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DUAL-FREQUENCY MULTI-CONSTELLATION SBAS SIMULATOR

Abstract

SBAS Simulator is a GNSS System Volume Simulator performing various analysis related to satellite navigation developed by Iguassu Software Systems under ESA supervision and funding. The focus is on the simulation of SBAS performance using customisable definition of GNSS constellations (real and imaginary), as well as to configure almost any parameter of each system and see resulting changes. SBAS Simulator has two main parts: the configuration section and the analysis section.

The configuration section provides settings related to space, ground and user segments. Space segment is the satellite constellations. By default it is possible to select satellites from GEO, GPS, GLONASS and Galileo. The simulator has multi-frequency support and can run either in single or dual frequency mode. Satellites' frequencies are configurable and independent. Ground segment reflects the network of RIMS stations (EGNOS, WAAS, Africa, etc.). The user segment specifies the simulation area and the step of the area grid. By default the area is the ECAC region, but it can be changed to any other area or to a simple point. All configuration parameters can be saved to configuration files which can be loaded later.

Analysis panel contains several simulation modules. SBAS related analyses are computed using the Minimum Operational Performance Standards for Global Positioning System (MOPS) or the Dual Frequency Multi Constellation (DFMC) Standard. Geometry conditions are reflected in DOP analysis. Accuracy is modelled in NSE module which also supports the LPV200 service and stores the 95%ile for the previous 24 hours. Protection levels are computed through the XPL simulation. Availability is then calculated using results from XPL and NSE. Continuity analysis also uses results computed in XPL. Ionospheric analysis is quite complex: the task is to compute the Grid Ionospheric Vertical Error (GIVE) for each Ionospheric Grid Point (IGP). At first ionospheric pierce points (IPPs) from RIMS to satellites are determined taking into account the scintillation effects. Variability of the ionosphere is modelled by a provided IONEX file. Ionospheric results are inputs for the NSE, XPL, availability and continuity analysis. Simulator also provides plots for depth of coverage, satellite coverage over a region, ground tracks and sky plot. Simulations are performed sequentially and results are stored into intermediate files in the scenario folder. With the same configuration the same file is never recomputed again which saves the simulation time for different analysis.