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DEVELOPMENT OF A CUBESAT GNSS RECEIVER FOR PRECISE POSITIONING

Abstract

For several years, space-grade GNSS receivers with various levels of functionality have been available on the micro and small satellite market. The most popular application of these satellite classes is precise formation flying and PVT correlated measurements in a spatially distributed network, which drives demand for such systems. Furthermore, these satellites' IOD potential makes them a suitable target for testing experimental missions for near orbital movements, collision avoidance as safety precautions, and potentially docking. Once proven, these technologies open up new opportunities for deorbiting, in-orbit servicing, close orbit monitoring, and examination of large targets (such as the International Space Station) and even fragmented spacecraft. The study describes a novel end-to-end strategy based on COTS GNSS positioning solutions that includes a dedicated hardware module capable of precise positioning. The integrated system offers a variety of operation modes, allowing the user to choose between low power consumption and exact point positioning with errors of less than $10cm$. A neural network augmented orbit propagation module acts as a fault detection, isolation and recovery (FDIR) for the GNSS receiver and replaces it completely for a low-power operating mode. For electrical connectivity, it uses the standard PC104 stacking header, making it completely compatible with the CubeSat platform. With a volume of $96 \times 90 \times 17$ mm and a maximum power consumption of 2 W, the receiver delivers to satellites as tiny as CubeSats the performance and reliability traditionally reserved and requested by commercial or research grade missions.

Keywords: *precise positioning*, *machine learning*, *commercial off the shelf*, *GNSS*