Student Project Proposal

February 2, 2024

Attitude Determination and Control System (ADCS) for AAUSAT 6

1. Background

AAU university has a student-driven program called AAUSAT. Since 2005, students have designed and launched their own CubeSat satellites that bear the group`s name. The latest satellite – called AAUSAT6 – is currently under development and, as all of them, it requires an ADCS.

There exist three previous projects connected to the ADCS of AAUSAT6 (see literature). All of them focus on the ACS aspect of the satellite, and they are all disconnected and incomplete for a full ADCS, so no development is officially recognised by the AAUSAT team.

Figure 1 AAUSAT satellite

2. ADCS description

The ADCS is a complex system with interconnected modules that must be precisely monitored to ensure correct functioning. Its inner systems can be broadly divided into:

- Sensors: A broad range of sensors can be employed. Their sensing capabilities vary within the mission, so their information must be combined to obtain solid results.
- ADS: obtain an estimate of the satellite rotation (attitude) by dynamically choosing the best sensors and applying signal processing and estimation algorithms.
- ACS: Effective controllers for each mission mode (detumbling, point-tracking, nadir pointing, …) are considered and designed.
- Actuators: Different actuation methods are required for attitude control in CubeSats.
- OBC: On board Computer, main brain that oversees the correct working and decides which modules to use.

Moreover, the ADCS system must be capable of controlling these modules for, among other things: overcome sensor failure, counteract external disturbances, manage power consumption, and satisfy requirements of the overall system.

3. The student project

This project intends to become the first one officially recognised by the AAUSAT team regarding AAUSAT6, by defining the core structure of the ADCS and unifying previous projects. This way, future efforts can build upon this project for the completion of the ADCS.

To attain this goal, the project will research the previous ADCS implementations of AAUSAT, to focus on defining:

- Required and best modules for satisfying AAUSAT6's mission (selecting sensors and actuators, as well as required ADS and ACS systems).
- Define the ADCS rules for the OBC for the management of these modules, to be implemented in the final spacecraft.
- Clear requirements for each module, to allow independent development.
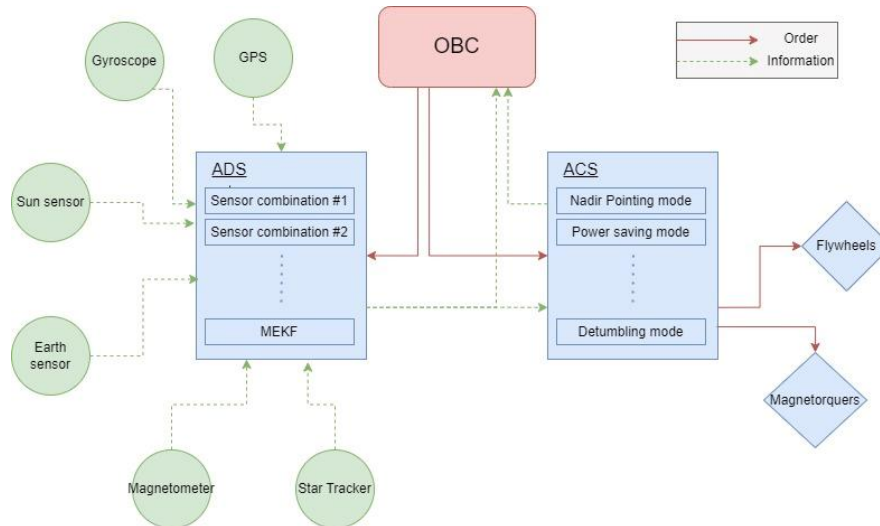

Figure 2 General ADCS structure

Once this is done, the student's efforts will be placed into starting development of these modules, with focus on the ACS part of the system.

Future projects can focus on developing the missing modules and improving the designed ones.

4. Literature

[1] Roskær, Christian Bekhøi, and Henrik Glavind Clausen. *Attitude Control System for AAUSAT6*. Aalborg Universitet, 2018.
[2] Thomsen, Brian Gasberg, and Jens Nielsen. *CubeSat Sliding Mode Attitude Control - Developing Testbed for Verification of Attitude Control Algorithms*. Aalborg Universitet, 2016.
[3] Laursen, Albert Werner, et al. *CubeSat ADCS*. Aalborg Universitet, 2023.

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