



SIGGRAPH 1992

*19th International Conference  
On Computer Graphics and  
Interactive Techniques*

*McCormick Place, Chicago  
July 26 - 31*

# COURSE NOTES

# 18

## GLOBAL ILLUMINATION

*Organizer*

**Paul Heckbert**

Delft University of Technology

*Lecturers*

**François X. Sillion**

École Normale Supérieure

**Peter Shirley**

Indiana University

**Greg Ward**

Lawrence Berkeley Laboratory

**Holly Rushmeier**

National Institute for Standards and  
Technology

# Global Illumination

SIGGRAPH '92 Course  
course organizer: Paul Heckbert

28 July 1992

## Abstract for Course

This course investigates the phenomena of global illumination (the scattering of light in three-dimensional scenes) and current algorithms for its simulation, including both radiosity and ray tracing approaches. Mathematical tools such as integral equations, finite element methods, and Monte Carlo techniques will be described. Current techniques will be described for extending radiosity methods to non-diffuse and foggy environments and for extending ray tracing methods to diffuse environments.

## Table of Contents / Schedule

SPEAKER	CHAPTER	TIME
Paul Heckbert	1. Introduction to Global Illumination	30 min
	2. Finite Element Methods for Radiosity	30 min
	3. Discontinuity Meshing for Radiosity (reprint)	
François Sillion	4. Extension of Radiosity Methods for Non-Diffuse Environments	60 min
	5. A Global Illumination Solution for General Reflectance Distributions (reprint)	
Peter Shirley	6. Monte Carlo Simulation and Integration	60 min
	7. Luminaire Sampling in Distribution Ray Tracing (reprint)	
Greg Ward	8. The RADIANCE Lighting Simulation System	60 min
	9. Adaptive Shadow Testing for Ray Tracing (reprint)	
	10. Irradiance Gradients (reprint)	
Holly Rushmeier	11. Solution Methods for Radiatively Participating Media	60 min
all	panel discussion of research topics in global illumination	45 min

## Speaker Biographies

Paul Heckbert is currently a postdoctoral researcher at the Delft University of Technology, the Netherlands. Starting in Fall 1992, Paul will be an assistant professor of Computer Science at Carnegie Mellon University. For his BS degree in Mathematics at MIT, he developed algorithms for color image quantization, and at the New York Institute of Technology and Pixar, he developed software for computer animation. Paul received master's and PhD degrees in Computer Science from the University of California at Berkeley in the topics of texture mapping and global illumination, respectively. His research interests are computer graphics and image processing.

François Sillion is a researcher at the Ecole Normale Supérieure, in Paris, France. He received an undergraduate education in math and physics, a graduate degree in Solid State Physics in 1986, and a Ph.D. in computer science in 1989 at the Ecole Normale Supérieure. From 1989-1991 he was a post-doctorate associate in the Program of Computer Graphics at Cornell University. He has co-authored several research papers on the topic of image synthesis. His research interests include light reflection modeling, global illumination algorithms, interactive simulation, and evaluation of image quality.

Peter Shirley is an Assistant Professor of Computer Science at Indiana University. He received his Ph.D. in Computer Science from the University of Illinois at Urbana-Champaign in 1990. His research interests include realistic image generation and scientific visualization.

Greg Ward is a staff scientist in the Lighting Systems Research Group at the Lawrence Berkeley Laboratory. He graduated in Physics from the University of California, Berkeley, and earned his Masters in Computer Science from San Francisco State University.

Holly Rushmeier received the BS('77), MS('86) and PhD('88) degrees in Mechanical Engineering from Cornell University. She has worked as an engineer at the Boeing Commercial Airplane Company and the Washington Natural Gas Company in Seattle, WA. She also served on the Mechanical Engineering faculty at the Georgia Institute of Technology, where she was a recipient of an NSF Presidential Young Investigator Award. She is currently on the staff of the Computing and Applied Mathematics Laboratory at the National Institute of Standards and Technology (the former NBS). Her research interests include scientific visualization, realistic image synthesis and radiative heat transfer.

## Speaker Addresses

Paul Heckbert  
School of Computer Science  
Carnegie Mellon University  
5000 Forbes Avenue  
Pittsburgh PA 15213-3890  
*email:* heckbert@cs.cmu.edu

François Sillion  
Laboratoire d'Informatique  
Ecole Normale Supérieure  
45 rue d'Ulm  
F-75005 Paris  
France  
*email:* sillion@dmi.ens.fr

Peter Shirley  
Department of Computer Science  
Lindley Hall  
Indiana University  
Bloomington IN 47405  
*email:* shirley@iuvax.cs.indiana.edu

Greg Ward  
Lawrence Berkeley Laboratory  
1 Cyclotron Rd. 90-3111  
Berkeley CA 94720  
*email:* gjward@lbl.gov

Holly Rushmeier  
Rm. B-146, Bldg. 225  
NIST  
Gaithersburg, MD 20899  
*email:* holly@cam.nist.gov