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OPTIMAL CONTROL OF ELECTRIC PROPULSION SPACETAG FOR OPERATION OF THE NEAR LUNAR INFRASTRUCTURE

Abstract

In this paper we consider the optimization of the control programs and the respective trajectories for electric propulsion spacecraft. We study the transport operations which purpose is to transport cargo between the low-Earth orbit, the low-Moon orbit and the libration points L1, L2 of the Earth-Moon system. These operations are required to maintain the operation of manned lunar base, and also habitable stations which are located in the Lagrangian points. The motion simulation was carried out with consideration of the attraction of the Earth, the Moon and the Sun. The orbit of the Moon was considered elliptic and coplanar. Under these assumptions the optimal control programs were obtained in two ways. In first way, the formalism of the Pontryagin's maximum was used and the parametric optimization of the piecewise constant control programs was used in second way. It is shown that the piecewise constant control law can be used for the flights optimization between Lagrangian points L1 and L2. The increase of the flight duration did not exceed 5 percent in comparison with the optimum. The described approach allowed to obtain the solutions within a wide range of the design parameters. These solutions are applicable to the calculations of the minimum fuel stocks and the minimum amount of the space tugs for the maintaining the near lunar infrastructure in whole.