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AUTONOMOUS OPTICAL NAVIGATION FOR ORBITS AROUND EARTH-MOON COLLINEAR LIBRATION POINTS

Abstract

The analysis of optical navigation in an Earth-Moon libration point orbit is presented in this paper. Missions to libration points have been winning momentum during the last decades. Its unique characteristics make them suitable for a number of operational and scientific goals. The literature aimed to study dynamics, guidance and control of unstable orbits around collinear libration points is vast. In particular, several papers deal with the optimization of the delta- V budget associated to the station-keeping of these orbits. One of the results obtained in the literature establishes the critical character of the Moon-Earth system in this aspect (1). The reason for this behavior is twofold: high delta-V cost and short optimal maneuver spacing.

Optical autonomous navigation can address the issue of allowing a more flexible maneuver design. This technology has been selected to overcome similar difficulties in other critical scenarios (2). This paper analyzes in detail this solution. A trade-off between different optical measurement types is performed, assessing t he requirements of the navigation system and selecting the better option. A whole GNC system is then defined to meet the requirements imposed by the unstable dynamical environment. This system is comprised of navigation sensors, navigation software and navigation processor. A discussion of all this three aspects is provided. Special attention is paid to image processing algorithms and state estimation and propagation.

Finally, a real simulation of a spacecraft following a halo orbit of the L2 Moon-Earth system is carried out to assess the actual capabilities of the optical navigation in this scenario.

Bibliography

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