

## Elemental Graph Data Model: A Semantic and Topological Representation of Building Elements

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**Abstract :** With the rapid increase of complexity in the building industry, professionals in the A/E/C industry were forced to adopt Building Information Modeling (BIM) in order to enhance the communication between the different project stakeholders throughout the project life cycle and create a semantic object-oriented building model that can support geometric-topological analysis of building elements during design and construction. This paper presents a model that extracts topological relationships and geometrical properties of building elements from an existing fully designed BIM, and maps this information into a directed acyclic Elemental Graph Data Model (EGDM). The model incorporates BIM-based search algorithms for automatic deduction of geometrical data and topological relationships for each building element type. Using graph search algorithms, such as Depth First Search (DFS) and topological sortings, all possible construction sequences can be generated and compared against production and construction rules to generate an optimized construction sequence and its associated schedule. The model is implemented in a C# platform.

**Keywords :** building information modeling (BIM), elemental graph data model (EGDM), geometric and topological data models, graph theory

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