Paper ID: 29070

66th International Astronautical Congress 2015

SPACE DEBRIS SYMPOSIUM (A6)
Interactive Presentations (IP)

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OPTIMAL DIRECTION AND A PROCESS DESIGN OF REMOVING LOW EARTH ORBIT DEBRIS WITH SPACE-BASED LASER

Abstract

To address the problem of how to remove low Earth orbit (LEO) debris with space-based high-powered pulse laser, a combined model of high-powered pulse laser ablation and variation of the debris' orbit element is advanced. By theoretical analysis, an expression of the single laser pulse's optimal interaction direction about the LEO debris' orbit element is derived, and the single laser pulse's optimal removal is proved to be mirror symmetric about the orbit major axis of debris. In consequence, aimed at optimizing both flight time of space platform and lasing time of laser, a simplified method of designing the removal process rapidly and effectively is brought out. The typical simulation and outcomes demonstrate that the optimal interaction direction is more efficient than others, and based on the simplified method, the lasing time of laser can be reduced by 30 percent with a 10 percent increase in space platform's flight time.