SPACE DEBRIS SYMPOSIUM (A6)
Modelling and Orbit Determination (9)

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AN ORBIT DETERMINATION METHOD OF IMPROVING PARAMETERS BY THE TRACK
DIRECTION ERROR BASED ON SPARSE OBSERVATION DATA

Abstract

"Double Fence Radar" is a detecting system put forward by some researchers in China using for the surveillance of the small size space objects in LEO. One specific property of the system is that the observation data is sparse on time dimension. The number of observations per object is small, typically no more than 10 each day. Besides, the dynamical parameters are normally not determined. The sparse observation data and the unknown dynamical parameters cause that it is hard to get a high precision orbit determination result. And the orbit prediction accuracy can't satisfy the need of further applications, such as collision risk analysis. However, the contribution to the prediction error by different orbit parameter error is not the same, and the track direction position error is normally the main component in the prediction error. The paper analyzes the relation between position error and orbit parameter error and shows that the variation of track direction error with time is mainly affected by the errors of semi-major axis and area-mass ratio. Through fitting the variation of track direction error with time by a quadratic function, the paper estimates and reduces the errors of semi-major axis and area-mass ratio. Although the error of orbit determination result also exists, the prediction accuracy gets much better than that before improving. The simulation illustrates that the position error of 3 days' prediction is within 8km, and the position error of 5 days' prediction is within 22km by this method, which could be enough for many further applications.