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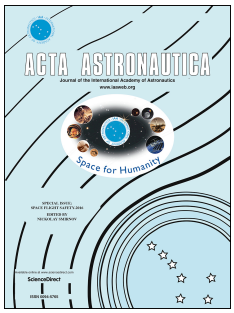

Optimal excitation design for identifying inertia parameters of spacecraft

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Optimal Excitation Design for Identifying Inertia Parameters of Spacecraft

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Abstract

Excitation design is one of the important contents in the identification of inertia parameters and the form of excitation has a great influence on the identification result. This paper presents a new method to design and calculate the optimal excitation. Firstly for a spacecraft equipped with momentum wheels, the identification problem is established based on conversation of angular momentum and an inverse operating. A performance index which is similar to but not the condition number is first defined as the benchmark for designing the optimal excitation. Because the performance index only depends on performances of the actuator, such as the angular momentum of the wheel, a simple direct-search method is applied to calculate the optimal excitation for the case without terminal angular velocity constraints and a two-step direct-search method for the case with terminal angular velocity constraints. While the initial angular momentum of spacecraft system is considered, the optimal excitation is obtained based on the difference of two successive measurements. Finally, the optimal excitation for a spacecraft using thrusters is designed according to the same design process. Simulation results show that the calculated optimal excitation has the good performance index and can produce accurate identification results even when some perturbations are considered.

Keywords: spacecraft, inertia parameters, identification, optimal excitation, least-squares method

I. Introduction

Considering the fact that inertia parameters of spacecraft are often changed along with the appendage's moving or deploying, the fuel consuming, and others on-orbit operating (such as space debris removal [1]), it is necessary to

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