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SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

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METHOD FOR ESTIMATING ROLLING PERIOD OF SPACE DEBRIS USING RCS

Abstract

Rolling motion is a common movement for space debris. Some space debris keeps rolling motion in its orbit for a long time due to space microgravity environment. For example, due to the separating force, the movement of upper stage often becomes rolling motion after the satellite separated from the rocket. So the rolling period is one of the important physical characteristics of space debris. The results of long-term evolution of space debris rolling period can support the analysis of aerospace mechanics environment. RCS (Radar Cross-Section) sequences of rolling space debris have periodicity because RCS is sensitive to the radar incidence angle. On the other hand, RCS sequences show fluctuant and non-stationary due to the uncertainty of RCS measurement data caused by the motion of space debris, space environment, measurement equipment and other factors. So the tradition methods for estimating rolling period base on self-correlation and spectrum analysis often get incorrect periods. This paper proposes a method for estimating rolling period which is based on empirical mode decomposition. Firstly, the variation trend of RCS sequence is extracted by the mathematical morphological close. Secondly, the extracted RCS sequence is operated by the empirical mode decomposition. The period of each intrinsic mode function is get using the spectral analysis method. Finallythe rolling period can be estimated using the nonparametric statistics theory. The experimental results using simulation data and measured data show that the proposed method can effectively solve the problem for miscalculating rolling period of space debris and improve the accuracy of the estimation results. The long-term observation results of rolling period for some space debris are shown in this paper.