

A New Method for 3D Cadastral Parcel Merging Based on Conformal Geometry Algebra

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SUMMARY

With the development of urbanization, conflicts between the demand for land due to urban expansion and the limitation of land resources contribute to the appearance of complex buildings below and above land surface. Traditional 2D cadastre has encountered great challenge in registering overlapping and interlocking constructions in the urban area. There is no doubt that developing 3D cadaster could resolve the problems in registering and managing objects with complex structures more efficiently. Much research has been carried out on the development of 3D cadaster in recent years, which is conducive to the implementation of 3D cadastral management. However, since Euclidean geometry lacks consistency in unified representation form for cadastral objects with different dimensions, traditional cadastral data models based on Euclidean geometry represent dimensional cadastral objects in a rather different way. Due to the dimensional isolation characteristics of Euclidean geometry, representation and management of 3D cadastral objects are more complex than 2D cadastral objects, thus hindering implementation of 3D cadastral objects management and updating. In order to represent cadastral objects with different dimensions in a unified multidimensional manner, Conformal Geometry Algebra (CGA) is introduced in this paper. As the hierarchical Grassmann structure corresponding to the hierarchical structure of dimensions in CGA, cadastral objects in different dimensions can be expressed in a unified form with outer product. Different dimensional objects can be organized and stored by the multivector structure in a multidimensional unified way in CGA. The advantages of CGA in multidimensional expression are used to construct a new cadastral data model which is introduced briefly in this paper to represent multidimensional objects in a unified form. Since 3D cadastral objects spatial updating is important in 3D cadastral management, operators based on CGA are developed to realize 3D cadastral objects' spatial merging in a symbolic way. The method for 3D cadastral spatial parcel merging based on CGA operators is analyzed in detailed in this paper. Case studies have been carried out to elevate the new method for 3D cadastral objects' updating. Results show that our method can merge

spatial objects in a more symbolic and geometry-oriented way compared with the traditional way based on Euclidean geometry.

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