Two-Line-Element Self Consistency Analysis of Orbital Debris in Geosynchronous Regime

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ABSTRACT

Due to unique space applications, several spacecrafts are being placed in geosynchronous regime. In the present scenario, geostationary orbit is crowded with active spacecrafts. As there is no natural mechanism for removal of inactive spacecrafts, post-mission disposal to graveyard orbit is the only feasible solution. Spacecrafts which could not be maneuvered, not attained the recommended height while decommissioning and which encountered anomaly during launch or in-orbit phase are collision threats to active spacecrafts. Based on the end of life conditions; these objects, either drift or liberate around the nearest equilibrium longitude. United States Strategic Command (USSTRATCOM) tracks all the space objects in geosynchronous regime using optical telescopes and publishes orbital data as Two-Line-Elements (TLE) in the Space Track website.

The orbital quality of a TLE depends on several parameters like, number of tracking measurements, measurement accuracy, tracking duration, number of ground stations, object-ground station geometry, orbit type, and orbit determination model. Consistency analysis of the latest TLE with respect to previous updates for an object is necessary, when a close approach situation is encountered. It helps to ascertain the correctness of the orbit data and to reject the wild or incorrect updates.

In this paper, we present the analysis of TLE self-consistency of uncontrolled objects in geosynchronous regime, based on their orbit classification. Position and velocity difference values of several objects is helpful in accessing the orbit accuracy levels involved in TLEs and also to improve the close approach analysis for geosynchronous space situational awareness.