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POSSIBLE DISPOSAL STRATEGIES FOR THE O3B AND SKIF SATELLITE SYSTEMS

Abstract

Historically, the population of MEO region had been formed by objects launched to maintain the global navigation field. Nowadays the region of medium orbits has been enriched with O3b (Luxembourg) and Skif (Russia) satellites. Both systems are still being deployed, therefore the number of spacecraft and upper stages in this region will increase. Besides, the active satellites will sooner or later break down, and new satellites will be launched. The O3b and Skif satellites are in circular orbits with an altitude of about 8 000 km, but in orthogonal planes with 0 deg and 90 deg inclinations, respectively. The paper studies the stability of current orbits of satellites and upper stages related to these two systems over the interval of 100-200 years. The medium orbits are remarkable in that resonance phenomena caused by the gravitational influence of the Moon and the Sun. This can make the perigee of the orbit to drop below 2000 km, creating unpredictable risks of collisions and dangerous encounters with other objects. In addition, the orbits of the two considered systems are noticeably more affected by accelerations from J2 perturbation, compared with the orbits of navigation satellites. Currently, the parameters of disposal orbits for classical MEO systems are not described in the standard, and for the new mentioned systems this issue has not yet been widely discussed. Nevertheless, in the future there is a risk of chaotic filling of this region with large space debris. Therefore, the development of proposals on disposal strategies for this region of MEO is required. The stability of close near-circular orbits above/below the operational altitude of the two systems is also considered in this paper. The search of orbit parameters leading to gravitational resonance is carried out and the ΔV costs are obtained to bring the orbit to an unstable state. The latter may be performed as a direct correction of the trajectory, as well as using the properties of the nodes line precession.