A Novel Beamforming Architecture with Software GNSS Receiver Implementation

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ABSTRACT

Digital beamforming is an effective way to improve gain in the direction of the GNSS satellites and to null in the direction of undesired signals such as interference and multipath. However, the utilization of multiple antennas makes the architecture and signal processing of GNSS receivers significantly different from single-antenna receivers. This paper describes a method of simplifying the architecture of multi-antenna GNSS receivers. The authors propose a novel beamforming architecture utilizing the maximum Signal to Interference plus Noise Ratio (SINR) criterion. This architecture can make the beamforming processing sub-system a standalone module instead of being integrated within the tracking loop. A software-based multi-antenna GNSS receiver was developed based on the Kai Borre single-antenna GNSS software receiver. Simulation results demonstrate that this architecture is effective in improving the carrier to noise density ratio of the received signal, as well as in reducing the receiver tracking error.