

21st IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations - 21st IAA SYMPOSIUM ON SPACE DEBRIS (IP)

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MANEUVERING DETECTION OF SPACE NON-COOPERATIVE TARGETS BASED ON TIME
SEQUENCE INFORMATION

Abstract

Maneuvering detection of failed spacecraft is the key to space on-orbit servicing missions. When the target satellite maneuvers in orbit, it will cause a step change in the rate of change of the relative distance between the target and the observing spacecraft, so target maneuver detection can be abstracted as a step change detection problem of the signal. Aiming at this problem, this paper proposes a detection method of target orbit maneuver based on timing information. In this method, the timing trajectory information of the target's movement is used as the detection sample, and the distance change rate is used as the feature quantity of the target's maneuver detection. First, according to the maneuvering mode of the spacecraft, the orbital maneuvering dynamics model under different thrusts is established, and the change law of the target trajectory under different maneuvering modes is analyzed; then, the maneuvering trajectory segmentation point detection model is constructed by using the support vector machine, and the target historical orbit The data is segmented according to certain rules to provide reliable track parameter time series for subsequent maneuver detection. At the same time, the dynamic time warping neural network algorithm is used to train the target time series information to build a maneuver trajectory recognition model. Finally, through the fusion of segmentation point detection model and maneuver trajectory recognition model, online target maneuver detection and recognition under different thrusts are realized. Combined with the observation data, the simulation analysis of the orbit maneuver detection and orbit accuracy recovery of non-cooperative targets under different thrusts is carried out. The simulation experiment results show that the method can accurately detect the sudden change of the distance change rate between the target and the observing spacecraft, and effectively detect the maneuvering of the target.