AN ISOLINE RENDERING METHOD UNDER MULTIPLE CONSTRAINTS

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The isoline graph is one of the most important maps and it has been widely used in engineering and technique field，such as exploration development，mining，geology，physical，geography, and so on. In geological field, the isoline map should reflect the fault, the ridge line, scarp, island area, research area boundary and other special factors, so these factors are usually the constraint conditions for isoline generation.

This paper mainly focuses on the isoline rendering method under the above constraint conditions. This method traces isolines based on TIN (Triangulated Irregular Networks), in which main steps include TIN's constructing, constraint factor's adding, isoline tracing, isoline smoothing and isoline map filling.

The algorithm first triangulates the boundary of sample data using delaunay triangulation rules, it constructs the convex hull, and connects one arbitrary vertex to all others, then insert the other sites one after the other. In order to get smooth isoline map, this algorithm will subdivide the TIN constructed by original data in the area where the TIN is sparse. When building the initial TIN, the area of every triangle is recorded. By setting up a threshold value based on the area of each triangle, the triangles which area is larger than the threshold, are subdivided. In this work, it divides a triangle into 9 equal triangles, using thin spline interpolation method to obtain the unknown points value. The neighbor points surrounding the triangle that are subdivided, are used to interpolate.

In order to integrate the constraint factors into the triangulation, this paper proposes a general algorithm of triangulation with constrained data. First, it forms a new TIN by inserting the points of the constraint factors into triangulation networks. Then it links the

points of the constraint factors in counterclockwise order and judges the relationship between constraint edge and triangulation. Assuming that the constraint factors is a fault that is a polygon, then it uses a clipping algorithm to clip the inner part of the constraint factors and judge how many edges intersect with each edge of the constraint factors edge. If the number of intersect point is 0, then the outer of constraint factors edge is remained, if the number of intersect point is 1, then use this point to subdivide the outer triangle into 2 parts, If the number of intersect point is larger than 1, then continue to subdivide the outer part so as to keep triangulation network.

After the isolines' tracing, we use Bezier method to handle the smooth problem of the isoline when rendering and the self-intersection of isolines are avoided.

A new method that can automatically store the isolines topological relationship is also discussed in this paper. The topologic relationship between boundary lines and isolines can be stored in a binary tree structure. Such topologic structure can display the relationship of linking and closing between boundary lines and unclosed isolines, the nesting among closed isolines in the order of tree rings. It is successfully applied in visualization and automatic mapping of submarine topographic data observed by multibeam, and it overcomes the insufficiency of contour mapping produced by common algorithm, especially conquers the inconsistency between color blocks and contours produced by mapping software for multibeam post-processing.

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