SPACE DEBRIS SYMPOSIUM (A6)
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ATTITUDE MOTION OF SPACE DEBRIS OBJECTS UNDER INFLUENCE OF SOLAR RADIATION PRESSURE

Abstract

Space debris objects are resident space objects, which are in a non-controlled state. The dynamical behavior of these objects has contributions from various sources. As Schildknecht in 2004 detected, some space debris objects have a high area-to-mass ratio (HAMR). For HAMR objects, solar radiation pressure is the main source of orbital perturbation. Solar radiation pressure is dependent on the orbit, as well as the shape and attitude of the objects, but at the same time can significantly influence the orbital and attitude evolution itself. Even in cases, for which the shape of the space debris object is known, the attitude state of inactive objects is unknown. The assumption of a stable attitude motion, which is appropriate for stabilized objects, or one that could be modeled by averaging the attitude motion over the data reduction interval of orbit determination, which holds for low area-to-mass ration objects, has proven to be not an appropriate assumption in the orbit propagation of non-controlled HAMR objects in general. This leads to the fact, that most of the HAMR objects are lost shortly after their detection, preventing the cataloging of the majority of those objects. In the current paper the dynamics of satellite covers as representatives of a HAMR space debris objects are simulated with different sets of initial conditions. In the simulation, these objects are assumed to be rigid bodies in geostationary orbits with a non-controlled attitude state, exposed to the integrated effect of the Earth gravitational field and solar radiation pressure. The evolution of the attitude of these objects under these perturbations is investigated. The simulation results are compared to so-called light curve measurements, which track the variation of the brightness over time. Light curves of satellite covers will be gained with the one meter Zimmerwald Laser and Astrometry Telescope (ZIMLAT) located in Switzerland.