CS181a: Computer Animation

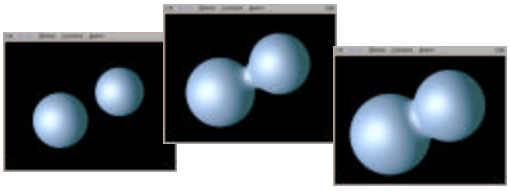
Modeling Miscellany
Z Sweedyk

Modeling Miscellany

- Blobby Objects
- Constructive Solid Geometry
- Sweep Surfaces
- Fractals
- Particle Systems

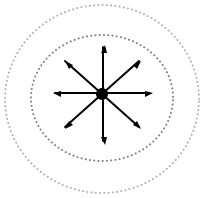
Blobby Objects

Images by Michael Ward, WPI CS



Blobby Objects

Object: iso-surface of a distribution function



Example:

$F(r) = e^{-r^2}$

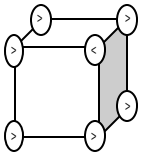
Multiple Blobby Objects

- Add fields
- Blending of objects is automatic

Rendering blobby objects

Marching Cubes Algorithm

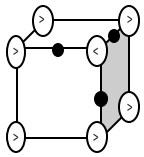
1. Determine field value at voxel corners relative to iso-surface



Rendering blobby objects

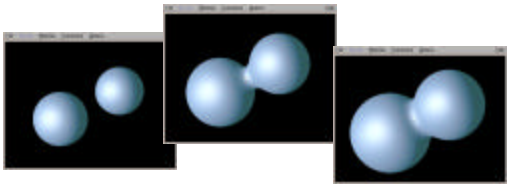
Marching Cubes Algorithm

2. Compute intersection points on voxel edges to create iso-surface patch



Blobby Objects

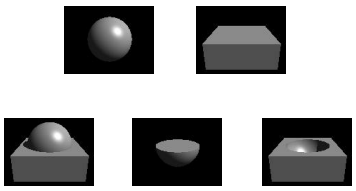
Images by Michael Ward, WPI CS



Problem: Rendering can be expensive in terms of time and space

Constructive Solid Geometry

Images by Neil Dodgson
University of Cambridge



Constructive Solid Geometry

- Simple Objects: represented explicitly (sphere, cube, etc.)
- Complex Objects: represented as simple objects and operations (union, intersection, etc.)

CSG models are implicit models

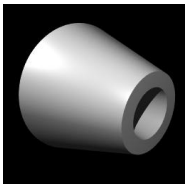
- Intersection is easy
- Ray tracing is easy
- Everything else is hard!

Sweep Surfaces

Sweep a shape (2D or 3D) in 3D space

Deborah Fowler, Hans Meinhardt, and Przemyslaw Prusinkiewicz: Modeling seashells, Siggraph '92

Special Case Sweeps

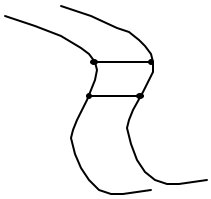


Surface of Revolution

Extrusion

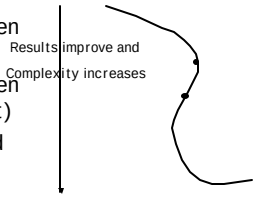
Rendering Sweeps

Approximate sweep with polygon mesh
- Where to sample curve?



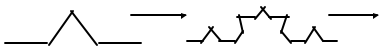
Sample Parametric Curve P(t)

- Sample P(t) at even intervals of t
- Sample P(t) at even intervals along P(t)
- Sample P(t) based on curvature

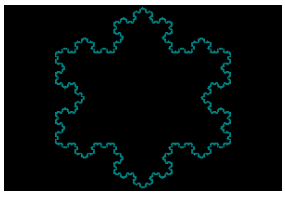


Fractals

- Recursive approximation of curve based on self-similarity

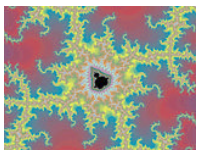


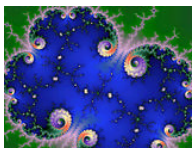
Koch Snowflake



Mandelbrot Set

http://www.deepleaf.com/fractal/





Mandelbrot Explorer

http://kosmoi.com/Science/Mathematics/Fractals/Mandelbrot/

Fractals

- Used to model natural forms
  - Plants
  - Terrain
  - Clouds
- Render strategies have devloped

Particle Systems

- A collection of particles that evolve over time
  - Fireworks
  - Cloth
  - Schooling fish

Ad hoc methods

- Water
- Fire
- Clouds
- Hair
- Skin
- Fur

Demo

- Fireworks
- Cloth
- Clouds
- Fractal clouds and mountains