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REALISTIC TRANSFER TRAJECTORY DESIGN OF MMX BETWEEN RELATIVE RETROGRADE ORBITS AROUND PHOBOS

Abstract

The moons Phobos and Deimos of Mars may hold the key to understanding how the Solar system formed. As a result, space agencies like NASA, CNES, JAXA have proposed numerous missions to study these bodies in the last few decades. Martian moons exploration (MMX) mission is JAXA's upcoming robotic sample return mission to explore martian moons [1]. MMX uses distant retrograde orbits (DROs) or quasi-satellite orbits (QSOs) as parking orbits before landing on Phobos. These orbits are proven to be stable with lower orbital maintenance costs. The proximity phase of the mission involves relative orbital transfers, orbital station-keeping, and landing operations. MMX inserted into a higher altitude QSO will gradually descent to lower altitude QSO using suitable Transfer and orbital maintenance techniques. Our previous research developed novel transfer techniques using bifurcated multiple-revolution QSOs to enable planar transfers between QSOs and transfers via invariant manifolds of bifurcated unstable three-dimensional QSOs in the proximity of Phobos considering Hills problem with ellipsoidal Phobos[2][3]. Such an approximated model for preliminary studies can serve as the basis for implementing higher fidelity models for the actual mission design. In this paper, we use preliminary results of the transfer trajectory design and utilize these trajectories as an initial guess for the realistic transfer design implementation of the MMX mission.

References

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