Alternative Paths for Insertion of Probes in High Inclination Lunar Orbits

C. F. de Melo (1) and **O. C. Winter** (2)

(1) Centro de Ensino Superior de Juiz de Fora, CESJF, Brasil, (2) Faculdade de Engenharia de Guaratinguetá, FEG/UNESP, Brasil, (cristianofiorilo@terra.com.br / + 55 32 3241-4744)

The dynamics of the circular, planar, restricted three-body Earth-Moon-particle problem predicts the existence of direct periodic orbits around the Lagrangian equilibrium point L1. From these orbits, derive a group of paths that form links between the Earth and the Moon. Moreover, they are capable of carrying out transfers between terrestrial and lunar orbits of low altitudes. When we considered more complex dynamical systems, such as the three-dimensional full four-body Sun-Earth-Moon-probe problem, which takes into account, besides other factors, the inclination of the orbit of the Moon, these paths, leaving terrestrial orbits of low altitudes (LEO), gain inclination when they penetrate in the sphere of lunar influence allowing the insertion of probes in lunar orbits of high inclinations and low altitudes. We studied this property giving emphasis to two types of transfer maneuvers. Firstly, we investigated direct transfers by inserting probes in lunar orbits with inclinations varying between 29^o and 42^o. Next, we investigated directed transfers with the application of a $\Delta \boldsymbol{V}$ along of the trajectory in order to lead the probe into lunar orbits with inclinations between 0^o and 180^o. The results allowed the definition of a group of paths capable of carrying out Earth-moon transfers with flight time between 13 and 16 days with relatively low costs.