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# A VALIDATION AND CALIBRATION METHODOLOGY FOR AUTONOMOUS NAVIGATION OF SMALL SATELLITES

**Abstract**

In addition to exploiting small satellites in the Earth orbit, space agencies and private companies have started adopting Smallsats also for deep space, mainly to support more complex missions. Autonomous operations are one of the key challenges these missions demand, either because of the communication delay or because a very fast response to external conditions is required. To properly design, tune and test such spacecrafts, complex validation systems are needed, to replicate in the most effective way the mission scenarios. This paper presents the methodology adopted by Argotec to validate and calibrate the autonomous navigation capability of its micro-satellites, in particular the LICIACube spacecraft, aimed at acquiring scientific images during the forthcoming NASA DART (Double Asteroid Redirection Test) mission. Argotec's micro-satellite relies on an image processing system for object detection, and an attitude control algorithm, used to track the target asteroid at a high angular speed. The proposed system, that have been adopted by Argotec also for other missions, consists of two main parts: a software environment used to test and tune the image processing pipeline and the control algorithms, and a Hardware-In-the-Loop setup that is used to validate the flight navigation software within a realistic simulation of the mission environment. Preliminary results show that the methodology described in this paper is effective for validating the algorithms, and that is a valuable strategy for parameters calibration even when the system is already deployed in space.