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# HIGH ACCURACY ATTITUDE ESTIMATION FOR CUBESAT USING FPGA IMPLEMENTATION WITH LOW EXECUTION TIME

**Abstract**

Organizations and universities are widely involved in developing CubeSats due to their low development cost and lead time compared with other Satellite types. Nowadays, high-resolution cameras are used in CubeSats, which requires high pointing accuracy. Meeting this requirement would cause an increase the power consumption and execution time of the Attitude Determination and Control Subsystem (ADCS). High pointing requirements can be achieved using complex estimation algorithms such as the Extended Kalman Filter (EKF). Although EKF increases the estimation's accuracy, it also increases the execution time of the ADCS software when using the commercial-off-the-shelf (COTS) components. Therefore, one of the main challenges in CubeSats is achieving high pointing accuracy with the limited power generation. Thus, this research aims to optimize the time required to run the EKF estimation algorithm. By reducing the time required to execute EKF, more algorithms can be added to the ADCS implementation. The ADCS execution loop time can be reduced. Accordingly, EKF design was implemented on a Field Programmable Gate Array (FPGA) board using Verilog language. A comparison has been conducted between implementing EKF on FPGA and using a CTOS microcontroller in terms of the execution time. The result shows that the parallel implementation of FPGA reduces the execution time while maintaining the same estimation accuracy.