

Real-time rendering closure method for continuous cutting of multi-level TIN geological models

Junjie Yang^{1,2}, Cuiying Zhou^{1,2,*}, Zhen Liu^{1,2*}, Liang Zeng^{1,2}

1 School of Civil Engineering, Sun Yat-sen University, No.135 XinGangXiLu, Guangzhou 510275, China

2 Guangdong Engineering Research Centre for Major Infrastructure Safety, Guangzhou 510275, China

* Correspondence: zhoucy@mail.sysu.edu.cn; liuzh8@mail.sysu.edu.cn

Abstract: The creation of a three-dimensional geological model, the successful completion of the cutting of the model, and the display of the section information in real time is of great significance for digital and visual analyses in geotechnical engineering. When employing commonly used 3D software for model cutting, the numerous formatting requirements of the model affect the reliability of the cutting; therefore, there is still room for improvement in terms of efficiency and accuracy. Today's mainstream cutting algorithms, such as the face-to-face intersection or spatial blanking, have certain limitations. These include the huge amount of computing and complex testing, which affect the real-time performance of the cutting. Regarding the above issues and based on the principle of generating a multi-level TIN model, of continuous cutting of the model, and of the real-time rendering closure of the model section, this paper proposes a real-time rendering closure method for the continuous cutting of a multi-level TIN model. This method can eliminate the complex process of calculating the intersection points and intersection lines in spatial geometry, thereby improving the real-time performance of the cutting. At the same time, this method can achieve the real-time rendering of a closed section in the hollow model to solve problems, such as the display of the hollow sections through a visual analysis of a multi-level TIN geological model, and to improve the accuracy of the cutting results. This method is then applied to an actual project in South China, and through a comparative analysis, as well as an analysis on the rationality, reliability, and the real-time performance of the related methods, the results are positive. This method can provide effective support for the visual analysis tasks of similar modeling and rendering processes, such as smart mines, oil and gas resource distribution, and the internal visualization analysis of mechanical parts.

Key words: TIN model; OpenGL; model section; Three.js; Stencil Test