Review

Image Synthesis
Torsten Möller
Review

• Hardware + Interaction
• Modelling I - lines + curves
• Transformation + Viewing
• Modelling II - primitives/tools
• Visibility
• Color
• Illumination + Shading
Textbooks

Review - Pipeline

Hardware

- Modelling
- Transform
- Visibility

Illumination + Shading

Perception, Interaction

Color

Texture/Realism

© Machiraju/Möller
Hardware

• Vector and raster devices
  – CRT, plotter, laser printer

• Interaction
  – Hardware
  – User interface design
  – Only the basics, rest in Vis or HCI

- Glassner: Ch. 3
- Angel: Ch. 1.8
- Shirley: Ch. 3
Modeling I

- Scan conversion of lines
  - DDA, Bresenham, Midpoint algorithms
- Circles, ellipsoids
- Polygon scan conversion
  - Polygon filling, AET
- Polygon fill algorithms
  - Flood/boundary
- Simple antialiasing
  - Box, pyramid, cone filters

- Angel: Ch. 8.8-8.12
- Shirley: Ch. 8
Modeling I

• Curves
  – Explicit vs. implicit vs. parametric
  – Hermite
  – Bezier
  – B-splines
  – NURBS

• Continuity
  - Parametric vs. geometric

• Bicubic surfaces

© Machiraju/Möller
Transformations

- Line and polygon clipping
  - Cohen-Sutherland, Cyrus-Beck, ...
- 2D and 3D transformation
  - Homogeneous coordinates
  - Scaling, translation, shearing, rotation
  - Matrix composition
- Right/left-handed system
- Affine and rigid body transformations

- Angel: Ch. 4
- Angel: Ch. 8.3, 8.7
- Shirley: Ch. 6, 8
Viewing in 3D

• Parallel projection
  – Orthographic, oblique
• Perspective
• Viewing frustum
• Projection matrix
• 3D clipping

IMPORTANT

• Angel: Ch. 5
• Shirley: Ch. 7
Modeling II

• Quadrics, implicit functions
• Fractals
• BREPs
• Primitive instancing
• CSG
• Sweeps
• Spatial partitioning
  – BSP trees
  – Octrees

• Angel: Ch. 9, 10
• Shirley: Ch. 12, 13

© Machiraju/Möller
Visibility

• Image-space vs. object-space algorithms
• Hidden surface algorithms
  – Z-buffer
  – List-priority
  – Area subdivision
  – Ray casting
• Coherency

IMPORTANT

• Angel: Ch. 5
• Shirley: Ch. 4
Color / Image Pipeline

• Achromatic light
  – Gamma correction
  – Dithering

• Color models
  – RGB vs. XYZ space
  – CMY and CMYK
  – YIQ
  – HSV/HSB
  – HLS/HSL/HSI

• Perceptual issues
  – 3 component color theory
  – Tone mapping

Glassner: Ch. 2, 3
Angel: Ch. 8.13
Shirley: Ch. 20 -- 23
Illumination and Shading

• Simple illumination
  – Ambient model
  – Lambertian (diffuse)
  – Phong (specular)

• Shading models
  – Flat
  – Gouraud
  – Phong

• Shadows and texture

© Machiraju/Möller