IAF ASTRODYNAMICS SYMPOSIUM (C1)
Orbital Dynamics (1) (6)

Author: Dr. Yu Jiang
State Key Laboratory of Astronautic Dynamics, China, jiangyu_xian_china@163.com

Dr. Hengnian Li
Xi'an Satellite Control Centre(XSCC), China, henry_xscc@yahoo.com.cn

SURFACE TRAJECTORIES OF PARTICLES ON THE PRIMARY OF THE SPHERE-RESTRICTED FULL 2-BODY PROBLEM

Abstract

This paper investigates the surface dynamics of particles on the primary of the Sphere-Restricted Full 2-Body Problem (SRF2BP). The primary is considered as a irregular-shaped body while the secondary is considered as a sphere. The motion equation of the SRF2BP has been presented. The locations of surface equilibrium for particles, the linearized equations of particles relative to the surface equilibrium, and the characteristic equation of the surface equilibrium have been investigated. The surface mechanical environment of a special binary asteroid 243 Ida and Dactyl has been studied with considering the polyhedron model of Ida including 2522 vertex and 5040 faces as well as the point mass model of Dactyl. We presents the influential mechanism of the natural trajectories and surface features of Ida. Some trajectories are unstable, which means that small disturbance can cause large variety of trajectories. This can help us to find better trajectories for landers and vehicles of space missions. The effect of Dactyl to the motion of particles on Ida is quite small. However, for some particles, the effect of Dactyl can not be neglected. Monte Carlo simulations are used to find the characteristic of particles' trajectories on different initial positions with static initial state. Furthermore, Monte Carlo simulations are performed to see the characteristic of particles' trajectories with different initial positions and initial velocities. We mapped the slope angle and the gravitional acceleration with considering the Coriolis effect onto the surface of Ida. For landers, the flat surface, concave surface, impact craters, as well as valleys are good landing target; and the gaps, convex surface, humps, as well as saddles are bad landing target. For vehicles, the concave surface, impact craters, as well as valleys with small slope angle can be used for landing target and initial position. If vehicles enter the regions of concave surface, impact craters, as well as valleys with large slope angle, it may be hard to move out; Thus these regions are not suitable for vehicles. This paper can provides reference and suggestion to the engineering design of the space mission to binary systems.