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Author: Prof. Michele Grassi
University of Naples "Federico II", Italy

Dr. Giancarlo Rufino
University of Naples "Federico II", Italy

MISSION-ORIENTED MICRO-SUN-SENSOR LABORATORY TESTING IN REAL-TIME OPERATION MODE

Abstract

In the last few years micro-satellites have received great attention due to several factors: reduced costs and frequent launch opportunity, chance for cost-effective flight validation of innovate technologies for major applications, new concepts of distributed spacecraft/payload [1]. This is still the current trend, while more and more challenging missions are being conceived using these spacecrafts. A major role in microsatellite development is played by Micro–Electro–Mechanical-System (MEMS) and CMOS technologies, which are evolving quickly impacting the design and development of attitude sensors, such as star and sun sensors[2]. In this context, the university team is developing a novel, CMOS digital sun sensor [3,4], selected for flight on the Italian Space Agency micro-satellite MIOsat. This paper is mainly focused on the tests that are being carried out to characterize and validate the adopted sensor design and algorithms, by exploiting the sensor hardware model presently available. It is a fully-functional model of the sensor designed for the MIOsat mission, and, also, it adopts several hardware components that will be tested and adapted for space operation. Tests are carried out in a laboratory facility reproducing sun illumination as well as variable sun line direction [3]. Recent facility upgrades will be also presented in the paper. Chief target of the tests is the validation of the planned in-orbit experiments, including sensor tasks timing characterization, verification of experiment profile compliance with in-orbit illumination conditions as well as mission resources for this experiment (time, on-board resources, data download). Interesting results and adequate validation are expected since laboratory tests are carried out in real-time simulation of in-orbit sensor operation, including sun illumination, sensor acquisition and processing, data interface from/to the sensor.

References: [1]I. Bekey, Advanced Space System Concepts and Technology: 2010-2034, AIAA, El Segundo (CA), USA, 2003; [2]Proceedings of the 2nd Round Table on Micro/Nanotechnology for Space, ESTEC, the Netherlands, 15-17 Oct 1997, ESA WPP-132; [3]G. Rufino, M. Grassi, and A. Perrotta, Development and Validation of a Modern CMOS Digital Sun Sensor at UniNa, Proc. Conference on Dynamics and Control of Systems and Structures in Space 2004, 18–22 July 2004 Riomaggiore, Italy; [4]G. Rufino, and M. Grassi, "Multi-Aperture CMOS Sun Sensor for Microsatellite Attitude Determination," Sensors, Vol. 9, N. 6, pp. 4503-4524, Basel (CH), DOI 10.3390/s90604503, ISSN 1424-8220, 2009