

TWO AND THREE DIMENSIONAL VISUALIZATION WORKSHOP

COURSE # 13

CHAIR:

Craig Upson
Stellar Computer, Inc.

SPEAKERS:

Robert Wolff
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Richard Weinberg
University of Southern California

David Kerlick
Computer Science Corporation



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Course Abstract

This workshop is designed to introduce two and three dimensional visualization techniques to the participants in a three pronged approach: reinforcing lectures with both hands-on experience and a comprehensive suite of prior examples on film and videotape. The lectures will introduce key concepts behind scientific data organization, the translation of that data into geometric primitives, and the rendering of those primitives into images. Building upon this theoretical foundation will be a laboratory session in which each student will explore these concepts first hand using state-of-the-art software and hardware. The software consists of a Mathematica™ Notebook, a hyper-text-like document which allows students to alter parameters thereby producing new images. In addition, two dimensional techniques will be presented using public domain software which will be distributed with the course. The hardware network is composed of numerous Stellar Graphics Supercomputers front ended with Macintosh II color workstations. Finally to reinforce these experiences, a session will be devoted to the presentation of numerous films and videos of scientific visualization over the past two decades.

Speaker Biographies

Craig Upson is a Visualization Scientist at Stellar Computer. His academic background is in numerical mathematics from the University of New Mexico. He worked at Lawrence Livermore National Laboratory for seven years performing three dimensional computational fluid dynamics research along with the development of computer graphics algorithms for the computational sciences. After leaving LLNL he worked in the film industry in Los Angeles at Digital Productions. His film credits include 2010, The Last Starfighter, and animations for several world's fairs as well as television commercials and scientific films. After leading the Scientific Visualization effort at Digital Productions, a phase-1 National Science Foundation Supercomputing Center, Mr. Upson left to work as a research scientist at the National Center for Supercomputing Applications at the University of Illinois. At NCSA he organized the Scientific Visualization project along with Nancy St. John. His current duties at Stellar Computer include the design of visualization environments for computational scientists and engineers. He has published numerous papers in the field of computer animation and fluid dynamics.

David Kerlick received his B.S. in Physics from Rensselaer Polytechnic Institute in 1970 and his Ph.D. in Theoretical Physics from Princeton University in 1975, where he studied with John A. Wheeler and F.W. Hehl. His thesis work and first few postdoctoral years were spent analyzing the Einstein-Cartan theory of Gravity, a non-Riemannian extension of General Relativity. He also did work on the weak-field, slow-motion approximation to General Relativity. In 1979, he began work in Computational Fluid Dynamics, and has published work on unsteady transonic flow, supersonic duct flow, and computational electromagnetics. Since 1986 he has worked in the areas of computational geometry, computer-aided geometric design, and computer graphics and visualization research. He is presently working on the application of local differential geometry to the extraction of topological information from flowfield data.

Richard Weinberg has had a joint appointment since 1984 in the school of cinema and the department of computer science at the University of Southern California where he also runs a computer animation laboratory. Prior to this he was a senior analyst at Cray Research for four years where he founded the computer graphics group. His work at Cray included the technical support at Digital Productions in Los Angeles. Before Cray, Mr. Weinberg led the software design for the Space Shuttle Guidance, Navigation and Control Test Station digital recording system at Lockheed. In addition to these activities he was the general co-chairman of SIGGRAPH '84, has published numerous papers and received several cinema awards for his computer animation work. He is a member of IEEE and ACM Siggraph.

Robert Wolff is senior research scientist in the User Technologies Group at Apple Computer. For 11 years prior to joining Apple he was a space physicist at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, CA. He spent a significant amount of his time designing computing environments for planetary missions and doing graphics simulations MHD phenomena. Wolff has been working on scientific visualization problems since 1981 and has produced several computer animations, articles and courses on scientific visualization. He is a member of the Voyager Plasma Science Team, guest investigator on the Pioneer Venus Mission, and a co-investigation on the Volcanology Experiment on the upcoming Earth Observing Systems Mission. He is visiting research scientist at the University of Illinois National Center for Supercomputing Applications, and is a member of the American Geophysical Union, the American Astronomical Society, and the Association for Computing Machinery. Wolff holds B.S. and M.S. degree in physics from Rensselaer Polytechnic Institute and MIT, respectively, and a Ph.D. in physics from Brandeis University.

Volumetric Visualization Techniques

by

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