

THE NAVIGATION ON THE GEOSTATIONARY ORBIT USING SIGNALS FROM GLOBAL NAVIGATION SATELLITE SYSTEMS

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The space satellite systems are an integral part of the modern world, they provide communication, both voice and data exchange; broadcast television programs; provide means to determine your own location.

A model is presented to estimate the accuracy and availability of the global navigation satellite system (GNSS) on the geostationary orbit (GO). The input data consists from an almanac of GPS (31 satellites), GLONASS (24 satellites), GALILEO (12 satellites), COMPASS (14 satellites) and the ephemeris of geostationary satellites, that broadcast navigation messages. The output data is given in the form of root mean square (RMS) of the error of coordinates estimation on the GO and geometric factor (GDOP). The problem of determining the coordinates is solved by the pseudo-ranging method. The pseudorange to the satellite is altered using statistics, which includes the ephemeris errors, the accuracy of signal in space, navigational receiver channel instability. The fundamental feature of the model is the use of the navigation satellites' signals that are broadcast through the side lobes of the antennas radiation pattern. The model uses the experimental radiation patterns of the GPS antennas and the theoretical radiation patterns of the antennas of other satellite systems. It is possible to use the data obtained from any of the mentioned navigation systems or their combination.

Some of the research results were published in the sources [1-3]. The following results represent the most common cases of modelling with the use of signals from side lobes.

The minimum and maximum RMS errors of the position while the RMS error of the pseudorange is 1.7 m are equal 2 and 7 m for GPS, 5 and 17 m for GLONASS, 4 and 9 m for GPS+GLONASS, respectively. For the RMS error of pseudorange of 6 m, the RMS errors of the position are equal 16 and 49 m for GPS, 18 and 62 m for GLONASS, 13 and 32 m for GPS+GLONASS, respectively. There are usually at least 8 satellites available in a point per system. The geometric factors of the dilution of precision range from 8 to 23 for GPS, 9 to 29 for GLONASS, 6 to 15 for GPS+GLONASS.

The use of GNSS is an important step in the development of near-Earth space and the solution of navigation tasks for service spacecraft and space debris collectors.

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2. Valeriy Konin, Fedir Shyshkov, Olexiy Pogurelskiy, Estimation of Coordinates on Geostationary Orbit by Using GNSS Signals, Proc. Of the 3rd Radar Methods and Remote Sensing Symposium (RMSW 2016), 27-28 September, 2016, Kyiv, Ukraine, - pp.32-35 – Way of Access : DOI: 10.1109/RMSW.2016.7778544

3. Konin., A. Pogurelskiy., F. Shyshkov, "GNSS availability on geostationary orbit," 5-th international conference «Space Technologies: Present and Future», Dnepropetrovsk, 19-21 May 2015, p. 145 - Way of Access: <http://er.nau.edu.ua:8080/handle/NAU/25209>