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.
Satellite Attitude Maneuver using Sliding Mode Control under Body Angular Velocity Constraints

References

- A. Bartoszewicz, "Sliding Mode Control," Published by Janeza Trdine 9, 51000 Rijeka, Croatia, Copyright © 2011.
- W. Perruquetti, J. Pierre Barbot, "sliding mode control in engineering," © 2002 by Marcel Dekker, NEW YORK.
- Rushi Ghadawala, "advances in spacecraft systems and orbit determination," Copyright © 2012 InTech. Croatia.
- Reast Ö. Doruk "Nonlinear Controller Design for a Reaction Wheel Actuated Observatory satellite," a thesis submitted to the graduate school of applied science of Middle East technical university 2008.
- J. Gießelmann, "Development of an Active Magnetic Attitude Determination and Control System for Picosatellites on highly inclined circular Low Earth Orbits," Master of Engineering RMIT University, June 2006.
Satellite Attitude Maneuver using Sliding Mode Control under Body Angular Velocity Constraints

Norway, pp 901-906, June 2005.

Index Terms
Computer Science Signal Processing

Keywords
Microsatellite attitude control sliding mode control