UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

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Evaluation of a space-grade fluxgate magnetometer for a CubeSat

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Abstract content
   (Max 300 words)

Magnetometers are often used in space application for the attitude determination and control system of a satellite. Very sensitive space-grade magnetometers are used as science payloads to measure the Earth's magnetic field accurately. The purpose of this research is to evaluate and space-qualify a low cost commercial-off-the-shelf (COTS) fluxgate magnetometer for space deployment. Various magnetometers are evaluated against the following criteria: mechanical and thermal robustness, power efficiency, weight, sensitivity, noise and linearity. After selection of a magnetometer, the sensor and the electronics are separated from the original enclosure. An aluminium enclosure is used for the sensor to shield it from damage that can affect its performance in space. The associated electronics is to be integrated with the satellite bus within the Cubesat.
Environmental testing and calibration were done at SANSA Space Science, the University of Stellenbosch, the Institute for Satellite and Software Application (ISSA) and SunSpace. These institutions are equipped with the appropriate facilities such as a Helmholtz coils system, thermal vacuum chambers, vibration test facilities and temperature cycle chambers. Thermal vacuum, thermal cycle, and vibration tests, which are part of the space qualification procedure, concluded the evaluation process.
The LEMI-011B fluxgate magnetometer was selected from a group of magnetometers as the best suited for CubeSat deployment. After separation of the electronics and sensor, the performance characteristics are as follows: 0.7 nT (rms) noise and ± 2 nT peak-to-peak noise, 0.0042 % non-linearity and 5.5 mA maximum current consumption. The modified LEMI-011B fluxgate magnetometer passed all the environmental test, thus, this magnetometer is space qualified for CubeSat applications.

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Prof. R.R. Van Zyl.VanzylR@cput.ac.za . Cape Peninsula University of Technology.

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Primary author: Ms SIZIBA, Electdom (Cape Peninsula University of Technology)

Co-authors: Mr GOUWS, Danie (SANSA Space Science); Ms SAUNDERSON, Elda (SANSA Space Science)

Presenter: Ms SIZIBA, Electdom (Cape Peninsula University of Technology)

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