances by using adaptive laws, ensure robustness in presence of parametric uncertainties and external disturbances, and reduce chattering problem by introducing an hyperbolic tangent function. Lyapunov stability theory is used to analyze the stability of the closed-loop system. As an exemplar, the schemes have been applied to a quadrotor unmanned aerial vehicle (QUAV) model. Simulation results for the control of the QUAV model are provided to illustrate the performance of the proposed robust adaptive sliding mode control scheme and demonstrate that the proposed method has good tracking performance. The simulation results clearly prove the effectiveness of our approach.

Keywords : adaptive control, Robust control, Sliding mode control, uncertain nonlinear systems, parametric uncertainties, external disturbances, adaptive laws, Lyapunov stability theory, quadrotor unmanned aerial vehicle