UNDERGROUND TRANSMISSION SYSTEM IN THE SURFACE TOPOGRAPHY OF REFERENCE

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***Abstract**: Depending on job opening mining (horizontal, inclined, vertical) using appropriate methods of breakdown. This paper presents a mechanical method of transmission, using a new procedure for processing the measured quantities in a triangle junction leading to a better accuracy.*

***Keywords:** mining, mechanical method, transmission, proccesing*

1. General Considerations

Mechanical method of transmission of the reference system from the surface through an underground mining job requires a sequence of operations vertical topography, important ones on the surface and underground junction with the reference system to translate the shaft and the free zone of it in the pit ramp. Wiring methods used differ in nature and measured quantities of processing methods. Following are different elements that make up the system and accuracies.

In order to achieve a higher accuracy at the junction connecting the triangle is proposed a process in which all sizes are measured triangle (angles and distances) and processed by the method of least squares.

2. By Measuring Triangles and Distances Junction

2.1. Block resolution version

The note about the triangle ABC are generally measured angles α, β, γ and sides a, b, c (fig.1).

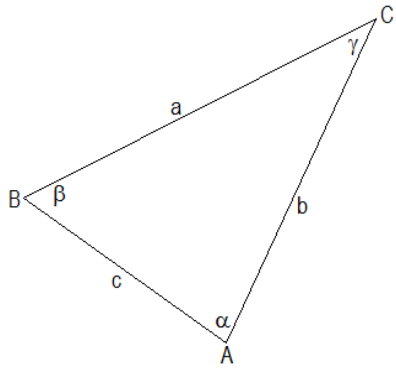

Fig. 1

If we note by $(\alpha), (\beta), (\gamma), (a), (b), (c)$ probable values of measured quantities, we can write the conditions to be met:

$$\frac{(a)}{\sin(\alpha)}=\frac{(b)}{\sin(\beta)}=\frac{(c)}{\sin(\gamma)}$$
$$(\alpha)+(\beta)+(\gamma)=200$$

Or:

$$(a)\sin(\gamma)=(c)\sin(\alpha)$$
$$(b)\sin(\gamma)=(c)\sin(\beta)$$
$$(\alpha)+(\beta)+(\gamma)-200=0$$

The logarithm and differentiation is achieved:

$$v_\alpha+v_\beta+v_\gamma+\omega_1=0\,; \qquad \omega_1''=\alpha+\beta+\gamma-200$$
$$\rho''\frac{v_a}{a}-\rho''\frac{v_c}{c}+ctg\gamma v_\gamma''-ctg\alpha v_\alpha''+\omega_2=0\,; \quad \omega_2''=\frac{\rho''}{M}\frac{a\sin\gamma}{c\sin\alpha}$$
$$\rho''\frac{v_b}{b}-\rho''\frac{v_c}{c}+ctg\gamma v_\gamma-ctg\beta v_\beta+\omega_3=0\,; \quad \omega_3''=\frac{\rho''}{M}\frac{b\sin\gamma}{c\sin\beta}$$
$$M=\log e=0{,}434...$$

He obtained the corrections system of equations whose coefficients with corresponding weights can be written in the following scheme:

$m\cdot m$	p	p'	a	b	c
a	$\left(\frac{m_\alpha}{m_a}\right)^2$	1	0	ρ/a	0
b	$\left(\frac{m_\beta}{m_b}\right)^2$	1	0	0	ρ/b
c	$\left(\frac{m_\gamma}{m_c}\right)^2$	1	0	$-\rho/c$	$-\rho/c$
α	1	1	1	$-ctg\alpha$	0
β	1	1	1	0	$-ctg\beta$
γ	1	1	1	$ctg\gamma$	$ctg\gamma$

It was considered:

$$m_\alpha, m_\beta, m_\gamma=m_a=m_b=m_c$$

because they use a trick: divide error linear m_s to express the angular error and linear error in the unit report:

$$e=\frac{m_a}{m_\alpha}$$

For example:

$$m_\alpha=4''\,;\ m_s=6cm$$
$$e=\frac{6}{4}=1{,}5\,;\ \ \frac{m_s}{e}=\frac{6}{1{,}5}=4 \text{ (in units 1,5 cm).}$$

In this way we have equal weights.

The equations that relate the side condition m_s is expressed also in its unity. The normal equation is:

$$3k_1+(ctg\gamma-ctg\alpha)k_2+(ctg\gamma-ctg\beta)k_3+\omega_1=0$$

$$\left(\frac{\rho^2}{a^2}+\frac{\rho^2}{c^2}+ctg^2\alpha+ctg^2\gamma\right)k_2+\left(\frac{\rho^2}{c^2}+ctg^2\gamma\right)k_3+\omega_2=0$$
$$\left(\frac{\rho^2}{b^2}+\frac{\rho^2}{c^2}+ctg^2\beta+ctg^2\gamma\right)k_3+\omega_3=0$$

It solves the normal equation system is obtained k_1, k_2, k_3 that corrections will be:

$$v_i=\left(a_ik_1+b_ik_2+c_ik_3\right)\quad i=1,2,\ldots,6$$

2.2. Variant of Settlement Groups

The system error equation can be formed groups are two: the first group that included the first equation and the second group included the other two equations.

Therefore:

Groups I-a:

$$v_1+v_2+v_3+\omega_1=0$$

Groups a II-a:

$$-ctg1v_1+ctg3v_3+\frac{\rho''}{a}v_a-\frac{\rho''}{c}v_c+\omega_2=0$$
$$-ctg2v_2+ctg3v_3+\frac{\rho''}{b}v_b-\frac{\rho''}{c}v_c+\omega_3=0$$

The first group obtain corrections:

$$v_1''=-\frac{\omega_1}{3}\ ;\ v_2''=-\frac{\omega_1}{3}\ ;\ v_3''=-\frac{\omega_1}{3}$$

Grupa a II-a transformată este Group a II-a is converted:

$$B_1v_1+B_2v_2+B_3v_3+B_4v_a+B_5v_b+B_6v_c+\omega_D=0$$
$$C_1v_1+C_2v_2+C_3v_3+C_4v_a+C_5v_b+C_6v_c+\omega_C=0$$

the:

$$B_1=-ctg1+\alpha \qquad C_1=0+\beta \qquad \omega_D=\omega_2+\alpha\omega_1$$
$$B_2=0+\alpha \qquad C_2=-ctg2+\beta \qquad \omega_C=\omega_3+\beta\omega_1$$
$$B_3=ctg3+\alpha \qquad C_3=ctg3+\beta$$
$$B_4=\frac{\rho}{a} \qquad C_4=0$$
$$B_5=0 \qquad C_5=\frac{\rho''}{b}$$
$$B_6=-\frac{\rho}{c} \qquad C_6=-\frac{\rho''}{c}$$

the:

$$\alpha=-\frac{[ad]}{[aa]}\ ;\ \beta=-\frac{[ac]}{[aa]}$$

so:

$$\alpha=-\frac{-ctg1+ctg3}{3}\ ;\ \beta=-\frac{ctg2+ctg3}{3}$$

It is noted that the values of the coefficients and free terms simple enough to obtain transformed.

Therefore you can shape:

$$[BB]k_B+[BC]k_C+\omega_D=0$$

$$[BC]k_B + [CC]k_C + \omega_C = 0$$

Related determine further k_D şi k_C and these corrections:

$$v_i'' = B_i k_B + C_i k_C$$

Eventually:

$$v_i = v_i' + v_i''$$

If the sides are different weights of one, so there will:

$$p_a = \left(\frac{m_\alpha}{m_a}\right)^2;\ p_b = \left(\frac{m_\beta}{m_b}\right)^2;\ p_c = \left(\frac{m_\gamma}{m_c}\right)^2$$

$$p_\alpha = p_\beta = p_\gamma = 1$$

When the weights involved in the methodology applied.

For example:

$$m_\alpha = m_\beta = m_\gamma = 5''$$

$$m_a = \pm 1mm;\ m_b = \pm 1mm;\ m_C = \pm 0{,}5mm$$

and:

$$p_a = 25;\ p_b = 25;\ p_c = 100$$

Comments:

In solving the connection problem, presented in two versions, can be used for matrix calculation.

Thus, in the following matrix presents the calculation tool easily programmed for use current computing technology.

Block resolution version

Corrections system of equations is written:

$$B'v = \omega$$

where:

$$B' = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 \\ \frac{\rho}{a} & 0 & -\frac{\rho}{c} & -ctg\alpha & 0 & ctg\gamma \\ 0 & \frac{\rho}{b} & -\frac{\rho}{c} & 0 & -ctg\beta & ctg\gamma \end{pmatrix}$$

$$v = \begin{pmatrix} v_\alpha \\ v_\beta \\ v_\gamma \\ v_a \\ v_b \\ v_c \end{pmatrix};\ \omega = \begin{pmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \end{pmatrix}$$

Denote:

$$Q=\begin{pmatrix} \frac{1}{p_\alpha} & - & - & - & - & - \\ - & \frac{1}{p_\beta} & - & - & - & - \\ - & - & \frac{1}{p_\gamma} & - & - & - \\ - & - & - & \frac{1}{p_a} & - & - \\ - & - & - & - & \frac{1}{p_b} & - \\ - & - & - & - & - & \frac{1}{p_c} \end{pmatrix}$$

or:

$$Q=\begin{pmatrix} 1 & - & - & - & - & - \\ - & 1 & - & - & - & - \\ - & - & 1 & - & - & - \\ - & - & - & \left(\frac{m_a}{m_\alpha}\right)^2 & - & - \\ - & - & - & - & \left(\frac{m_b}{m_\beta}\right)^2 & - \\ - & - & - & - & - & \left(\frac{m_c}{m_\gamma}\right)^2 \end{pmatrix} = p^{-1}$$

And then:

$$K=\left(B'QB\right)^{-1}\omega$$

and:

$$v=QBK$$

To calculate the weight coefficients of the corrections we write:

$$Q_{11}=Q-QB\left(B'QB\right)^{-1}B'Q$$

It is noted that the method is very simple matrix to determine accu-compensated quantities.

Variant of settlement groups

Using matrix calculus is recommended only for solving the system of equations transformed errors. It follows that the correction values are obtained using the above procedure.

The calculation is done after clearing block solving equations of the corrections system.

It said that where errors angles and distances, considered initially, not final check, processing continues at the errors started using weights determined.

3. Conclusions

Junction elements in surface and underground surveying the triangle linking method in which the expected values measured quantities are obtained by methods described provide a coordinated transfer guidelines and increased accuracy. Such precision may also be correlated with the measured quantities to meet the values of the quantities determined initially imposed.

4. References

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