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ORBFIX - PRECISE POSITIONING AND MACHINE LEARNING ON A CUBESAT GNSS RECEIVER

Abstract

Space grade GNSS receivers with varying degrees of functionality have been available on the micro and small satellite market for several years. The demand for such systems is firstly derived from the most sought application of these satellite classes: precise formation flying and PVT correlated measurements in a spatially distributed network. Furthermore, the IOD potential of these satellites makes them the ideal target for experimental missions testing for close orbital manoeuvres, for collision avoidance as safety procedures and even for docking. Once demonstrated, these technologies open up new possibilities for deorbiting, in orbit servicing applications, close orbit monitoring and inspection of large targets (i.e. ISS) and even fragmented spacecraft. In this context, the paper presents an innovative end to end approach based on COTS GNSS positioning solutions which involves a dedicated hardware module capable of precise positioning. The integrated system provides flexible operation modes allowing the user to trade-off between power consumption and accurate precise point positioning with errors of 10 cm or less. A neural networks augmented orbital propagator takes over in low-power mode and provides FDIR functionalities for GNSS operation. It makes use of the standard PC104 stacking header for electrical interfaces, being fully compatible with the CubeSat platform. With a volume of $96 \times 90 \times 17$ mm and a maximum power consumption of 2 W, OrbFIX brings to satellites as compact as CubeSats the performance and reliability typically reserved and demanded by commercial or scientific grade missions.

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