Last Lecture

Today

■ Course recap
■ History of rendering in images
■ Feedback and discussion
Goal: How to generate photorealistic images?

Applications

- Movies
- Games
- Industrial design
- Architecture
- Commerce
- Cultural heritage
- Holy Grail: Virtual reality

Brave (2012)
Modeling & Simulating Appearance

Models

- Light
- Light sources
- Materials and shapes
  - Surfaces: Reflection and texture models
  - Media: Atmospheric scattering models
- Cameras

Simulation

- Illumination calculations
  - Efficient ray-surface queries for many shapes
  - Monte Carlo integration
Lighting Simulation

The Rendering Equation

Given a scene consisting of set of shapes with material properties and a set of light sources, compute the illumination on the film plane of the camera

Challenges

■ Primitives complex: lights, materials, shapes
■ Infinite number of light paths

How to solve it?

■ Ray tracing ⟷ Monte Carlo (best known method)
■ Radiosity ⟷ Finite element (not covered)
Monte Carlo Integration

Rendering involves integrals

Why MC?

- Works well for high dimensional integrals
- Robust and relatively easy to implement (but subtle)
- Output sensitive
Material Recognition

People recognize materials more easily under natural illumination than simplified illumination.

Illusion due to Ted Adelson
The Goals of Rendering

Accurate physical simulation (perfect duplicate)

Naive realism

Real goals

- Artistic or expressive (tell a personal story)
- Informative or useful (visualization)
Complex Real-World Light Transport
Rendering History
(And Future)
Figure 6. A sample image. All objects are neutral grey. Color on the objects is due to caustics from the green glass balls and color bleeding from the base polygon.
SAME SCENE, TWO RENDERS

3D Max Scanline

Arnold

Image by Daniel Martinez Lara

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Metropolis light transport

Bidirectional path tracing
A Practical Extension to Microfacet Theory for the Modeling of Varying Iridescence
Efficient Rendering of Layered Materials using an Atomic Decomposition with Statistical Operators
Feedback?