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DESIGN OF FLIGHT FORMATION STRATEGY FOR LUNAR ELLIPTICAL ORBIT

Abstract

It is an assumption that two satellites are moving in lunar large elliptical orbit. Guiding the two satellites approaching from a few thousand kilometers to a distance of less than ten kilometers to form the follow-up flight formation, the strategy of the two satellites' orbit maneuvers is designed. Based on the orbit rendezvous control mode, the idea of controlling all orbital factors including plane, arch line, shape and phase is proposed. Aiming at the characteristics of lunar elliptical orbit's perturbation and evolution, on the basis of analyzing the effects of maneuver impulses, the two satellites' formation control strategy of a sequential optimized 5-impulse maneuver is developed. The design idea is as follows: 1) When the deviations of the two satellites' orbital plane elements of i and are large, the normal impulse to correct the orbit plane deviations has a great impact on the orbital eccentricity and the perilune argument, So the orbital plane correction is designed as the first impulse. 2) When the deviation of the perilune argument as is large, the correction of the perilune argument causes a large impact on the parameters in the orbital plane, such as the semi-major axis and the phase, so the second impulse is expected to correct the perilune argument. 3) Finally, three joint along-track impulses are used to control the four elements of a, e, , and u in the orbit plane to achieve the rendezvous phase at the specified time to achieve the goal of the follow-up flight formation. Considering the error of orbit determination and orbit maneuver, the plan of segmented control formed by the long-distance approach, the mid-range adjustment and the formation capture is proposed. In the section of the long-distance approach and the mid-range adjustment, the strategy of 5-impulse maneuvers is adopted due to the large difference between the orbital plane and the orbital perilune argument. During the section of the formation capture, the orbital planes and the orbital arches are basically the same, no corrections for them are required. Instead, the strategy of 3-impulse maneuvers is adopted for the rendezvous in the orbital plane. Simulation examples show that via the multiple gradual orbit maneuvers, the goal of the two satellites flight formation can be achieved. Based on the simulated accuracy of the orbit determine and the orbit maneuver, the formation flight deviation effect is further analyzed.