

Review of Object Representations

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Object Rep Considerations

◆ **Accuracy**

- How well does the representation approximate the object?

◆ **Computational Efficiency**

- How quickly can we generate images from the representation?
- How quickly can we compute intersections with the rep?

◆ **Storage Efficiency**

- How much data is required to store the representation?

◆ **Construction Efficiency**

- How easy is it to construct the representation from available input data?

Object Rep Overview

◆ **Boundary representations**

- Polygonal meshes
- Parametric surfaces
- Subdivision surfaces
- Algebraic surfaces

◆ **Solid representations**

- Voxels
- Octrees
- BSP trees
- Constructive solid geometry

◆ **Composite representations**

- Scene graphs

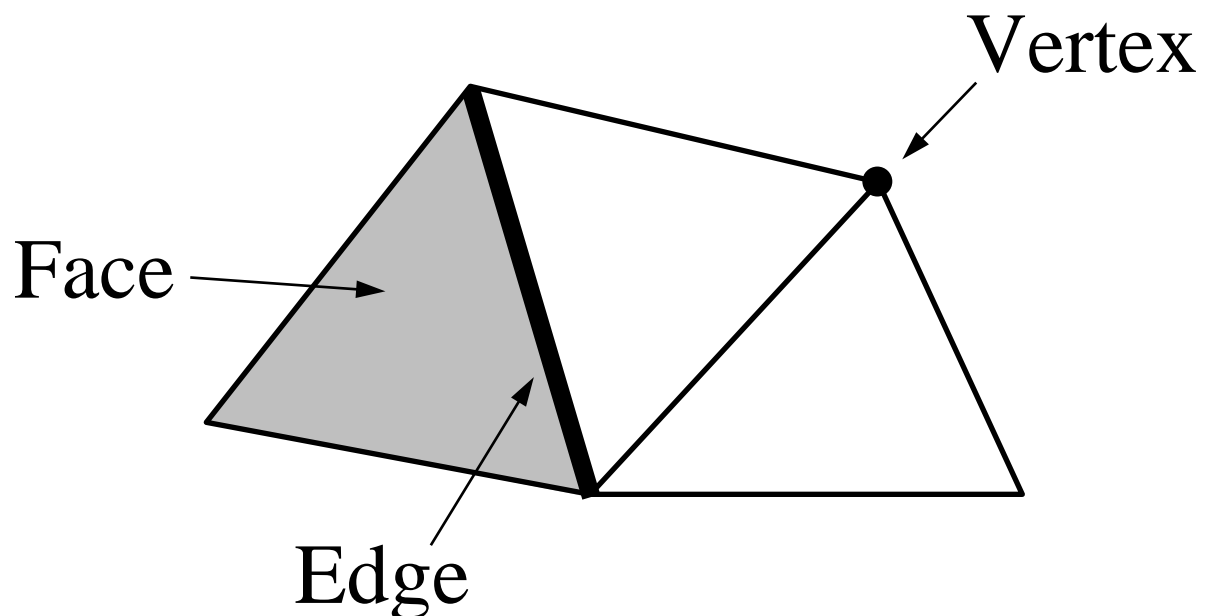
Boundary Representations

◆ Polygonal Meshes:

- + Fast rendering
- Approximate curved surfaces

◆ Mesh Descriptions

- Vertex and Face tables
- Triangle strips
- Adjacency lists
- Winged-edge
- Multiresolution



Boundary Representations

◆ Parametric Surfaces:

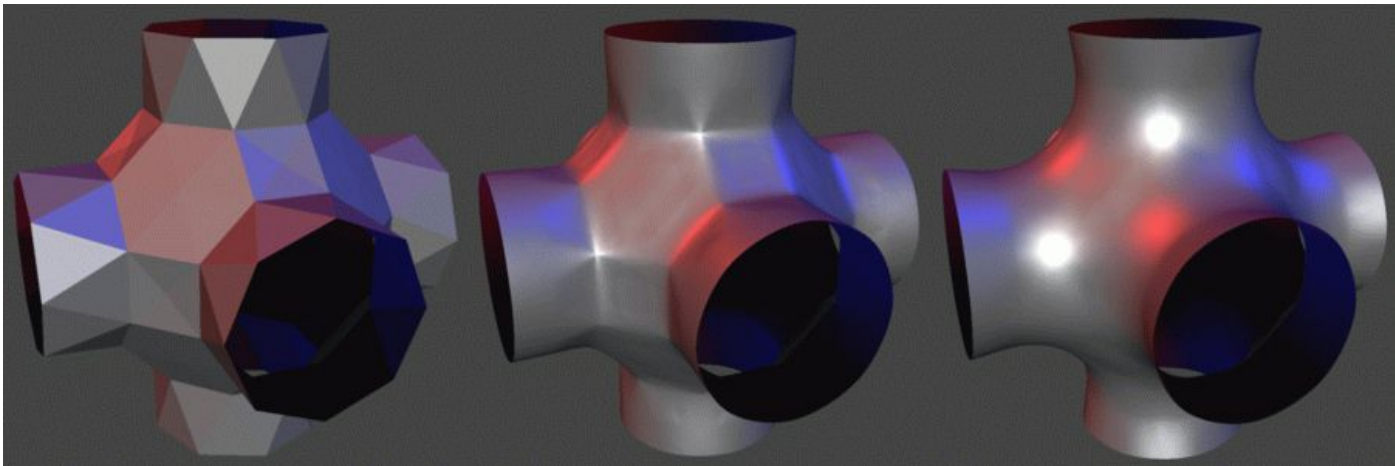
- + More accurate for curved surfaces
- + More concise
- Tessellate for rendering
- Expensive intersections

$$P(u,v) = \sum_{j=0}^m \sum_{k=0}^n p_{i,k} B_{j,m}(v) B_{k,n}(u)$$

Boundary Representations

◆ Subdivision Surfaces

- + Very concise
- Tessellate for rendering
- Expensive intersections

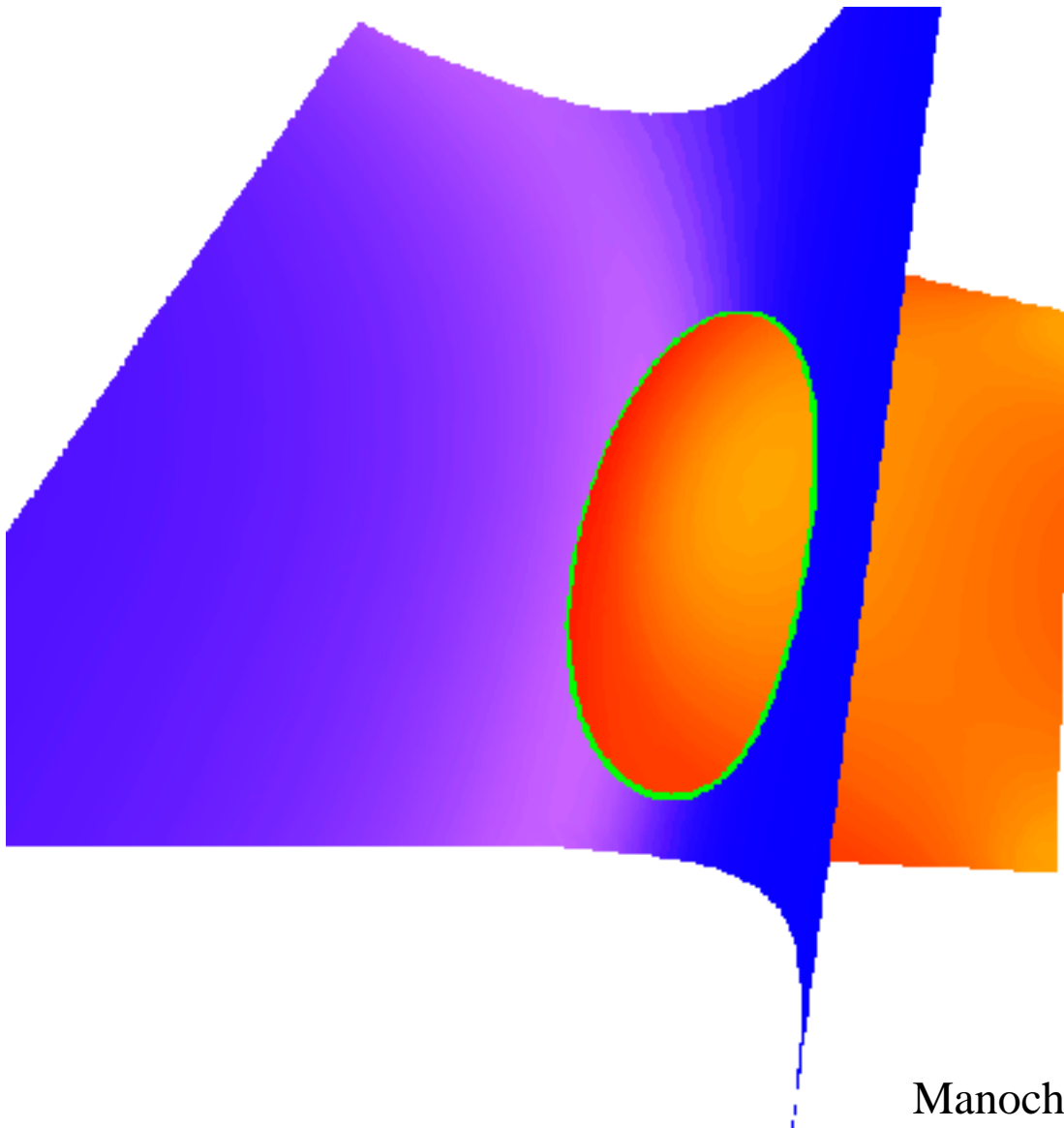


Zorin et al.

Boundary Representations

◆ Algebraic Surfaces

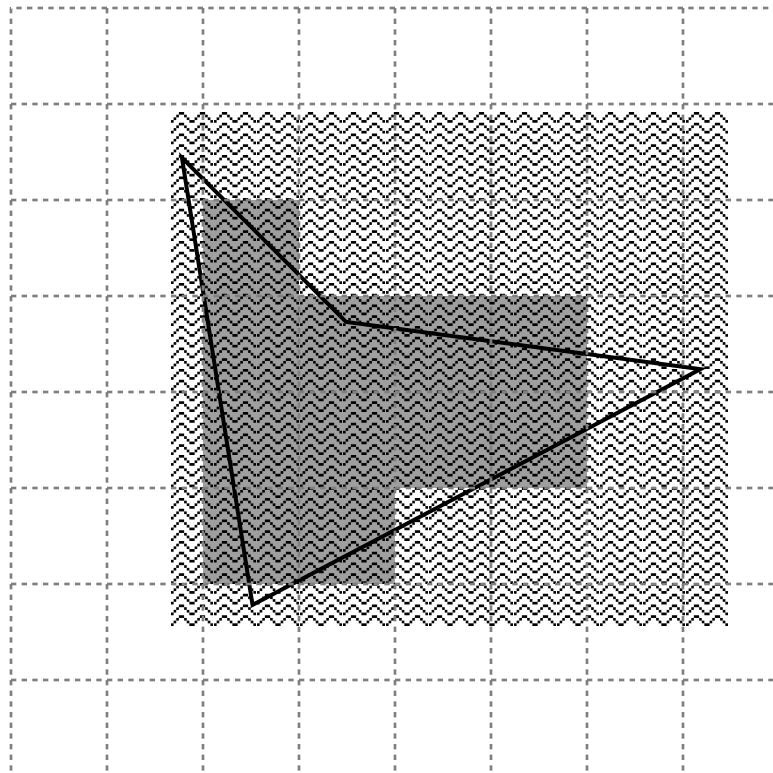
- Functional
 - + Difficult for arbitrary surfaces
 - + High accuracy
 - + Very concise
 - Implicit representation



Solid Representations

◆ Voxels

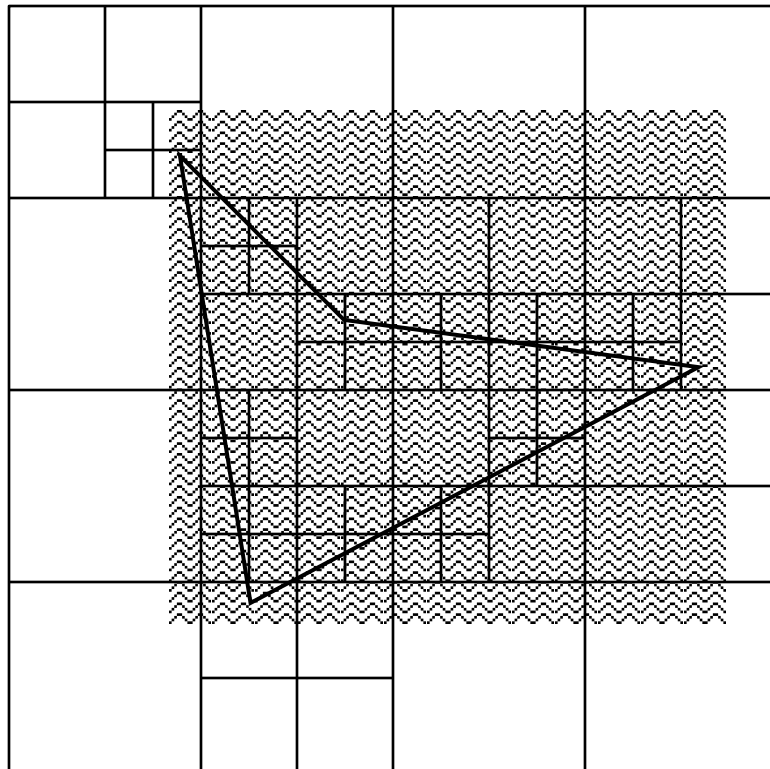
- + Simple
- + Construction from sensor data
- + Fast intersections
- + Depth sorting
- Not real-time rendering?
- Less accuracy
- Lots of storage



Solid Representations

◆ Octrees

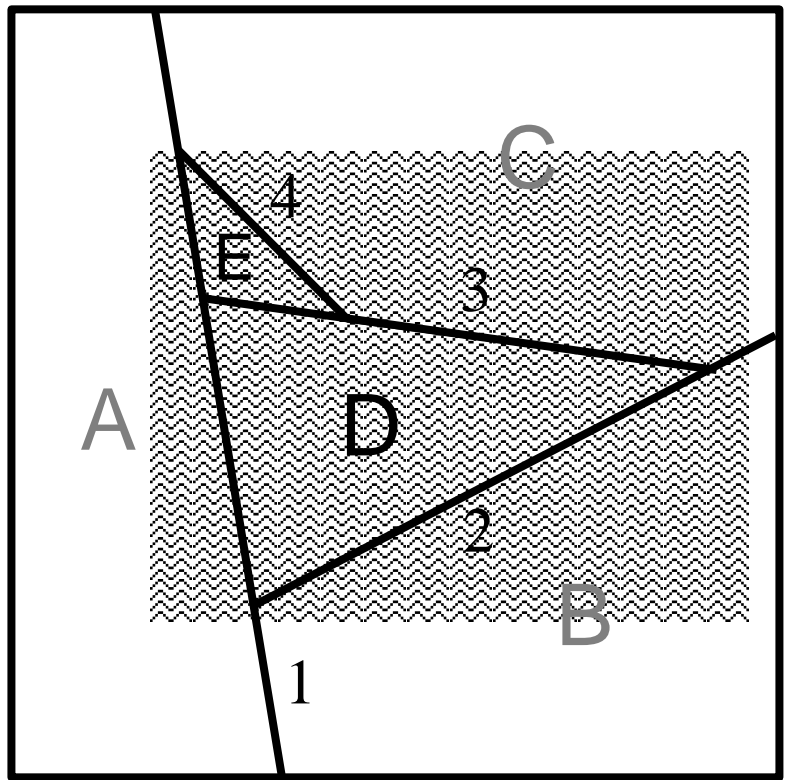
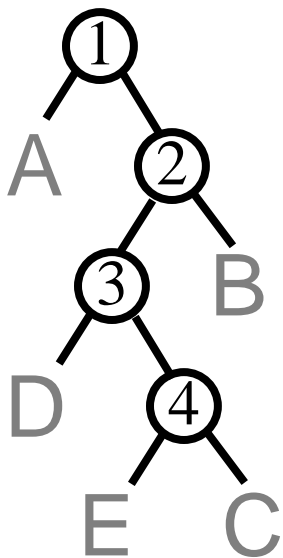
- Similar to voxels, but
 - + Multiresolution
 - + More efficient rendering & isects
 - + More accuracy
 - + Less storage
 - More complex than voxels



Solid Representations

◆ BSP Trees

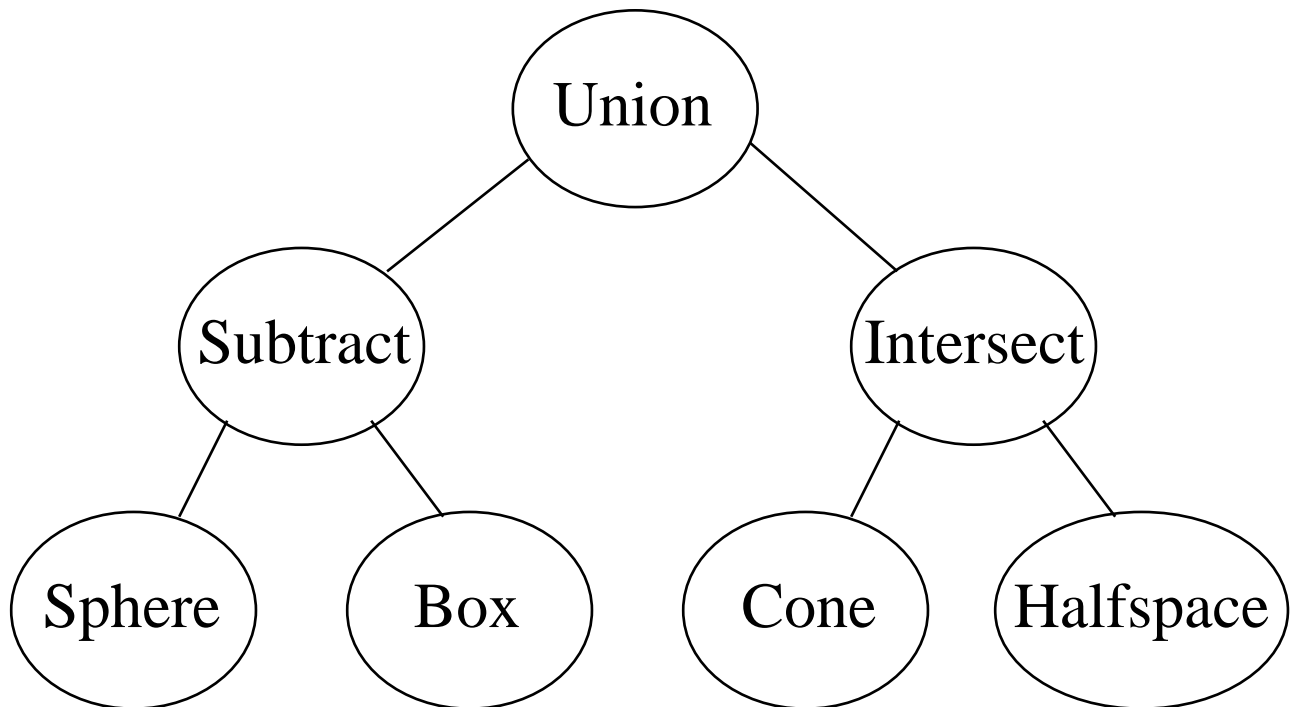
- Binary partition of space
- + Multiresolution
- + Object space
- Implicit representation
- Irregularly shaped cells



Solid Representations

◆ CSG

- Boolean solid operators
 - + Easy specification
 - + High accuracy
 - + Very concise
 - Implicit representation



Composite Representations

◆ Scene Graphs

- + Combine multiple reps
- + Hierarchical attribute specification

