31st IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Generic Technologies for Small/Micro Platforms (6A)

Author: Mr. Guan Wang
Beijing AZSPACE Technology Co., Ltd, China

IN-ORBIT VERIFICATION ON ATTITUDE CONTROL SYSTEM (ACS) OF DEAR-1

Abstract

DEAR-1 is an A10 series micro-spacecraft verification satellite developed by AZSPACE. It is an essential prototype for the forthcoming B300 series recoverable spacecraft which is designed to facilitate microgravity experiments. At present, this satellite has demonstrated stable in-orbit operations exceeding two months, incorporating a sophisticated attitude control system (ACS). The ACS is equipped with a high-performance control unit, three star sensors, two sun sensors, two gyros, a set of magnetorquers, and a cold gas propulsion system. This paper delves into the in-orbit verification of the ACS, covering several key aspects: 1)It outlines the dual attitude determination methods employed by DEAR-1 during sun-pointing mode, alongside the implemented attitude control strategy. 2)It examines how the constant gyro bias error influences the attitude pointing precision in sun-pointing mode. 3)It assesses the impact of varying phase plane control parameters on the spacecraft's fuel efficiency. 4)It explores the practicality of exclusively utilizing magnetorquers as actuators in sun-pointing mode to extend the spacecraft's operational lifespan in orbit. 5)Drawing from in-orbit data and the analysis conducted, this study proposes optimized attitude determination and control strategies aimed at minimizing the impact of constant gyro bias error and enhancing fuel efficiency. The paper also presents related modeling and simulation efforts to support these findings.