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COMPARATIVE STUDIES ON SATELLITE FORMATION FLIGHT ARCHITECTURE FOR DEVELOPING AN EMBEDDED CONTROL ALGORITHM: AN OVERVIEW

Abstract

The research gives a complete analysis of CubeSat formation flight control. The survey updates, which extend a survey from 2015, are the outcome of recent missions. The virtual structural, cyclic, and behavioural parts make up the three primary divisions of this bibliography. To assess the robustness and efficiency of the three architectures, MIMO, and Leader/Follower (L/F) are also examined for comparison. It would be interesting, but it needs to be more clearly described - how is robustness and optimality determined? And why are the three strategies being assessed? Minimum time, separation acceleration, fuel consumption, and minimum power are the four criteria for optimality that are taken into consideration in this work. The Pontryagin principle is applied to confirm the solution's optimality in the absence of feedback. As an additional step towards increasing robustness, the SDRE is used to eliminate orientation errors. Using an SDRE-driven coupled satellite system, the stability region is numerically computed to demonstrate the steering method's global asymptotic robustness. It can be used to compare targeting effectiveness in a dynamic system and is appropriate for both centralized and decentralized approaches. Many directions have evolved as a result of this research gap. By choosing the most appropriate architecture for the task of a tiny satellite cluster, these directions include improving system stability and reliability, lowering information limitations, and increasing CubeSat autonomy. When compared to the PROBA-3 mission's architecture control scheme. Compared to L/F, MIMO is more stable and optimal. Increased leadership in L/F addresses the issue of dependability. However, this method is less effective than MIMO in terms of optimality and fuel balancing concerns, and it requires much more data to achieve high system stability. The cyclic architecture combines LF and MIMO systems. Although the information requirements are as high as those for MIMO, they are bridging for stability, optimal performance, and robustness.