28th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Interactive Presentations - 28th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

Author: Mr. Lorenzo Colaninno
Politecnico di Milano, Italy, lorenzo.colaninno@mail.polimi.it

Dr. Andrea Colagrossi
Politecnico di Milano, Italy, andrea.colagrossi@polimi.it
Dr. Paolo Lunghi
Politecnico di Milano, Italy, paolo.lunghi@polimi.it
Prof. Michèle Lavagna
Politecnico di Milano, Italy, michelle.lavagna@polimi.it

TECHNOLOGIES AND FACILITIES FOR THE AIV/AIT PHASE OF NANOSATELLITE ADCS SUBSYSTEMS: HERMES AS AN APPLICATIVE CASE

Abstract

Today's space sector is experiencing an increasing demand of small satellite platforms, ranging in the class of nanosatellites. These space systems, despite their dimensions, are now technological mature and they are entering the market of complex space missions with stringent system requirements. In fact, their system peculiarities allow to easily implement distributed space architectures to boost the mission return.

Among all the subsystems of these advanced nanosatellites, the Attitude Determination and Control Subsystem (ADCS) is particularly stressed with complex pointing and maneuvering profiles. The algorithms and the software are continuously required with new and computationally relevant on-board functions, the hardware is loaded with relevant duty cycles and frequent demanding actuations. In these regards, the AIV/AIT phase is becoming more and more crucial also for small spacecraft. However, the required time-to-space and the cost caps of such missions prevent to apply all the standards and to access the facilities of large space systems. Thus, there is an emerging request of technologies and facilities to support the AIV/AIT phase of the ADCS for this class of spacecraft.

The paper presents the technologies and the facilities that are being implemented at Politecnico di Milano, Department of Aerospace Science and Technology, by ASTRA research group. These have been designed and realized to support the AIV/AIT phase of the ADCS of HERMES (High Energy Rapid Modular Ensemble of Satellites) project. HERMES is an astrophysics mission for high-energy rapid transient localization and detection composed of 3U nanosatellites, distributed in a constellation, to perform sky monitoring and localization through triangularization.

The paper describes the AIV/AIT procedures for the ADCS subsystem of the platform. The facilities where these are carried out are reported, highlighting the requirements that have been applied for their implementation. In particular, in-house developed technologies and tools for sensors and actuators characterization and calibration are presented. The technological architecture to conduct Model, Software, Processor, Hardware-In-The-Loop (MIL, SIL, PIL, HIL) testing activities is described, discussing the verification steps that are possible with the available laboratory facilities. The discussion also reports the main outcomes of the software qualification plan, discussing all the key points that prove the possibility for the HERMES system to fulfil its mission requirements in any operational mode.