

عنوان مقاله:

Satellite Attitude Maneuver Using a Chattering Eliminated Sliding Mode Control

محل انتشار:

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خلاصه مقاله:

Energy consumption of control actuators is an important issue in space systems, due to considerable cost of supplies in orbit. In this paper, a chattering avoidance sliding mode control law is developed for space assemblies during a rotational maneuver, which results in significant savings in energy consumption. Although the sliding mode controller usually results in an acceptable performance especially in the presence of modeling uncertainties and system's nonlinearities, but may lead to chattering phenomenon which results in significant energy dissipation. In order to fulfill stability requirements, robustness properties and chattering elimination, a regulating routine is proposed to determine proper positive values for the coefficient of sliding condition. The main idea of developing this new method is to keep the state of the system close to the nominal (desired) value near the sliding surface. So the coefficient of sliding condition is tuned by a function of distance from sliding surface. To this end, first a multi input sliding mode control law is applied to a given satellite in order to control its orientation. Next, focusing on the chattering phenomenon that is of main concern in space due to energy limitations, the aforementioned new approach is proposed to alleviate (ideally eliminate) the chattering trend. The developed control law is applied on a given satellite during a rotational maneuver. To consider practical aspects, servo actuators with saturation limits, activity margins and resolutions are used, and the system dynamics is modeled in the presence of parametric uncertainties, also deviations (noises) in measurements are considered. A criterion, Chattering Intensity Factor (CIF), is introduced to measure the effectiveness of the proposed algorithm, which is defined as the ratio of the energy consumption of the actuators by using the new approach with respect to the conventional law. The simulation results show that the amplitude of chattering reduces due to the activity of the new routine and therefore energy consumption will be substantially decreased which reveals the merits of the developed control law.

کلمات کلیدی:

Satellite attitude control – Sliding mode Control – Chattering – Simulation

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