Paper ID: 11021
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ASTRODYNAMICS SYMPOSIUM (C1)
Orbital Dynamics - Part 2 (4)

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INFLUENCE OF NONSPHERICITY OF PLANETARY SATELLITES AND PERTURBATION OF THE THIRD-BODY ON THE ARTIFICIAL SATELLITES MOTION

Abstract

Low-altitude, near-polar orbits are very desirable as science orbits for missions to planetary satellites, such as Moon, Europa, Io, Ganymede and Callisto. Frozen orbits around these moons, or asteroids is of current interest because several space missions have the goal of orbiting around such bodies. In this paper we present the dynamics of orbits around a planetary satellite, taking into account the gravitational attraction of a third-body and the non-uniform distribution of mass of the planetary satellite is studied. Legendre polynomials are expanded in powers of the eccentricity up to the degree two and are used for the disturbing potential due to the third-body. A special study is made for the case of frozen orbits that are orbits that try to keep the argument of the periapsis and the eccentricity of the orbit constant, to make the satellite to pass by a given latitude with the same altitude, benefiting the users when they study the data obtained. We fix a parameter to get frozen orbits when new terms are added to the disturbing potential. The conditions to get frozen orbits are presented. Here, using an averaged analytical model, simple and double, we found orbits with constant orbital element in average with long period of time. A comparison between the averaged models, simple and double, is presented. Using an approach with the simple-averaged problem, we found families of periodic orbits for the problem of an orbiter around the moon, where frozen orbits valid for long periods of time are found. Numerical simulations are made with the equations developed to study the orbital motion for hypothetical artificial satellites in low altitude around planetary satellites.