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CALIBRATION OF ON-ORBIT MAGNETOMETER DATA OBSERVED BY 6U CUBESAT KITSUNE USING GENETIC ALGORITHM

Abstract

This paper focuses on the analysis of the magnetic field measurements observed by the nanosatellite KITSUNE, focusing on the calibration methods used during the development and operations of the satellite. KITSUNE is a 6U CubeSat developed at Kyushu Institute of Technology, Japan, and deployed to orbit on 24th March 2022. It is equipped with an active 3-axis attitude control system consisting of reaction wheels, magnetorquers, an Inertial Measurement Unit (IMU), an external magnetometer, and six coarse sun sensors. Typically, the magnetometers used in CubeSats missions are attached to the satellite body. Hence, the magnetometers can give unexpected results due to scaling factors, offsets, and non-orthogonality errors. The non-orthogonality errors are defined as angular deviations from the orthogonal three-axis. The genetic algorithm is being used in this study to calibrate the on-orbit magnetometer data. As a study case, the on-orbit magnetic field data collected by this magnetometer was used to demonstrate the performance of the proposed genetic algorithm to calibrate the magnetometer on the ground. The Fortran language is used to develop the genetic algorithm to calibrate the magnetometer data. The genetic algorithm uses a weight function to find the best match for the unknowns. A relationship between the reference magnetic field, the measured magnetic field by the magnetometer, non-orthogonality error, offsets, and scaling factors, is used as the weight function of this study. The magnetometer data from the International Geomagnetic Reference Field (IGRF) is used as the reference magnetic field in the weight function. The results of the implemented genetic algorithm for the calibration of KITSUNE magnetometer shows that, the observed error in the measured magnetic field can be reduced by this method.