

# Orthogonal Least Squares Adjustment Processing Algorithm for Data Loggers

Joel van Cranenbroeck and Sara Salehi

**KEY WORDS:** Innovative Concepts for Sensors and Methods, Automation of Monitoring Measurements and Interpretation

## **ABSTRACT:**

Least Squares Adjustment is largely used to process surveying and geodetic observables in order to derive the best linear unbiased estimates for the parameters often the coordinates of points. In geodetic monitoring with the advent of distributed networked smart sensors pre-processing of the observables request algorithms that can be implemented on data loggers generally having not the same unlimited processing capabilities. The Orthogonal Least Squares Adjustment model fits very well with that constraint and has been used at the time PC computers where first considered to run geodetic network calculations. Instead of using the classical Gauss reduction or the Cholesky decomposition, orthogonalisation algorithms such Gram-Schmidt and the modified version elaborated to address the relative numerical instability as well as the Givens deflection have proven to be very efficient. The Modified Gram-Schmidt algorithm suits even very well to cope with rank deficiency linear systems where the functional model doesn't consider any a priori datum named by the geodesists as Free Network. The author will review the principle of the Orthogonal approach and will present an algorithm that uses both the Givens deflection to identify the rank deficiency and the Modified Gram-Schmidt algorithm to derive the best unbiased linear estimates. The implementation of that approach in a programming language will illustrate how compact such algorithm can be to be considered as embedded in data loggers and processors.