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MINIATURE MAGNETIC SENSOR FOR SPACE RESEARCH

Abstract

Ionospheric processes and wave activity in space plasmas in general are governed by electric and magnetic fields there. Thus, electric and magnetic fields are measured onboard practically all scientific ionospheric missions. The principal tendency in space research nowadays is the decrease of spacecrafts dimensions, weight and costs. The recent challenges are micro- and nanostatellites, including cubesats, more and more used especially in scientific space research. The most complicated problem for the realization of scientific experiments onboard cubesats remains the development of small and light but enough sensitive sensors. The electric field intensity in space plasma is measured by electric field sensors - a pair of spherical probes spaced at a known distance, the magnetic field – with the help of flux-gate or induction magnetometers. To combine both electric and magnetic field sensors in one body would greatly help technological problems solution onboard, especially with necessary booms number decreasing. In the present report a combined electromagnetic probe is proposed. This probe consists of three-component induction sensor placed into a sphere working as electric probe. The overview of the sensor design as well as expected noise level calculation for three-component induction magnetometer is made. The possibility to improve induction sensor sensitivity using flux concentrators is investigated and experimentally confirmed. The influence of electric probe conductive body on induction sensor sensitivity and noise level is analyzed. The experimental data obtained at the laboratory tests are presented. The new sensor as a part of the SQUID (Spinning QUad Ionospheric Deployer) experiment (www.squid-kth.se) onboard the REXUS sounding rocket, was launched in Feb. 2011 from Esrange Space Center in northern Sweden. The ways to improve the parameters of such a combined sensor and the plans of its application for next space experiments onboard cubesats are discussed. This work was partially supported by SSAU contract N 1-05/08.