Special Topics II — Visualization

1 The Rendering process

Models to pixels.

- Image-Order methods
  Always done in software.
  - Ray Tracing
    Povray
  - Total Scene Radiance
    Similar to the N-body problem.
- Object-order methods
  Often done in hardware.
  - Decompose objects into polygons.
  - Transform polygons into camera coordinates
    Use perspective or orthogonal transformations.
  - Clipping
  - Shading
    Flat, Gouraud, or Phong
  - Scan conversion
  - Hidden surface removal.
    Depth first drawing or z-buffering.
  - Transparency
    Generates significant computational cost.
  - Stereo

2 Dataset representation

- Structured points
- Rectilinear Grid
- Structured Grid
- Unstructured Points
- Polygonal data
- Unstructured Grid

3 Visualization methods

- Point sets

  Color for scalar, hedgehog plot for vector, axes or ellipsoids for tensor.

- Surface contour

  Marching cubes algorithm

- Extract plane

  Color by scalar value

  Warp for vector value

- Streamlines

  Particle traces, Streaklines, Streamlines, Hyperstreamlines.

- Texture map

- Voxels

  Requires transparency and object ordering

4 Visual programming environments

AVS, Khoros, Data Explorer, Iris Explorer

5 Visualization Toolkit: VTK

6 Making Movies

GUI tools:
Photoshop, GIMP, Premiere
Scripting tools:

- PBM

  Image formats: GIF, TIFF, JPEG

- MPEG

  I P and B frames.

7 Recording Video

Broadcast quality: 720x486
VHS and Constrained Parameter MPEG-1 quality: 352x240.
Overscans: 5% is lost on each side: Use pnmpad
Color: Avoid Pure Reds and Blues
Frame-rate: Drop frames.