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ANALYTIC PARAMETRISATION OF PERIODIC ORBITS AROUND THE ROTATIONAL EQUILIBRIA OF AN ASTEROID PERTURBED BY SUN GRAVITY AND RADIATION PRESSURE

Abstract

The dynamics of a massless spacecraft in the vicinity of the rotational equilibrium points of an asteroid is here investigated. The asteroid is here modeled by three point masses rotating in rigid configuration on circular orbits around their center of mass with arbitrary frequency. The solar radiation perturbation of a radiating primary is accounted into the study as well.
The (planar) bicircular restricted five body problem (BR5BP) with arbitrary rotation rate is chosen to tackle the problem, where the massless spacecraft moves under the gravitational attraction of the three masses, plus a fourth radiating primary revolving around them in a circular orbit.
Results show that the rotational equilibria of the spacectaft-asteroid (three point masses) system are replaced, when including the perturbation due to Sun gravity into the system, by periodic orbits around the equilibria, which can be enlarged exploiting the Solar pressure effect. Such periodic orbits are of key observational relevance for missions to asteroids.
The central manifold technique and Lindstedt-Poincaré method are applied to parametrise explicitly these orbits as function of the parameters describing the physical, orbital and geometric properties of a generic asteroid plus the solar pressure parameter. thus providing a general solution.