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FORCED HOVERING ORBIT ABOVE THE PRIMARY IN THE BINARY ASTEROID SYSTEM

Abstract

The various orbits in the vicinity of a binary asteroid system (BAS) have been studied extensively, motivated by the abundant dynamical environment and ongoing space missions. In this work, we address a new forced hovering orbit above the primary (FHO) in a binary asteroid system. The dynamics model of FHO considers two major perturbations, secondary gravity and solar radiation pressures. The primary is modelled as a tri-axial ellipsoid, and the second degree and order-gravity field is adopted. We present the analytical series solution in Cartesian coordination by expanding from the stable equilibrium points. Using the analytical approximation, the applicability of the FHO is then discussed. Analyzing the actual BASs in the solar system, three clusters of BAS are distinguished. We find that the secondary perturbation and the SRP jointly dominate the orbit dynamics in most BASs. In the secondary-dominated cluster, the prograde configuration of BAS will arouse a resonance between the secondary's frequency and eigen-frequency. In the joint-dominated cluster, we analyzed the stability of FHO in (66391) Moshup and Squannit. Utilizing the multiple shooting method, we find an exact FHO in (66391) Moshup and Squannit, which has shown that the analytical solution of FHO can be used to design the in-situ exploration orbit near the primary.