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SPACE DEBRIS SYMPOSIUM (A6)
Space Debris Removal Issues (5)

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CONCEPT OF OPERATIONS FOR LEO DEBRIS REMOVAL USING HIGH PERFORMANCE COMPUTING

Abstract

Modeling results from the last five years have suggested that the future LEO debris population is likely to grow even with the introduction of debris mitigation measures, including post-mission disposal. Consequently, the remediation of the near-Earth debris environment is necessary to limit population growth, and this requirement has led to recent efforts to develop concepts for Active Debris Removal (ADR). Whilst these early concepts have tended to optimize the mission analysis, concept of operations and removal technologies for specific debris targets, there remains a need to consider more generic approaches to these challenges. Therefore, this paper explores and gives preliminary results of a holistic approach to optimizing LEO debris removal in terms of delta-v, transfer time, specific impulse and fuel mass for multiple ADR targets. The approach employs a bespoke orbital propagator and the NRLMSIS-00 atmospheric model to consider both a variety of different electric and chemical propulsion systems for removal crafts transferring between targets. The optimization is achieved through the use of high performance computing to solve the 'travelling salesman problem' between targets by using a brute-force approach, thereby providing solutions within a practical time. The paper also examines crucial trade-offs for ADR in terms of the aforementioned parameters, for example, multiple de-orbits of single debris targets versus a single de-orbit of multiple debris targets strategy.