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ON THE DISPOSAL OF NAVIGATION SATELLITES

Abstract

Nowadays there is international consensus that space activities must be managed to minimize debris generation and risk. The paper presents a method for the end-of-life (EoL) disposal of spacecraft in Medium Earth Orbit (MEO). The problem is formulated as a multiobjective optimization one, which is solved with an evolutionary algorithm. One or two impulses are design either to re-enter the spacecraft in Earth's atmosphere or to move them to a graveyard orbit. In the design of the re-entry the maximization of eccentricity build-up is achieved by using the minimization of the pericenter radius and disposal ΔV as problem objectives. When the graveyard disposal is addressed, the long-term probability of interfere with operative spacecraft is minimized together with the disposal ΔV . To explore at the best the search space a semi-analytical orbit propagator, which allows the propagation of the orbit motion for 100 years in few seconds, is adopted. Test cases for different navigation satellites are presented, focusing in particular on the Galileo constellation. The results are then used for a critical analysis on MEO missions' disposal and on the suitable definition of graveyard regions.