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Safe-trajectory optimization and tracking control in ultra-close proximity to a failed satellite

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1 Safe-Trajectory Optimization and Tracking Control in Ultra-close

2 Proximity to a Failed Satellite

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

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

20 I. Introduction

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

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