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TWO FLIGHTS ON ELLIPTICAL ORBITS: TO THE ASTEROID BELT AND TO THE SUN

Abstract

One of the problems associated with research in deep space is the transmission of the received information to Earth. The power of the transmitters of space probes (SP) is limited and electromagnetic radiation in the course of its movement is scattered, so that only a small part of the initial flow reaches the Earth. This requires the use of sophisticated devices to receive the signal and special methods of processing the received signal to separate the noise. It may be more effective to accumulate the collected information and transmit it to the Earth during the subsequent approach of the SP to the Earth. The implementation of this approach requires the launch of the SP in special orbits that ensure the return of the SP to the same point in space simultaneously with the Earth. The report provides calculations of such elliptical orbits and data on the approach of SP to various celestial bodies based on the analysis of their ephemeris. The aphelion and perihelion of the Earth are chosen as starting points, since in these positions the Earth has zero radial velocity relative to the Sun, which facilitates both the calculation of the orbit and its practical implementation. The starting points are at the boundary of the Earth's sphere of gravity. The orbit towards the asteroid belt has a length of the semimajor axis of 237 million km and an eccentricity of 0.35 at departure from the aphelion of the Earth and 0.37 at departure from the perihelion. The period of rotation is 2 earth years. The departure point is the pericenter of the orbit. The velocity pulse for entering the orbit is 4.3 km/s, which is significantly less than when launching a spacecraft to the asteroid belt in parabolic orbits. Orbits of the SP crosses the orbit of Mars and approaches the orbit of Vesta when departing from perihelion, and the orbit of Pallas when departing from aphelion. The orbit towards the Sun has a length of the semimajor axis of 94 million km and an eccentricity of 0.54 at departure from perihelion and 0.59 at departure from aphelion of the Earth. The period of rotation is earth year. The departure point is the apocenter of the orbit. For the transition in this orbits it is necessary to apply braking with a speed pulse of more than 9 km/s. In this orbit SP crosses the orbits of Venus and Mercury and approaches the Sun up to 39 million km. An important feature of the inner orbit is the possibility of observing Mercury and Venus from the solar side. In addition to the already formulated tasks of approaching both planets and large asteroids, such flights provide an opportunity for further research of interplanetary space and the main asteroid belt, the solar wind and the solar corona. In addition, they provide opportunities for working out the methodology for returning spacecraft to Earth.