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A NOVEL ALGORITHM OF ON-ORBIT PERFORMANCE EVALUATION OF INFRARED STATIC EARTH SENSORS WITH STAR SENSORS

Abstract

On-orbit experiments should be carried out for new type spaceborne payloads and new techniques before they are put into market or practical applications. The purposes of these experiments are to test and evaluate the functions, performances, life-span and reliability. This paper we have raised a novel method using star sensors to evaluate the on-orbit performance of a new type of infrared static Earth horizon sensors. We take the sun synchronous satellite into consideration, whose orbit inclination is close to 90 degree. The Earth oblateness is a dominating error source for the attitude measurement using the infrared static Earth horizon sensor. The influence of the oblateness is severe and must be considered. We propose a new method to eliminate the trend terms of the satellite attitude using the star sensors. A mathematical model is established to depict the attitude measurement errors introduced by the Earth oblateness. The attitude error calculation formula is also deduced, which can be used to correct the measurement data collected by the Earth sensor in real-time. Furthermore, the on-orbit functioning performances of this new type infrared static Earth sensor are evaluated. Simulation data are employed in validating the algorithm. The results show that the method can effectively evaluate the on-orbit performance of the infrared static Earth horizon sensors. The algorithm is simple and can be easily realized by the on-board computer. Additionally, the method proposed can also be used in the fault detection analysis for the payloads.