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Author: Dr. Alexander Schmidt
German Aerospace Center (DLR), Germany

USING ONBOARD DATA FUSION OF IMU AND GNSS FOR IMPROVEMENT OF SCIENTIFIC ROCKET FLIGHTS

Abstract

Quite often scientific sounding rocket missions, as the microgravity-mission MAIUS in 2017 for example, require drift free attitude determination. Up to now, on sounding rocket flights, GNSS and IMU data have mostly been used separately. IMU data have been used for attitude determination solely, while GNSS data provided position and velocity vector of the rocket with a high accuracy but low sample rate. Normally, this data have so far been combined only during post flight processing to get a better understanding of the flight dynamics. In a recent sounding rocket flight program MORABA, the Mobile Rocket Base of DLR – German Aerospace Center, was, as usual for missions executed by MORABA, responsible for trajectory and attitude determination as well as for the live data handling on board and the communication with the ground stations. However, during this mission, additionally a newly implemented algorithm, running on the onboard computer, performed the combination of the highly sampled, but drifting IMU data and of the very accurate, but low sampled GNSS data. Although the GNSS only delivers position and velocity vector, the attitude data was improved with the help of this fusion algorithm. The used algorithm is based on Kalman filtering. The results show that this technique can also be useful for missions which require sophisticated guidance and control. For example, the inclination and orbital accuracy of satellite launchers could be improved as well. In this paper we present the results of the fusion and the improvements which have been gained with this new technique on the basis of the flight data of a recent sounding rocket mission.