

Topic 12 :

Storing B-Rep Geometry in an Object-Relational Database

Background

In a current research project we are developing a 3D Spatial Query Language for Building Information Models. The language includes metric, topological and directional operators. The implementation of the language shall be based on the declarative query language SQL. The latest version of the standard, SQL:1999, extends the relational model by object-oriented features, such as Abstract Data Types (ADTs) that may even offer user-defined methods. Database systems that support this standard are called object-relational database management systems (ORDBMS).

In standard CAD applications the geometry of building components is usually modelled by a boundary representation (B-Rep) description. In its most basic form, a B-Rep model consists of vertices, edges and faces, as well as the adjacency relations between these items. Over the years more expressive and highly optimized B-Rep data structures, such as the Half-Edge, the Winged-Edge and the Radial-Edge model have been developed. The ACIS modeller is a very powerful BRep-based geometry kernel that uses an Radial-Edge data structure and is integrated in a broad variety of CAD applications, such as AutoCAD™ and CATIA™.

Task

Develop a suitable object-relational database schema that allows to store B-Rep geometry in an object-relational database. Write a program that reads in an ACIS file (SAT file) using the ACIS library and stores the geometry information in the database by means of SQL declarations. To validate the chosen database schema, write another program that retrieves the geometry from the database by using SQL statements and writes a SAT file to disk. The input file and the output file should be identical.

In a first step, only objects with plane surfaces have to be considered.

Realization

The realization is done in the following steps:

- Study literature about B-Rep data structures
- Study literature about object-relational databases
- Develop an object-relational database schema
- Implement the schema in an Oracle 10g database
- Write a SAT file reader that stores the geometry in the database
- Write a SAT file writer that retrieves the geometry from the database

Prerequisites

- experiences of object-oriented programming using C++
- basic knowledge of databases and the query language SQL

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