

Robust Rotorcraft Control using an Adaptive Incremental Sliding Mode Controller

The paper presents a novel control approach based on a discontinuous form of the pre-existing Incremental Nonlinear Dynamic Inversion (INDI) control technique for uncertain nonlinear Multi-Input Multi-Output (MIMO) systems using angular acceleration feedback. The pseudo-control is substituted by a robust first-order sliding mode controller, which employs a discontinuous component to compensate for time-delay and parametric uncertainties. A comprehensive mathematical proof of its inherent robustness with respect to the time delays or parametric uncertainties of the control effectiveness matrix is provided. In order to show the real-time application of the controller and to verify the robustness characteristics, the control approach is applied directly to the stabilization and control of a quadrotor system. It was shown that the novel control approach is considerably more robust to perturbations.