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An Algorithm for Searching Boundary Octants in 3D Geological Subsurface Modeling

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Abstract

In geological subsurface modeling, large quantities of data are usually involved, which require extensive efforts to process using traditional methods. In addition, 3D representations and spatial operations are essential for computerised processing. With the recent advance in Geographic Information Systems (GIS) and computer technology, a wide range of spatial analysis and processing procedures for geological subsurface modeling are expected to be improved if 2D and 2.5D GIS functions are to be extended to handle 3D objects such as subsurface layers.

This paper gives a brief description of a 3D system for modeling geological subsurface information developed at the Department of Geomatics Engineering, The University of Calgary. In this system, an octree data structure is employed to model 3D information due to its efficiency in Boolean operations, compactness in storing data and capability of intelligent data access. Surface representations are used for visualisation purposes. An algorithm for searching neighbour octants encoded by Peano keys is presented. Instead of dividing large octants into smallest ones at the bottom level, it finds neighbour octants of both the same size and different sizes based on original octants at all levels. In particular, large octants which are partially covered by other smaller octants can be found.

The system has been developed on a Silicon Graphics Workstation and based on the GL (Graphics Library) and "C" programming language.