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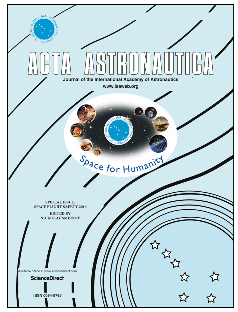

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Safe-Trajectory Optimization and Tracking Control in Ultra-close Proximity to a Failed Satellite

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This paper presents a trajectory-optimization method for a chaser spacecraft operating in ultra-close proximity to a failed satellite. Based on the combination of active and passive trajectory protection, the constraints in the optimization framework are formulated for collision avoidance and successful docking in the presence of any thruster failure. The constraints are then handled by an adaptive Gauss pseudospectral method, in which the dynamic residuals are used as the metric to determine the distribution of collocation points. A finite-time feedback control is further employed in tracking the optimized trajectory. In particular, the stability and convergence of the controller are proved. Numerical results are given to demonstrate the effectiveness of the proposed methods.

Key words: trajectory optimization; collision avoidance; active and passive trajectory protection; adaptive Gauss pseudospectral method; finite-time control

I. Introduction

Autonomous spacecraft rendezvous is an enabling technology for many space missions. The first successful test of autonomous spacecraft rendezvous took place in 1967[1]; since then,

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