Automation of data processing processes

A E Dudnik*, O V Germak, G K Tupoleva
Don State Technical University, 1, Gagarin sq., Rostov-on-Don, 344010, Russia
E-mail: nasty777@bk.ru

Abstract. The article describes the process of automated data processing. The examples of actual programs that are in demand for geodetic data applicable in the construction industry. In an experimental part of the paper provides a comparison of models reflectorless total station (BET), automating.

Introduction
Long since the geodesy was applied in various areas of activity of the person: division of the land plots, construction, tracing of cards and many others. Since then the main objectives of this science remained almost the same, and here geodetic tools underwent significant changes. Practically on any modern building site the place of honor is taken by the professional surveyor, his powerful computer and the special program, and often and not one. The purpose of this work is the analysis of the choice of the software of automation of the processing of geodetic information. Cameral processing of results of geodetic measurements is one of the most important parts of the process of receiving the digital model of the area. At the cameral processing of results of measurements of surveys, the volume becomes very big. It is connected with specifics of these works - high precision demands special methods both carrying out actually measurements and cameral processing of their results. It gives rise for itself to certain problems which treat:

1. Prevention of mistakes at information processing;
2. A long time of the processing because of its large volume.

But as a contractor is a person, it is impossible to guarantee a lack of mistakes completely. Application of special computer program results, in big benefit in time, and gives security from human mistakes. However, for rational use, it is necessary to choose the most suitable software.

Goal, tasks, methods of study
With the advent of the automated geodesic process there is a need in applications in which calculations are performed and processing of field measurements.

All programs can be classified into two types:
1. General Use;
2. Specialized.

The development of automation of processes of processing of survey data
Public programs are a rather primitive system. Microsoft Excel spreadsheets are a typical example of a public utility program.

With Excel perform the following types of computing work:
- calculate the direct and inverse geodesic problem;
- determine the volume and area of land;
- processing theodolite and kneeling moves;
- determination of deviations from the design planes.

These programs are useful for small amounts of data and simple calculations. In addition, they are suitable for predvaritelnyy data processing.

The advantages of the programs for General use can be attributed to their prevalence and easy to understand.

The disadvantage is the need to know the methods and formulas of data processing, as well as the need to adjust the calculation sheets (a set of formulas in the tables) when changing the amount of information processed.

When processing a large amount of data, it is necessary to use specialized programs.

Such programs are used in a wide range of tasks of geodetic production.

There are both standard and individuals.

Under individual programs mean their single production for special types of work, developed for individual organizations or projects.

As a rule, standard programs present a set of templates with a certain sequence of actions. When using standard programs, knowledge of processing technology is not required, you only need to follow the established procedure for the successful solution of the task.

As an example of such programs, we can cite the software package "Credo", as once one of the most popular software solutions.

All CREDO modules use a single set of data, as each module of the complex is involved in a single process.

Module Credo-dat created specifically to automate the processing and computing operations traverse and move polygonometry, their adjustment, the design of tachometric surveys.

The Credo-level module and, accordingly, Credo-calculation of deformations are used for high-altitude observations of sedimentary deformations of the foundations of structures, determination of elevations and processing of leveling passages.

At the performance of numerous engineering surveys with the purpose of creating a DTM (digital terrain model), the production of topographic maps, the linear survey used Credo-Credo topo plan or linear surveys.

Credo-transcoder, Credo-GNSS, Credo-dat professional are used for the formation of state reference, survey and center networks for the conversion of geocentric spatial, geodetic rectangular coordinates.

Unit Credo-volumes are used for work related to the movement of the earth (building, landscape works)

This ensures the continuity of the process of processing research and design. However, all modules of the complex are a separate software unit and can be used separately.

AutoCAD software products are universal platforms for automation of design, construction, drawing. now gaining popularity using AutoCAD Civil 3D program — a program based on the AutoCAD platform and designed for land surveyors, General plan designers, designers of linear structures.

A key feature of the program is the intelligent communication between objects, allowing you to dynamically update all related objects when changes are made to the results of research or design decisions.

Thanks to features such as field data transmission, calculations, and automated drawing, AutoCAD Civil 3D tools optimize all processes associated with the construction of engineering structures. AutoCAD Civil 3D combines the entire cycle of design work — from geodetic surveys to the construction of the object.

Surface models in Civil 3D support dynamic relationships with source data such as contours, feature lines, corridor models, and grading objects. The formed surface is used to display contours, catchment areas, flow directions, slope and elevation analysis results. It is completely ready for visualization.
The surface is used as the basis for longitudinal and transverse profiles, grading plans, and corridors. Any changes to the source data result in automatic updates to surfaces and related elements of the project.

Building information modeling is an integrated approach to the construction, equipment, maintenance, and repair, which involves the collection and processing in the design process of all architectural, technological, economic and other information and documentation about the building with all its relationships and dependencies. Access to this 3D model of the building is available to all professionals involved in the construction.

BIM has a huge number of advantages:
1) Allows you to conduct several parallel works at the same time: to prepare documents, to conduct research, to make calculations
2) Significantly reduce the time for data processing and collection
3) Automatically calculates the number of materials needed for building construction.
4) When adjusting, there is no need to make changes to the entire project and completely redo the documents.

Experimental part

For the processing of spatially distributed data, it is advisable to use tools that can perform multidimensional analysis and geospatial modeling. In this case, the tools that provide spatial interpretation and visual visualization of terrain objects for a more realistic representation of their mutual position become essential. The obtained results can be used as an additional source of knowledge for information support of design and survey, architectural and planning and engineering-geodetic works performed in Russia.

Currently, modern methods and tools for three-dimensional modeling and analysis of geospatial data obtained by ground methods are becoming more and more widespread. In engineering-geodesic and surveying practice it became possible thanks to the development of software and hardware systems and the use of modern measurement and computer technology. Three-dimensional laser scanners are ideal instruments for determining the geometric parameters of terrain objects. Such devices allow accelerating the process of measurement and data acquisition to create three-dimensional digital models of objects, as well as the situation and terrain. However, at present, despite the active development of a laser location, this technology is still expensive and requires a high qualification of specialists.

At the same time, there were a number of models of non-reflective electronic total stations (BET), significantly automating the processes of collecting GEODATA compared to conventional electronic total stations. Technical characteristics of modern BET models allow in some cases to use them instead of expensive 3D scanners.

It is advisable to perform measurements with the help of BET in the mode of rectangular coordinates to obtain data ready for transfer to the 3D modeling system. For further processing of the received data and performance of 3D modeling, it is offered to use the special software intended for 3D scanners.

The greatest effect in three-dimensional modeling and visualization of objects is achieved with the help of Cyclone software company Leica Geosystems. The Cyclone program is designed to work with a huge number of points, that is, with a cloud of points obtained by a laser scanner. In some cases, such a set of points is redundant, so with the help of BET can be obtained only the necessary data, which is easy to interpret in Cyclone.

Three-dimensional object models presented in Cyclone can be exported to external AutoCAD computer-aided design systems. To create more realistic spatial data, export it to ArcGIS and then present it in AicScene.

Thus, the following method of processing geospatial data obtained using non-reflective electronic total stations is proposed
1. Measurements using BET in the rectangular coordinate mode,
2. data Transfer from the electronic total station to PC,
3. Importing data into the software Cyclone,
4. Creating 3D models in Cyclone,
5. Export 3D models from Cyclone to ArcGIS,
6. Visualization of the 3D project in AicScene.

This technique can be used for shooting, for example, facades of buildings and structures, 3D modeling and analysis of the geometric parameters of the terrain.

**Summary**

In conclusion, it is necessary to pay attention to such an important aspect of a problem as pluses and minuses of automation. Automation allows increasing multiple efficiencies of processing of results of geodetic measurements due to an increase in the speed of their realization, and many times over to reduce the probability of emergence of mistakes in the course of camera processing. Therefore automation, at first sight, seems almost absolute benefit which needs to be applied anywhere and everywhere. The technology of receiving the required results in common is automated almost to a limit – shooting of the area, the record of results, performing cameral works is automatic, with a minimum participation of the person. Therefore there is normal such a situation at which the contractor doesn’t understand a substance of what he does but only well and legibly knows an algorithm of the actions which are subject to the realization from its party. It is necessary to pay attention to the danger of this approach. The risk of obtaining the irregular result increases in the absence of comprehension of the essence of work as the performer. In this case, it is necessary to differentiate the scopes of these or those automation equipment depending on solvable tasks. In general automation of processing of results of geodetic measurements is necessary for various areas, the bound to geodesy. Prerequisites to it are automation equipment depending on solvable tasks.

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