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MANEUVER DETECTION FOR NON-COOPERATIVE OBJECTS IN CIS-LUNAR SPACE

Abstract

Ensuring spacecraft safety during proximity operations in cis-lunar space requires advanced contingency response capabilities, particularly when addressing communication disruptions or propulsion system anomalies during orbital rendezvous. Autonomous detection of unanticipated maneuvers becomes imperative for collision avoidance in such scenarios.Current maneuver detection methodologies exhibit limitations in three-body dynamical environments, with existing research predominantly confined to two-body Keplerian regimes. This paper makes two key contributions:(1) Description and analysis of relative motion patterns in the LVLH coordinate system under the Circular Restricted Three-Body Problem (CRTBP) framework; (2)A dual-mode detection method combining filtering-based state estimation with sliding-window motion analysis, achieving simultaneous determination of maneuver timestamps and velocity increment quantification for both impulsive and finite-thrust targets. Numerical simulations confirm the method's effectiveness in CRTBP environments, demonstrating consistent maneuver detection capability without prior knowledge of thrust profiles.