Parameterized FEA Model Generation and Simulation of Underground Structures Based on BIM: A Case Study

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ABSTRACT

Building information modeling (BIM) and finite element analysis (FEA) are widely used technologies for underground structure design; however, they failed to coordinate work well. Currently, existing BIM-to-FEA model conversion methods have a coarse conversion effect and a narrow scope of application. They do not consider the variational working conditions in the construction of underground structures, and thus can hardly be used in the simulations. To address this problem, this research proposes a semi-automatic BIM-to-FEA conversion method for construction simulation of underground structures based on Revit Dynamo and OpenSees software. The method is realized in three steps. Firstly, typical subway stations are selected as the research objects, and the parameterized BIM models are established. Secondly, based on Dynamo visual programming and tool command language (TCL) scripts, a BIM-to-FEA semi-automatic conversion method is formed to carry out FEA calculation. Finally, the method is extended for construction simulation. Based on the BIM model of the station's enveloping structure, an FEA model of diaphragm wall with multiple working conditions is automatically generated, and the structural simulation of the open-cut excavation process is conducted. This method provides an automatic BIM-to-FEA conversion way that can efficiently generate FEA construction simulation models with various working conditions, and realizes a time-saving construction simulation framework based on BIM technology.