



# Global Illumination in Architecture and Entertainment

## Course Notes for SIGGRAPH '96

### Course Organizer

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### Course Speakers

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Stuart Feldman  
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Lightscape Technologies, Inc.

Robert A. Shakespeare  
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Indiana University

Greg J. Ward  
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## ABSTRACT

Global illumination techniques such as Monte Carlo ray tracing and radiosity enable us to accurately model lighting designs and create physically realistic renderings for architectural, theater and stage, and entertainment applications. This course reviews these techniques, with an emphasis on useful solutions, available software and hardware tools, and real-world case studies.

This course will:

- a) Provide a brief overview and history of global illumination techniques, with an emphasis on their application to physically realistic image synthesis and lighting design;
- b) Present case studies on the application of global illumination techniques to lighting design for theater and stage, with an emphasis on their value in designing lighting layouts and evaluating set designs during the planning stages of a production;
- c) Examine some of the advanced tools available to lighting designers and architects that can reduce uncertainty in lighting design and provide clients with predictive visualizations; and
- d) Provide an in-depth look at how global illumination techniques are being used to create physically accurate and visually realistic images and videos for architectural and entertainment applications.

# TABLE OF CONTENTS

|   |     |
|---|-----|
| Abstract .....  | I-1 |
| Table of Contents .....   | I-3 |
| Schedule .....  | I-4 |
| Speaker Biographies .....   | I-5 |
| <b>Global Illumination and Lighting Design</b> (Ashdown) .....  | 1-1 |
| <b>Applications of Theatrical Lighting Design</b> (Shakespeare) .....   | 2-1 |
| <b>Tools for Lighting Design and Analysis</b> (Ward) .....  | 3-1 |
| <b>Photorealism in Architecture and Entertainment</b> (Feldman) .....   | 4-1 |
| <b>Appendices</b>   |     |
| Applications of <i>RADIANCE</i> to Architecture and Lighting Design (Ward) .....  | A-1 |
|  From Local to Global Illumination and Back (Fournier) ..... | B-1 |
| Monte Carlo Methods in Rendering (Shirley) .....  | C-1 |
| Radiosity On-line: A Bibliography (Ashdown and Haines) .....  | D-1 |
| The <i>HELIOS</i> Radiosity Renderer (Ashdown) .....  | E-1 |

# SCHEDULE

| <b>Topic</b>  | <b>Speaker</b> | <b>Time</b> |
|---|----------------|-------------|
| <b>Global Illumination and Lighting Design</b>        | Ashdown        | 1:30 pm     |
| <b>Applications of Theatrical Lighting Design</b>     | Shakespeare    | 2:15 pm     |
| Java Break  |                | 3:00 pm     |
| <b>Tools for Lighting Design and Analysis</b>         | Ward           | 3:15 pm     |
| <b>Photorealism in Architecture and Entertainment</b> | Feldman        | 4:00 pm     |
| Question Period                                       | All            | 4:45 pm     |

## **SPEAKERS**

### **Ian Ashdown (chair)**

Ian Ashdown is Research & Development Manager for Ledalite Architectural Products Inc. (Langley, BC), a manufacturer of linear fluorescent lighting systems. He received his B. App. Sc. (1973) in Electrical Engineering from the University of British Columbia, and worked as an electrical engineer specializing in lighting design for ten years, followed by five years as a software engineer with Glenayre Research & Development (Burnaby, BC). He has done research in nonimaging optics design, photometric methods, and image synthesis techniques at Ledalite since 1990, and has published 8 academic papers, one book (and co-authored another), and 29 articles on radiosity, illumination engineering, photometric techniques, genetic algorithms, compiler theory, numerical analysis, and other topics.

Ian holds US and Canadian patents on a near-field goniophotometer, and is the author of *Radiosity: A Programmer's Perspective* (Wiley, 1994). His research interests include global illumination, image synthesis, radiometry and photometry, and nonimaging optics design. His professional affiliations include the Illuminating Engineering Society of North America (IESNA), ACM SIGGRAPH, International Lighting Commission (CIE), Eurographics, and the IEEE Computer Society. He is a member of the IESNA Computer and Calculations Committees and the CIE Lighting Calculations Technical Committee. He chaired the SIGGRAPH '95 course, "Realistic Input for Realistic Images."

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### **Stuart Feldman**

Stuart Feldman is a cofounder of Lightscape Technologies (San Jose, CA), and is currently their Product Marketing Manager for the AEC (architecture, engineering, and construction) markets. He graduated in 1984 with a B. Arch. from Cornell University, and in 1988 with an M. S. from the Cornell Program of Computer Graphics, where he studied the applicability of advanced rendering techniques to design applications under the direction of Drs. Michael Cohen and Donald Greenberg.

Stuart was involved in the design and implementation of the Lightscape Visualization System, a radiosity-based rendering application that was developed to address the needs of the architectural design community. Prior to founding Lightscape, Stuart worked for several architectural design firms. He was also involved in the production of a number of published computer graphics projects, including the often-reproduced Steel Mill image (1988).

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### **Robert A. Shakespeare**

Robert Shakespeare is a professional lighting designer, Associate Professor at the Department of Theatre and Drama of Indiana University, and Director of the Indiana University Theatre Computer Visualization Center. He has lighted over 150 stage productions, with recent work including the Utah Shakespearean Festival and

Carmen at the Lyric Theatre in Hong Kong. His architectural lighting projects have included Times Square, the Jin Jaing Hotel in Shanghai, the Shangri-la Hotel & Convention Center in Dalian, China, and the Hong Kong Marriot atrium, Harbour-Gateway buildings, and Tsing Ma Bridge in Hong Kong.

Robert uses *RADIANCE* and other lighting visualization software as part of his design process, and is developing interface systems to advance the use of these tools. Current projects include linking databases derived from lighting/computer visualization interactions directly to the technology of complex lighting control environments, such as theaters and theme parks. His professional affiliations include the Illuminating Engineering Society of North America, the International Association of Lighting Designers, and the United States Institute for Theatre Technology. He is a member of the IESNA Computer Committee, and he was a speaker for the SIGGRAPH '95 course, "Realistic Input for Realistic Images."

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### **Greg J. Ward**

Greg Ward is a staff scientist at the Lighting Systems Research Group at the Lawrence Berkeley Laboratory. He graduated with a B. S. in Physics in 1983 from the University of California at Berkeley, and earned his Master's (1985) in Computer Science from San Francisco State University. His professional interests include physically based rendering, global and local illumination, luminaire simulation, electronic data standards, and lighting-related energy and environmental conservation issues.

Greg has published numerous papers in computer graphics (including four SIGGRAPH papers) and illumination engineering. He is the chief architect of the widely used *RADIANCE* software system for the analysis and visualization of lighting in architectural design. He is a member of the IESNA Computer Committee, and he was a speaker for the SIGGRAPH '95 course, "Realistic Input for Realistic Images." He is also writing a book for John Wiley & Sons, called *The RADIANCE Book*.

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