Author: D. SKOULIDOU
Aristotle University of Thessaloniki (Greece)
Title: *"The orbital dynamics environment about Earth: application to passive debris removal"*

Abstract. The dynamical environment occupied by artificial celestial bodies of the Earth are subject to motions that are widely separated in frequency: the earthly day, the lunar month, the solar year, and various precession frequencies ranging from a few years to 10^5 years for the ecliptic. This great disparity of timescales involved, on account of the basic degeneracy of the Kepler problem, gives rise to a remarkably diverse collection of resonant phenomena associated with satellite orbital motions. Those satellites that satisfy such commensurability conditions can suffer quasi-secular or dramatic variations in their orbital elements as a result of the oscillation of large periods in the resonance terms. An understanding of their implications for Earth-orbiting space debris has led to a resurgence of interest in artificial satellite theory, with great import for celestial mechanics in general. It has been realized in the last few years that the satellite navigation constellations in medium-Earth orbits (MEOs) exist in a background of third-body secular resonances stemming from the perturbing gravitational effects of the Moon and the Sun. The resulting instabilities, brought on by these commensurabilities, induce especially strong changes on the orbital eccentricity, which can be transported to Earth-reentry values. These results have put forward the idea that similar phenomena could manifest themselves throughout all circumterrestrial space regions, from very low-altitude orbits up to the geostationary region and beyond. Here, we characterize the (drag free) dynamical architecture of the Earth-orbiting environment through a cartography of stability maps, using a suitably modified version of the SWIFT symplectic integration scheme to account for the coupled gravitational and radiation pressure perturbations. We find that many of the semi-secular resonances studied over a decade ago by Breiter become particularly important at the transition region between LEO and MEO.

Joint work with Aaron J. Rosengren, Kleomenis Tsiganis and George Voyatzis.