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LOW-COST MISSION TO NEO BINARY 1999 KW4

Abstract

In this work, we present a procedure to generate a low-cost trajectory that will intercept the binary NEO 1999 KW4 between May and June of 2018, when it will be at closest point approach with the Earth. The transfer is studied considering natural routes between LEOs and the lunar sphere of influence and also swing-by maneuvers with the Moon and the Earth (de Melo et al. 2009). Methodology: the spaceship is inserted into a translunar trajectory derived from a periodic orbit around the Lagrangian equilibrium point L1 (Broucke, 1968) and that will take it up to the proximities of the Moon. This requests a V smaller than the necessary one to generate an interplanetary trajectory (de Melo et al. 2008). Orbit of the 1999 KW4 has an inclination relatively high (38.89 degrees). Then, during the passage through the lunar sphere the influence, a controlled swing-by with the Moon will supply the necessary energy and the inclination change to generate the trajectory that will intercept the 1999 KW4. We also show that after the first swing-by, if necessary, other maneuvers of the same type can be designed with the Earth or the Moon starting from the Weak Stability Boundary region associated with the three-body Sun-Earth-particle (Belbruno, 1987, Biesbroek and Janin, 2000). This way, it is possible to generate interplanetary trajectories with larger reach, but also with low-cost. The use of derived trajectories from the periodic orbits between LEOs and the sphere of lunar influence combined with swing-by maneuvers provide considerable reductions in VTotal requested to generate interplanetary trajectories.

de Melo et al., 2009, Celest Mech Dyn Astr, in press (DOI 10.1007/s10569-009-9193-6). de Melo et al., 2008, IAC.08.A3.2.INT12. Broucke R., 1968, JPL,TR 321168. Belbruno E. A., 1987, AIAA-87-1054. Biesbroek and Janin, 2000, ESA Bulletin 103.