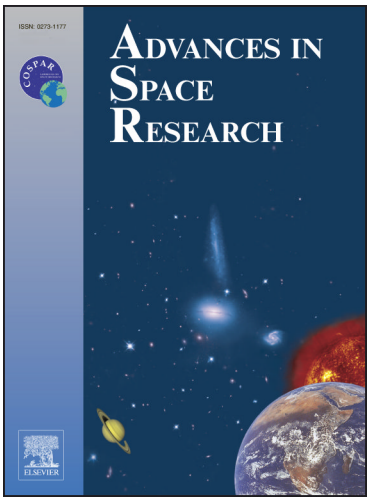

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Potential function based robust safety control for spacecraft rendezvous and proximity operations under path constraint

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Abstract

This paper deals with the safety control problem for spacecraft rendezvous and docking with coupled position and attitude dynamics under external disturbances and unknown model parameters. Given the path constraint, a semi-cubical parabola based curve is employed to restrict the motion area of the chaser spacecraft during the process of rendezvous and proximity operations. By combining the sliding mode technique with the artificial potential function, a robust adaptive control strategy is presented for driving the chaser spacecraft to rendezvous and dock with a space target without violating the path constraint. The stability of the closed-loop system is then proved within the Lyapunov framework. Numerical simulations are carried out to illustrate the effectiveness of the proposed control strategy.

Keywords: Spacecraft rendezvous and docking, Artificial potential function, Path constraint, Collision avoidance, Line-of-sight constraint

1. Introduction

With the rapid development of spacecraft industry, autonomous rendezvous and docking (AR&D) has been recognized as an important research topic in

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