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SMALL EXPLORER FOR ADVANCED MISSIONS PECULIARITIES

Abstract

Micro- and nanosatellites have become more attractive due to their low development and launch cost. A class of nanosatellites defined by the cubesat standard allows standardizing cubesat preparation and launch, thus making the projects more affordable. Because of the complexity of sensors miniaturization to install them onboard cubesat, the majority of cubesat launches are aimed the technology demonstration or education missions. The SEAM (Small Explorer for Advanced Missions) project is funded within the EU 7th Framework Programme to develop a set of improved critical subsystems and to build and fly a 3U cubesat for scientific research at low Earth orbit. The objective of the SEAM satellite is to provide high resolution measurements of DC magnetic and AC magnetic and electric fields in the Earth's ionosphere, with the following research areas in mind: - characterization of auroral current systems; - monitoring of natural VLF and ELF waves; - observation of anthropogenic VLF and ELF waves; - precise measurements of DC magnetic field for the geomagnetic field modelling. For this the SEAM consortium will develop and demonstrate in flight for the first time the concept of an electromagnetically clean nanosatellite with precision attitude determination, flexible autonomous data acquisition system, high-bandwidth telemetry and an integrated solution for ground control and data handling. The project success highly depends on the sensors quality. In spite that the sensitivity of the magnetic sensors strongly depends on their size, the recent development in this branch allows us to propose tiny but sensitive both AC and DC magnetometers. The new design of miniature three-component sensors for measurement of vector magnetic fields – for quasi-stationary and slowly fluctuating - flux-gate magnetometer - and for alternative ones – search-coil magnetometer are described. Serious limitation of such a design is compact layout of service and scientific instrumentation. Because of this sensitive measuring electric and magnetic fields in various frequency ranges calls for an electromagnetically clean payload. This implies reducing capacitive and inductive coupling between parts of the electrical systems, as well as reducing the radiated components in the frequencies of interest. The instrument for electromagnetic cleanliness measurement and its operation algorithm are proposed. This work is supported by EC Framework 7 funded project 607197.