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## Design of the GNSS reflectometry satellites constellation

Summary of PhD thesis

Analysis of sea surface height (SSH) variations is currently an important issue from the point of view of geodynamics, physical geodesy, oceanography and other earth sciences. Global measurements of SSH variations are currently carried out using the satellite altimetry technique, which provides information to develop the SSH models and model several geophysical phenomena related to ocean dynamics. The alternative to satellite altimetry may be the satellite reflectometry technique, which uses Global Navigation Satellite Systems (GNSS) signals reflected from the ocean surface. Unfortunately, there is currently no global reflectometry satellites constellation (GNSS-R).

In this PhD thesis, original methodology for determining of GNSS-R satellites orbits elements was proposed. For this purpose, several computational simulations were performed based on original algorithms. The simulation of GNSS signal reflections from the sea surface model and the simulation of intersection of reflected GNSS signals in the range of low Earth orbits were carried out. For this purpose, the precision orbits of real GNSS satellites determined by two independent computing centers GeoForschungsZentrum Potsdam and Center for Orbit Determination in Europe were used. Then, the analysis of the spatio-temporal relationships of the intersection points was performed to fit the circular orbit of the GNSS-R satellite. This analysis allowed determination of semi-major axis, orbit inclination, longitude of the ascending node and the moment of crossing the Earth's equator by satellite. The determined orbits can form the optimal GNSS-R constellation for monitoring SSH variations. Based on the determined orbits, GNSS-R constellation concepts consisting of 18 satellites in 3 or 6 orbital planes and 6 satellites in 6 orbital planes for an optimal recording of reflected GNSS signals from the sea surface in the analysed periods were proposed.

The research conducted in this PhD thesis proves the possibilities of determining the GNSS-R constellation based on simulation of GNSS signals reflections and shows the high potential and applicability of GNSS reflectometry to monitor SSH variations.

**Key words:** GNSS-R, satellite reflectometry, sea surface height, orbit, satellite altimetry

