3D CAVE MODEL WITH SPARSE DATA

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I. INTRODUCTION

Speleology is the science that studies caves. Currently, with the development and reduction of the cost of technology, an integral component of speleology is rapidly developing - topographic survey of caves, which involves determining the shape and size of the cave. The data collected in caves using various instruments (for example: compass, eclimeter, laser rangefinders) must be processed and visualized. This requires the appropriate programs. One of such programs is Topo [1].

Topo software allows you to process, edit and visualize the topographic data of the cave. An integral part of the visualization of the topographic survey of the cave is the display of its volumetric model. The volumetric model of a cave is needed to visualize it, to document the caves and to calculate such characteristics of the cave as length, surface area and volume. In addition, with the help of a volumetric model, it is possible to outline the most promising places for further research and search for the continuation of the cave.

The aim of this work is to construct a three-dimensional surface of a cave in conditions of sparse data within the Topo program.

II. FORMULATION OF THE PROBLEM

The sparseness of the data means that intelligent algorithms are needed to process them and build on their basis the surface of the cave, which fill the "void". Without the use of such algorithms, an insufficiently visual representation of the cave is obtained, "twists" and sharp corners appear. The algorithm in the Topo program has these drawbacks. The algorithm is based on stitching polygons of adjacent pickets, which are obtained by traversing the shot points clockwise.

It is necessary to create and implement an algorithm for constructing a smooth three-dimensional cave model in conditions of sparse data.

III. ALGORITHM FOR CONSTRUCTING A 3D CAVE MODEL WITH SPARSE DATA

The idea of the algorithm is as follows. First, the thread of the curve of the cave is smoothed out [2,3]. Then the shots are projected onto the normal plane of the resulting curve. After that, a normal vector is introduced on a smooth curve, which allows the connection of the coordinate systems from one section to another. Further, the interpolation of sections between pickets is carried out [4]. By sewing adjacent sections, the surface of the cave is obtained.

IV. IMPLEMENTATION OF THE ALGORITHM WITHIN THE TOPO PROGRAM

Within the Topo program, the algorithm was implemented as a separate software module written in the C++ programming language. The input to the module is picket points with coordinates of shot points to neighboring pickets and coordinates of shots from pickets directly to the surface of the cave. The output is an array of polygons, which is directly used to display the cave model.

V. CONCLUSIONS

The paper presents the results of the algorithm and carries out an analysis in comparison with the algorithm already available in the Topo program.

REFERENCES

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