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"ROBUST RELATIVE DYNAMIC MODEL: A NOVEL APPROACH FOR CLUSTER FORMATION SATELLITES"

Abstract

This paper introduces a groundbreaking technology for designing robust formation controllers in small satellite formation flying. The controller effectively tackles the complex dynamics characterized by nonlinearities and uncertainties within satellite clusters. Our innovative approach leverages a robust state estimator (RSE) to achieve local state identification, precise trajectory tracking, and collision avoidance scheme. The RSE not only enables scalability, fault tolerance, and adaptability in cluster formation flying but also empowers autonomy and decision-making capabilities through the integration of cutting-edge adaptive robust control techniques. The RSE effectively addresses challenges such as maintaining eccentricity over extended durations and preserving the semimajor axis of agent/follower satellites. The efficacy of our proposed estimator scheme is validated through meticulous comparisons with a high-fidelity numerical orbit propagator encompassing a wide range of perturbations. Simulation results unequivocally demonstrate superior tracking performance in the presence of external disturbances, surpassing the capabilities of previous robust-based control methods.