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IN ORBIT NOISE EVALUATION OF COTS SENSORS USED FOR ATTITUDE DETERMINATION ON AAUSAT3

Abstract

AAUSAT3 was launched February 2013, as a science experiment, for the Danish Maritime Safety Administration, for monitoring ship traffic in arctic regions. In general the mission of AAUSAT3 has been a great success, but the satellite is not equipped with a working attitude determination and control system (ADCS). In order to make a satellite determine its accurate attitude, it is needed to be able to get good sensor measurements, and this is can be done with success by knowing the properties of the noise which is present on the sensor signals.

With AAUSAT3 already in orbit and with the possibility to communicate with the satellite on a daily basis, it is also possible to receive measurements from the sensors on the in-orbit satellite. A system with sensors, identical to the one in orbit, is also present for experiments on Earth. Sensor measurements are done on the system on Earth, in the same way as it is done for the system in orbit. Analyses of the covariances, autocorrelations and power spectral densities are done to determine properties of the noise signals present on the sensors. Furthermore a high-order Taylor approximation is made to isolate the noise on the sensor signals from space. The noise analyses are used to compare in-orbit sensor noise to the noise present on the sensors on Earth. It is then evaluated if it is possible to conclude that the sensor noise in orbit and on Earth is similar.

When looking at the results, it is seen that the covariances of the measurements from the in-orbit sensors are about 50 times bigger than the covariances measured on Earth. Furthermore from comparing the autocorrelations and power spectral densities of the in-orbit and Earth measurements, it is seen that there are some similarities between them.

As seen in the results, the noise on the sensors are much bigger when looking at the in-orbit system compared to the measurements from Earth. There are several different reasons that this might be the case. The measurements on Earth are done in a controlled environment while the in-orbit measurements are done on electronic components moving very fast through a magnetic field. As components on AAUSAT3 are not space graded components, this will especially affect the measurements done in-orbit compared to the measurements on Earth. Furthermore, from the measurements of the in-orbit gyroscope, it seems that the gyroscope is not working correctly.