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DEVELOPING AN LQR/APF BASED ORBIT CORRECTION, ORBIT PREDICTION, AND NAVIGATION CONTROL FOR CUBESAT'S FORMATION FLYING

Abstract

This paper presents a control strategy for orbit correction, prediction, and relative navigation control for CubeSat formations. The goal is to maintain the robustness of an embedded onboard controller. The proposed LQR-APF (Linear Quadratic Regulator- Artificial Potential Function) enables real-time feedback generation and qualifies initialization, stationing, reconfiguration, and maneuvering satellite formation to the desired position. LQR-APF includes a relative navigation filter for orbit correction. The SGP4 algorithm is employed to predict orbit. Also, an unscented Kalman filter (UKF) implementation is providing fast convergence, reliable accuracy, and real-time navigation capability, along with GPS sensors. The proposed controller LQR-APF can perform on-orbit operations such as defining, updating, sorting and executing ground orbit control instructions. Simulation results show that LQR-APF performs better in orbit correction, prediction, and relative navigation control compared to existing mission control scenarios.