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LOW THRUST MANOEUVRE DETECTION FOR LOW EARTH ORBIT SPACE OBJECTS

Abstract

One of the key challenges in space situational awareness is the ability to detect and characterize space object manoeuvres. Manoeuvre detection plays a crucial role in track correlation and the ability to maintain custody of cataloged objects; in addition, it provides information that is useful to classify space objects and ascribe their origin and intent.

Research groups in Australia are currently examining the use of low thrust manoeuvres in low Earth orbit (LEO) to manage the orbits of cubesats and debris objects using aerodynamic forces and ground-based laser photon pressure. These scenarios are challenging to observe using ground-based sensors due to the sparseness of data and the relatively small changes in the orbit as compared to large uncertainties in orbit prediction associated with dynamical parameters such as atmospheric density.

This paper evaluates the use of multiple model filtering and binary hypothesis testing using a control distance metric across several different LEO manoeuvre scenarios, including cubesats flying individually and in lead-follow formation, and debris objects of various area-to-mass ratios. Measurements are simulated using passive and active optical sensors to provide range, angles, and light curve data.