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Author: Dr. Elisa Maria Alessi
IFAC-CNR, Italy

Dr. Ioannis Gkolias
Politecnico di Milano, Italy
Dr. Camilla Colombo
Politecnico di Milano, Italy

TIME CHARACTERIZATION OF THE COUPLED SOLAR RADIATION PRESSURE-PLANETARY OBLATENESS DYNAMICS

Abstract

Recent works show how the dynamics caused by the planetary oblateness coupled with the solar radiation pressure can be described by means of an analytical model based on singly-averaged equations of motion. The coupled perturbations affect the evolution of the eccentricity, inclination and orientation of the orbit with respect to the Sun–Earth line. The model is able to provide the location of the central and hyperbolic invariant manifolds which organize the phase space, and the dynamical systems theory can be applied for studying practical applications. In this work, we will continue the analysis by focusing on the timescale associated with a given behavior. The characterization will be given analytically on the basis of the linear theory, as a function of the semi-major axis, area-to-mass ratio, initial phase with respect to the Sun and the integral of motion associated with the dynamical system. The application cases that will be considered include frozen orbits designed for scientific observations specific of the orientation with respect to the Sun, and de-orbiting strategies for end-of-life purposes. The results will be numerically validated by means of a more complete dynamical model, depending on the application.