Abstract

This paper presents a robust sliding-mode control technique to be applied to quaternion-based attitude control for rest-to-rest maneuvers with external disturbances. A sliding mode controller has been designed to force the state variables of the closed loop system to converge to the desired values. A control strategy is designed based on a novel mathematical rule that computes the discontinuous feedback gains. The proposed approach is defined in such a way that the selected controller parameters can drive the state to hit the sliding surface fast and then keep the state sliding along the surface with less chattering and tracking error. Moreover, the control parameters are adjusted to avoid the body angular velocity reached the upper limit during the maneuver. A simulation model of the controlled spacecraft system was developed in MATLAB-SIMULINK software. The phase portraits and the state plots prove the control technique power. The "chattering" problem of the sliding mode control has been adopted using variable thickness boundary layer technique. The second method of Lyapunov is used to guarantee the system stability under the proposed control laws action. Simulations have been carried out to demonstrate and verify the developed controller performance.
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