SIGGRAPH 1992

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On Computer Graphics and
Interactive Techniques

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COURSE NOTES 19

AN INTRODUCTION TO PHYSICALLY BASED MODELING

Co-Organizers

Andrew P Witkin
Carnegie Mellon University

Michael Kass
Apple Computer Inc

Lecturers

David Baraff
Cornell University

Alan Barr
The California Institute of Technology

An Introduction to Physically Based Modeling

Co-Chairs

Andrew Witkin
Carnegie Mellon University

Michael Kass
Apple Computer

During the past few years, physically based modeling has emerged as an important new approach to computer animation and computer graphics modeling Although physically based modeling is inherently a mathematical subject, the math involved needn't be any more difficult nor esoteric than the math that underlies many other areas of computer graphics To date, however, most discussions of the subject have presupposed a specialized mathematical background that many members of the computer graphics community lack

This course addresses the need to make the principles and methods of physically based modeling accessible to a broader computer graphics audience—those who are familiar with mainstream computer graphics and understand basic computer graphics math, such as vector/matrix manipulations, but whose first year calculus course is a dim recollection

Course Schedule

8 45 am	Introduction	
9 00 am	Differential Equation Basics	Witkin
9 30 am	Particle Dynamics	Witkin
10 15 am	Break	
10 30 am	Energy Functions and Stiffness	Kass
11 15 am	Continuum Dynamics	Kass
12 00 pm	Lunch	
1 30 pm	Constrained Dynamics	Witkin
2 30 pm	Einstein Summation Notation	Barr
3 15 pm	Break	
3 30 pm	Rigid Body Simulation	Baraff
4 45 pm	End	

Course Speakers

Andrew Witkin is a Professor of Computer Science and Robotics at Carnegie Mellon University He received his B A from Columbia College, and his Ph D from M I T Prior to joining the faculty at Carnegie Mellon, he headed the perception and graphics group at Schlumberger Palo Alto Research His research interests include computer animation, com puter vision, and simulation He has taught three previous Siggraph courses on physically based modeling

Michael Kass is a Staff Research Scientist with the Advanced Technology Group of Apple Computer He received a B A in Artificial Intelligence from Princeton University, an M S in Computer Science from M I T , and a Ph D in Electrical Engineering from Stanford University Before joining Apple Computer in 1988, he worked at Schlumberger Palo Alto Research in the field of computer graphics and computer vision His research focus is on the use of physical simulation for computer graphics

David Baraff is currently a Research Associate in Cornell University's Program of Computer Graphics He received his PhD in Computer Science from Cornell University s Department of Computer Science in 1992, and his BsE in Computer Science from the University of Pennsylvania in 1987 At Cornell, he was named an AT&T Bell Laboratories PhD Fellow in 1988 His research work has focused on simulating the motion of rigid bodies, subject to non-penetration constraints He has presented papers on this topic at previous SIGGRAPH conferences and will present a joint paper with Andrew Witkin that extends this work to encompass flexible bodies, at SIGGRAPH 92

Alan Barr is an Associate Professor of Computer Science and faculty member in the Computation and Neural Systems department at the California Institute of Tehcnology He received his PhD in Mathematics from Rensselaer Polytechnic Institute in 1983, joining the Caltech faculty shortly thereafter In 1988, he received the Siggraph Achievement award for his work in computer graphics modeling, particularly for physically based and teleological modeling

Contents