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Miniature scientific-grade induction magnetometer for cubesats

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One of the main areas of space research is the study and forecasting of space weather. The society is more and more depending nowadays on satellite technology and communications, so it is vital to understand the physical process in the solar-terrestrial system which may disturb them. Besides the solar radiation and Space Weather effects, the Earth's ionosphere is also modified by the ever increasing industrial activity. There have been also multiple reports relating VLF and ELF wave activity to atmospheric storms and geological processes, such as earthquakes and volcanic activity. For advancing in these fields, the AC magnetic field permanent monitoring is crucial. Using the cubesat technology would allow increasing the number of measuring points dramatically.
It is necessary to mention that the cubesats use for scientific research requires the miniaturization of scientific sensors what is a serious problem because the reduction of their dimensions leads, as a rule, to the parameters degradation, especially of sensitivity threshold. Today, there is no basic model of a sensitive miniature induction magnetometer. Even the smallest one of the known – for the Bepi-Colombo mission to Mercury – is too big for cubesats.
The goal of the present report is to introduce the new design of miniature three-component sensor for measurement of alternative vector magnetic fields – induction magnetometer (IM). The study directions were concentrated on the ways and possibilities to create the miniature magnetometer with best combination of parameters. For this a set of scientific and technological problems, mostly aimed at the sensor construction improvement, was solved. The most important parameter characterizing magnetometer quality is its own magnetic noise level (NL). The analysis of the NL influencing factors is made and the ways to decrease it are discussed in the report.
Finally, the LEMI-151 IM was developed for the SEAM cubesat mission with optimal performances within the weight and volume constraints. Construction details, tests results and technical specifications of miniature but sensitive IM for cubesat missions are presented.
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