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ADVANCED IMAGE SYNTHESIS

James F. Blinn
Jet Propulsion Laboratory

Franklin C. Crow
University of Texas

Alvy Ray Smith III
New York Institute of Technology

This tutorial is intended to bring the attendee up to date on the most recent developments in computer image synthesis. It will concentrate on the production of realistic looking images of three dimensional scenes, emphasizing mathematical modelling techniques, lighting simulation and optimal display utilization. It will serve as useful background in understanding the papers on this subject to be presented in the conference. There will be one session in common with the tutorial on animation concerning digital painting as a method of generating data bases for texture mapping. The tutorial is aimed at programmers, researchers and graphics "progressionals" in this field and assumes some familiarity with computer graphics and three dimensional geometry. Many examples of the techniques will be illustrated via 35mm slides and 16mm movies. The course will consist of the following sessions.

MONDAY

MORNING

Introduction - Blinn

- Course contents
- Slide show
- Relation to other Tutorials

Polygonal Modelling Techniques - Crow

- Data Structures
- Digitizing
- Algorithmic Generation

Review of Three Dimensional Geometry - Crow

- Homogeneous Coordinates
- Transformations
- Perspective and Viewing

Polygon Drawing - Crow

- Scan Conversion of Polygons

Full Screen Z Buffer
 Scan Line Z Buffer
 Bouknight Z List Sorting
 Watkins Scan Line Subdivision
 Newell Overlay Technique
 Wieler-Atherton Cookie Cutter

LUNCH

AFTERNOON

Frame Buffer Painting Programs - Smith

Advanced Surface Simulation - Blinn

Diffuse Reflection
 Specular Reflection
 Mixing Diffuse and Specular
 Transparency
 Texture Mapping
 Bump Mapping
 Chinese Army Algorithm

TUESDAY

MORNING

Lighting Simulation - Crow

Point Lights (Infinite and Local)
 Ambient Light
 Distance Cueing
 Environment Models
 Shadows
 Ray Tracing

Algebraic Curved Surfaces - Blinn

Quadric Surface Modelling
 Scan Conversion
 3D Density Contours

Parametric Surfaces - Blinn

Modelling
 Bezier, Coons, B-Spline, etc
 Data Structures

Scan Conversion
 Dissection into Polygons
 Patch Splitting (Catmull, Lane/Carpenter)
 Numerical Solutions (Blinn, Whitted)

Display Device Tradeoffs and Enhancement - Crow

Anti-aliasing

Edges

Highlights

Texture Mapping (MIP Mapping)

Intensity Compensation and Gamma Correction

Color Encoding Methods

Dithering

Summary - Blinn

Hybrid Algorithms

Case Study: Voyager Simulation Film

Future Prospects