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Evaluation of a Commercial-Off-the-Shelf Fluxgate Magnetometer for CubeSat Space Magnetometry

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Abstract

A low-cost, commercial-off-the-shelf (COTS) fluxgate magnetometer suitable for space magnetometry applications on a CubeSat mission is proposed as a cost effective science grade magnetometer. Three commercial-off-the-shelf fluxgate magnetometers were identified and evaluated against the following criteria: power efficiency, weight, noise, linearity and adaptability. The evaluation was concluded with environmental testing of the selected magnetometer, which included thermal cycling, functional temperature and vibration tests as a measure of space qualification of the instrument. Separation of the sensor and electronics was one of the major modifications to enable the sensor to be deployed on a boom, which is important to minimize magnetic interference from the satellite, while the electronics board is placed within the satellite body. The LEMI-011B fluxgate magnetometer passed the environmental tests and was proposed as suitable for CubeSat deployment. The performance characteristics of the magnetometer after modification and environmental tests are as follows: 0.7 nT (rms) noise at 12.83 Hz, ±2 nT over ±60000 nT non-linearity and 0.03 W power consumption.

1. Introduction

CubeSat developments at Universities offer a platform for students to realize space-based research goals within a short time frame and at relatively low cost. A CubeSat is a nano-satellite with standard dimensions of 100 x 100 x 100 mm and mass less than 1.33 kg. With this form factor the CubeSat is generally referred to as a "1U" (Munakata, 2009). The use of commercial-off-the-shelf (COTS) components in CubeSat designs

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