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DISPOSAL STRATEGY FOR THE GEOSYNCHRONOUS ORBITS OF THE BEIDOU NAVIGATION SATELLITE SYSTEM

Abstract

Beidou Navigation Satellite System (BDS) is China's navigation satelite system. It is now operational for navigation service in China and Asia-Pacific region and is due to be fully operational as a global navigation system by 2020. Unlike other navigation satellite systems, BDS consists of both 12-hour medium Earth orbit and 24-hour geosynchronous orbit.

To sustain a safe environment for the navigation satellites, the end-of-life satellites must be disposed appropriately so they do not pose potential dangers to the operational satellites. There are currently two strategies for the disposal orbit. One is to put the disposed satellite in a graveyard orbit that has a safe distance from the operational satellites. It is often applied in geosynchronous orbits and such graveyard orbit can always maintain a safe distance even for a few centuries. This strategy is also currently adopted by GPS, yet recent researches show a re-entry orbit can sometimes be a better alternative. The interaction of Earth oblateness and lunisolar gravitation can lead to a rapid increase in the orbit eccentricity such that by proper design the disposed GPS satellite can be cleared out by re-entry into the atmosphere.

In this work we focus on the disposal strategy for BDS geosynchronous orbit, which consists of the equatorial stationary orbit (GEO) and the inclined orbit (IGSO). We show that these two orbits are essentially in two different dynamical environments and evolve quite distinctly over a long period of time. Taking advantage of the dynamic nature, we apply the graveyard orbit and the re-entry orbit to GEO and IGSO respectively and propose appropriate disposal strategies accordingly.