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A GROUND ATTITUDE ANALYSIS METHOD OF THE LEO SATELLITE EMPLOYING LARGE-SCALE ROTATING INSTRUMENTS

Abstract

With the development of satellite technology, a growing number of LEO satellites, especially the microwave remote sensing satellite, employ multiple large-scale rotating payloads with reflector antenna. These payloads have large mass and high speed, and will rotate all time in the period of on-orbit. Because of long distance to the mass center of satellite, the dynamic unbalance and the static unbalance will generate additional disturbance torque to the satellite, and the torque will increase with the distance to the mass center. Furthermore, the disturbance torque will approach 10E-1 Nm level, which is greater than space environment disturbance. So the rotating disturbance will affect the attitude precision and stability directly, if the satellite employs more than two large-scale rotating payloads, the disturbance will be a complex, random periodic disturbance, thus reduce the satellite attitude precision further.

According to the LEO microwave remote sensing satellite employing more than two large-scale rotating payloads with large reflector antenna, the paper introduce a new experimental validation method on ground to get the satellite attitude precision in space. The method uses three-axis air floated platform to get the interference torque to satellite, and then calculates the wind resistance of the large reflector antenna through fluid mechanics analysis software, finally obtains the satellite attitude precision based on the accurate dynamic model of space. The method will help satellite engineer to simulate the attitude precision on orbit before the launch, confirm the interference torque of rotating payload, and perfect the design state of the satellite in advance.

The method has been validated through a microwave remote sensing satellite on orbit, which the simulation result is similar to the actual data.