CONTRIBUTION TO SOLVING GEOMETRIC LEVELING UNDERGROUND NETWORKS

Ofelia-Larisa Filip, *Lector Ph.D, University of Petrosani*
Nicolae Dima, *Prof.Ph.D., University of Petrosani*
Ioel Veres, *Assoc. Prof.Ph.D., University of Petrosani*

ABSTRACT: *Processing of measured size in geometric leveling underground networks to obtain their likely values, using the theory of indirect measurements and measurements conditioned. The article introduced a new method of indirect measurements respectively multiple observations*

KEYWORDS*: underground network, leveling, topographic, reference system*

1. THE PURPOSE AND IMPORTANCE OF THE WORK

Showcasing a deposit of useful minerals are require creation of a complex underground mining works opening, training and service provided in the project developed for this purpose.

Leadership in digging such work is possible using appropriate methods of measurement and processing (underground topographic methods).

It works by transmitting topographic reference system surface underground transmission works topographic reference system from one horizon to another, topographic works to achieve topographic base of support in underground works and tracing lifting of penetrations mining particular etc. Given the precision that is required for positioning in space mining works (as designed), topographic execution needed is an absolute priority.

Achieving this goal is achieved by performing a complex topographic high quality works among which an important role geometric leveling networks.

Superior quality is very high accuracy in obtaining determinate, which ensure the proper measurement techniques and processing methods based on the theory of least squares.

2. MAKING GEOMETRIC LEVELING UNDERGROUND NETWORK

We recognize that access to the underground at some horizon is provided by two galleries (G_1 si G_2), and about another skyline is made by two vertical wells (wells blind PO_1 si PO_2) (fig.1).

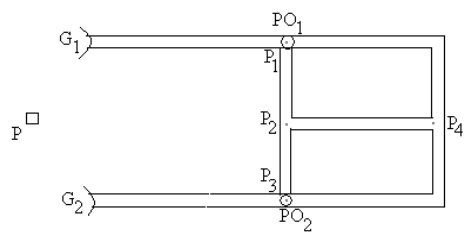

Fig.1

Also admits that galleries near the coast is materialized the absolute point P whose HP is known.

If the wells blind about height between horizons is achieved through mechanical transmission rates, it can be achieved using geometric leveling network nivement geometric paths in the two horizons (fig.2).

It is appreciated that the two adits routes PP_1 and PP_3 (upper horizon) and routes the lower horizon P_1P_2, P_2P_3, P_1P_4, P_2P_4 and P_3P_4.

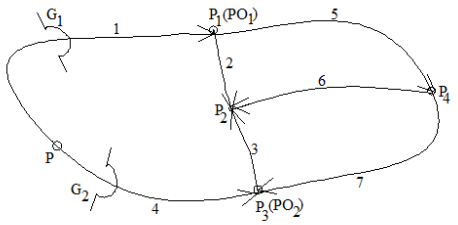

Fig.2

Leveling lines are marked, as shownin fig., with 1, 2, 3,…,7 and directions of increase or decrease in the level differences by arrows.

Level differences mentioned leveling lines is measured using the geometric leveling the middle and with this length leveling lines.

Therefore, the measured sizes are: h_1, h_2,…,h_7 and S_1, S_2,…,S_7. To determine the absolute quotas of points P_1, P_2, P_3, P_4, sizes that measured level differences must be processed in order to obtain their likely values.

In the following presents a processing method according to the probable values are obtained quota points P_1, P_2, P_3, P_4, and the measured level differences.

Leveling network considered in the first stage can be determined Provisional quota values pointsP_1, P_2 and P_3 with relations:

$H_1^0 = H_p + h_1$ at upper horizon
$H_2^0 = (H_1^0) + h_2$ at lower horizon:
(H_1^0) it is H_1^0 submitted (1)
$H_3^0 = H_p + h_4$ at the upper horizon

Denote corrections provisional rates x_1, x_2, x_3. It is specified that the pointsP_1 and P_2 determine at the upper horizon, provisional quotas using measured

level differences h_1 and h_4, which are transmitted to the lower horizon, using size (difference in height between horizons) and get quotas measured points P_1 and P_3 in underground. x_1 si x_3 corrections admit the same for points determined in the upper horizon of the transmitted underground (lower horizon).

If v_1, v_2,…,v_7 are corrections to the measured level differences, their likely values are:

$$\begin{aligned}&(h_1) = h_1 + v_1\\&(h_2) = h_2 + v_2\\&\ldots\ldots\ldots\ldots\ldots\\&(h_7) = h_7 + v_7\end{aligned} \qquad (2)$$

And probable values of shares the points P_1, P_2, P_3 are:

$$\begin{aligned}&H_1 = H_1^0 + x_1\\&H_2 = H_2^0 + x_2\\&\ldots\ldots\ldots\ldots\\&H_3 = H_3^0 + x_3\end{aligned} \qquad (3)$$

With these notations we can form a system of equations consisting of six equations in which:

- four equations corresponding to the measured level differences: h_1, h_2, h_3, h_4;
- two polygons corresponding equations I and II

The shape of the system is:

$$\begin{aligned}&H_1^0 + x_1 - (H_p + h_1) = -v_1\\&H_2^0 + x_2 - (H_1^0 + x_1 + h_2) = -v_2\\&H_3^0 + x_3 - (H_2^0 + x_2 - h_3) = -v_3\\&H_3^0 + x_3 - (H_A + h_4) = -v_4\\&-(h_2) + (h_5) + (h_6) = 0\\&(h_3) - (h_6) + (h_7) = 0\end{aligned} \qquad (4)$$

Where in:

$$\begin{aligned}&(h_2) = h_2 + v_2\\&(h_3) = h_3 + v_3\\&(h_5) = h_5 + v_5\\&(h_6) = h_6 + v_6\\&(h_7) = h_6 + v_6\end{aligned} \qquad (5)$$

System (4) can be written

$$\begin{aligned}&+v_1 \qquad\qquad +x_1 + l_1 = 0\\&+v_2 \qquad +x_2 - x_1 + l_2 = 0\\&+v_3 \quad x_3 - x_2 \quad + l_3 = 0\\&+v_4\ x_3 \qquad\quad + l_4 = 0\\&-v_2 + v_5 + v_6 + \omega_1 = 0\\&v_3 - v_6 + v_7 + \omega_2 = 0\end{aligned} \qquad (6)$$

Where in:

$$\begin{aligned}&l_1 = H_1^0 - (H_p + h_1)\\&l_2 = H_2^0 - (H_1^0 + h_2)\\&l_3 = H_3^0 - (H_2^0 - h_3)\\&l_4 = H_3^0 - (H_A + h_4)\\&\omega_1 = -h_2 + h_5 + h_6\\&\omega_2 = h_3 - h_6 + h_7\end{aligned} \qquad (7)$$

The system of equations (6) corresponds to indirect measurements of multiple observations. Therefore, applying the method, known at this type of measurements, we obtain:

$$\begin{aligned}&S_1K_1 + 0K_2 + 0K_3 + 0K_4 + 0K_5 + 0K_6 + x_1 + 0x_2 + 0x_3 - S_1l_1 = 0\\&0K_1 + S_2K_2 + 0K_3 + 0K_4 + S_2K_5 + 0K_6 - x_1 + x_2 + 0x_3 - S_2l_2 = 0\\&0K_1 + 0K_2 + S_3K_3 + 0K_4 + 0K_5 - S_3K_6 + 0x_1 - x_2 + x_3 - S_3l_3 = 0\\&0K_1 + 0K_2 + 0K_3 + S_4K_4 + 0K_5 + 0K_6 + 0x_1 + 0x_2 + x_3 - S_4l_4 = 0\\&0K_1 + S_2K_2 + 0K_3 + 0K_4 + S^IK_5 + S_6K_6 + 0x_1 + 0x_2 + 0x_3 -\\&-S_2l_2 + S_5l_5 + S_6l_6 = 0\\&0K_1 + 0K_2 - S_3K_3 + 0K_4 - S_6K_5 + S^{II}K_6 + 0x_1 +\\&+0x_2 + 0x_3 + S_3l_3 - S_5l_5 + S_6l_6 = 0\\&K_1 - K_2 + 0K_3 + 0K_4 + 0K_5 + 0K_6 = 0\\&0K_1 + K_2 - K_3 + 0K_4 + 0K_5 + 0K_6 = 0\\&0K_1 + 0K_2 + K_3 + K_4 + 0K_5 + 0K_6 = 0\end{aligned} \qquad (8)$$

By solving the system (8) we obtain:

- corrections x_1, x_2, x_3
- correlates k_1, k_2,…,k_6

Correlates values are calculated corrections v_1, v_2,…,v_7 with relations:

$$v_i = S_i(a_iK_1 + b_iK_2 + \cdots + f_iK_6) \qquad (9)$$
$$i = 1, 2, \ldots, 7$$

Or:

$$\begin{aligned}&v_1 = S_1K_1 \qquad v_4 = S_4K_4\\&v_2 = S_2(K_2 - K_5) \qquad v_5 = S_5K_5\\&v_3 = S_3(K_3 + K_6) \qquad v_6 = S_6(K_5 - K_6)\\&v_7 = S_7K_7\end{aligned} \qquad (10)$$

Finally we obtain:

$$\begin{aligned}&H_1 = H_1^0 + x_1\\&H_2 = H_2^0 + x_2\\&H_3 = H_3^0 + x_3\end{aligned}$$

And: (11)

$(h_i) = h_i + v_i$ for i = 1,2,…,7

3. CONCLUSIONS:

Base topographic leveling underground consists of leveling routes gepmetric existing open and closed horizon or several horizons.

This is a network dependent leveling a point or points known by their absolute quotas existing at the surface.

Considering the role of leveling network made underground mine workings in proper management, measurements made and their processing should lead to values with high accuracy and probably calculated.

This requirement is fulfilled considering the open or closed routes from many horizons form a network of leveling unit and measurement process is based on the theory of least squares.

As a result, such a network, considered in the paper, can be solved using the theory of indirect measurements with multiple observations. It is to determine the benefits of a number of fixed quotas to the two horizons, by their likely values at the same time accurately determining appropriate intervals.

REFERENCES

[1]. Dima N., s.a., *Mining topography*, Corvin Publishing House, Deva, 1998

[2]. Dima N., *The theory of errors and method of least squares*, Universitas Publishing House, Petrosani, 2001

[3]. Filip L., s.a., *Specialised mining topography*, Universitas Publishing House, Petrosani, 2014

[4]. Filip L., *The theory of errors and method of least squares*, Sample Calculation, Petrosani, 2010