

Advanced Topics in Photorealistic Graphics

Course no. 67684

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Tue 12:00-13:45, Shprinzak 201

Photorealism

- Photorealistic image synthesis - the “Holy Grail” of computer graphics
- Goal - produce synthetic images indistinguishable from real photographs
- The computer graphics Turing Test

Applications

- Simulators (flight, driving)
- Architectural visualization
- Automotive design
- Computer games
- Virtual Reality
- Special effects

Course Topics

- The global illumination problem
 - Finite-element solutions
 - Stochastic simulations
- Image-based rendering
- Other advanced topics

Global Illumination

- Input:
 - 3D scene model (geometry)
 - Light sources (geometry + physics)
 - Reflectance models + material properties (physics)
 - Camera model, film response model (optics + chemistry)
- Output:
 - Simulated illumination
- What are the potential causes for errors?

Global Illumination

- The physics of light transport
- Radiometric and photometric concepts
- The Rendering Equation

Finite Elements and Radiosity

- Solving integral equations using finite elements:
 - Point collocation
 - Galerkin method
- The Radiosity method
- Progressive Radiosity
- Hierarchical Radiosity



Stochastic Solutions

- Solving integral equations with Monte Carlo sampling
- Path tracing
- Bi-directional path tracing
- The RADIANCE algorithm
- Metropolis light transport

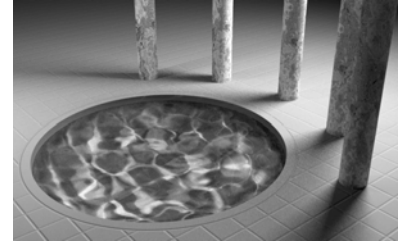



Image-Based Rendering

- Image warping
- Image morphing
- View morphing
- 3D warping
- Layered depth images
- Light-field rendering



Other Advanced Topics

- Precomputed radiance transfer
- Image-based relighting 

Recommended Reading

- Cohen & Wallace: Radiosity and Realistic Image Synthesis
- Sillion & Puech: Radiosity and Global Illumination
- Glassner: Principles of Digital Image Synthesis
- Wolberg: Digital Image Warping

Programming Assignments

- Hierarchical Radiosity
- Path tracing or Photon maps
- 3D image warping

- Work in teams
- Using existing code/libraries