Paper ID: 33972
student

14TH IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations (IP)

Author: Mr. Fei Han
Harbin Institute of Technology, China

Prof. zhang jinxiu
Harbin Institute of Technology, China
Mr. Qing Chen
Research Center of Satellite Technology, Harbin Institute of Technology, China

THE RESEARCH OF TINY NON-COOPERATIVE SPACE TARGET RELATIVE ORBIT DETERMINATION WITH INTERMITTENT MEASUREMENT INFORMATION

Abstract

Since launch of the first satellite in 1957, an increasing number of satellites have been sent to space. As the science and technology of space developed, and more and more countries have the ability to launch satellite or have the ability to designed satellite, as a result the number of remaining satellites in orbit is more than 3000 and it grows rapidly. And the satellites that are out of service and the upper stage of rockets turn to debris, which decrease the available room for the satellites to take. As the increasing of space development activities, collisions of the retired satellites and the influx of cubesats lead to a surge in the number of tiny non-cooperative space debris. The primary problem to clean space is to detect the tiny non-cooperative target in cryogenic space. Suppose the measure device is limited to CCD camera to measure the altitude and azimuth and satellite laser ranging (SLR) to measure the relative distance from the service satellite to target. When the target is in the dark region of earth shadow, it is difficult to detect it. Aiming at determining the relative orbit of tiny target whose measurement information is intermittently attained with the restriction of illumination, this paper proposes a discrete-EKF-based method to determine the relative orbit. And the numerical simulation demonstrates that estimated error is around 1 cm when angle-measurement is attained and it takes less than 100s to converge. When the angle cannot be measured estimated error of angular momentum direction increases to nearly 2 dm and it will decrease to the 1cm after regaining the measurement. The proposed approach can meet the need to estimate the relative position of tiny non-cooperative target during the detecting stage. The proposed words will be divided into three segments. The first part builds the model of relative motion and measurement, and then analyze the observability. The second studies the constrict condition of intermittent measurement and designs the EKF-based relative orbit determination method. The Last part comes with the simulation output and the analytics.