

# Coordinate Transformation Program Design base on VBA

LIU Jingjing<sup>1</sup>, YANG Tieli<sup>1,2</sup>, ZHANG Min<sup>1</sup>, ZHAO Aina<sup>1</sup>, PAN Shu<sup>1</sup>

<sup>1</sup>School of civil engineering, University of Science and Technology Liaoning, Anshan, CHINA

<sup>2</sup>China Academy of Surveying and Mapping, Beijing, China

**Abstract:** The transformation between construction coordinate system and national unified coordinate is always needed in engineering surveying. According to different cases, there is not only the application of coordinate transformation model of the same type of plane coordinate system but also the model under different types of reference coordinate in the process of the coordinate transformation. In addition, the precision evaluation of coordinate transformation is an important factor, and is the key to affect if the result can be used. This paper analyzes the precision of coordinate transformation, implement the precision evaluation of coordinate transformation rely on software, research the problem of positioning which solved by conversion program when the observed value or known result is false.

**Keywords:** Engineering surveying; Coordinate transformation; Precision evaluation

## 1. Introduction

In the actual measurement, because of the economic conditions and environmental conditions, the measurement workers in the selection of the coordinate system will often choose the most practical coordinate system for the actual situation, which puts forward the new requirements for the software, the need for data processing, coordinate conversion. The accuracy of the conversion work is an extremely important factor, which is the key to the normal use of the results.

Firstly, this paper describes the theory of coordinate system conversion, based on the existing functions of Excel to develop two times, the use of Excel embedded VBA language development coordinate conversion and precision evaluation method.

## 2. Purpose and Significance of Research

Through the program to reduce the complexity of manual calculation, greatly save the manpower and material resources, improve the efficiency of calculation, shorten the time.

Although there are a lot of similar functions of the software, but there are some defects, for example, the software only gives the final results, the lack of accuracy assessment, will affect the measurement project quality, causing damage. This project aims to design a set of procedures with accuracy evaluation function, which helps the staff to find errors in time and correct, and reduce the loss of the project.

The theoretical method of coordinate system conversion: Gauss set the coordinates of each point are known (Xi, Yi), assumed coordinates (Xi', Yi'), according to the Helmert method to establish the formula.

$$\begin{bmatrix} X_i \\ Y_i \end{bmatrix} = \begin{bmatrix} p \\ q \end{bmatrix} + \begin{bmatrix} a & -b \\ b & a \end{bmatrix} \begin{bmatrix} X'_i \\ Y'_i \end{bmatrix} \tag{1}$$

$$\begin{bmatrix} V_{x_i} \\ V_{y_i} \end{bmatrix} = \begin{bmatrix} p \\ q \end{bmatrix} + \begin{bmatrix} a & -b \\ b & a \end{bmatrix} \begin{bmatrix} X'_i \\ Y'_i \end{bmatrix} - \begin{bmatrix} X_i \\ Y_i \end{bmatrix}$$

According to the least square principle, that is

$$\Phi = [V_x V_x] + [V_y V_y] = \min \tag{2}$$

The diameter of p, q, a, b first-order partial derivative is zero, the simultaneous solution well equation, calculate the parameters of p, q, a, b.

$$p = ([X] - [X']a + [Y']b) / n \tag{3}$$

$$q = ([Y] - [Y']a + [X']b) / n$$

$$a = \frac{n[X'X + Y'Y] - [X']([X] - [Y'])[Y]}{n[X'^2 + Y'^2] - [X']^2 - [Y']^2} \tag{4}$$

$$b = \frac{n[X'Y + Y'X] + [Y']([X] - [X'])[Y]}{n[X'^2 + Y'^2] - [X']^2 - [Y']^2}$$

(p, q), the site coordinates, according to the formula to find out the residual error

According to the following formula, the error M0, My, and Mx are derived.



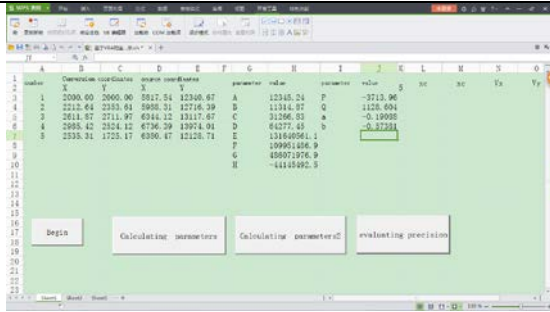


Figure 5. The result of run window

In order to verify the correctness of the design process, in this reference by the Kong Xiangyuan editor, Wuhan University Press published in 2001, "the foundation of the land survey" (hereinafter referred to as the "reference book") in a Book of the original data. Based on the reference book 15-5, the results obtained from the calculation of the program and the reference books in the print output data were compared, and the difference. The results are summarized as table.

Table 1 shows that it is feasible to realize coordinate conversion calculation by VBA Excel programming. The precision can meet the requirements of production practice.

**6. Conclusion**

In this paper, the process of the conversion of the coordinate is realized by using VBA Excel technology. Through the software development, the following conclusions are drawn:

- 1) it is feasible and efficient to carry out the solution of coordinate transformation based on VBA Excel.
- 2) select Excel as the development platform has the following advantages:
  - (1) the development cycle is short: it can be carried out on the existing functions of Excel two times, convenient and fast;
  - (2) a broad operating environment: almost all the computer has been installed Excel, which is based on VBA Excel programming to provide a broad environment support;

(3) operation is simple and easy to master: users have already had some experience with Excel, on this platform two development, easy to master;

(4) development of Surveying and mapping industry, "Excel Geomatics".

VBA is a powerful Excel development tool for the user to provide the VBA, you can create your own menu and toolbar through, custom mapping industry Excel Geomatics".

**7. Acknowledgment**

Thanks for the University student research training program from University of Science and Technology Liaoning.

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