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DYNAMICAL SYSTEM DESCRIPTION OF THE SOLAR RADIATION PRESSURE AND J2 PHASE SPACE FOR END-OF-LIFE DESIGN AND FROZEN ORBIT DESIGN

Abstract

In this work we review the effect of solar radiation pressure on the eccentricity of circumterrestrial orbits, perturbed also by the oblateness of the Earth. We compute the equilibrium points of a reduced system of equations describing the time evolution of the eccentricity, the longitude of the ascending node and the argument of pericenter, and their linear stability. This analysis is the basis for understanding how the phase space is organized in terms of central and hyperbolic orbits. Considering as independent variables the eccentricity of the orbit and the characteristic specific resonant angle associated to each equilibrium point, we compute the periodic orbits and hyperbolic manifolds associated to these points. The general behavior is studied for increasing values of area-to-mass ratio and semi-major axis. The role of the initial phase with respect to the Sun and of the magnitude of the inclination evolution is also examined. The results follow previous investigations performed by the authors, providing a more complete picture of the whole dynamics, that can be applied to design convenient end-of-life strategies for small satellites equipped with a solar sail or to determine quasi stable Sun-following orbits for satellites swarms.

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