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TIME EVOLUTION OF THE ECCENTRICITY AND INCLINATION OF SPACE DEBRIS IN THE GEOSTATIONARY RING DEPENDING ON THE AREA TO MASS RATIO

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Space Debris located at the Geostationary (GEO) region are affected by the joint action of disturbing forces such as the nonuniform mass distribution of the Earth (oblateness), the gravitational forces of the Sun and Moon as third bodies, and most importantly, the solar radiation pressure, the latter being directly proportional to the area to mass ratio of the space debris.

Thanks to an analytical model (Casanova et al. 2015), we estimate the evolution of the eccentricity or the inclination depending on the area to mass ratio of the object. This model plus different observations of a particular object in the GEO region will provide an estimation of the area to mass ratio of the object by adjusting the observational evolution of the inclination with the analytical evolution of the inclination by just varying the area to mass ratio.

The increase of space debris located in the geostationary region in the last decades implies new techniques to observe, detect and track space debris population. Thanks to the observations made at the Venezuelan observatory, it is possible to detect a piece of space debris and determine its preliminary orbit. In particular, the orbital elements, and their time evolution. Thus, once we know the evolution of the inclination, thanks to the analytical model it is possible to fit the observational evolution with the analytical evolution and get an idea of the area to mass ratio of the object.

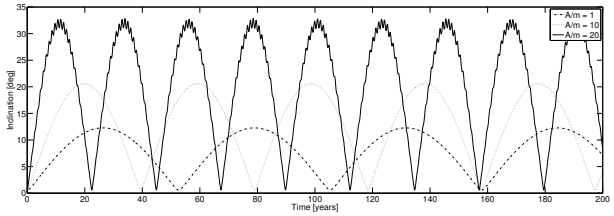

Fig. 1. Evolution of the inclination during 200 years of a piece of space debris located at the GEO region. Initial conditions: $a = 42164.137$ km, $e = 0.01$, $i = 0.01$ deg, $\Omega = \omega = M = 0$ deg. January 01, 2014. 00:00:00

To clarify the process, we plot in Fig.1 the analytical evolution of the inclination of a piece of debris in the GEO region during 200 years for three different area to mass ratio. The idea is to fit the observational evolution of the inclination with the analytical evolution, and consequently, it is possible to estimate the area to mass ratio of the piece of space debris.

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