Data Transport and Enhancement

TechniGraphics Inc (TechniGraphics) has developed a flexible process for automated conversion of 2D and 2.5D geospatial structure data, such as buildings, into 3D solid CAD models. The purpose of this conversion is twofold. Firstly, to allow realistic structural analysis of how such structures behave in adverse conditions, either as a result of impact from munitions/explosive devices or during natural disaster, and secondly to provide a platform for advanced simulation of human and vehicle movement through 3D environments. Key to success is definition of the implicit 3D topology from the geospatial data, and passing on of these features to the CAD software in such a way that the features are recognised as true solids. Current R&D focuses on how to migrate this process from proprietary GIS and CAD transport formats to the OGC CityGML 1.0 standard.

Approximate Modelling

The source information typically comprises only a building footprint and height for each structure, along with an attribute identifying its general use. Once imported into transport format the structures are automatically populated with appropriate materials and methods of construction as per a set of predefined rules appropriate for each building/structure type. For instance, a building classified as a 'North American school, brick, pre-1980' is divided into the appropriate number of floors for its measured height and given a brick exterior with realistically spaced windows. The interior construction will include concrete slab floors, metal studs at 16" spacing, sheet-rock dividing walls, and so on. The completed 3D-model is thus representative of how the building is most probably constructed, although it will not perfectly match the real construction details. Such modelling is appropriate for structural analysis and simulation of movement around the exterior of the facility. Should more detailed information be available regarding the construction details, be that information on paper or in 2D or 3D CAD, it is easily assimilated into the model using tried and proven automated and semi-automated techniques that form the mainstay of TechniGraphics business.

CityGML

One of the uses for this data is simulation of how structures respond to the application of external force, be this the result of earthquake, tsunami, strong wind or blast. TechniGraphics is currently using the Application Domain Extensions (ADE) of CityGML 1.0 to store Finite Element Meshes and/or eight-node grids and structural properties of each element in these structures so that they can be exposed in a modelling environment to these external forces. OGC standards have facilitated the transport of data between major software platforms for this project. However, the key value lies in the specific flexibility of the ADEs for CityGML 1.0, which allow ease of import of less common data types into very specialised software.

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