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GPS and GALILEO precise positioning using the Modified Ambiguity Function Approach

Dawid Kwaśniak
University of Warmia and Mazury in Olsztyn, Olsztyn, Poland (dawidkwachu@gmail.com)

For many years GPS and GLONNAS were leading navigation systems. However, recent years two new navigational systems have appeared. These systems are the European Galileo System and the Chinese BeiDou System. The full operability of both systems is foreseen for 2020. Galileo System is quickly developing in last years and still increasing number of satellites allows to use this system for positioning. GPS and Galileo systems share some of their signals frequencies. These shared signals frequencies allows to combine observation of both systems. The goal of this study is use the Galileo System along with GPS for positioning purpose. However still low number of Galileo satellites not allow to use this system only for precise positioning, that is why combination of GPS and Galileo is used for tests.
For test purpose a self-made software was created in MatLab. It consists of three modules. First is responsible for reading RINEX files, second for the DGPS or the DGNSS in case of combined GPS and Galileo observations and the third one uses The Modified Ambiguity Function Approach (MAFA) method for precise positioning purposes. MAFA is a method of processing GNSS carrier phase observations. In this method the integer nature of ambiguities is taken into account using appropriate form of mathematical model. The theoretical Foundations of Precise Positioning Using MAFA will be presented. For test purpose data from three different days for the same baseline was used. Test was divided on two parts. In the first part short static sessions were performed for GPS only and for GPS and Galileo combination. In the second part data was tested in RTK mode for GPS only and for GPS and Galileo combination.
The usage of GPS and Galileo combinations allows to increase the precision of the obtained result comparing to GPS only solution. Very important thing is to remember about inter system bias (ISB) - the difference between the receiver hardware delays affecting the signals from different systems, that can affect for the results.