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THE METHOD OF IMPLEMENTING RELATIVE GEODETIC POSITIONING BY GPS/GLONASS SIGNALS USING THE FLOAT PROCESSING OF PHASE OBSERVATIONS

A. A. Zhalilo and A. I. Yakovchenko

National Center of Control and Communications, Kiev, Ukraine

The article proposed a method of implementing relative geodetic definitions by GPS and/or GLONASS signals using the current processing of the first differences of phase observations. The algorithm of processing observations is universal for single-frequency and double-frequency observations, and makes it possible sufficiently simply to form weight matrices of observations, to rule out the problem of choosing a reference satellite and organize the recovery of the losses of the phase cycles. The proposed method of processing makes it possible to simplify program implementation of relative geodetic definitions in static and kinematic operational modes and raise the reliability of resolving phase ambiguity.

In the practice of processing phase observations by GPS/GLONASS signals (in particular, in geodetic relative definitions) a stable geodetic tendency has taken shape; the tendency of linear combining the equations of phase observations in the course of their processing with the purpose of ruling out the impact of discrepancies of time scales of diversified receivers (formation of the second differences) and resolution of phase ambiguity (formation of the third differences) [1]. Such an approach has been widely used when processing GPS observations, while upon the emergence of combined receivers, GPS/GLONASS was spread also to multi-frequency GLONASS observations [2, 3].

Main difficulties when developing software for processing phase observations with their linear combination lie in the choice of reference satellites (especially during long-hour observations) and in the formation of weight observation matrices under conditions of noncoinciding intervals of radio imaging of different satellites and possible interruptions of radio communication. In addition, during the formation of the second and third differences of observations the information about mutual drifts of the time scale of diversified receivers is lost. Therefore, when solving problems of high-accuracy synchronization additional software for defining mutual coordinates is needed.

The present article proposes a universal algorithm in whose basis lies the float processing of phase observations and which implies a sufficiently simple implementation of processing first differences L1 (or L1, L2) of GPS/GLONASS observations. The said algorithm is equivalent in terms of accuracy to traditional methods of processing the second and third difference observations.

Let us consider the proposed method of float processing the first differences using as an example the static mode of determining the base vector formed by reference point and point determined using the results of L1 GPS/GLONASS observations. Let us write down the initial system of equations (after known preliminary transformations of observations) in the form of the first differences of phase pseudo-ranges between receivers of navigation signals:

$$\Delta \hat{S}^{j}(t_k) = R_2^{j}(t_k) - \hat{R}_1^{j}(t_k) + \Delta(t_k) - N^{j}\lambda_j, \tag{1}$$

where $\Delta \hat{S}^{j}(t_k)$ are the estimates of the first differences of phase pseudo-ranges on the reference point (1st) and point (2nd) determined with respect to the jth satellite at the instance of observations t_k; $R_2^{j}(t_k)$ is the known function of the distance

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