Paper ID: 64380
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. Hai-Shuo Wang
Nanjing University, China

Prof. Xiyun Hou
Nanjing University, China

FORCED HOVERING ORBIT ABOVE THE PRIMARY IN A BINARY ASTEROID SYSTEM DUE TO SOLAR RADIATION PRESSURE

Abstract

The dynamical environment around a binary asteroid system (BAS) is complex, that is why the BAS is a valuable but challenging scientific target. Previous researches mainly focused on trajectories such as terminator orbits, interior retrograde orbits , and orbits around libration points in the BAS. In this work, another special kind of orbit, HPO, is proposed, which hovers above the primary in the BAS. The orbit is simultaneously influenced by the two asteroids' gravity and the solar radiation pressure (SRP). By truncating the force model at low orders, we are able to construct analytical approximations of this kind of orbit. Stability and safety of this kind of orbit is also studied. In this research, using the a tri-axial ellipsoid primary and a spherical secondary model of the BAS, the HPO is analytically described, first by only considering the primary's gravity and then including the secondary's gravity and the SRP. In the case of only considering the primary's gravity, there are two types of exactly hovering orbits above the primary. These orbits appear as equilibrium points (EPs) in the primary's body-fixed frame. Truncated at the second degree and order (2DO) gravitational potential, The EPs are outside of the asteroid. Two of them lie on the long axis (LEPs), and the other two lie on the short axis (SEPs). In the current study, we focus on the equilibrium points at the short axis of the primary. By including the secondary's gravity and the SRP into our force model, the 'equilibrium' points are no longer in an equilibrium state, and forced quasi-periodic orbits are induced by the secondary's gravity and the SRP. By truncating the force model at moderate orders, we analytically describe the forced orbits. Besides, some assumptions are put forward. 1. The motion of the BAS is coplanar and circular. 2. The Sun's position is assumed 'frozen' in inertial space. 3. The secondary is further away from the primary than the probe.