SPACE DEBRIS SYMPOSIUM (A6)
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Author: Prof. zhang jinxiu
Harbin Institute of Technology, China

Mr. Li Feng
School of Astronautics, Harbin Institute of Technology, China
Prof. Xibin Cao
China
Mr. Xiaoyu Lang
Research Center of Satellite Technology, Harbin Institute of Technology, China

SYNCHRONIZATION STRATEGY OF ORBITAL PLANE AND PHASING FOR ACTIVE DEBRIS REMOVAL WITH MICRO-THRUSTER

Abstract

Recent decade year, more and more space agency and center are concentrating on active debris removal technology. In particular, the Swiss Space Center is developing a project of active debris removal, named CleanSpace One(CSO), in order to demonstrate the key technology for decreasing the collision risk from space debris, especially failure satellite or launcher upper stage. The other motivation behind the this project is to increase awareness and start mitigating the impact on the space environment by acting responsibly and removing debris from orbit. The orbital synchronization with debris' orbital plane and phasing, has becoming a key problem that must be solved before starting approach and rendezvous. Whatever debris and de-orbiter runs any orbit, the natural drifting rate of relative RAAN can be analyzed. Due to using low-thrust at mN-level, we will regard it as continues constant force. Then the transfer and synchronization of orbital plane and phasing could be simplified as a relative trajectory optimization problem with constant force. Taking into account the limitation of initial orbit and micro-thrust, we will look forward the optimal natural drift time, the number of low-thrust arc, time of start and end of low-thrust arc, so that relative status between debris and de-orbiter could meet with the requirements of relative distance and phasing. The proposed work will be divided into five segments. The first part briefly introduces the different phase of mission and operation concept. The second focuses on the initial orbit analysis for short-time RAAN synchronization. The analyzed relative mean orbit elements will be given under influence of low-thrust and J2 perturbation in third segment. On the basis of genetic algorithm, we will solve the relative trajectory optimization problem to meet with boundary conditions the phasing and homing.