A D V A N C E   P R O G R A M

  IEEE Visualization '93
 Sponsored by IEEE Computer Society Technical Committee on
     Computer Graphics

      In Cooperation with ACM / SIGGRAPH

  October 25-29, 1993
   Red Lion Hotel
      San Jose, California

 For further information about the IEEE Visualization '93 Conference
 call (510) 423-9368 or email: Vis93@llnl.gov

 Additional information available via anonymous ftp at:
 ftp.uml.edu, in the "vis93" directory

You're invited to IEEE Visualization '93. We
look forward to meeting you at this fourth annual IEEE
Visualization conference which promises to be our strongest
technical program yet. As with previous VIS conferences, our focus
is devoted to visualization and its applications. We will offer you
tutorials and workshops on Sunday, Monday, and Tuesday. In
addition, we offer you a Symposium on Parallel Rendering and a
Symposium on Research Frontiers in Virtual Reality. Both
symposia are two-day programs scheduled for Monday and Tuesday.
The Vis'93 Conference begins on Wednesday morning with Keynote
Address and Panel, followed by our three-track concurrent sessions
Wednesday afternoon, Thursday, and Friday. You will have your
choice of panels, papers, and case studies on a wide variety of
visualization topics. Demonstrations of visualization products,
tools, and applications begin mid-day Wednesday and continue
through Thursday afternoon. The conference concludes with the
Capstone Address on Friday afternoon.

We encourage you to join us in San Jose, California the week of October 25-29, 1993 for IEEE Visualization '93. The conference is an important forum in the area of data visualization and a unique opportunity for interactions with researchers, developers, and colleagues.

Carol L. Hunter, Lawrence Livermore National Laboratory
Georges Grinstein, University of Massachusetts at Lowell
IEEE Visualization '93 Conference Co-Chairs

What do you get with your Registration ???

(registration forms at end of announcement)

Register for: To get:

Conference: Vis93 Proceedings
  Vis93 Reception
        Wednesday 7:00 pm - 10:00 pm Red Lion Inn
  Demonstrations
  Vis93 Keynote Events
  Papers
  Panels
  Case Studies
  Vis93 Capstone Address

Tutorial: Tutorial Notes
  Tutorial Attendance
  Tutorial Lunch (for
  full day or 2-half days)
  Demonstrations

Workshop: Workshop Notes
  Workshop Attendance
  Workshop Lunch
  Demonstrations

Parallel Rendering or
Virtual Reality Symposium:

  Symposium Proceedings
  Symposium Attendance
  2 Symposium Lunches
  Symposium Reception

Demonstrations

Demonstration Only:
 Demonstrations

Birds Of a Feather and Evening Sessions are open to all registrants.

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Visualization '93 Workshops:

Participation in the workshops requires approval by the workshop
organizers. Please contact the workshop organizer directly to
indicate your interest. Participants are expected to prepare a short
paper that outlines their research and to provide data to be shared
by colleagues in the field. Participation is limited.

Workshop position statements must be received by the workshop
organizer by September 1. A registration form for the workshop
will be mailed to each workshop participant by the Registration
Chair by October 1. The fee for a one-day workshop is $100,
which includes breaks and lunch. Visualization '93 registration is
not required for a Workshop registration.

Workshop 1 (Full Day)
Monday, 8:30 am - 5:00 pm
Visualization Education
Organizers:
Polly Baker, NCSA, University of Illinois
Robert McDermott, USI, University of Utah
Please Contact:
 Polly Baker
 baker@ncsa.uiuc.edu
 NCSA, University of Illinois
 405 North Mathews, Drawer 25
 Urbana, IL 61801
 (217) 244-1997
 (217) 244-2909 (fax)

Workshop Description:

As the use of visualization increases, education about the field
becomes more and more important. In this full day workshop, we
will discuss approaches to formal and informal education in
visualization. Teaching visualization is challenging because of

the breadth of topic, the multi-disciplinary nature of the area, the mixed backgrounds of potential student audiences, and the relative scarcity of the types of instructional resources that are usually available for more well-established areas. This workshop presents an opportunity for participants to share their solutions to these problems, discuss related issues, and learn what their counterparts are doing in the area of visualization education. The primary goal of the workshop is information exchange among a diverse group of providers of visualization education.

The workshop will address the following issues:
% What are the essential topics to teach about visualization?
% Who are the target audiences for visualization education? Researchers and students? Disciplines?
% What are different strategies for developing expertise in visualization? Topics or Project Emphasis?
% What are the tradeoffs among different strategies?
% What resources are available for visualization education?
% What hardware, software, output are necessary to support visualization education?

Workshop 2 (Full Day)
Monday, 8:30 am - 5:00 pm
Workshop on Intelligent Visualization
Systems
Organizers:
Zahid Ahmed, San Diego Supercomputer Center
Steve Casner, NASA Ames Research Center
Kristina Miceli, NASA Ames Research Center
Steve Roth, Carnegie-Mellon University
Please Contact:
 Zahid Ahmed
 ahmed@cassatt.sdsc.edu
 SDSC, 0505
 Univ of California, San Diego
 9500 Gilman Drive
 La Jolla, CA 92093-0505
 (619) 534-5105
 (619) 534-5113 (fax)

Workshop Description:

Visualization is a powerful method for performing data analysis in many disciplines, and like other data analysis tasks requires different levels of decision-making processes. These decision-making processes require knowledge and experience from

interdisciplinary areas such as data and visual representation, as well as knowledge of the functional characteristics of data manipulation and visualization procedures, and software packages that perform these procedures. Due to the heavy knowledge requirements of current visualization systems, data analysis has required a level of expertise that exceeds the qualifications of ordinary data analysts or scientists. Ideally, a visualization analysis scenario must go through the steps of relevant data search and retrieval, acquistion of user's task requirements, and then production of useful data display plans or designs. The three fundamental areas that visualization systems inadequately handle are: (1) Data Access, (2) Task Understanding, and (3) Visualization Design processes. The design of visualization systems that intelligently handle these three issues is the focus of this one day workshop.

Workshop 3 (Full Day)
Tuesday, 8:30 am - 5:00 pm
Visualization in Decision-Support
Organizer:
Jeff Beddow, Hennepin County, Minnesota
Please Contact:
 Jeff Beddow
 beddow@staff.tc.umn.edu
 Hennepin County Public Affairs
 Mail Code 011
 300 S. 6th Street
 Minneapolis, MN 55487
 (612) 348 3105
 (612) 348 9857 (fax)

Workshop Description:

This workshop will bring together researchers from a number of fields to share work on supporting the human decision maker under conditions of less than perfect knowledge and less than perfect criteria for a decision. Its primary focus will be on visualization methods that support this process. The emphasis will be on visual representations of problem sets that facilitate the perception of patterns, relations, and exceptions in the representation itself. Statistical or AI heuristic methods that present results in novel graphic form will be considered.

Workshop 4 (Full Day)
Tuesday, 8:30 am - 5:00 pm

Database Issues for Data Visualization
Organizers:
J.P. Lee, University of Massachusetts at Lowell
Georges Grinstein, University of Massachusetts at Lowell
Please Contact:
 J. P. Lee
 jlee@cs.ulowell.edu
 Institute for Visualization and Perception Research
 Univ of Mass at Lowell
 1 University Ave
 Lowell, MA 01854
 (508) 934-3384
 (508) 452-4298

Workshop Description:

Data Visualization deals with the effective portrayal of data with a
goal towards insight about the data. Typically, the data is of high
volume, multidimensional in nature, and does not lend itself to
easy display. The data is also often spatial and temporal in nature.

Database issues for data visualization have become increasingly important as
ever-larger data set sizes and dimensionality create problems that present-day
systems cannot handle. Collaborative computing requires multiple users
accessing multiple, heterogeneous databases. To explore relationships between
many data variables, researchers must be able to query data in meaningful
ways. Currently, visualization system users are only given minimal querying
support, limited in most cases to interaction with output data represent-
ations, or single-valued data probes. This workshop intends to deal with
issues specifically related to the integration of database management sys-
tems with data visualization in hopes of determining methods for supplying
end users with the data interaction support they require, and overcoming
performance impediments related to the integration.

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Visualization '93 Tutorials:

Tutorial 1
Sunday, 8:30 am - 5:00 pm
Virtual Reality for Visualization
Instructors:
Steve Bryson, CSC/NASA Ames Research Center
Steve Feiner, Columbia University

Course Description:
This course will survey the theory and development of interactive visualization systems based on virtual reality interface techniques. These techniques encompass a variety of hardware and software technologies and allow natural display and control in three-dimensional interactive environments. These technologies will be surveyed with a focus on applications in scientific visualization.

Who Should Attend?
This course is intended for those who are interested in developing systems which will use virtual reality technology for scientific visualization. Familiarity with three-dimensional computer graphics and basic scientific visualization techniques will be assumed. No previous experience with virtual reality technology will be necessary.

Instructor:
Steve Bryson is an employee of Computer Sciences Corporation working under contract for the Applied Research Office of the Numerical Aerodynamics Simulation Systems Division at NASA Ames Research Center. Steve Feiner is an Associate Professor of Computer Science at Columbia University.

Tutorial 2
Monday, 8:30 am - 5:00 pm
The Process of Visualizing Environmental Data Sets
 (Examining air, water and subsurface data)
Instructors:
Theresa Marie Rhyne, Martin Marietta/U.S.EPA Visualization Center
Bill Hibbard, University of Wisconsin at Madison
Lloyd Treinish, IBM T.J. Watson Labs
Chris Landreth, North Carolina Supercomputing Center (A Division of MCNC)

Course Description:
This tutorial examines issues associated with visualizing environmental sciences data sets. Data formats, using visualization for environmental model verification and the development of new computational algorithms, customizing toolkit software for environmental research, using visualization as an environmental decision support tool, and the application of animation techniques for analyzing air,

water and subsurface data are the topics to be presented.

Who Should Attend:
This tutorial is designed for scientific researchers and visualization specialists interested in examining the particular issues associated with handling environmental science data sets. A general knowledge of graphics, programming and math is required. Experience with visualization systems and terminology is helpful.

Instructors:
Theresa Marie Rhyne is a Senior Visualization Researcher for the EPA's High Performance Computing and Communications Initiatives and employed by Martin Marietta Technical Services at the U.S. EPA Scientific Visualization Center. Bill Hibbard is the principal author of the 4-D McIDAS system, VIS-5D and VIS-AD. Lloyd A. Treinish is a research staff member in the Visualization Systems Group at the IBM T. J. Watson Research Center. Chris Landreth is the senior animator at the North Carolina Supercomputing Center.

Tutorial 3
Monday, 8:30 am - 5:00 pm
Visualization of Vector and Tensor Fields
Instructors:
Lambertus Hesselink, Stanford University
Frits H. Post, Delft University of Technology

Course Description:
This course presents an overview of techniques for visualization of vector and tensor field data, with applications primarily to flow data visualization. The course consists of two main parts: an introductory part, and a collection of recent examples and advanced topics. A broad overview is given of basic techniques for vector field and computational fluid dynamics (CFD) data visualization, and an introduction to 2D and 3D digital and optical image processing techniques, for extracting numerical data from experimental images, for decomposition of images, and to recognize patterns and features for visualization. In the second part, we will discuss the fundamentals of vector field topology, and a number of recent research results in vector and tensor field visualization, such as stream surface generation methods; new vector field rendering methods, such as virtual smoke, texture, advection, and surface particles; visualization of specific flow features, such as vortices;

techniques for data selection and focusing; and techniques for the visualization of second-order tensor fields. The course will be concluded by a discussion of current and future research directions.

Who Should Attend:
Visualization, computer graphics, or CFD users and professionals interested in the state-of-the-art in vector and tensor field visualization of flow data. No specialist knowledge of computer graphics, image processing, or fluid dynamics is required.

Instructors:
Lambertus Hesselink holds a joint appointment as a professor in the Electrical Engineering and Aeronautics and Astronautics departments at Stanford University. Frits Post is an associate professor of computer science (computer graphics) at Delft University of Technology, the Netherlands.

Tutorial 4
Monday, 8:30 am - 12:00 noon
Software Visualization
Instructor:
Stephen G. Eick, AT&T Bell Labs. Naperville, IL

Course Description:
Software is a huge industry producing the most complicated systems ever created by mankind. This tutorial discusses visualization methods for displaying software. Software visualization can help developers to understand the evolution, execution, and structure of programs. This tutorial includes the following components:
% A taxonomy for software visualization;
% Techniques for visualizing code, data structures, program execution, and the software development process;
% Examples of exceptional software visualization systems;
% Open research problems in software visualization with large payoffs.

Who Should Attend?
The course is for anyone involved with software who is challenged by its complexity (e.g. software developers, algorithm designers, individuals who program as part of their work), and
researchers interested in techniques for visualizing abstract data.

Instructor:
Stephen G. Eick is a member of the Technical Staff at AT&T
Bell Laboratories.

Tutorial 5
Monday, 1:30 pm - 5:00 pm
A Guided Tour of High Performance
Computing:
Architecture, Software, Applications
Instructor:
H. Simon, NASA Ames

Course Description:
The focus of this tutorial will be a discussion of current
hardware and software trends for massively parallel
supercomputers from the perspective of application users. In
case studies, the lessons learned in NASA Ames will be
presented. The main thrust of the tutorial will a presentation
of high performance computing issues which will remain
relevant for a long period of time, independently of currently
"hot" machines. A new taxonomy of parallel application will
be developed. The matching of the application taxonomy
with the architectural characteristics of the machine will form
the basis for the understanding of high performance
computing.

Who Should Attend?
Scientists with large scale visualization applications, who
are interested in the potential use of massively parallel
supercomputers for their applications. A general audience,
who wants to get up to date information on the current status
of using massively parallel supercomputers for Grand
Challenge type applications.

Instructor:
Horst D. Simon is a department manager with Computer
Sciences Corporation at the Applied Research Branch at the
National Aerodynamics Simulator Systems Division at NASA
Ames Research Center in Moffett Field, California.

Tutorial 6
Tuesday, 8:30 am - 5:00 pm
Vector Field Topology

Instructors:
Daniel Asimov, NASA Ames
Al Globus, NASA Ames
Creon Levit, NASA Ames

Course Description:
Vector fields play a crucial role in relating differential
equations to
transformations of space. As a result, vector fields have
many uses in science, including computational fluid
dynamics, magnetohydrodynamics, structural mechanics, and
the underlying mathematical field of dynamical systems.

This course will provide the groundwork for understanding
vector field topology and related visualization techniques. It
will discuss the mathematics of flow topology and the
interactive visualization of flow fields using topological
techniques. Interactive 2D, 3D steady-state and time-varying
flow topology analysis software will be demonstrated.
Related numerical analysis and software implementation
strategies will be discussed in detail. A survey of the
literature and open research problems will conclude the
course.

Who Should Attend?
This course is designed for those interested in understanding
the topological underpinnings of vector fields and flows.
Those interested in developing or using state-of-the-art
software for scientific visualization of vector field topology.
A familiarity with basic vector calculus and linear algebra is
strongly recommended.

Instructors:
Daniel Asimov, Al Globus, and Creon Levit are all research
scientists at the Numerical Aerodynamic Simulation Systems
Division at NASA Ames Research Center in Mountain View,
California.

Tutorial 7
Tuesday, 8:30 am - 5:00 pm
Visualizing Statistical Data
Instructor:
W.S. Cleveland, AT&T Bell Labs

Course Description:
There are two components to visualizing the structure of

statistical data - graphing and fitting. Just graphing raw data - without fitting mathematical structures to them and without graphing the fits and residual - often leaves important aspects of the data undiscovered. This full day tutorial presents methods for graphing and fitting. The material is organized around applications of the visualization methods to data from scientific studies.

Who Should Attend:
This tutorial and the book on which it is based, Visualizing Data, are meant for those who analyze statistical data. A knowledge of very basic statistics is suggested although much of the tutorial does not require it.

Instructor:
William S. Cleveland is a member of the Mathematics Research Center at AT&T Bell Laboratories.

Tutorial 8
Tuesday, 8:30 am - 12:00 noon
Stereo Computer Graphics with Applications to Visualization
Instructors:
D. McAllister, North Carolina State University
L. Harrison, North Carolina State University

Course Description:
This tutorial presents an introduction to depth perception, techniques for generation of stereoscopic images, and stereoscopic interface issues. Many example of stereo images will be shown. The tutorial provides an introduction to the rapidly growing area of stereo computer graphics. It introduces the participants to some of the issues in creating stereo computer graphics. Topics include: introduction to depth perception, computation of stereo images, and stereoscopic interface issues.

Who Should Attend?
This tutorial is aimed at computer graphics professionals, and others who need a "true" three-dimensional representation to disambiguate depth information and detail in complex models.

Instructors:
Dr. McAllister is a professor in the Department of Computer Science at North Carolina State University. Mr. Harrison is currently Software Systems Manager for the Department of

Computer Science at NCSU while pursuing his Ph. D.

Tutorial 9
Tuesday, 1:30 pm - 5:00 pm
Volume Visualization Algorithms and
Applications
Instructors:
Arie E. Kaufman, State University of New York at Stony
Brook
William E. Lorensen, General Electric Company
Roni Yagel, The Ohio State University

Course Description:
Volume visualization is concerned with the tasks of
representing, manipulating, and rendering volumetric data.
This course provides an overview of the technology, the
nomenclature, and the techniques for these tasks,
emphasizing algorithms, architectures, and applications.
The course covers and compares different approaches in
volume representation, volume synthesis, volume and surface
viewing, volume shading, and applications of volume
visualization.

Who Should Attend?
The course is intended for computer scientists and
professionals who develop visualization techniques for
volume data, and professionals in scientific, engineering, and
biomedical disciplines who use these techniques and want to
learn how they work.

Instructors:
Arie E. Kaufman is a Professor of Computer Science and the
director of the Cube project for volume visualization at the
State University of New York at Stony Brook. William E.
Lorensen is a Graphics Engineer in the Information Systems
Laboratory at General Electric's Corporate Research and
Development Center in Schenectady, New York. Roni Yagel
is an Assistant Professor in the Department of Computer and
Information Science at The Ohio State University.

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Visualization '93 Special Sessions:

Date and Times to be announced

1. Panel: Data Visualization: Research Issues,
 Applications, and Future Directions

Vis'93 presents a panel of visualization experts as a special
evening session. These panel members participated in a Office of
Naval Research Workshop on State of the Art in Data
Visualization in Darmstadt, Germany. This Special Session will
report the major findings of the workshop to you and continue the
lively discussion from that workshop.

Panel Chair: Rae A. Earnshaw,University of Leeds, UK

Panelists:
Steve Bryson, CSC/NASA Ames, USA
Jose L. Encarnacao, TH Darmstadt, FRG
Hans Hagen, University of Kaiserslautern, FRG
Lambertus Hesselink, Stanford University, USA

2. Workshop Findings:

The Workshop Organizers, participants and the Workshop Co-
Chairs will discuss and review the results of the Monday and
Tuesday workshops on Visualization Education, Intelligent
Visualization Systems, Visualization in Decision-Support, and
Database Issues for Data Visualization. This session is open to
all workshop, tutorial, symposia, and conference attendees.

3. Research Problems in Visualization

This is an informal meeting to provide attendees the
new problems collected over the past year, discuss
results on any of the 1991-2 research problems, or
to present new research questions to be included in
the 1993 research problem set. These problems will
be published in the IEEE Technical Committee on
Computer Graphics Newsletter. Presenters should
send their one page descriptions of results or the
new research problem to grinstein@cs.ulowell.edu
by October 10, 1993.

4. How to Lie and Confuse with Visualization

People have lied with statistics and maps for
years. Now it's time to look into lying and confusing
in the field of visualization. Your once-a-year big
chance to do just that, in the open, will be in this
special session on Tuesday, October 26, 1993 at 7:00
pm. You are invited to bring with you visualization
lies and confusing articles, yours or others, on 35
mm slides or video. During this evening, it will be
allowed to lie but not to borrow credit, so please do
not forget to mention the producers' names. After
the informal presentations and truthful debates, the
audience will choose the biggest (visualization) lie
for 1993. When the evening is over, lying will be
outlawed again. Then, we will be all able to benefit
from this teaching of what it takes to produce
realistic and faithful visualizations.

   Reservations and advance submissions are now
being accepted (c/o Nahum Gershon, The MITRE
Corporation, 7525 Colshire Drive, McLean, VA
22102). Both are not required but are strongly
recommended. For more information   (genuine!),
please contact gershon@mitre.org.

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 Symposium on Research Frontiers in Virtual Reality

Monday, October 25
8:45 - 9:00 Opening Remarks:
 Steve Bryson, CSC/NASA
Ames
 Steve Feiner, Columbia
University

9:00 - 10:00 Keynote:
 Hype and Hope---What is
Real?
 Frederick P. Brooks, Jr.
 University of North Carolina,
Chapel Hill

10:30 - 12:00 Paper Session:
Technology

DIVER: A Distributed Virtual
Environment Research Platform, Rich
Gossweiler, Chris Long, Shuichi Koga, Randy
Pausch, University of Virginia

Volume Haptization, Hiroo Iwata, University of
Tsukuba

Interactive Collision Detection, Philip M.
Hubbard, Brown University

12:00 Lunch

1:30 - 3:00 Panel : Evaluation of VR
Systems
Chair: Randy Pausch, University of Virginia
Panel Members:
James C. Chung, University of North Carolina,
Chapel Hill
Robert Eggleston, Wright-Patterson Air Force Base
Tom Piantanida, SRI International

3:30 - 5:15 Paper Session: Human
Factors

The Human Factors of Virtual
Environments,
Kenneth Nemire, San Jose State University
Foundation and NASA Ames Research Center,
Stephen R. Ellis, NASA Ames Research Center

A User Study Comparing Head-Mounted
and Stationary Displays, Randy Pausch, M.
Anne Shackelford, Dennis Proffitt, University of
Virginia

Perceptual Decomposition of Virtual
Haptic Surfaces, Louis B. Rosenberg, Stanford
University, Bernard D. Adelstein, NASA Ames
Research Center

Position Paper: Understanding Synthetic
Experience Must Begin with the Analysis
of Ordinary Perceptual Experience, Jack M.
Loomis, University of California at Santa Barbara

6:15 - 7:00 pm Poster Session

7:00 - 9:30 pm Symposia Buffet and
Reception

Tuesday, October 26
9:00 - 10:00 Invited Talk:
 Interaction in Virtual
Environments: Implications
of New Paradigms
 Andries van Dam,
 Brown University

10:30 - 12:00
Paper Session: Applications

Scientists in Wonderland, A Report on
Visualization Applications in the CAVE
Virtual Reality Environment, Carolina Cruz-
Neira, Jason Leigh, Craig Barnes, Steven M. Cohen,
Sumit Das, Roger Engelmann, Randy Hudson, Mike
Papka, Trina Roy, Lewis Siegel, Christina Vasilakis,
Thomas A. DeFanti, Daniel J. Sandin, University of
Illinois at Chicago

Applying Virtual Reality in Education: A
Prototypical Virtual Physics Laboratory,
R. Bowen Loftin, University of Houston, Mark
Engelberg, LinCom Corporation, Robin Benedetti,
University of Southern California

Cosmic Explorer: A Virtual Reality
Environment for Exploring Cosmic Data,
Deyang Song, Michael L. Norman, NCSA

On Recording Virtual Environments, John
C. Hart, Washington State University

12:00 Lunch

1:30 - 3:00 Panel : Effective Use of
Non-speech Audio in Virtual Reality
Chair: Meera M. Blattner, University of California at
Davis and Lawrence Livermore National Laboratory
Panelists:
Robin Barger, NCSA and University of Illinois
Gregory Kramer, Clarity and the Santa Fe Institute
Julius O. Smith, Stanford University

Elizabeth M. Wenzel, NASA Ames Research Center

3:30 - 5:00 Paper Session: Sound in
Virtual Worlds

Virtual Gain for Audio Windows, Michael
Cohen, University of Aizu, Nobuo Koizumi, Nippon
Telegraph and Telephone Corporation

Using Virtual Sounds to Represent
Stationary and Moving Targets to a
Moving Observer: The Problem of
Distance Perception, Jack M. Loomis, Jon M.
Speigle, University of California at Santa Barbara

What you See is What you Hear: Acoustics
Applied in Virtual Worlds, Peter Astheimer,
Fraunhofer-Institute for Computer Graphics

Symposium on Research Frontiers in Virtual Reality Program Committee:

Co-Chairs:
Steve Bryson, CSC/NASA Ames Research Center
Steve Feiner, Columbia University

Program Committee:
Dov Adelstein, NASA Ames Research Center
Mark Bolas, Fake Space Labs
Kellogg Booth, University of British Columbia
William Bricken, University of Washington
Carolina Cruz-Neira, University of Illinois, Chicago
Nathaniel Durlach, Massachusetts Institute of Technology
Wolfgang Felger, Fraunhofer Institute for Computer Graphics
Henry Fuchs, UNC, Chapel Hill

Mark Green, University of Alberta
Randy Pausch, University of Virginia
Tom Piantanida, SRI International
Larry Rosenblum, Office of Naval Research
Larry Stark, University of California at Berkeley
Susumu Tachi, University of Tokyo
Andries van Dam, Brown University
Elizabeth Wenzel, NASA Ames Research Center
David Zeltzer, Massachusetts Institute of Technology

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Symposium on Parallel Rendering

Monday, October 25
8:15 - 8:30 Welcome and
Announcements

8:30 - 10:00 Papers: Volume
Rendering 1
Segmented Ray Casting for Data
Parallel Volume Rendering,
William M. Hsu, Digital Equipment
Corporation

A Data Distributed, Parallel
Algorithm for Ray-Traced Volume
Rendering, Kwan-Liu Ma, Institute for
Computer Applications in Science and
Engineering, James S. Painter, University
of Utah, Charles D. Hansen, Michael F.
Krogh, Los Alamos National Laboratory

Parallel Volume Rendering and
Data Coherence, Brian Corrie, Paul
Mackerras, Australian National University

10:30 - 12:00 Papers: Polygon
Methods
A Task Adaptive Parallel Graphics
Renderer, Scott Whitman, David Sarnoff
Research Center

A MIMD Rendering Algorithm for
Distributed Memory
Architectures, Thomas W. Crockett.
Institute for Computer Applications in
Science and Engineering, Tobias Orloff,
Minerva Software

A Multicomputer Polygon
Rendering Algorithm for
Interactive Applications, David
Ellsworth, The University of North

Carolina at Chapel Hill

12:00 Lunch

1:30 - 3:00 Papers: Parallel
Algorithmic Techniques
Pixel Merging for Object-Parallel
Rendering: A Distributed
Snooping Algorithm, Michael Cox,
Pat Hanrahan, Princeton University

Permutation Warping for Data
Parallel Volume Rendering, Craig
M. Wittenbrink, Arun K. Somani,
University of Washington

Parallel Approximate
Computation of Projections for
Animated Volume Rendered
Displays, Tung-Kuang Wu, Martin L.
Brady, Pennsylvania State University

3:30 - 4:30 Parallel Potpourri 1
Developing Modular Application
Builders to Exploit MIMD
Parallel Resources, Chris
Thornborrow, Andrew J. S. Wilson, Chris
Faigle, Edinburgh Parallel Computing
Center

A Voxel-based, Forward
Projection Algorithm
Implemented on a Highly Parallel
Architecture, John R. Wright, Hughes
Training, Inc., Charles Bryant, Kendall
Square Research

4:30 - 5:30 Discussion 1

7:00 - 9:30 pm: Symposia
Buffet and Reception

Tuesday, October 26
8:30 - 10:00 Papers: Terrain
Rendering, Ray Tracing, and
Radiosity
A Pyramid-Based Approach to
Interactive Terrain Visualization,

Jim Kaba and Joseph Peters, David Sarnoff
Research Center

Progressive Refinement Radiosity
on Ring-Connected
Multicomputers, Tolga K. Capin,
Cevdet Aykanat, Bulent Ozguc, Bilkent
University

An Efficient Parallel Ray Tracing
Scheme for Distributed Memory
Parallel Computers, Wilfrid Lefer,
Laboratoire d'Informatique Fondamentale
de Lille

10:30 - 12:00 Papers: Volume
Rendering 2
Scalable Parallel Volume
Raycasting for Nonrectilinear
Computational Grids, Judy
Challinger, University of California at
Santa Cruz

Integrating Volume Data Analysis
and Rendering on Distributed
Memory Architectures, Emilio
Camahort, The University of Texas at
Austin, Indranil Chakravarty,
Schlumberger Laboratory for Computer
Science

Parallel Volume Rendering
Algorithm Performance on Mesh-
Connected Multicomputers, Ulrich
Neumann, University of North Carolina at
Chapel Hill

12:00 Lunch

1:30 - 3:00 Keynote Panel:
Issues, Trends, and Future
Directions in Parallel Rendering
Panel Chair: Scott Whitman, David
Sarnoff Research Center
Panelists:
 Pat Hanrahan, Princeton University
 Chuck Hansen, Los Alamos National
Laboratory

Paul Mackerras, Australian National
University
 David Ellsworth, University of North
Carolina
 Jim Salem, Exa Corporation

3:30 - 4:00 Parallel Potpourri 2
An Optimal Architecture for
Volume Rendering, Vineet Goel, Amar
Mukherjee, University of Central Florida

4:00 - 5:00 Discussion 2

Symposium on Parallel Rendering Program Committee:

Co-Chairs:
Tom Crockett, ICASE
Chuck Hansen, Los Alamos National Laboratory
Scott Whitman, David Sarnoff Research Center

Program Committee
Zahid Ahmed, San Diego Supercomputer Center
Patricia Crossno, Sandia National Laboratory
Frank Crow, Apple Computer
Richard J. Greco, Intel Supercomputer Systems Division
Pat Hanrahan, Princeton University

Arie Kaufman, State University of New York at Stony Brook
Paul Mackerras, Australian National University
Steven Molnar, University of North Carolina at Chapel Hill
Derek Paddon, University of Bristol
James B. Salem, Exa Corporation

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Visualization '93 Paper and Panel Sessions:

Wednesday, 9:00 - 10:15
Welcome and Announcements

Keynote Address:

"A Vision for Visualization"

Frederick P. Brooks, Jr.

Frederick P. Brooks, Jr. is Kenan Professor of Computer
Science at the University of North Carolina in Chapel
Hill. He received his Ph.D. in computer science at
Harvard. He joined IBM upon graduating and was one of
the architects of the IBM Stretch and Harvest Computer.
He was Corporate Project Manager for the System/360,
including the development of the System/360 computer
family hardware, and the Operating System/360 software,
for which he shared the National Medal of Technology
with Bob Evans and Erich Bloch, and for which he
received the IEEE Computer Society MacDowell Award. He
joined UNC in 1964, where he founded the Department of
Computer Science and chaired it for its first 20 years. His
research has been in computer architecture, software
engineering, and interactive 3-D computer graphics
("virtual reality"). His best-known book is The Mythical
Man Month: Essays on Software Engineering.

Wednesday, 10:30 - 12:00
Keynote Panel:

Visualizing the Environment
Panel Chair: Gregory McRae
Dr. Gregory McRae is the Joseph J. Mares Professor of
Chemical Engineering at the Massachusetts Institute of
Technology. His principal area of research is
understanding the physical and chemical transformation
processes responsible for the formation of urban,
regional, and global scale air pollution. He has made
important contributions to the development of three-
dimensional photochemical models and their use in the
design of cost effective abatement strategies. He was
awarded the NSF Presidential Young Investigator Award
(1984), the George Tallman Ladd Research Prize (1985),
the first Forefronts of Computational Science Award
(1990), the Niccograph Scientific Visualization Prize
(1991) and the National Computer Graphics Prize (1991).

Visualization in the Sciences
Mark Ellisman
Mark H. Ellisman is a Professor of Neuroscience at the
University of California at San Diego and the Director of

the National Research Resource for Microscopic Imaging and Image Analysis. Dr. Ellisman received his Ph.D. from the University of Colorado and is a Founding Fellow of the American Institute for Medican and Biological Engineering. His research interests include the devleopment and application of advanced imaging technologies to obtain new information about cell structure and function.

Visualizing the Universe
Margaret Geller
Dr. Margaret Geller is a Professor of Astronomy at Harvard University and Senior Scientist at the Harvard-Smithsonian Center for Astrophysics. In July 1990, she was awarded a MacArthur Foundation Fellowship. She is a member of the National Academy of Sciences and of the American Academy of Arts and Sciences. Margaret Geller and Boyd Estus won a CINE Gold Eagle, a Gold Medal in the Houston Film Festival and several other awards for their video Where the Galaxies Are.

Wednesday, 1:30 - 3:30
2A
Papers:
Volume Visualization I

(2A-1) Fast Volume Rendering of Compressed Data, Paul Ning, Lambertus Hesselink, Stanford University

(2A-2) Flow Volumes for Interactive Vector Field Visualization, Nelson Max, Barry Becker, Roger Crawfis, Lawrence Livermore National Laboratory

(2A-3) The Vision Camera: An Interactive Tool for Volume Data Exploration and Navigation, Hans-Heino Ehricke, Gerhard Daiber, Wolfgang Strasser, Universitaet Tuebingen

2B
Panel:
(2B) Applications in Virtual Environments: Bridging the Gap Between Prototypes and Working Tools

Chair: William Ribarsky, Georgia Institute of Technology
Panelists:

Larry Hodges, Georgia Institute of Technology
Steve Bryson, CSC/NASA Ames Research Center
Mark Green, University of Alberta
Randy Pausch, University of Virginia
Steve Benton, MIT Media Laboratory

2C
Case Studies Session:
Oil and CFD

(2C-1)Visualization and Modeling of
Geophysical Data, Indranil Chakravarty, G. Celniker,
and J. Moorman, Schlumberger Laboratory for Computer
Science

(2C-2)Visualization of Oil Reservoirs Over a
Large Range of Scales as a Catalyst for
Multidisciplinary Integration, Stephen Tyson and
B. William, Santos, Australia

(2C-3) Unsteady Phenomena, Hypersonic
Flows, and Co-operative Flow Visualization in
Aerospace Research, Hans-Georg Pagendarm, Institue
for Theoretical Fluid Mechanics, German Aerospace
Research Establishment

(2C-4) Towards Interactive Steering,
Visualization and Animation of Unsteady
Finite Element Simulations, David Kerlick and E.
Kirby, Boeing Computer Services

Thursday, 8:30 - 10:15
3A
Papers:
Flow Visualization I

(3A-1) Visualization of Time-Dependent Flow
Fields, David A. Lane, NASA Ames Research Center

(3A-2) A Probe for Local Flow Field
Visualization, Willem C. de Leeuw, Delft University of
Technology, Jarke J. van Wijk, Netherlands Energy
Research Foundation ECN, The Netherlands

(3A-3) Visualization of Turbulent Flow with
Particles, Andrea J. S. Hin, Frits H. Post, Delft

University of Technology, The Netherlands

3B
Panel:
(3B) Visualization System Reference Models

Chair: David Butler, Limit Point Systems, Sandia National
Laboratory
Panelists:
Bob Haber, University of Illinois at Champaign-Urbana
Jim Almond, Texas Supercomputer Center
Ken Brodlie, University of Leeds
R. Daniel Bergeron, University of New Hampshire at
Durham

3C
Case Studies Session:
High Energy Physics

(3C-1) The Quantum Coulomb Three Body
Problem, Visualization of Simulation Results
and Numerical Methods, Wolfgang Krueger, D.
Abramov, V. Gusev, S. Klimenko, L. Ponomarev, W.
Renz, German National Research Center for Computer
Technology, GMD

(3C-2) Fanal: A Relational Analysis and
Visualization Package for High Energy
Physics, Henri Videau, Ecole Polytechnique, Laboratoir
de Physique Nucleaire des Hautes Energies, FRANCE

(3C-3) Non-Conventional Methods for the
Visualization of Events from High Energy
Physics, Hans Drevermann, CERN, Switzerland

Thursday, 10:30-12:30
4A
Papers:
Volume Visualization II

(4A-1) Optimal Filter Design for Volume
Reconstruction and Visualization, Ingrid
Carlbom, Digital Equipment Corporation, Cambridge
Research Laboratory

(4A-2) Accelerating Volume Animation by

Space-Leaping, Roni Yagel, Zhouhong Shi, The Ohio
State University

(4A-3) Rapid Exploration of Curvilinear Grids
Using Direct Volume Rendering, Allen Van Gelder,
Jane Wilhelms, University of California at Santa Cruz

(4A-4) Volume Sampled Voxelization of
Geometric Primitives, Sidney W. Wang, Arie E.
Kaufman, State University of New York at Stony Brook

4B
Panel:
(4B) Is Visualization REALLY Necessary?
The Role of Visualization in Science,
Engineering, and Medicine

Chair: Nahum Gershon, The MITRE Corporation

Panelists:
Robert Abarbanel, Boeing Computer Services
Richard Mark Friedhoff, Visicom Corporation
Robert Langridge, University of California at San
Francisco
Justin D. Pearlman, Beth Israel Hospital, Harvard Medical
School
Jeffrey L. Star, NCGIA and University of California at
Santa Barbara

4C
Papers:
Visualization Environments

(4C-1) Tioga: A Database-Oriented
Visualization Tool, Michael Stonebraker, Jolly Chen,
Nobuko Nathan, Caroline Paxson, University of California
at Berkeley

(4C-2) Bridging the Gap Between Visualization
and Data Management: A Simple Visualization
Management System, Peter Kochevar, Digital
Equipment Corporation, Zahid Ahmed, Jonathan Shade,
Colin Sharp, San Diego Supercomputer Center

(4C-3) GRASPARC - A Problem Solving
Environment Integrating Computation and
Visualization, Ken Brodlie, University of Leeds, Lesley
Brankin, Greg Banecki, Alan Gay, NAG Ltd, Oxford,

Andrew Poon, Helen Wright, University of Leeds,
England

(4C-4) An Environment for Telecollaborative
Data Exploration, Gudrun J. Klinker, Digital
Equipment Corporation, Cambridge Research Lab

Thursday, 1:30 - 3:30
5A
Papers:
Visualization Techniques and Algorithms I

(5A-1) HyperSlice, Jarke J. van Wijk, Netherlands
Energy Research Foundation ECN, Robert van Liere,
Centrum voor Wiskunde en Informatica, The Netherlands

(5A-2) Fine-Grain Visualization Algorithms in
Dataflow Environments, Deyang Song, Eric Golin,
University of Illinois at Champaign-Urbana

(5A-3) Developing Modular Application
Builders to Exploit MIMD Parallel Resources,
Chris Thornborrow, Andrew J. S. Wilson, Chris Faigle,
University of Edinburgh, Scotland

(5A-4) Virtual Input Devices for 3D System,
Taosong He, Arie Kaufman, State University of New York
at Stony Brook

5B
Papers:
Visualizing Databases and Parallel Programs

(5B-1) InfoCrystal: A Visual Tool for
Information Retrieval, Anselm Spoerri,
Massachusetts Institute of Technology

(5B-2) Visual Feedback in Querying Large
Databases, Daniel Keim, Hans-Peter Kriegel, Thomas
Seidl, University of Munich, Germany

(5B-3) DIVIDE: Distributed Visual Display of
the Execution of Asynchronous, Distributed
Algorithms on Loosely-Coupled Parallel
Processors, Tom Morrow, Sumit Ghosh, Brown
University

(5B-4) Performance Visualization of Parallel
Programs, Abdul Waheed, Diane T. Rover, Michigan
State University

 5C
Case Studies:
The Environment

(5C-1) Visualization of Stratospheric Ozone
Depletion and the Polar Vortex, Lloyd Treinish,
IBM T. J. Watson Research Center

(5C-2) A Climate Simulation Case Study, Philip
Chen, Fujitsu America

(5C-3) Feature Extraction for Oceanographic
Data Using a 3D Edge Operator, Robert Moorhead
and Z. Zhu, NSF Engineering Research Center for
Computational Field Simulation, Mississippi State
University

(5C-4) Visualizing Results of Transient Flow
Simulations, Harald Mayer, Institute for Information
Systems, Joanneum Research, Austria

Thursday, 3:45 - 5:45
6A
Papers:
Visualization Techniques and Algorithms II

(6A-1) Orientation Maps: Techniques for
Visualizing Rotations (A Consumer's Guide),
Bowen Alpern, Larry Carter, Matt Grayson, IBM T. J.
Watson Research Center, Chris Pelkie, Cornell Theory
Center

(6A-2) Geometric Optimization, Paul Hinker,
Charles Hansen, Los Alamos National Laboratory

(6A-3) Interactive Visualization Methods for
Four Dimensions, Andrew J. Hanson, Robert A. Cross,
Indiana University

(6A-4) Navigating Large Networks with
Hierarchies, Stephen G. Eick, Graham J. Wills, AT&T

Bell Laboratories

6B
Panel:
(6B) Visualization and Beyond: Unresolved
Computing Challenges in the Environmental
Sciences

Chair: Theresa Marie Rhyne, Martin Marietta/U.S. EPA
Organizers: Theresa Marie Rhyne, Len Wagner
Panelists:
Gary Darling, California Department of Water Resources
Philip K. Robertson, CSIRO/Australia
Len Wagner, Sequoia Project/San Diego Supercomputer
Center

6C
Papers:
Human Factors Issues in Visualization

(6C-1) Dichromatic Color Representations for
Complex Display Systems, Mark S. Peercy,
Lambertus Hesselink, Stanford University

(6C-2) Towards a Texture Naming System:
Identifying Relevant Dimensions of Texture, A.
Ravishankar Rao, IBM T. J. Watson Research Center,
Gerald L. Lohse, University of Pennsylvania

(6C-3) Applying Observations of Work
Activity in Designing Prototype Data Analysis
Tools, Rebecca R. Springmeyer, Lawrence Livermore
National Laboratory

(6C-4) An Architecture for Rule-Based
Visualization, Bernice E. Rogowitz, Lloyd A. Treinish,
IBM T. J. Watson Research Center

Friday, 8:30 - 10:15
7A
Papers:
Flow Visualization II

(7A-1) Implicit Stream Surfaces, Jarke J. van
Wijk, Netherlands Energy Research Foundation, ECN
Technology, The Netherlands

(7A-2) Cloud Tracing in Convection-Diffusion
Systems, Kwan-Liu Ma, Phillip J. Smith, University of
Utah

(7A-3) Texture Splats for 3D Vector and Scalar
Field Visualization, Roger A. Crawfis, Nelson Max,
Lawrence Livermore National Laboratory

7B
Panel:
(7B) The Psychology of Visualization

Chair: Frank M. Marchak, TASC
Panelists:
William S. Cleveland, AT&T Bell Laboratories
Bernice E. Rogowitz, IBM T. J. Watson Research Center
Christopher D. Wickens, University of Illinois

7C
Case Studies:
Medicine and Archeology

(7C-1) Enhancing Reality in the Operating
Room, Bill Lorensen, Harvey Cline, Chris Nafis, GE
Corporate R&D, Ron Kikinis, Dave Altobelli, Langham
Gleason, Brigham and Women's Hospital

(7C-2) 3D Simulation of Delivery in Medicine,
B. Geiger and J. Boissonet, INRIA, France

(7C-3) The Virtual Restoration of the Visir
Tomb, Patrizia Palamidese and G. Muccioli, CNUCE,
Instituto del CNR, Italy

Friday, 10:30 - 12:30
8A
Papers:
Textures and Shading

(8A-1) Geometric Clipping Using Boolean
Textures, William E. Lorensen, General Electric
Corporate Research and Development

(8A-2) Data Shaders, Brian Corrie, Paul Mackerras,
Australian National University

(8A-3) Spray Rendering: Visualization Using
Smart Particles, Alex Pang, Kyle Smith, University of
California at Santa Cruz

(8A4) Interactive Shading for Surface and
Volume Visualization on Graphics
Workstations, Peter A. Fletcher, Philip K. Robertson,
CSIRO Division of Information Technology, Australia

8B
Panel:
(8B) Data Models and Access Software for
Scientific Visualization

Chairs: Lloyd Treinish, IBM T. J. Watson Research Center
Ravi Kulkarni, University of Maryland
Panelists:
Mike Folk, NCSA, University of Illinois at Champaign-
Urbana
Greg Goucher, NASA/Goddard Space Flight Center
Russ Rew, Unidata Program Center

8C
Papers:
Visualization Application in the Sciences

(8C-1) Fast Analytical Computation of
Richard's Smooth Molecular Surface, Amitabh
Varshney, Frederick P. Brooks, Jr., University of North
Carolina at Chapel Hill

(8C-2) Computer Visualization of Long
Genomic Sequences, Dachywan Wu, James Roberge,
Douglas J. Cork, Bao Gia Nguyen, Thom Grace, Illinois
Institute of Technology

(8C-3) Visualization of Acoustic Lens Data,
Anthony J. Bladek, University of Washington

(8C-4) MRIVIEW: An Interactive
Computational Tool for Investigation of Brain
Structure and Function, Doug Ranken, John George,
Los Alamos National Laboratory

Friday, 1:30 - 3:00
9ABC
Closing

Awards for Best Paper, Panel, and
Case Study

Capstone Address

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Visualization '93 Demonstrations:

The IEEE Visualization '93 Demonstration/Exhibit is pleased to introduce
its three Corporate Partners: AVS, IBM, and Kubota Pacific. These
companies are helping to make the Demonstration/Exhibit outstanding and
successful.

Advanced Visual Systems Inc., headquartered in Waltham, MA, is the
developer of the AVS family of visualization software products for
scientific, engineering, and business professionals and software
developers. AVS was first introduced in 1988. It is a general-purpose,
platform-independent software product used in a wide variety of scientific
and engineering disciplines. It is a visualization application software
and development environment available on systems from a number of
manufacturers.

International Business Machines, Inc. will be represented through IBM
Visualization Systems of the Thomas J. Watson Research Center in
Hawthorne, NY, the developer of the IBM POWER Visualization System and
the IBM Visualization Data Explorer, which were introduced in 1991. Data
Explorer is a general-purpose, portable software product for the
visualization and analysis of data in a wide variety of scientific and
engineering disciplines. It is available as an application and for
development on systems from a number of manufacturers.

Kubota Pacific Computer Inc. of Santa Clara, CA, produces the Kubota Kenai
family of Imaging and 3D Graphics Computers for product development,
image analysis, and technical research. The Kenai computers are balanced
for highly interactive performance in both imaging and 3D graphics and
employ 64 bit Alpha AXP architecture. Typical applications are mechanical
engineering and analysis, computational fluid dynamics, molecular
simulations, strategic imaging, and visualization.

 VIS'93 DEMONSTRATIONS open at noon Wednesday

 VIS'93 DEMONSTRATIONS 9am to 4pm Thursday

This year, as at past IEEE Visualization Conferences, the Demonstration/Exhibit will emphasize research and new technology. Listed below are some of the For-Profit companies who have signed up to participate. We would like to see your name on the Vis'93 Demonstrator List, too. We are still accepting applications for Corporate Partners, For-Profit Corporate Demonstrators, and Non-Profit Demonstrators. For more information, contact the Demonstrations Co-Chair: Bill Ribarsky at (404) 894-6148, by FAX at (404) 894-9548, or by email:

bill.ribarsky@oit.gatech.edu

Advanced Visual Systems Inc.
300 Fifth Ave.
Waltham, MA 02154
Marsha Gordon
(mgordon@avs.com,
617-890-4300)

Addison Wesley
1 Jacob Way
Reading, MA 01867
Gail Goodell
(bdaw@world.std.com,
617-944-3700, ext. 2833)

Aurora Systems
2230 Martin Ave.
Santa Clara, CA 95050
Megan Reese
(408-988-2000)

Eye Point Engineering
24 Springpoint Rd.
Castroville, CA 95012
Bob Duncan
(408-879-4975)

IBM Corp.
8 Skyline Drive
Hawthorne, NY 10532
Rich Buckta
(bucktar@watson.ibm.com,
914-784-5110)

Kendall Square Research
170 Tracer Lane
Waltham, MA 02154

Scott Free
(sfree@ksr.com,
617-895-3570)

Kubota Pacific Computer Inc.
2630 Walsh Ave.
Santa Clara CA 95051-0905
Jodie Frerichs
(jfrerichs@kpc.com,
408-987-3393)

Lateiner Dataspace Corp.
500 West Cummings Park
Suite 1700
Woburn, MA 01801
Joshua Lateiner
(617-937-8330)

Research Systems, Inc.
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Boulder, CO 80301
Julie Ceranski
(julie@rsinc.com,
303-786-9930, ext. 301)

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415-390-1820)

Wolfram Research Inc.
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Champaign, IL 61820
Howard Berg
(info@wri.com,
217-398-0700)

Xidak, Inc.
3475 Deer Creek Road, Bldg. C
Palo Alto, CA 94304
Michael W. Achenbach
(mike@xidak.com,
415-855-9271)

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Visualization Literature:

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Workshop Registration is handled through the Workshop Organizer.

Tutorial Choices   (please check a first choice and a second choice)

  1st   2nd
choice choice
[   ] [   ] 1. Sunday Full Day Virtual Reality for Visualization
[   ] [   ] 2. Monday Full Day Visualizing Environmental Data Sets

[   ] [   ] 3. Monday Full Day Visualization of Vector & Tensor Fields
[   ] [   ] 4. Monday Half Day, AM Software Visualization
[   ] [   ] 5. Monday Half Day, PM Guided Tour of High Performance Comp.
[   ] [   ] 6. Tuesday Full Day Vector Field Topology
[   ] [   ] 7. Tuesday Full Day Visualizing Statistical Data
[   ] [   ] 8. Tuesday Half Day, AM Stereo Computer Graphics with Appls.
[   ] [   ] 9. Tuesday Half Day, PM Volume Vis Algorithms and Appls.

Tutorial Fees:

        Early Registration   Late Registration
          (before Oct 1)   (Oct. 1 or later)

   Full Day Half Day Full Day Half Day

IEEE/ACM member 250 175 300 210
Non member 315 220 380 265
FT Student 190 135 230 165

(multiply number of tutorials chosen as first choices by appropriate fees
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_____ # full day tutorials x _____ full day fee = $ _____

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Conference Fees: (includes Wed, Thurs, Fri sessions, demos, and Wed reception)

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            (before Oct 1)   (Oct. 1 or later)

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Full-time Student 150   190

        Conference Fee $ _____

Symposium Choices: (includes Mon, Tues sessions, and Mon reception)

Please select one:

 [ ] Parallel Rendering Symposium   [ ] Virtual Reality Symposium

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IEEE/ACM member	270	325
Non member	340	410
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3. Are you a conference speaker?
 yes no

4. Are you a symposia speaker?
 yes no

5. Are you a tutorial presenter?
 yes no

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Ross Gaunt/Registration Chair
Shirley Stephan/Registration Chair
Lawrence Livermore National Laboratory
POB 808 MS L-73,
Livermore, CA 94551 USA

Questions about registration?
Please call the VIS93 phone:
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or
send email to Vis93@llnl.gov

_____
_____

Accomodations: The Red Lion Hotel

The Red Lion Hotel in San Jose, California is the site of the IEEE
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three eating establishments, a pool, spa, and health club. A nearby light-
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