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Author: Mr. Marc Lehmann
Technische Universität Berlin, Germany

Mr. Merlin F. Barschke
Technische Universität Berlin, Germany
Mr. Karsten Gordon
Technische Universität Berlin, Germany

IMPROVED ATTITUDE DETERMINATION FOR TUBIX20: EVALUATION, INTEGRATION AND TESTING OF A FLUXGATE MAGNETOMETER

Abstract

The small satellite industry sees constantly rising demands due to more and more challenging mission scenarios, particularly in reliability and performance. This paper focusses on the latter by presenting the evaluation, integration and environmental testing of a fluxgate magnetometer into Technische Universität Berlin's 20 kg satellite platform TUBiX20. The magnetometer will upgrade the attitude determination and control system's basic sensor set, which consists of Sun sensors, MEMS gyroscopes and IC magnetometers. The upgrade of the magnetic field sensors is motivated by the higher performance of the fluxgate technology compared to the IC magnetometers used up until now. Following the modular TUBiX20 architecture, the commercial fluxgate sensors are integrated via a self-reliant computational node which hence does not entail any modifications of the platform's other hardware; the electrical interface includes the read-out electronics for two three-axis fluxgate sensors to be operated in cold redundancy, as well as a cold redundant pair of microcontrollers to retrieve and filter the magnetic field data and connect to the TUBiX20 power and data bus. Before the mechanical integration is approached, a suitable position is found by investigating the operation-induced noise of the platform in a magnetically clean facility using the engineering model of a current TUBiX20 mission. To test and evaluate the complete magnetometer system under realistic operation conditions, the modular design of the TUBiX20 platform allows connecting the fluxgate system externally to an existing satellite model's data bus without additional effort. In this manner, the sensor along with its complete software may already be tested on an attitude test bed within the attitude determination loop of an entire satellite model. This in turn allows to present first results of the performance of the new magnetometer sensor system already taking the entire satellite platform into consideration. Furthermore, the influence of radiation and temperature on the developed sensor system is investigated. The presented fluxgate magnetometer is scheduled for in orbit demonstration within the TUBIN mission in 2018. It will be tested alongside the original IC-based sensors it may replace on following missions.