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AN ATTITUDE DETERMINATION AND CONTROL SYSTEM FOR A NANO-SATELLITE ALTERNATIVE LAUNCH PLATFORM

Abstract

The market of nano-satellites has recently experienced a growth in demands for new solutions to reach the space. As technologies shrink, more applications become viable for nano-satellites, which were restricted to bigger spacecrafts before. Nano-satellites constellations are a real and cheap alternative to heavier and expensive satellites for several applications, but need precise release conditions and the possibility of choosing their orbit.

In order to meet these requirements, GAUSS srl is developing its launch platform which allows to carry in orbit nano-satellites like CubeSats, PocketQubeSats and TubeSats. The platform is a small spacecraft itself, with an heritage of 2 space missions for nano-satellites deployment, during which 12 nano-satellites were released in orbit from the GPOD embedded mechanical deployer. In the future missions, the capability to point the platform in any direction shall grant the possibility to change its orbit with a propulsion system and to release the nano-satellites in the proper conditions. Furthermore, a full attitude control enables other uses of the platform after the release of the nano-satellites, such as Earth observation.

For these reasons, a dedicated attitude determination and control system for the GAUSS platform is being investigated in this paper. The system has dimensions compatible with those of a Cubesat mission and it is easily reconfigurable in order to match different other missions purposes. The control is based on reaction wheels and magnetorquers. Attitude determination uses measurements from the on-board gyros, magnetometers and Sun sensor. In order to process the measurements, the UnScented QUaternion Estimator (USQUE) is employed.

This paper describes the design, manufacturing and testing of the proposed attitude determination and control system