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INITIAL ORBIT OPTIMUM DESIGN FOR LOW-THRUST TRANSFER TRAJECTORY OF LUNAR EXPLORATION

Abstract

As for low-thrust transfer trajecroty design for lunar exploration using electric thrusters, invariant manifolds of L1 or L2 Libration point in the Earth-moon system can decrease the propellant consumption so that the effective load ratio of spacecraft can be greatly increased. During the optimal design design process of low-thrust transfer trajectory from GTO to invariant manifolds, the governing variable such as pitching and yaw angle of satellite were considered. However, the consideration is not enough because the selection of initial orbit after satellite-rocket separation and the inlet point of invariant manifolds are also of great importance to the transition time and the fuel consumption, which influence optimal design. In this paper, optimal control method is adopted to calculate the optimal transfer orbit of Lunar Exploration Satellite using eletric thrusters based on the range of initial orbits according to the launch capacity of launch vehicle and the extinction selection of low-thrust transfer trajectory. Initial orbit parameters of low-thrust transfer trajectory and invariant manifold of Lunar Exploration Satellite are optimized. The result shows the design rules and the algorithm is of great important engineering meaning and it also provided references for initial orbit design of transfer trajectory for Mars Exploration, Space Exploration and Interplanetary Superhignway.