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OPTIMIZING MULTI-DEBRIS REMOVAL SEQUENCING UNDER MULTIPLE CONSTRAINTS

Abstract

This paper addresses the challenge of planning efficient debris removal sequences under multiple mission constraints. We propose a three-stage methodology to solve this problem. Building on Edelbaum's transfer theory, we establish an analytical estimator for impulsive v under J2 perturbations. This method rapidly and accurately estimates transfer costs under different mission time constraints, offering an efficient tool for sequence search in global optimization. To optimize space debris clearance sequence, we enhance ant colony optimization through expanding the time and velocity dimensions of pheromones. The final trajectory optimization adopts differential evolution algorithm, considering multiple transfer orbit constraints and terminal constraints, achieving the task of removing multiple space debris targets with a single spacecraft. The validity and multi task applicability of the proposed problem formulation and the optimization framework is demonstrated through ADR case studies.