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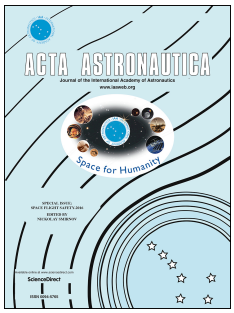

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Francesco Sansone, Francesco Branz, Alessandro Francesconi

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A Relative Navigation Sensor for CubeSats Based on LED Fiducial Markers

Francesco Sansone[a,*], Francesco Branz[b], Alessandro Francesconi[b]

[a] *Stellar Project Srl, via Niccolò Tommaseo 69, 35131 Padova, Italy*
[b] *University of Padova - Department of Industrial Engineering, via Venezia 1, 35131 Padova, Italy*

Abstract

Small satellite platforms are becoming very appealing both for scientific and commercial applications, thanks to their low cost, short development times and availability of standard components and subsystems. The main disadvantage with such vehicles is the limitation of available resources to perform mission tasks. To overcome this drawback, mission concepts are under study that foresee cooperation between autonomous small satellites to accomplish complex tasks; among these, on-orbit servicing and on-orbit assembly of large structures are of particular interest and the global scientific community is putting a significant effort in the miniaturization of critical technologies that are required for such innovative mission scenarios. In this work, the development and the laboratory testing of an accurate relative navigation package for nanosatellites compliant to the CubeSat standard is presented. The system features a small camera and two sets of LED fiducial markers, and is conceived as a standard package that allows small spacecraft to perform mutual tracking during rendezvous and docking maneuvers. The hardware is based on off-the-shelf components assembled in a compact configuration that is compatible with the CubeSat standard. The image processing and pose estimation software was custom developed. The experimental evaluation of the system allowed to determine both the static and dynamic performances. The system is capable to determine the close range

*Corresponding author
Email address: francesco.sansone@stellarproject.space (Francesco Sansone)