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AN AUTONOMOUS OPTICAL NAVIGATION FILTER FOR A CUBESAT MISSION TO A BINARY ASTEROID SYSTEM

Abstract

We consider the autonomous optical navigation problem for a CubeSat mission to a binary asteroid system. This is a follow-up of a study previously undertaken by the authors, under ESA contract, within a team led by University of Vigo (Spain) with University of Bologna (Italy) and Micos Engineering (Swiss) as subcontractors, in response to ESA Asteroid Impact Mission CubeSat Opportunity Payloads (COPINS), and having as a target Didymos binary asteroid system.

In this work, we aim at developing a navigation filter which computes the position of a CubeSat starting from images of the two primaries using both information on the line-of-sight and targets size. The likelihood of the observations is then fused to the a-priori information coming from a reduced dynamic model, in a Kalman-like recursive filter. To address the performance of the above concept, we set up a simulation environment which, thanks to a high-fidelity ephemerides model, generates synthetic observations from the assumed asteroids' shape models and the predicted relative positions between the CubeSat and the targets.

Preliminary results show the effectiveness of the proposed approach to meet the target level of 10m in position accuracy, which is the requirement provided by the original mission analysis study. The full paper will provide a comprehensive analysis to precisely assess the accuracy of the proposed approach, under reasonable assumptions on the magnitude of the measurement error sources and on the level of detail of the implemented filter dynamics.