



## **GNSS RTK NOISE REDUCTION IN POSITION DOMAIN USING CAUSAL FIR FILTERING FOR GEOTECHNICAL AND STRUCTURAL ENGINEERING APPLICATIONS**

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**ABSTRACT.** There is no doubt that GPS/GNSS has introduced a disruptive change in the way we are handling structural monitoring operations. Short range GPS/GNSS positioning can today rivals in term of precision with the traditional geodetic technology based on Total Stations.

While today the GNSS receivers can process the observation at highest rate such 20 Hz than before, it has all been a concern to reduce the result noise inherent of the observations contaminated by atmosphere turbulence, inaccurate orbits information etc, and to take advantage of most data we can collect to do so.

Applying an appropriated causal Finite Impulse Response filter directly on the position domain (coordinates) guarantees a noise reduction of around 35%. On the same time the characteristic of the sample distribution is tested to ensure the filter can be reset in case of even small and abrupt changes.

After comparing the merit of a conventional Kalman filter with the performance of a causal FIR filter, Leica Geosystems has opted and decided to implement such filter in both his Leica GNSS Spider positioning software and in the Leica GNSS QC software.

The author will review the characteristic of the filter implementation, the different parameters that can be set and the resulting performances on different projects using dual frequency GNSS receivers and the new single frequency Leica GMX901 receiver in real time as well as in near real time or post-processing mode. The results obtained show remarkable performances in noise attenuation and therefore open the way to give more credit to the use of GNSS technology for geotechnical and structural engineering application as well.

**Key words:** GPS, GNSS, reference Station network, deformation monitoring, geotechnical and structural monitoring, Leica GNSS Spider, RTCM, RTK, FIR, filtering, smoothing, data snooping.

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