

CCI-36 – Computação Gráfica

Modelagem de Sólidos

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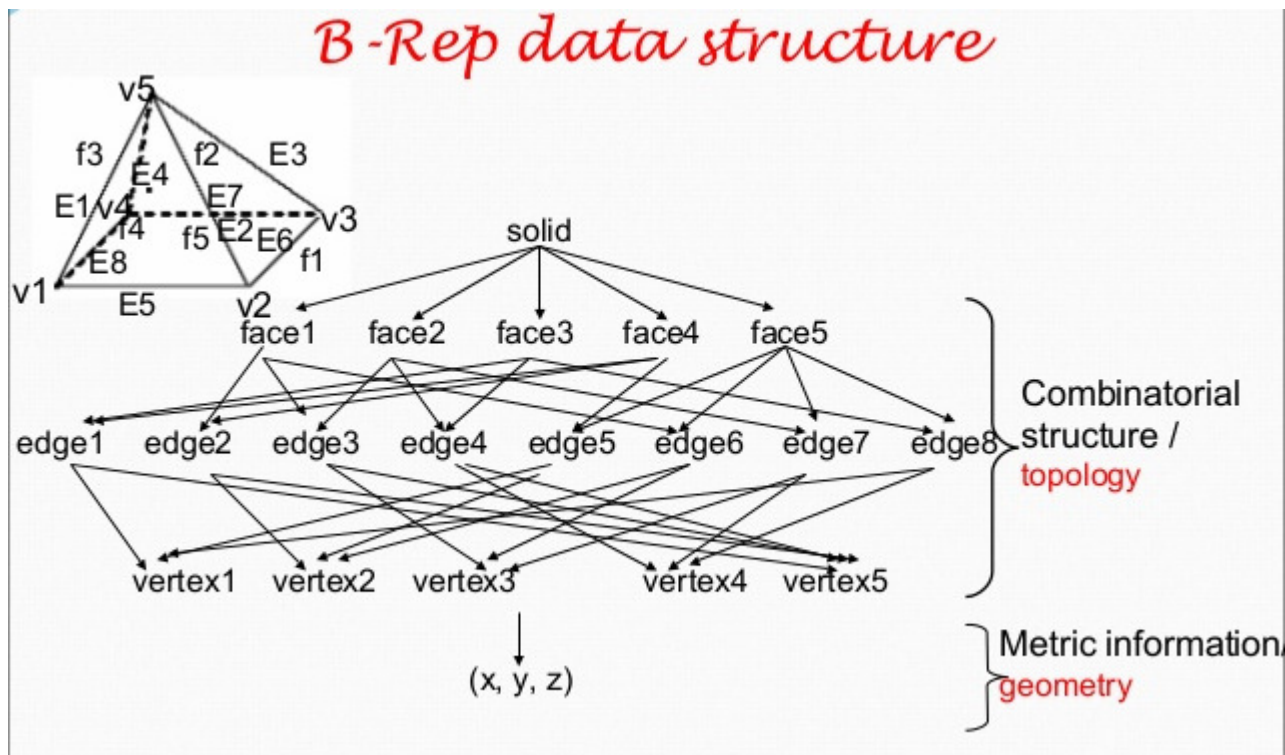
Tópicos da aula

- Modelo de malha (B-Rep)
- Modelo CSG
- Modelo Octree
- Modelo BSP-tree
- Superfícies implícitas e o Marching cubes

Livro para acompanhar essa aula

Foley

Modelo de malha (B-Rep)



Boundary Representation dissectiona a topologia de uma forma geométrica detalhando seus elementos

Manifold – localmente semelhante a um espaço Euclidiano em cada ponto

Observações

B-Rep é genérico, não considera apenas malhas triangulares ou poligonais.

Cada elemento além do vértice é um manifold (aberto).

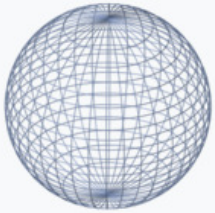



Os elementos (faces, arestas) podem ter uma orientação.

Se duas faces compartilham uma aresta, as orientações da aresta para cada face são opostas.

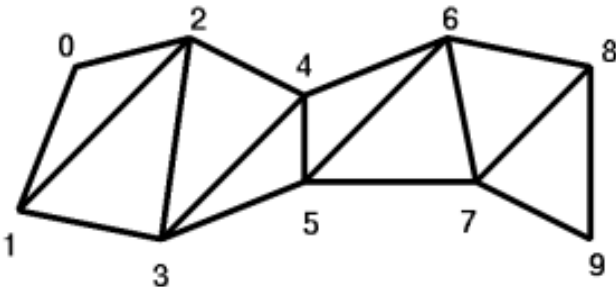
Valem as fórmulas de característica de Euler

$$\chi = V - E + F$$

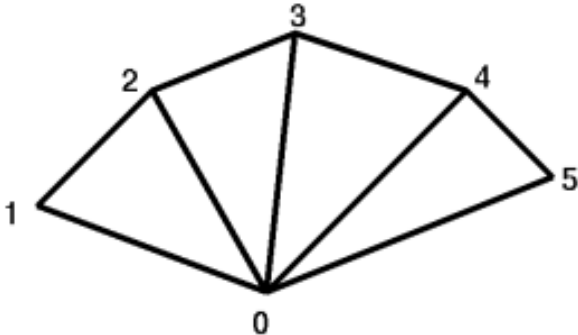
$V - E + F = 2$ para poliedro convexo.

Sphere		2
Torus (Product of two circles)		0
Double torus		-2
Triple torus		-4

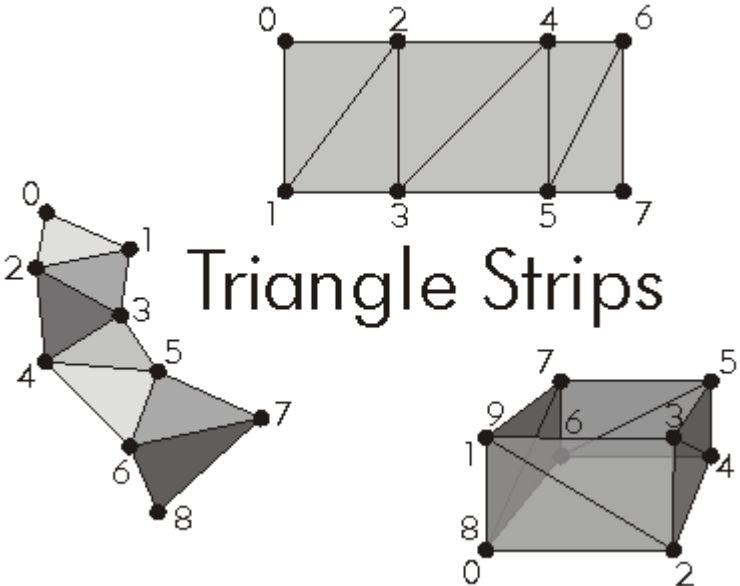
Fans e Strips



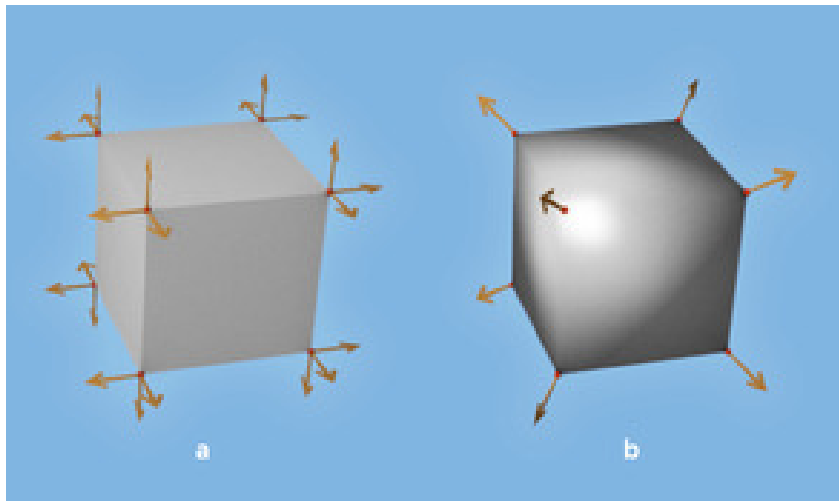
triangle "strip"
 vertices: 10 triangles: 8
 vertices per triangle: 1.25



triangle "fan"
 vertices: 6 triangles: 4
 vertices per triangle: 1.5

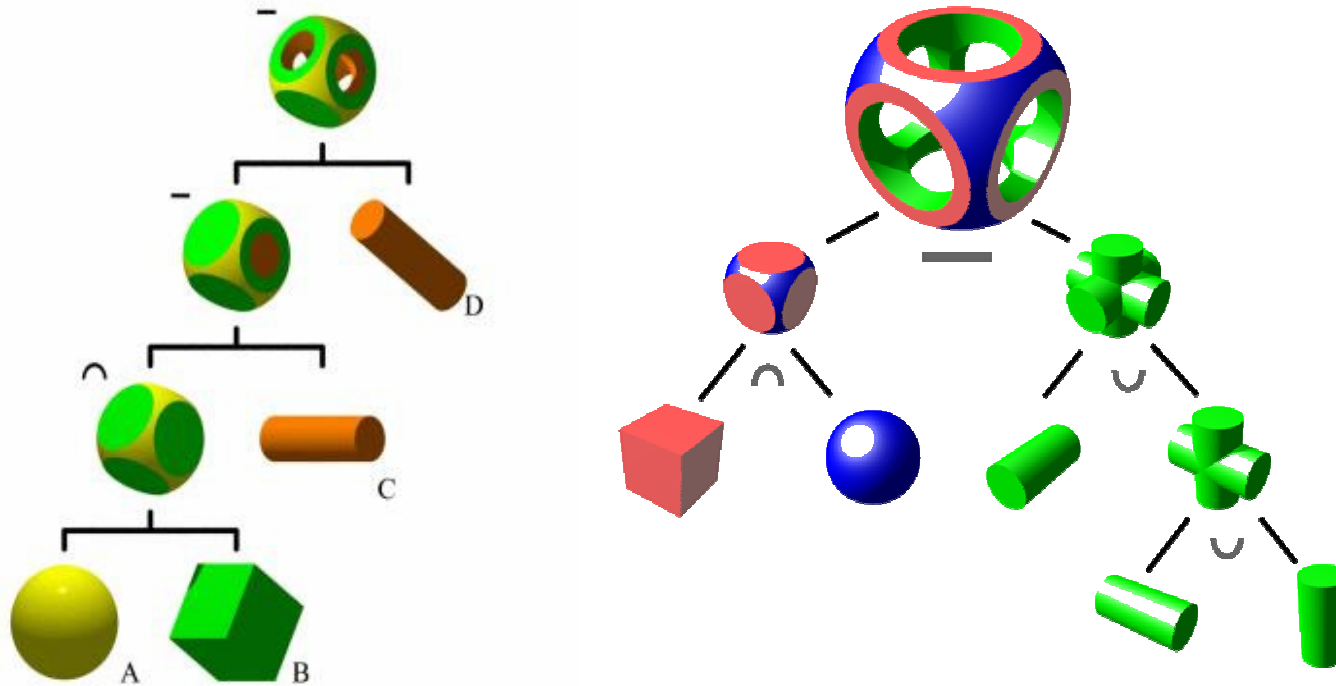


Face and vertex normals



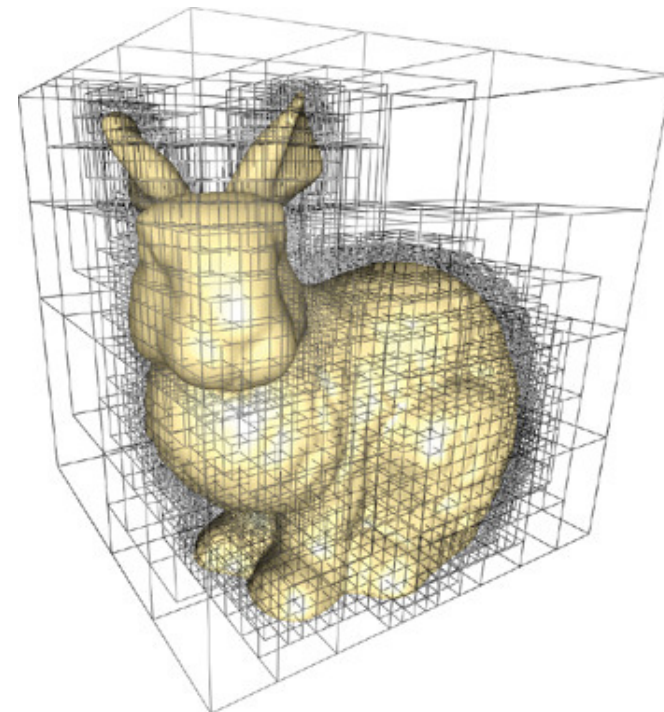
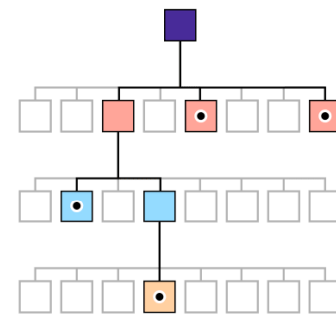
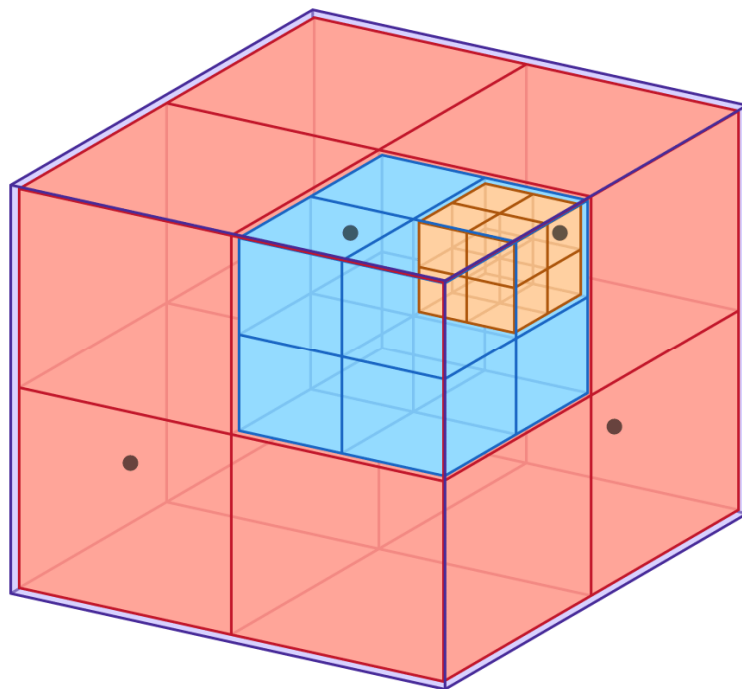
Multiplos vértices num ponto com arestas afiadas

Modelo CSG

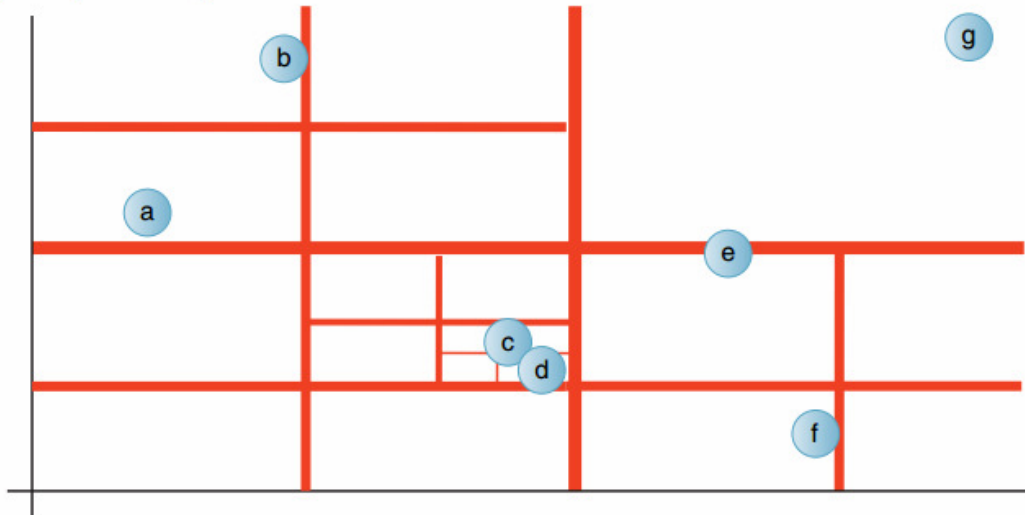


Operações regularizadas. Há necessidade de remover objetos de conteúdo nulo, que não tenham volume. Por exemplo, a intersecção regular de dois cubos que compartilham uma face deve ser nula.

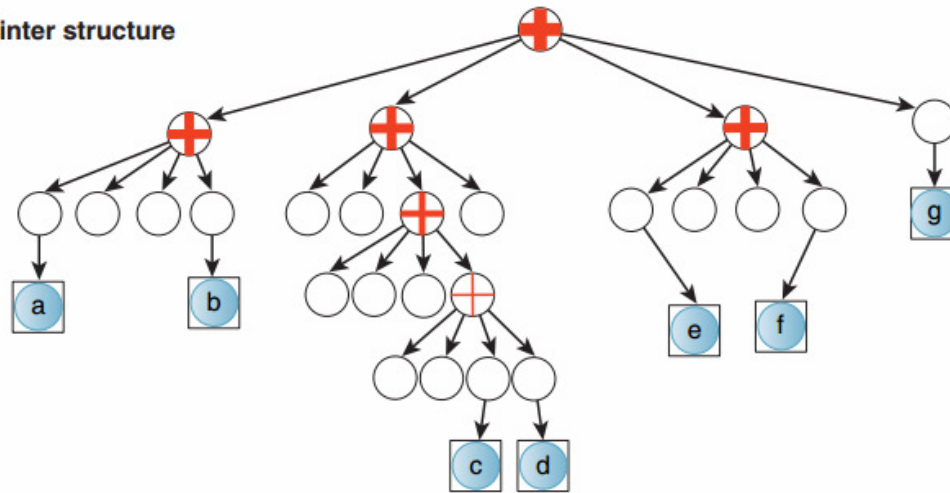
Modelo Octree



Spatial partitioning

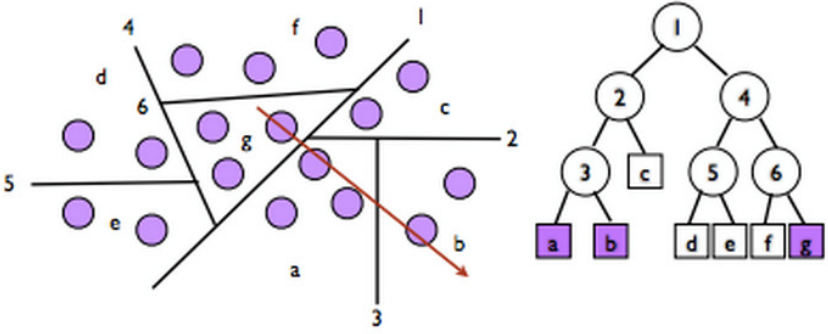
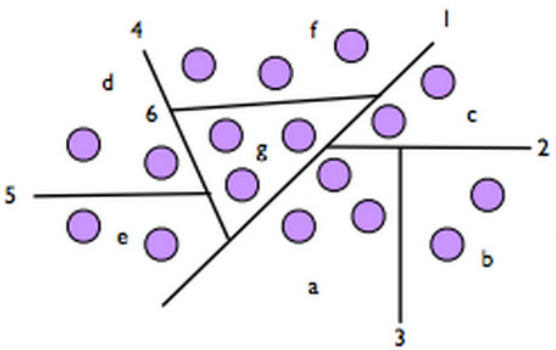
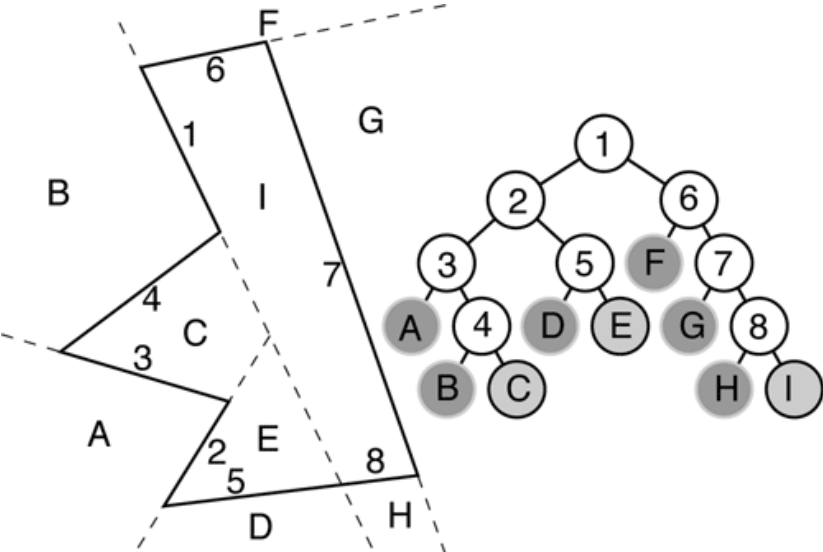


Pointer structure



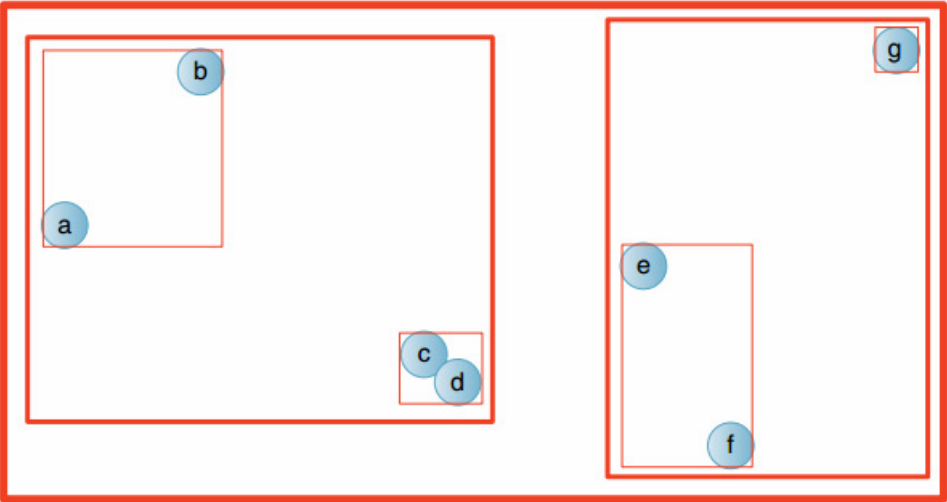
exemplo quadtree

Modelo BSP-tree

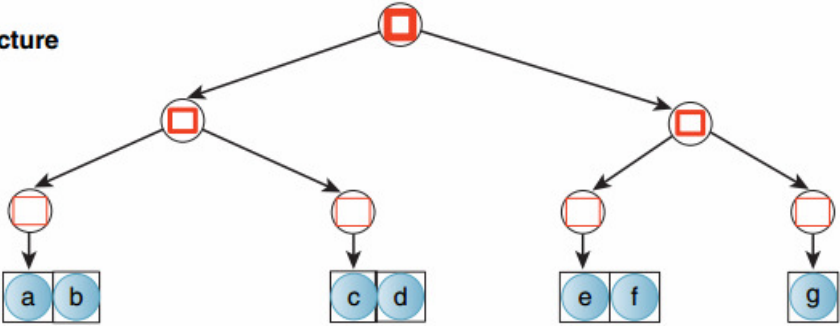


Bounding Volume Hierarchy

Spatial structure

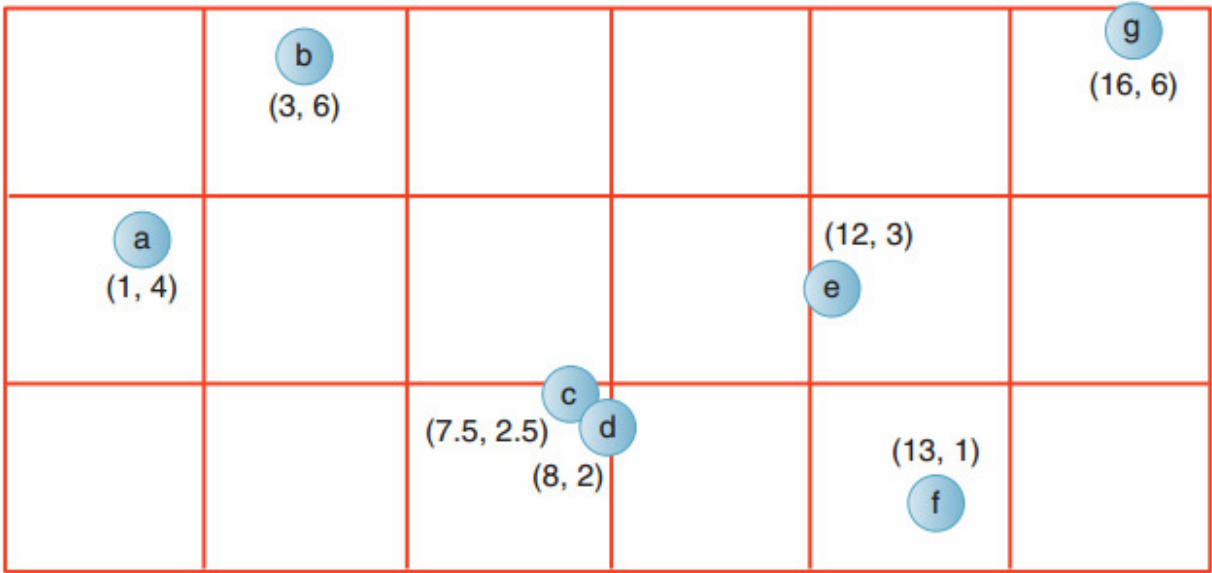


Logical structure

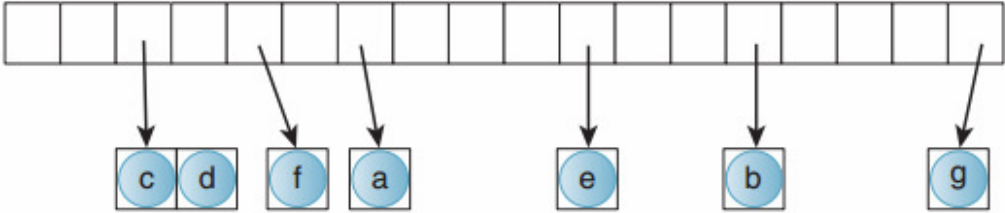


Buckets / Grid

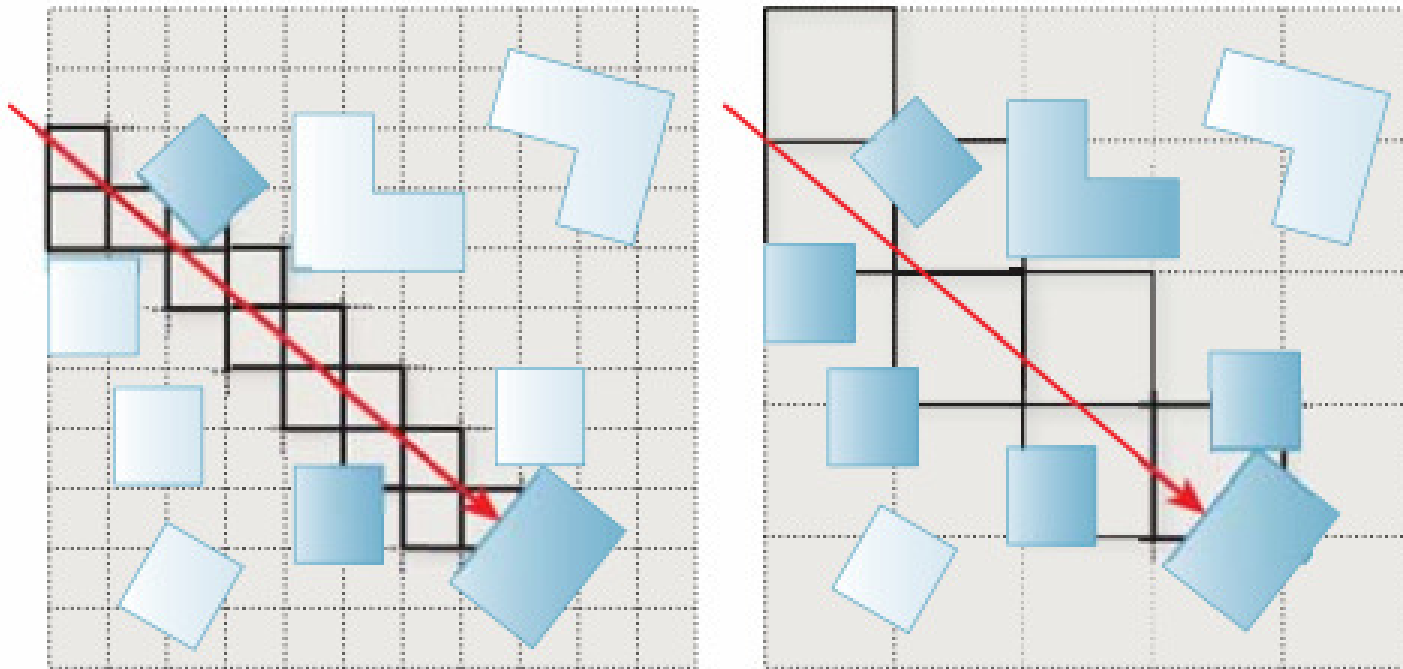
Spatial structure



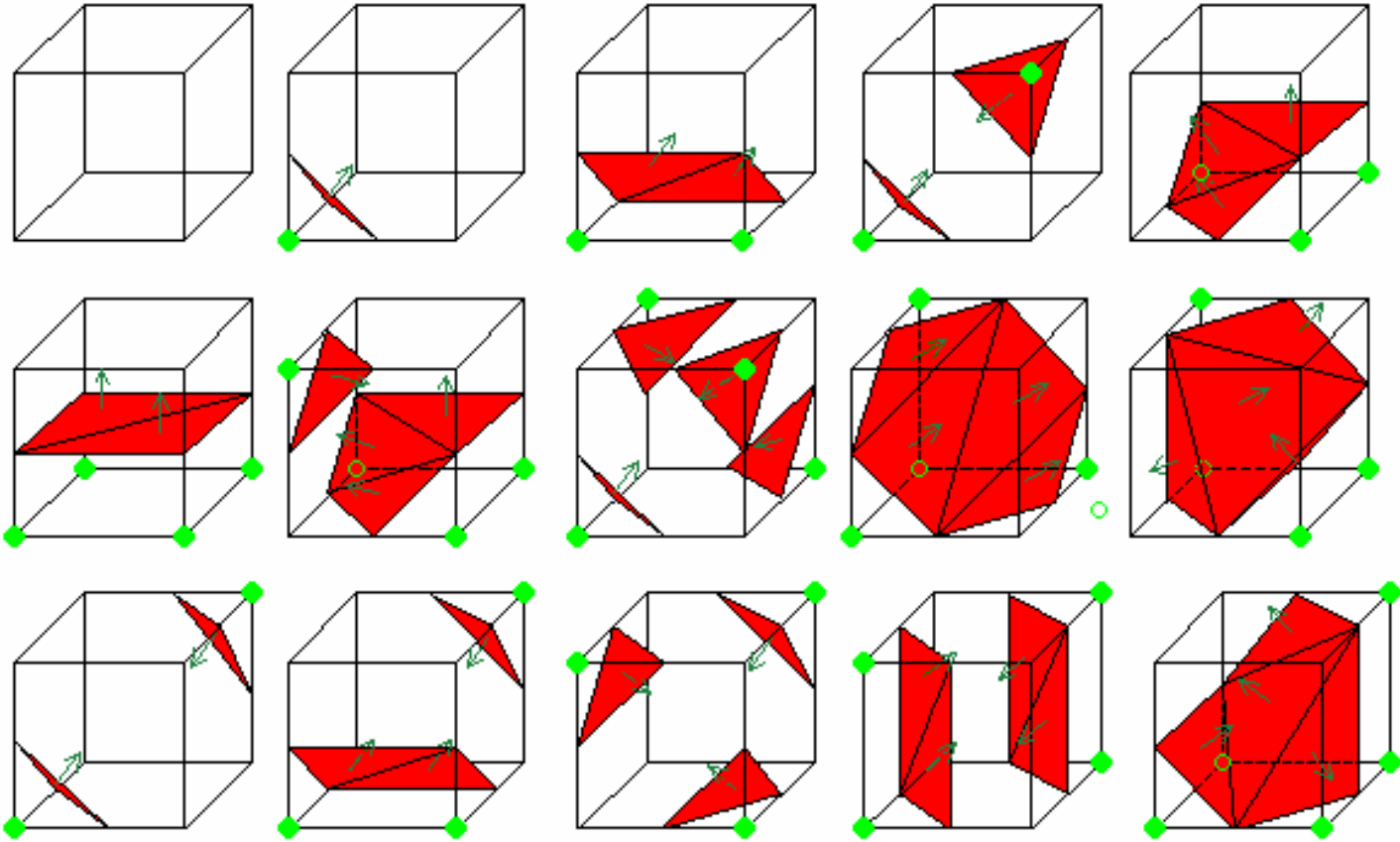
Logical structure



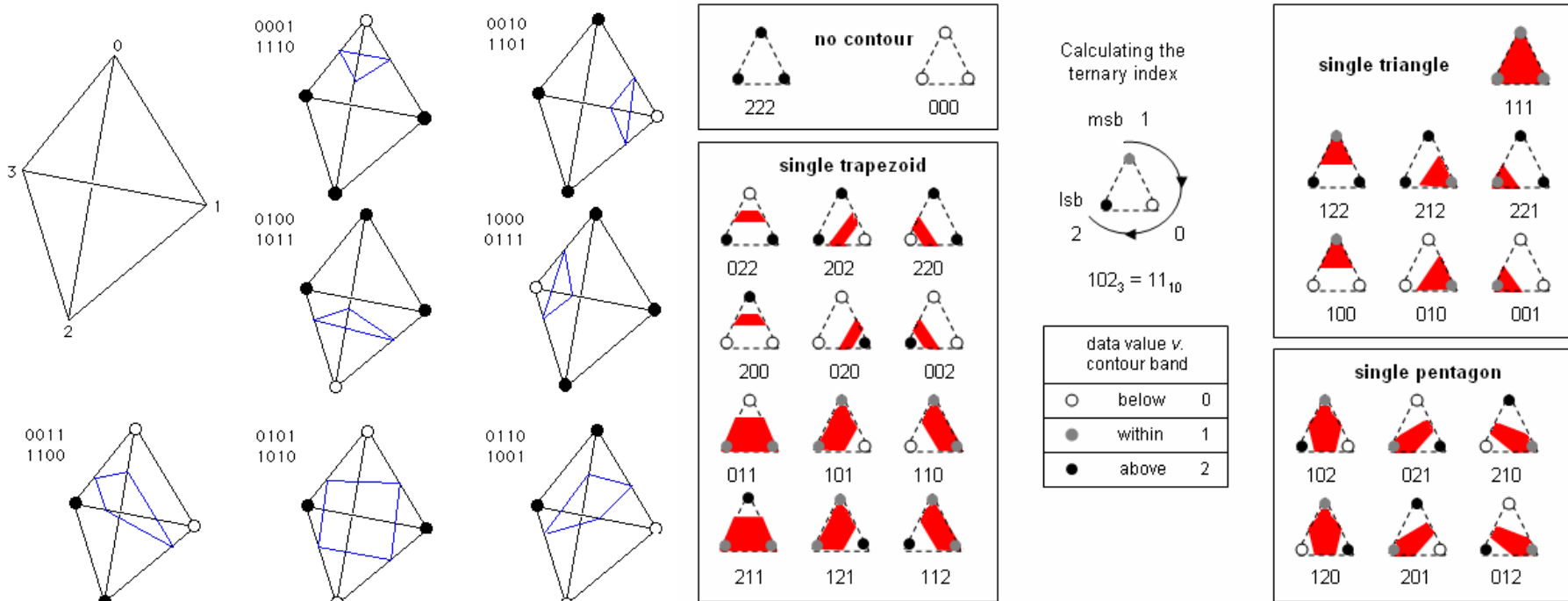
Traçando raio pelo grid:



Superfícies implícitas e o Marching cubes



Marching tetrahedron



(Triângulos marchantes)

Divide o cubo em tetrahedros irregulares.

(Tetrahedros regulares não enchem o espaço)