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METHODS OF BUILDING HIGH-PRECISION GEODASION NETWORKS

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ANNOTATION: The article deals with issues of creation of high precision mine surveying networks. They can be used for the building and equipment installation. Also there is a method of joint adjustment of satellite, geodetic and mine surveying measurements.. To solve this problem, we propose a mathematical apparatus for converting measurements into a local rectangular coordinate system. The joint system of linear equations of satellite and geodetic measurements is solved by the method of least squares by the method of conjugate gradients in a special software package. The complex has the ability to strictly precomputation the accuracy of mixed networks, taking into account all the geometric conditions that arise in the network.

The technology development of industrial production requires especial demands to building, installation and alignment of the mine and metallurgical equipment. At the same time there is a tendency to increase the sizes of it and the required accuracy of its installation. The higher the production and installation accuracy of such equipment, the more reliable will be its work and maintenance-free period. For example, now the installation accuracy of the equipment in mine and metallurgical industry is 0,1..0,5 mm. To provide such accuracy by traditional geodetical methods [1, 2] is impossible. In mine surveying instruction [3] there is no requirements for high accuracy measurements. This is due to the new conditions that demand a design proof for geodetic network and an appropriate technique of measurement. The authors believe that the development of such works will be due to two main components – joint adjustment of all kinds of measurements (geodetic, mine surveying and satellite) and preliminary accuracy calculation of designed geodetic and mine surveying networks. Such approach leads to correct technique and measurement equipment selection and respectively to the quality results. In recent years there is an unprecedented increase of satellite and navigation systems and respectively the improvement of accuracy measurements by their joint use [13-18]. These measurements are quite ordinary for any surveyor. Wide use of satellite measurement system for geodetic purposes allows talking about occurrence of so-called geodetic navigation space. It can gradually slow down and move out the space of geodetic base points. Because the full transfer to the satellite technologies cannot be performed in short period, all kinds of traditional geodetic measurements are performed using geodetic equipment as well as satellite navigation receivers [4, 5, 6, 7].

The satellite measurements in present geodetic networks are used mainly for [4-12]: improving the accuracy and reliability of the networks; transfering the coordinate system from base points, which are far from the local network; combining the local networks into the united common network. The satellite measurements requires open area around the network placements, that is why in geodetic production pure satellite measurements are not used, just in combination with another technique. In a built-up area or enclosed ground it is necessary to set the receiver quite far from the control or defined points. In this case its snap men makes using additional units of the network. As a result we obtain complicated and various geometric constructions which require more flexible and intellectual algorithms of calculation and adjustment. In addition the satellite and geodetic measurements have the similar accuracy that is why they should be adjusted jointly. Wide use of total stations in geodetic production broke the traditional rule of

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networks creation. As a result we have just one network type – linear-angular network and do not use any network type division for different types - theodolite traverse, trilateration survey, analytical networks etc. The accuracy of geodetic measurements increased and new methods for estimating the quality of geodetic networks [19-21].

During the handling of such networks as a rule man uses a separate processing for satellite and geodetic measurements, i.e. after the satellite measurements adjustment the obtained coordinates of the points are used as control for the geodetic measurement adjustment . In such cases we lose the accuracy and have some kind of ambiguity of the results estimation. That is why there is a wide interest in scientific articles to joint adjustment of geodetic and satellite measurements [4, 5, 6, 7, 8, 9]. Often there is a recommendation to perform such adjustment using spatial geocentric coordination system, which is used for satellite determination as well as for geodetic terrain measurements processing. Theoretically it is quite correct but the modern conditions of geodetic and mine surveying production do not let to perform a rigorous calculations.

First of all it is necessary that the initial ground stations were linked to some coordinate reference ellipsoid and must be known the exact parameters of the transition to the reference ellipsoid, which are defined with respect to a coordinates of satellite observations. Providing of these requirements in terms of construction the engineering local networks difficult to fulfill: there are some restrictions on access to the complete coordinates, moreover, used coordinate system SC-42 and SC-63 do not have the exact parameters of the transition in WGS-84, which performs a specific origin satellite system GPS. The result of satellite definitions are the accurate projections of the vectors in the geocentric coordinate system between the base station and the current positions of the receivers, as well as the approximate geodetic coordinates of the end points of the vectors. Projections of the vectors can be considered as independent measured values that have to be adjusted.

The direct accurate recalculation of the vector projections from geocentric coordinate system to the system coordinate of terrain points is practically impossible for the following reasons: global transformation parameters between the geocentric coordinate system of satellites and use different reference ellipsoid, the relative position between them in the body of the Earth is known with insufficient accuracy; the coordinate system of ground points can be local and not related to the reference ellipsoid; end point vectors have very approximate coordinates, so the transition to geodetic coordinates on the ellipsoid will be accompanied by prominent projections of systematic errors.

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