45th STUDENT CONFERENCE (E2)
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CUBETH ADCS DESIGN, IMPLEMENTATION AND VALIDATION TESTS

Abstract

CubETH is a one unit CubeSat developed in collaboration between EPFL (Lausanne) and ETH Zurich. The main objective of CubETH is to demonstrate the use of commercial GNSS receivers in space and test Precision Orbit Determination algorithms. One of the key driving requirements is to provide nadir pointing with a 20 degrees of precision and rotation rate less than 2 degree / second, in order to track GNSS constellation satellites. In this paper the solutions for the ADCS and the designed operatives modes are described. The ADCS shall provide for the Payload a nadir pointing with relaxed requirements, and in order to do that the team paid particular attention to the validation of the chosen hardware and software solutions. According the experience of SwissCube, its five years of data collected and lessons learned, we have started a vigorous process of design, implementation and validation for ADCS with several test setups and characterizations for sensors and actuators. We present the ADCS focusing mainly in the implementation, in the errors encountered and the process of validation in our test setups. A ball bearing with a Helmotz Cage has been used to validate the functionality of implemented algorithms (B-dot, TRIAD and an Extended Kalman Filter), results will be presented. Sensors calibrations and characterizations are addressed giving particular emphasis on their thermal drifts that can affect the determination process. Tests in Thermal Chambers show some interesting behaviors of the selected COTS sensors. A vigorous test campaign has been done on the first batch of Sun Sensors revealing not negligible effects that should be taken into account during final implementation. Even the actuators (magnetorquers) have been heavily tested to characterize their dipoles; tests revealed a really good match between the theoretical models and the hardware. Several test setups have been designed in order to

characterize separately COTS components, and actuators for ADCS but more remarkable is the effort that has been spent for the validation of the whole ADCS system: one of the most challenging subsystem for CubeSat is the ADCS due to the several test setup and validations necessary to prove its functionality.