SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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DESIGN OF THE RETURN TRAJECTORIES FROM A POLAR ARTIFICIAL LUNAR SATELLITE ORBIT TO THE EARTH, PROVIDING LANDING OF THE REENTRY VEHICLE INTO THE GIVEN RESTRICTED AREA OF THE EARTH SURFACE

Abstract

Nowadays one of the most perspective directions of space activity in the Russian Federation for the nearest future is the exploration and development of the Moon. Many of the designed Russian lunar missions assume to use for utilitarian purposes the polar circumlunar satellite orbit. Such a kind orbit possess the obvious advantages at the solution of problems such as: geological reconnaissance of lunar polar areas, global mapping of a lunar surface, studying of the lunar gravitational anomalies, adapting of technologies for the future manned missions, assembling of technological bases on a lunar surface, search for the most suitable landing areas of the future missions and start of a round-trip vehicle from a lunar surface to return to the Earth. One of the most difficult tasks for design of manned missions to the Moon is finding the appropriate return trajectories for the lunar space vehicle being in the polar circumlunar that can provide the landing of this vehicle in the given restricted area on the Earth surface using the aero-braking maneuver. Very important problem in the design of such a kind of the return trajectories is the guaranteeing some given parameters of a spacecraft' reentry into the Earth' atmosphere. Designing of the returnable trajectories providing the strong restrictions on parameters of landing of a reentry vehicle on the Russian territory when a spacecraft is passing along the direction from the south to the north is the principal goal of the proposed paper. Expenditure of energy required for start from a polar artificial lunar satellite orbit and transfer to the return trajectory as well as the most suitable start windows is analyzed. Modeling the return trajectories from a circumpolar artificial lunar satellite orbit to the Earth was implemented in strong statement taking into account the main gravitational and not gravitational perturbations, with using of a high-precise numerical integration of the equations of the spacecraft motion and updated ephemerides DE for the description of motion of the Earth and Moon.