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A SEMI-PASSIVE CONTROL SOLUTION TO BUAA-SAT ADCS: AN EARTH REMOTE-SENSING STUDENT MICRO SATELLITE

Abstract

BUAA-sat is a 40kg microsatellite fully designed and ready to be manufactured by the Chinese and foreign students of Beihang university of China. Its launch date is due to the beginning of 2016 by LM4B. The mission of this micro satellite is to take pictures of itself during the boom deployment and imaging the Earth when the satellite is passing over Beijing. Earth imaging has been added to the missions in the year 2013. Therefore, to fulfill this requirement, 3-axis stabilization is required with the pointing accuracy of less than 2deg and pointing stability of better than 0.01deg/s. So far no paper has been published on ADCS of BUAA-Sat. It is not common to use gravity gradient boom for the student small satellites with the remote sensing mission due to its libration which can be very harmful to the camera during the imaging phase. Since the boom deployment test has been one of the primary missions of the project, it cannot be deleted from the satellite. Hence, instead of using a completely active attitude control method a semi-passive control method has been designed. First of all, this paper introduces the operational control modes of the ADCS, the control laws used at each operational mode, hardware used at each control mode, environmental effects on the satellite, the difficulties, challenges and considerations due to the boom deployment sequence and after the deployment (such as libration), etc. Later in the analysis part, this paper explains the development of a Matlab based simulation that is used to firstly design and then to test the algorithm of BUAA-Sat and demonstrates the ability of ADCS design and hardware to meet the mission requirements. At last the verification procedure of the simulation and the selected devices are discussed to prove that the results obtained by them are reliable and also to assess the affiliated uncertainties. At the end, this paper concludes the finalized configuration and design of ADCS for BUAA-Sat, lessons learnt and following works in the next steps. Hopefully this paper can benefit not only the following ADCS members of BUAA microsat laboratory, but also all the students around the world who work on the same field.