IAF ASTRODYNAMICS SYMPOSIUM (C1)
Attitude Dynamics (2) (2)

Author: Prof.Dr. Ilyas El Wafi
Morocco

UM5-EOSAT : IN-ORBIT ATTITUDE DETERMINATION AND CONTROL SYSTEM PERFORMANCE ANALYSIS AND VALIDATION

Abstract

Demand for high-performing attitude determination and control systems (ADCS) is increasing with the recent outbreaks in CubeSat technologies. Their small size and relatively low cost make it possible to perform a wide range of missions. But this also put stringent limitations on the devices that could be used on-board making it challenging to design a high accuracy ADCS for them. UM5-EOSAT is a 3U low-Earth Sun-synchronous orbit CubeSat mission with the goal of Earth observation and global coverage. The spacecraft is designed to take images of the surface of the Earth at around an altitude of 600 Km. This paper presents the relevant requirements, the design choices, and the analysis performed to validate the CubeSat attitude determination and control system design on the ground and in-orbit. An overview of the subsystem is provided which describes pointing modes, as well as the control and determination algorithms developed. A statistical analysis is done to assess a processor-in-the-loop ADCS simulator, the engineering model hardware-in-the-loop setup and in-orbit ADCS performance. The comparison with our ADCS simulators on the ground shows close alignments with in-orbit results making them a powerful tool for future ADCS design and analysis. On the other hand, in-orbit pointing budget and stability demonstrate that the system's performance matches the desired pointing accuracy needed to take clear images, to establish communication with the ground station and to recharge the batteries via sun pointing.