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Methods of Calculating Function Range Calculations in Accuracy Assessment. Evaluation of Parametric Determination of Equation

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Abstract: In this article, the evaluation method of determining the equalization of the function wave by the parametric method is considered. In this case, calculation of the weight of the function in the parametric method of equalization, calculation of the weight coefficients according to the Ganzen method, . τ Calculation of weights of unknowns, Weights of last two unknowns, Calculation of function weights, Calculation of function weights in complementary graph, Complementary graph t_j Issues focused on the requirements for calculating the weight of the unknown and assessing accuracy are covered. Also, an example of accuracy assessment is given as an example

Keywords:. reference ellipsoid, geodetic coordinates, triangulation network, point coordinate, directional angle, starting point, initial directionsб, width, longitude, geodetic azimuth, initial geodetic dates, .

Introduction.

Calculation of the weight of the function in the parametric method of equalization. To evaluate the accuracy of any magnitude x_i should be given in the form of a function of measurement results, as a result of which the following formula of the theory of measurement errors can be accepted

$$\frac{1}{P_\Phi} = \left[\left(\frac{\partial \Phi}{\partial x}\right)^2 * \frac{1}{p_i}\right]$$

The weight to be searched for is the magnitude, given the condition of the problem, or the desired unknown t through equalized values of or measured quantities x_i' can be clearly expressed by equalized values. Let's denote the evaluated quantity by F.

Expressed by the equalized values of the parameters as follows

$$F = F(t_1,....,t_k),$$

the second case, i.e. when it is expressed by the equalized values of the measured quantities, is as follows

$$F = \varphi(x_1',....,x_n').$$

will be.

But all measurement results are expressed in the form of the following equations through the necessary unknowns:

$$x_i' = f_i(t_1,....t_k)....(i = 1,...,n)$$

then the second state easily follows the first state [1-5]. Therefore, we limit ourselves to considering only the first case (the case of expression of unknowns by equal values).

So the following function

$$F = F(t_1,....,t_k)$$

is available and it is required to determine the weight of the quantity F. Here, t-values are not measurement results. Therefore, we will discuss as follows: $t = t^0 + \tau$ va F and the size τ can be considered as a function

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of unknowns, that is, as unknowns of a system of normal equations. If we express the measurement results of these unknowns by , then the problem will have a solution presented in the form of the function of the measurement results of the quantity F.
For this, we get the result as follows. Before, τ We express the unknowns in the form of linear functions of the normal equations and the degrees of freedom. For example, these exemptions $[pa_1l]$, $[pa_2l]$,…,$[pa_kl]$ are sums of , then it is not difficult to express the unknowns in the form of linear functions of l, i.e., in the form of the freedom terms of the correction equation. So if $l_i = f_i(t_1^0, t_2^0, t_3^0) - x_i = x_i^0 - x_i$ if we consider that the weight of the quantity is equal to the weight of the measurement result, the problem is solved, i.e, quantities act as the results of measurements in the assessment of accuracy.
τ it is easy to express the unknowns in the form of linear functions of the degrees of freedom of the normal equations using the inverse matrix [6-10]. We write the system of normal equations in matrix form.

$$N\tau = -L$$

From here

$$\tau = -\frac{L}{N} = -N^{-1}L$$

$N^{-1} = Q$ as and corresponding inverse matrix elements Q_{js} we enter the designations via , here, j - line number, s - is the column number. In that case

$$\tau = -QL$$

or

$$\begin{pmatrix} \tau_1 \\ \cdots\cdots \\ \tau_k \end{pmatrix} = \begin{pmatrix} Q_{11}, \ldots\ldots Q_{1k} \\ \ldots\ldots\ldots\ldots\ldots\ldots \\ Q_{k1}, \ldots\ldots, Q_{kk} \end{pmatrix} \times \begin{pmatrix} -L_1 \\ \cdots\cdots \\ -L_k \end{pmatrix}.$$

Any τ_j for the unknown can be written as follows

$$\tau_j = -Q_{j1} * L_1 - Q_{j2} * L_2 - \ldots. - Q_{jk} * L_k \qquad (1)$$

In the parametric method, the coefficients of the inverse matrix of normal equations are also called weight coefficients.

The Main Part.

1. Calculation of weight coefficients by the additional graph method

Q_{jj} weight coefficients, that is, the diagonal elements of the inverse matrix are called coefficients squared. Below we will consider whether they are always positive. The remaining weight coefficients are called non-quadratic coefficients.
Coefficients off the square diagonal have properties of symmetry with respect to this diagonal, i.e

$$Q_{js} = Q_{sj}. \qquad (2)$$

We will prove the validity of this equality below.
It is known that the following theorem for square matrices is known from matrix theory

$$\frac{1}{N^T} = \left(\frac{1}{N}\right)^{\mathrm{T}}$$

$$1^{\mathrm{T}} = 1 gako'ra \qquad (3)$$

$$(N^T)^{-1} = (N^{-1})^T$$

that is, the permutation operation and square matrix substitution can be interchanged.
As a result of its symmetry, the matrix of coefficients of normal equations can be written as follows

$$N^T = N \qquad (4)$$

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therefore, taking into account (3) and (4), we obtain the following

$$(N^T)^{-1} = N^{-1}$$

from here

$$N^{-1} = (N^T)^{-1}$$

or

$$Q = Q^{\mathrm{T}}$$

that is, as we were asked to prove, the inverse matrix is also symmetric with respect to the main diagonal.
Now let's consider the methods of calculating weight coefficients.
These methods are based on the following known relationships

$$N^{-1}N = NN^{-1} = E \qquad (5)$$

$$\textbf{\textit{(ya'ni}}\ \frac{1}{N}N = N\frac{1}{N} = 1\textbf{\textit{)}}$$

where E is the unit matrix. For N and Q matrices, equality (5) in expanded form is as follows:

$$\begin{pmatrix} Q_{11},......Q_{1k} \\ .... \\ Q_{k1},......,Q_{kk} \end{pmatrix} \times \begin{pmatrix} N_{11},......N_{1k} \\ .... \\ N_{k1},......,N_{kk} \end{pmatrix} = \qquad (6)$$

$$\begin{pmatrix} N_{11},......N_{1k} \\ .... \\ N_{k1},......,N_{kk} \end{pmatrix} \times . \begin{pmatrix} Q_{11},......Q_{1k} \\ .... \\ Q_{k1},......,Q_{kk} \end{pmatrix} = \begin{pmatrix} 1,0,....,0 \\ 0,1,0,.,0 \\ .... \\ 0,....,0,1 \end{pmatrix}$$

Based on the rule of substitution of matrices and taking into account the symmetry of non-quadratic elements of matrices N and Q, for any arbitrary row (column), the following system of weighting coefficients can be written:

$$\left.\begin{array}{l} \left.\begin{array}{l} N_{11}Q_{j1} + ... + N_{1k}Q_{jk} = 0 \\ .... \end{array}\right\} nollar \\ N_{1j}Q_{j1} + ... + N_{jk}Q_{jk} = 1 \\ \left.\begin{array}{l} .... \\ N_{1k}Q_{j1} + ... + N_{kk}Q_{jk} = 0 \end{array}\right\} nollar \end{array}\right\} \qquad (7)$$

We got a system of normal equations that differs from the main system (for unknowns t) only by the degrees of freedom. In system (7), all free terms are equal to zero in all equations, except for the jth equation, where the free term is equal to 1(one).
In order to find the s-th row of weighting coefficients, it is necessary to solve the system of equations almost the same as (7) by putting 1 (one) instead of the free term in the same s-th equation (the remaining free terms are zero) .
The system of equations (7) is performed based on the calculation of weight coefficients by the method of additional graphs. This method is based on the following procedure.
Additional graphs are included in the scheme of solving normal equations for each sought j-th row of weight coefficients. In this graph, -1 is written in the j-th equation row of the main system. In the additional column, the same changes are made as in the L column.

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After all the transformations are completed, the weighting coefficients are calculated in the same way as the unknowns, but not by using the L graph, but by using the appropriate additional graph.
The method of calculating weight coefficients using an additional graph is accepted only in cases where it is necessary to determine some rows of the inverse matrix. If it is required to find all the elements of the inverse matrix, then it is effective to choose the Ganzen method [11-15].

2. Calculation of weight coefficients according to the Hansen method

If all the rows of the inverse matrix are counted in sequence, starting from the last and ending at the first, then no additional graphing is required. To determine all weight coefficients, it is sufficient to have the eliminative equations of the main system of normal equations. Such a solution may be the result of the property of symmetry of the weight coefficients with respect to the quadratic diagonal.

We consider the calculation of weight coefficients by the Ganzen method on the example of four normal equations.

First of all, we determine the last row of weight coefficients. We write down the following system of equations in the appropriate case.

$$\left.\begin{array}{l} N_{11}Q_{41}+N_{12}Q_{42}+N_{13}Q_{43}+N_{14}Q_{44}=0 \\ N_{12}Q_{41}+N_{22}Q_{42}+N_{23}Q_{43}+N_{24}Q_{44}=0 \\ N_{13}Q_{41}+N_{23}Q_{42}+N_{33}Q_{43}+N_{34}Q_{44}=0 \\ N_{14}Q_{41}+N_{24}Q_{42}+N_{34}Q_{43}+N_{44}Q_{44}-1=0 \end{array}\right\} \qquad (8)$$

For example, the free terms of the first three equations are equal to zero here, then the free term of the last equation remains unchanged after the first three unknowns are eliminated, as a result we get the following equation

$$N_{44}^{(3)}Q_{44}-1=0\,.$$

in which the weight coefficient is as follows

$$Q_{44}=\frac{1}{N_{44}^{(3)}}$$

In general, it is as follows

$$Q_{kk}=\frac{1}{N_{kk}^{(k-1)}} \qquad (9)$$

$Q_{43}, Q_{42} va Q_{41}$ the weight coefficients can be easily found using the eliminative series, a scheme for solving normal equations. In these lines, taking into account the system (8), the free limits should be taken as zero [16-20]. Thus, the weighting coefficients are determined as follows

$$\left.\begin{array}{l} Q_{43}=E_{34}Q_{44} \\ Q_{42}=E_{23}Q_{43}+E_{24}Q_{44} \\ Q_{41}=E_{12}Q_{42}+E_{13}Q_{43}+E_{14}Q_{44} \end{array}\right\} \qquad (10)$$

Below we write the system of equations for the third row of the inverse matrix

$$\left.\begin{array}{l} N_{11}Q_{31}+N_{12}Q_{32}+N_{13}Q_{33}+N_{14}Q_{34}=0 \\ N_{12}Q_{31}+N_{22}Q_{32}+N_{23}Q_{33}+N_{24}Q_{34}=0 \\ N_{13}Q_{31}+N_{23}Q_{32}+N_{33}Q_{43}+N_{34}Q_{34}-1=0 \\ N_{14}Q_{31}+N_{24}Q_{32}+N_{34}Q_{33}+N_{44}Q_{34}=0 \end{array}\right\} \qquad (11)$$

(11) the last of the four unknowns of the system is defined as $Q_{33}=Q_{34}$ above.
We have the following system to determine the remaining unknowns

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$$\left.\begin{aligned} Q_{33} &= E_{34}Q_{34} + \frac{1}{N_{33}^{(2)}} \\ Q_{32} &= E_{23}Q_{33} + E_{24}Q_{34} \\ Q_{31} &= E_{12}Q_{32} + E_{13}Q_{33} + E_{14}Q_{34} \end{aligned}\right\} \quad (12)$$

The second line of weighting coefficients is defined as follows

$$\left.\begin{aligned} Q_{24} &= Q_{42} \\ Q_{23} &= Q_{32} \\ Q_{22} &= E_{23}Q_{23} + E_{24}Q_{24} + \frac{1}{N_{22}^{(1)}} \\ Q_{21} &= E_{12}Q_{22} + E_{13}Q_{23} + E_{14}Q_{24} \end{aligned}\right\} \quad (13)$$

Finally, we get the following formulas for calculating the weight coefficients of the first row

$$\left.\begin{aligned} Q_{14} &= Q_{41} \\ Q_{13} &= Q_{31} \\ Q_{12} &= Q_{21} \\ Q_{11} &= E_{12}Q_{12} + E_{13}Q_{13} + E_{14}Q_{14} + \frac{1}{N_{11}} \end{aligned}\right\} \quad (14)$$

After obtaining the inverse matrix of each successive j-th row, the following formula is used to check it

$$(\sum\nolimits_1 - L_1)Q_{j1} + (\sum\nolimits_2 - L_2)Q_{j2} + ... + (\sum\nolimits_k - L_k)Q_{jk} = 1 \quad (15)$$

It is easy to sum up this formula, the equations of any system of equations for the weighting coefficients [21-24].

All calculations with the Hansen method are performed on small electronic calculators without intermediate records.

References.

1. Большаков В.Д., Гайдаев П.А. Теория математической обработки геодезических измерений. М.,1977.
2. Большаков В.Д., Маркузе Ю.И. Практикум по теорию математической обработке геодезических измерений. М.1984
3. Muborakov X.M., T’ashpulalov S.A., Nazarov B.R. "Oliy geodeziya" darslik TAQI. 2014y
4. Н.В.Яковлев, Н.А. Беспалов и др Практикум по высшей геодезии (Вычислительные работы). — М. Недра. 1982 г.
5. Akhmedov B. M. GEODETIC SURVEY NETWORKS (CREATING LEVEL-HEIGHT GEODETIC SURVEY NETWORKS IN ENGINEERING-GEODETIC RESEARCH FOR CONSTRUCTION) //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 3. – С. 1040-1052.
6. Ibayevich M. Q. Design of Foundations in Extremely Solid Soils //Texas Journal of Agriculture and Biological Sciences. – 2023. – Т. 16. – С. 11-15.
7. Axmedov B. M. et al. Knauf Insulation is Effective Isolation //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 298-302.
8. Ibayevich M. Q. Свайные Фундаменты Сельскохозяйственных Зданий На Засоленных Грунтах //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 10. – С. 290-295.
9. Axmedov B. M. et al. POLIGONOMETRIYA YO‘LINI O‘TKAZISHDA OLINGAN DALA O‘LCHASH NATIJALARINI TENGLASHTIRISH VA UNING PUNKTLARI

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KOORDINATALARINI HISOBLASH //INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING. – 2022. – Т. 1. – №. 8. – С. 234-239.

10. Ibayevich M. K. В ГОРИЗОНТАЛЬНО ЗАГРУЖЕНЫЕ СВАИ В ЗАСОЛЕННЫХ ГРУНТАХ //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 3. – С. 1085-1092.
11. Ахмедов Б. М., ўғли Ёкубов Ш. Ш. КАДАСТР СЁМКАСИНИ БАЖАРИШ УЧУН ТОПОГРАФИК АСОСЛАР //INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING. – 2022. – Т. 1. – №. 8. – С. 287-291.
12. Ibayevich M. K., Qizi E. M. A. Preparation of Maps for Tourist and Recreational Purposes Based on GIS Technologies //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 10. – С. 296-302.
13. Marupov A. A., Ahmedov B. M. General Characteristics of Zones with Special Conditions of use of the Territory //Middle European Scientific Bulletin. – 2021. – Т. 18. – С. 446-451.
14. Abdurakhmanov A. A., Mirzaakhmedov S. S. H. DEVELOPMENT OF MECHANISM FOR CARTOGRAPHIC SUPPORT OF REGIONAL DEVELOPMENT //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 3. – С. 1110-1118.
15. Marupov A., Axmedov B. General characteristics of zones with special conditions for using the territory of the city of Fergana //Збірник наукових праць ΛΌГOΣ. – 2020. – С. 7-10.
16. Abduvakhabovich A. A., Shavkat o‘g‘li S. Y. IMPROVING THE METHOD OF MAPPING AGRICULTURE USING REMOTE SENSING DATA //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 3. – С. 1093-1100.
17. Abbosxonovich M. A., Abduvaxobovich A. A. Measures for the Protection of the Historical and Cultural Heritage of Fergana and the Mode of Monitoring of Cultures with the Help of Geoinformation Systems //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 342-348.
18. Abduraxmonov A. A. et al. DAVLAT YER KADASTRIDA GIS TEXNALOGIYALARIDAN FOYDALANISH //INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING. – 2022. – Т. 1. – №. 8. – С. 228-233.
19. Abduvaxobovich A. A. Methods of Improving Physical and Mechanical Properties of Light Concrete on the Basis of Chemical Additives //Texas Journal of Multidisciplinary Studies. – 2022. – Т. 8. – С. 165-167.
20. Khakimova K. et al. Application of GIS technologies for improving the content of the tourist map of Fergana province, Uzbekistan //E3S Web of Conferences. – EDP Sciences, 2023. – Т. 386.
21. Kamariddinovich O. R. et al. IMPROVING METHODS FOR MAPPING IRRIGATION NETWORKS USING GIS TECHNOLOGIES //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 4. – С. 691-699.
22. Musimovich S. M. et al. THEORETICAL AND PRACTICAL ISSUES IN CREATING POPULATION EMPLOYMENT MAPS USING GIS SOFTWARE //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 3. – С. 1060-1068.
23. Rakhimjonovna K. K. et al. Creation of a database for the compilation of digital land Cadastral maps //Texas Journal of Engineering and Technology. – 2023. – Т. 21. – С. 10-16.
24. Rakhimjonovna K. K., Komiljonovich B. A. The role, importance and role of ecotourism in the development of the state in foreign countries //Texas Journal of Philology, Culture and History. – 2023. – Т. 18. – С. 51-59.