

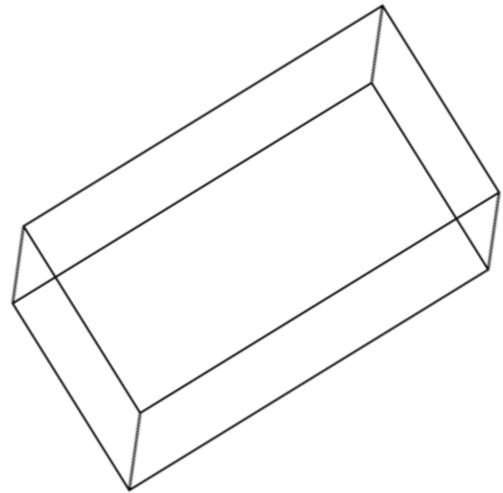
6. Exercise: Geometric Modeling

1. Geometry Data

A cuboid and its position in space can be defined in different ways, e.g.

- by its 8 vertexes and their connection,
- by its 12 edges and their connection,
- by its 6 faces and their connection, or
- by its 3 dimensions (width, length, height) and a translation and rotation.

What could be according data structures and which of these would cause the least amount of redundancy?



2. Geometric Modeling Methods

A simple house (cube as base, pyramid as roof) at some random position in space has to be described by the following geometrical modeling methods:

- Wire-frames
- CSG
 - with primitives cuboid, pyramid
 - with primitive cuboid only
- Triangle meshes
- B-Rep
 - with basic topology (faces, edges, vertexes)
 - with sweeping and CSG

What are the necessary data structures (schema) and data to describe the geometry? Discuss advantages and disadvantages of each of these models/representations?

3. B-Rep

Explain the term “semantically rich model” by comparing B-REP to Triangle Mesh modeling!

4. What is described in the following simple COLLADA file [Marcus Barnes: What is COLLADA? collada.org]. What kind of modeling technique is used? How is XML used to describe the geometry and topology?

```
<library type="GEOMETRY">
  <geometry name="what's that?">
    <mesh>
      <source id="what-Pos">
        <array id="what-Position-array" type="float"
              count="24">
          -0.5 0.5 0.5
          0.5 0.5 0.5
          -0.5 -0.5 0.5
          0.5 -0.5 0.5
          -0.5 0.5 -0.5
          0.5 0.5 -0.5
          -0.5 -0.5 -0.5
          0.5 -0.5 -0.5
        </array>
        <technique profile="COMMON">
          <accessor source="#what-Position-array"
                  count="8" stride="3">
            <param name="X" type="float" />
            <param name="Y" type="float" />
            <param name="Z" type="float" />
          </accessor>
        </technique>
      </source>
      <vertices id="what-Vtx">
        <input semantic="POSITION" source="#what-Pos"/>
      </vertices>
      <polygons count="6" material="#Blue">
        <input semantic="VERTEX" source="#what-Vtx"/>
        <p>0 2 3 1</p>
        <p>0 1 5 4</p>
        <p>6 7 3 2</p>
        <p>0 4 6 2</p>
        <p>3 7 5 1</p>
        <p>5 7 6 4</p>
      </polygons>
    </mesh>
  </geometry>
```