SIGGRAPH 1994

21st International Conference
On Computer Graphics and
Interactive Techniques

Orange County Convention Center
Orlando, Florida
July 24-29

Course Notes 28

ADVANCED TOPICS IN RADIOSITY

Organizer
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National Institute Of Standards and Technology

Lecturers
Michael F. Cohen
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Dani Lischinski
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Peter Shirley
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ADVANCED TOPICS IN RADIOSITY

Tuesday, July 26, 1994
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Holly Rushmeier
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LECTURERS
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ABSTRACT

Radiosity methods compute light interreflections to render physically accurate images. This course consists of a series of in-depth discussions of areas of advanced research in radiosity algorithms. The intent is to provide an understanding of current problems in radiosity, and a view of improvements in radiosity that can be expected in the near future. Specifically, the issues addressed are how the selection of basis functions affects the quality and efficiency of a radiosity method, how concepts from computational geometry are applied to radiosity methods, how radiosity is integrated with other image synthesis techniques, how radiosity is reformulated as a design tool, and how to display radiosity solutions.

COURSE ORGANIZATION

- Introduction *Rushmeier*
  - pages 1-1 to 1-6, "Introduction"
- Finite Element Formulations *Cohen*
  - pages 2-1 to 2-38, Chapters 3 and 5 from *Radiosity and Realistic Image Synthesis* by Cohen and Wallace
- Hierarchical and Wavelet Bases *Schröder*
  - pages 3-1 to 3-22, "Wavelet Methods for Radiosity"
  - pages 4-1 to 4-10, "Wavelet Projections for Radiosity"
- Discontinuities *Lischniski*
  - pages 5-1 to 5-48, "Combining Hierarchical Radiosity and Discontinuity Meshing"
- Visibility *Teller*
  - pages 6-1 to 6-12, presentation slides (draft)
  - pages 7-1 to 7-10,"Computing the Antipenumbra of an Area Light Source"
  - pages 8-1 to 8-10, "Computing the Lines Piercing Four lines"
  - pages 9-1 to 9-12, "A Methodology for Geometric Algorithm Development"
- Hybrid Radiosity/Monte Carlo methods *Shirley*
  - pages 10-1 to 10-8, presentation slides (draft)
  - pages 11-1 to 11-24, "Hybrid Radiosity/Monte Carlo Methods"
- Inverse Methods *Cohen*
  - pages 12-1 to 12-14, "Inverse Methods for Rendering"
- Tone Reproduction *Rushmeier*
  - pages 13-1 to 13-13, "Tone Reproduction"

ABOUT THE LECTURERS

Michael Cohen

Dr. Michael Cohen is currently an Assistant Professor of Computer Science at Princeton University. He holds a Ph.D. from the University of Utah, an M.S. degree from Cornell University, and undergraduate degrees from Rutgers University and Beloit College. From 1985-1988, he was on the faculty of the Program of Computer Graphics at Cornell University where he conducted research in the area of realistic image synthesis, in particular, the development of the Radiosity Method. He has also made contributions in the area of physically based animation of linked figures. Prof. Cohen is an author (with John Wallace) of the recent book, "Radiosity and Realistic Image Synthesis". Current interests include constrained optimization for animation, image synthesis, CAGD, and scientific visualization. *Address:* Dept. of Computer Science, 35 Olden Street, Princeton, NJ 08544-2087, *E-mail:* mfc@princeton.edu, *Phone:* (609) 258-4633, *Fax:* (609)258-1771.

Dani Lischinski

Dani Lischinski is a Ph.D. candidate at the Program of Computer Graphics and the Department of Computer Science at Cornell University. He received his B.Sc. in Computer Science in 1987 and his M.Sc. in Computer Science in 1989 from the Hebrew University of Jerusalem, Israel. He has published several articles on the topics of radiosity and ray-tracing. His research interests include accurate and efficient algorithms for global illumination, photorealistic image synthesis, practical and robust geometric algorithms, geometric modeling, and scientific visualization.

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Holly E. Rushmeier (chair)

Holly Rushmeier is on the staff of the Computing and Applied Mathematics Laboratory at the National Institute of Standards and Technology. She received the B.S.(1977), M.S.(1986) and Ph.D.(1988) degrees in Mechanical Engineering from Cornell University. Following receipt of the B.S. degree she worked as an engineer at the Boeing Commercial Airplane Company, and at the Washington Natural Gas Company (both in Seattle, WA). Upon completion of the Ph.D., she served on the Mechanical Engineering faculty at Georgia Institute of Technology, where she was the recipient of an NSF Presidential Young Investigator Award. She is the author of articles in the fields of computer graphics and in radiative heat transfer. Her research interests include computer graphics synthetic image generation, scientific visualization, and radiant heat transfer. *Address:* Bldg. 225, Rm. B-146, NIST, Gaithersburg, MD, 20899, *E-mail:* holly@cam.nist.gov, *Phone:* (301)216-0013, *Fax:*(301)963-9137.

Peter Schröder

Peter Schröder is a doctoral candidate in Computer Science at Princeton University, where his research concerns the use of wavelets for global illumination algorithms. Prior to Princeton University he received his undergraduate degree in Mathematics and Computer Science from the Technical University of Berlin, a Master's degree in computer graphics from MIT's Media Laboratory, and has worked

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Seth Teller

Seth Teller received his Ph.D. in Computer Science, from UC Berkeley in 1992, under the direction of Carlo S'equin. His research investigated visibility computations for large (mega-polygon) indoor environments, with the intent of accelerating real-time "walkthroughs" of such environments. Seth has also been a member of the Research and Development group at Silicon Graphics, Inc., working principally with Jim Winget on a variety of topics including geometric algorithm visualization, direct manipulation of 3D geometric data, spatial subdivisions, and visibility computations. Seth is currently a Postdoctoral Research Fellow at Princeton University, working principally with Pat Hanrahan. His research concerns visibility algorithms, 3D model reconstruction from photographs, spatial subdivisions, illumination algorithms for enormous environments, and the geometry of linespace. *Address:* Dept. of Computer Science, 35 Olden Street, Princeton, NJ 08544-2087, *E-mail:* seth@cs.princeton.edu, *Phone:* (609) 258-3946, *Fax:* (609)258-1771.