Paper ID: 86275
interactive
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IAF ASTRODYNAMICS SYMPOSIUM (C1)
Interactive Presentations - IAF ASTRODYNAMICS SYMPOSIUM (IP)

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SPACECRAFT DYNAMIC WINDOW ATTITUDE PLANNING METHOD FOR PLANETARY APPROACH DETECTION

Abstract

In traditional spacecraft attitude planning, both target pointing and taboo pointing constraints are static. However, the spacecraft needs to maneuver its attitude to accurately aim at the target area when carrying out the observation of the topography of the asteroid. Due to the high-speed spin of the asteroid, the target observation area moves relatively dynamically, forming a dynamic forced pointing constraint. In addition, unlike the strong light of static bright celestial bodies such as the sun, the spacecraft is affected by the comet gas jet on the sensor and the field of view of the payload in the comet approach observation. Considering the uncertainty and dynamics of comet geological activities, there are dynamic taboo constraints in the approach detection. Therefore, facing the new problem of spacecraft attitude maneuver planning under dynamic multi constraints of planetary approach detection, this paper proposes a spacecraft dynamic window attitude planning method. Firstly, considering the dynamic multi constraints in the pointing space, a dynamic window composed of angular velocity sets is established, and the attitude maneuver safety trajectory is simulated in the dynamic window according to the allowable steering angular velocity of the spacecraft; Then the constraint evaluation of the simulated safety trajectory is carried out based on the dynamic multi constraints evaluation function, including the position deviation from the target pointing, the turning angular velocity of the spacecraft, and the safety distance measurement from the dynamic taboo pointing and the mandatory pointing area; The angular velocity in the dynamic window is selected by maximizing the evaluation function, the space attitude maneuver position is recorded and selected. The optimal trajectory to reach the target is generated iteratively in the dynamic window. Finally, the attitude maneuver scenario under the dynamic multi constraints of planetary approach detection is established. Through comparative simulation, the safety of attitude maneuver planning path and the rapidity of maneuver time under the dynamic multi constraints of this method are verified.