Paper ID: 102452
interactive
student

23rd IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations - 23rd IAA SYMPOSIUM ON SPACE DEBRIS (IP)

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GENETIC ALGORITHM-BASED DESIGN OPTIMIZATION OF 3D DRAG SAILS

Abstract

Space debris is forming a great problem that threatens satellite operations and future space missions especially in Low earth orbit. This paper introduces improvement to satellite de-orbiting by optimizing 3D drag sails for D-Orbit devices using genetic algorithms.

The approach involves several steps. First, using computer-aided design (CAD) software to create a variety of 3D drag sail models. These models are tested using computational fluid dynamics (CFD) simulations to see how they perform under different orbital conditions. Then applying a genetic algorithm to refine the designs by focusing on maximizing drag efficiency, ensuring structural strength, and making them easier to manufacture. The preliminary results are promising. Achieving drag sails that are up to 10% more efficient than traditional designs. These optimized structures are not only more effective but also more stable and easier to produce.

This Paper offers a good perspective on satellite de-orbiting, with the potential to significantly cut down the time and resources needed for managing end-of-life satellites. Offering a sustainable solution to tackle space debris, cost effectiveness and supports global efforts to keep space operations viable for the long term.

Keywords: Genetic Algorithms, Drag sails, Satellite De-orbiting, Space Sustainability, Computational Optimization.