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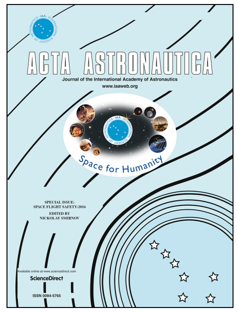

Experiments study on attitude coupling control method for flexible spacecraft

Jie Wang, Dongxu Li

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Experiments Study on Attitude Coupling Control Method for Flexible Spacecraft

Wang Jie*, Li Dongxu
College of Aerospace Science and Engineering, National University of Defense Technology
NO.47 Yanwachi Street, Changsha 410073
**Corresponding author. E-mail: wangjie@nudt.edu.cn*

Abstract

High pointing accuracy and stabilization are significant for spacecrafts to carry out Earth observing, laser communication and space exploration missions. However, when ~~the~~ a spacecraft undergoes large angle maneuver, the excited elastic oscillation of flexible appendages, for instance, solar wing and onboard antenna, would downgrade the performance of the spacecraft platform. This paper proposes a coupling control method, which synthesizes the adaptive sliding mode controller and the positive position feedback (PPF) controller, to control the attitude and suppress the elastic vibration simultaneously. Because of its prominent performance ~~in~~ for attitude tracking and stabilization, the proposed method is capable of slewing the flexible spacecraft with a large angle. Also, the method is robust to parametric uncertainties of the spacecraft model. Numerical simulations are carried out with a hub-plate system which undergoes a single-axis attitude maneuver. An attitude control testbed ~~of~~ for the flexible spacecraft is established and experiments are conducted to validate the coupling control method. Both ~~the~~ numerical and experimental results demonstrate that the method discussed above can effectively decrease the stabilization time and improve the attitude accuracy of the flexible spacecraft.

Keywords: Flexible Spacecraft; Sliding mode control; Positive position feedback; Attitude Coupling Control; Experiment

1 Introduction

Early spacecrafts ~~is~~ were usually idealized as ~~a~~ rigid bodies for attitude control while the flexible parts ~~is~~ were ignored because of ~~its~~ their small mass or inertia [1-4]. With the application of large scale solar wings and antennas on modern spacecrafts, the influences of flexibilities on characteristics and attitude of the whole system