Geometric Design

Conference Themes

Curve and Surface Design
Solid Modeling and Manufacturing
Multidimensional Modeling
Geometry Processing

November 4-8, 1991
Sheraton Tempe
Mission Palms Hotel
Tempe, Arizona

Plus a Short Course on
Rational Curves and Surfaces
November 3, 1991

Preliminary Program

SIAM
Society for Industrial and Applied Mathematics

▲ Deadline Dates ▼

Hotel Reservations:
October 7, 1991

Advance Conference Registration:
October 25, 1991

▲ Organizing Committee ▼

Robert E. Barnhill, Chair
Arizona State University

Rosemary E. Chang
Silicon Graphics

Gerald E. Farin
Arizona State University

David R. Ferguson
Boeing Computer Services

Thomas A. Foley
Arizona State University

Harry McLaughlin
Rensselaer Polytechnic Institute

Ramon F. Sarraga
General Motors Research Laboratories

Tony C. Woo
University of Michigan

Michael J. Wozny
Rensselaer Polytechnic Institute

▲ Funding Agency ▼

SIAM is conducting this conference with the partial support of the Department of Energy.

▲ Get-Togethers ▼

SIAM Welcoming Reception
Sunday, November 3
7:00 PM - 9:00 PM
Cash Bar

Western Buffet Dinner
Wednesday, November 6
6:30 PM - 8:00 PM
Sheraton Tempe Mission Palms, Courtyard

This is a great time to get together with your colleagues and listen to the sounds of the Mariachi band while enjoying a buffet dinner consisting of barbeque beef ribs, grilled chicken, potato salad, cole slaw, Texas toast, corn on the cob, Texas beans,and assorted desserts. Assorted sodas and beer will be available. Vegetarian meals will be available upon request. Cost $29.00

Attention Participants

All presenters, either in a minisymposium or in a contributed session, should submit an extended abstract, not more than one-page long, typed single spaced on 8-1/2" x 11" bond paper.

Abstract Format: 1) Center the title of your abstract in upper/lower case, 1" from the top of the page; 2) leave two lines, and type your name and affiliation; 3) leave two lines and begin typing your abstract, flush left, leaving 1" margins on both left and right sides of the page.

Ways to submit Extended Abstract: 1) Electronically: in TeX or LaTeX via e-mail. Macros are available in LaTeX or TeX to format your submission; 2) Hard copy--please follow preceding instructions and use 10 or 12 point size type.

If you want your abstract included in the Book of Abstracts, which will be distributed on-site, your extended summary must reach the SIAM office, Attention Conference Department, by September 23, 1991.

Short Course

Rational Curves and Surfaces

Sunday, November 3, 1991
Sheraton Tempe Mission Palms Hotel
Tempe, Arizona

Organizer
Gerald E. Farin,
Arizona State University

Instructors
Wolfgang Boehm
Universität Braunschweig, Germany
▲
Gerald E. Farin
Organizer
▼
Alyn Rockwood
Arizona State University

Rational Curves and Surfaces (often referred to as NURBS, for Nonuniform Rational B-splines) are playing an increasingly important role in industrial applications and more theoretical research. They have become a de-facto industry standard because of their ability to model both conics and polynomial splines. However, their benefits are often not exploited. This course will introduce theoretical and practical aspects of rational curves and surfaces. The objective is to prepare participants to understand current research.

Gerald E. Farin is author of the text *"Curves and Surfaces for Computer-Aided Geometric Design"*. Prior to joining Arizona State University, he worked in CAD/CAM development at Mercedes-Benz.

Wolfgang Boehm is co-editor of the Journal *"Computer-Aided Geometric Design."* He has numerous contributions in the field of CAGD to his credit.

Alyn Rockwood, now at Arizona State University, has developed rendering algorithms for trimmed NURBS at Silicon Graphics. Prior to that, he implemented fillet surfaces into the solid modeller ROMULUS.

Locations

Short Course	Ballroom 1
Lunch	Courtyard
Coffee	Prefunction Area

Program

Sunday, November 3, 1991

Morning

9:00 **Projective Geometry and Conics**
Wolfgang Boehm and Gerald E. Farin

10:30 **Coffee**

11:00 **Rational Bezier and B-spline Curves**
Wolfgang Boehm and Gerald E. Farin

12:30 **Lunch**

Afternoon

2:00 **Rational Surfaces**
Wolfgang Boehm, Gerald E. Farin and Alyn Rockwood

3:00 **Coffee**

3:30 **Industrial Applications (rendering, trimming, filleting)**
Alyn Rockwood

5:00 **Adjournment**

Each session will have subtopics and will leave ample room for discussions. The last session will include on-site demonstrations on a Silicon Graphics workstation.

Short Course Registration Fees*

	SIAM Member	Non-Member	Student
Advance	$125	$140	$75
On-Site	$140	$160	$95

*Registration fee includes course materials, coffee, and lunch. Lecture materials will be distributed upon check-in at the SIAM registration desk. Course materials will include *"NURBS for Curve and Surface Design"* edited by Gerald Farin, to be published by SIAM.

Following are subject classifications for the sessions. The codes in parentheses designate session type and number. The session types are: invited (IP), minisymposium (MS), and contributed (CP).

Curve and Surface Design

A Remarkable Class of Quintic Curves (IP1, page 4)
Approximation Methods in Algebraic Geometry (IP2, page 4)
Bezier and B-splines (CP15, page 11)
Curve Methods (CP20, page 15)
Curve Shape (CP8, page 6)
Cylides (MS23, page 14)
Graphics (CP14, page 10)
Implicits and Algebraics (CP9, page 7)
Math Fundamentals (CP10, page 7)
NURBS (MS1, page 4)
Piecewise Polynomial Surfaces for Complex Shapes (MS10, page 7)
Rational Curves and Surfaces (MS1, page 4, CP12, page 8)
Surfaces 1, 2, and 3 (CP3, CP6, CP19, pages 5, 6, 14)
SSI Loop Detection (MS14, page 8)

Geometry Processing

Approximate Conversion and Merging of Trimmed Spline Surface Patches (IP6, page 8)
CAGD and Base Points (MS3, page 4)
Constructive Representation (MS5, page 5)
Geometric Modeling in Grid Generation (MS13, page 8)
Geometry Processing and Multidimensional Interpolation (IP7, page 8; CP18, page 11)
Intersections (CP2, page 5)
Surface Reconstruction from Unorganized Point Sets (MS20, page 11)
Singular Geometries, (CP11, page 7)
Triangulation and Grids (CP13, page 10)

Multidimensional Modeling

Computational Representation of Space with Binary Space Partitioning Trees (MS11, page 7)
Gaussian Blending and Visualization (MS25, page 15)
Higher-Dimensional Methods in Computer-Aided Geometric Design (IP5, page 6)
Interactive Modeling of Geological Surfaces (MS17, page 10)
Interactive Visualization and Animation of 2-D and 3-D Fluid Flow Simulations (IP9, page 10)
Non-Manifold Data Structures and Subdivisions of 3-D Space (MS2, page 4)
The Future of Computer Graphics (IP8, page 10)
Trivariate Scattered Data (MS7, page 6)

Solid Modeling and Manufacturing

Algebraic Geometry in CAGD (MS22, page 14)
Design Automation (CP7, page 6)
Design Optimization (MS6, page 6)
Discrete Solid Models for Modeling & CAD/CAE (MS8, page 7 ; MS9, page 7; MS13, page 8)
Free Form Volumes in Solid Modeling (MS21, page 14)
Geometry in Engineering (MS24, page 14)
Implicit Modeling in Engineering (MS18, page 11; MS19, page 11)
Motion in CAD/CAM (MS8, page 7; MS9, page 7)
Motion Planning (CP5, page 5)
Physical System and Simulation (MS16, page 10)
Product Models with Built-in Physics (IP3, page 4)
Solid Modeling (IP4, page 6)
Solids 1, 2, and 3 (CP1, page 4; CP16, page 11; CP17, page 11)
Tolerancing Theory (IP11, page 14)
Variational Design (MS15, page 10)
Vehicle Lights Simulation (MS4, page 5)

SIAM ACTIVITY GROUP ON GEOMETRIC DESIGN

Focuses on the mathematical and computational problems in the application of geometry to current problems of design, manufacturing, and automation. One of today's national needs is improving competitiveness of American industry and science in design, manufacturing, and automation. Successful interplay between mathematics, computing, and real problems is an essential ingredient of this nationally important issue.

Geometric design encompasses many aspects of science and engineering, including curve and surface design, solid modeling and manufacturing, geometric complexity, computer graphics, interpolation of physical phenomena, and supercomputing.

This activity group disseminates information about meetings and sponsors special sessions at SIAM meetings.

To join: If you are a SIAM member, write "Geometric Design AG" on your renewal form and add $10.00 to your total. If you are not a member or have already renewed your SIAM membership, contact SIAM Customer Service at 3600 University City Science Center, Philadelphia, PA 19104-2688 Phone: 215-382-9800 / Toll free in U.S.: 800-447-SIAM Fax: 215-386-7999 / E-mail: siam@wharton.upenn.edu Remember, participation in SIAM Activity Groups is available to SIAM members only--so join or renew your membership now!

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Monday Morning, November 4

7:30/Ballroom Foyer
Registration Opens

8:15/Ballroom 1
Welcoming Remarks
Lattie Coor, President, Arizona State University


8:30/Ballroom 1
IP1/Chair: Robert E. Barnhill, Arizona State University

A Remarkable Class of Quintic Curves

Among the family of all plane polynomial parametric curves of degree five, there exists a special subset whose members exhibit two very attractive properties for CAD applications: (i) their arc length may be computed exactly, without numerical quadrature; and (ii) their offset curves admit a precise representation as rational Bezier curves. These "Pythagorean-hodograph" quintics satisfy the general first-order Hermite interpolation problem, and are thus sufficiently flexible for most free-form design purposes. However, algebraic arguments indicate that (unlike the familiar Hermite cubic) the Pythagorean-hodograph quintic interpolant to prescribed end points and tangent vectors is not unique - there are always four distinct solutions! We differentiate between these solutions by comparing rotation indices and exploring the geometry of the corresponding control polygons.

Rida T. Farouki
IBM Thomas J. Watson Research Center


9:15/Ballroom 1
IP2/Chair: Robert E. Barnhill, Arizona State University

Approximation Methods in Algebraic Geometry

Algebraic geometry traditionally deals with exact numbers, whereas geometric design typically deals with floating point approximations. The speaker will present some results in combining techniques from algebraic geometry and approximation theory. For example, a resultant is a tool for determining whether two polynomials have a common root. This tool, which has wide application in CAGD, is made even more useful by considering the question, given two polynomials, what is the smallest perturbation under which they will experience common root. The speaker will address this perturbation problem, its applications, and related topics.

Thomas W. Sederberg
Civil Engineering Department
Brigham Young University

10:00-10:30/Courtyard
Coffee

10:30-12:30
Concurrent Sessions
(Minisymposia and Contributed)


MS1/Ballroom 1
Rational Curves and Surfaces

NURBS have become a de-facto industry standard for curve and surface representation. Their main feature, the added flexibility of certain weight parameters is often not taken advantage of. The speakers will present methods that directly address the rational nature of these curves and surfaces. We will also discuss methods to approximate rational curves and surfaces by nonrational ones.

Organizer: Gerald E. Farin
Arizona State University

10:30 title to be announced
Gerald E. Farin, organizer

11:00 title to be announced
Wolfgang Boehm, Universität Brunschweig, Germany

11:30 title to be announced
A. Worsey, General Electric Co.


MS2/Ballroom 3
Nonmanifold Data Structures and Subdivisions of the Three-dimensional Space

Nonmanifold data structures have been proposed to represent solids whose boundary is not a 2-manifold. Actually, these data structures can be used to model cellular subdivisions of the three-dimensional space. Such subdivisions occur, for instance, when one models an object that is composed of several different materials, or when one subdivides a solid in order to apply some type of finite element analysis.

The speakers in this minisymposium will discuss nonmanifold data structures and their use to model spatial subdivisions, and also address other methodologies (such as Constructive Non-Regularized Geometry) to deal with the same problem.

Organizers: Paulo C.P. Carvalho and Jonas de M. Gomes, IMPA-Instituto de Matematica Pura e Aplicada, Brazil

10:30 Nonmanifold Data Structures: Conceptual Issues
Jonas de M. Gomes, co-organizer

11:00 A Nonmanifold Data Structure and Its Basic Operators
Wu Shing-Ting, Technische Hochschule Darmstadt, Germany

11:30 Handling Subdivisions of the Three-Dimensional Euclidean Space
Paulo C.P. Carvalho, Instituto de Matematica Pura e Aplicada, Brazil; and Luiz F. Martha, Pontificia Universidade Catolica do Rio de Janeiro, Brazil

12:00 Geometric Utilities for Advanced Modeling: Interface Issues
Jarek Rossignac, IBM Thomas J. Watson Research Center


CP1/Ballroom 2
Solids 1
Chair: Doug Moore, Rice University

10:30 Constructive Solid Geometry for Algebraic Sets
Doug Moore, Rice University

10:50 On the Recognition of Line Drawings
Debasish Dutta and *Y.L. Srinivas*, University of Michigan

11:10 Determination of Mass Properties of CSG Objects in Parallel
Chandrasekhar Narayanaswami, IBM Corporation, Austin

11:30 Working with Dimension-Independent Polyhedra
Fausto Bernardini, Vincenzo Ferrucci and *Alberto Paoluzzi*, Università "La Sapienza", Italy

11:50 Building Solid Models from Discrete Boundary Data
Stephane Aubry and Vincent Hayward, McGill University, Canada

12:10 Point Inclusion in n Dimensions
John G. Aspinall, Symbolics Inc.

Monday Afternoon, November 4

12:30
Lunch


2:00/Ballroom 1
IP3/Chair: Michael J. Wozny, Rensselaer Polytechnic Institute

Product Models with Built-in Physics

The speaker will discuss future research directions for mechanical computer-aided engineering (MCAE) systems. He will review limitations of current geometric modeling technology and areas where advances can have high payoff. Current research activities will be presented in two areas: Automatic generation of spatial configurations of assemblies of solid models and design of free-form surfaces. In both activities conventional Newtonian "physics" are embedded in the product model(s). The speaker will show how the innovative application of this approach to the design of automotive inner panels leads to a true "paradigm shift" in the engineering process.

David Gossard
Department of Mechanical Engineering
Massachusetts Institute of Technology

2:45-3:15/Courtyard
Coffee

3:15-5:15
Concurrent Sessions
(Minisymposia)


MS3/Ballroom 1
Techniques from CAGD using Base Points

Rational parametric surfaces are an important class of surfaces used in CAGD. A parameter value for which all of the rational functions evaluate to 0/0 is said to be a base point of the parameterization. Base points induce several interesting effects on the resulting rational surface including: increasing the number of sides of the patch, lowering the degree of boundary curves of the patch, lowering the implicit degree of the patch, and separating twist constraints at the vertices of the patch. These phenomena have been exploited in a number of different methods such Gregory patches, S-patches, and quadric surface patches.

The purpose of this minisymposium is to elucidate the connection between these techniques and the properties of base points. Knowledge of such a connection will certainly aid in advancing the theory of rational surfaces for use in CAGD.

Organizer: Joe Warren
Rice University

3:15 **Generalizing S-patches**
Tony DeRose, University of Washington, and Joe Warren, organizer

3:45 **Creating Multiple-Sided Patches using Base Points**
Joe Warren, organizer

4:15 **Dual Representation Surface Patches**
Suresh Lodha and Joe Warren, Rice University

4:45 **Efficient Algorithms for Implicitizing Parametric Surfaces**
Dinesh Manocha and John Canny, University of California, Berkeley

MS4/Ballroom 2

Calculating and Simulating Vehicle Lights

Vehicle lights are high-tech components responsible for safety at all speeds and traffic conditions. Marketing demands stylistic and aerodynamic lights for the modern car for which the ultimate criterium is still 'To see and to be seen'. The symposium describes the challenge faced by a lighting engineer and illustrate computer solutions with practical examples. The following topics will be treated in detail:

- Light source description for visibility
- CAD modeling extensions for optical simulation
- Modeling of 'Features' for aesthetic design, simulation and manufacture
- Physiology of night driving

Organizer: Burkhardt Wordenweber
Hella KG Hueck & Co., Germany

3:15 **Feature Modelling for Optical Systems**
Burkhardt Wordenweber, organizer

3:45 **Computer Aided Lighting - A Method of Theoretical Analysis of Light Distribution**
Henning Hogrefe, Bosch GmbH, Germany

4:15 **Monte Carlo Simulation**
W. Brandenburg, Hella KG Hueck & Co., Germany

4:45 **Optical Simulation of Motor Vehicle Headlamp Systems**
Rainer Neumann, Bosch GmbH, Germany

MS5/Ballroom 3

Advances in Constructive Representations

Recent trends in geometric modeling emphasize explicit boundary representations over constructive representations using set and topological operations. Yet, constructive geometric representations arise naturally in many applications, have well established mathematical properties, and offer many computational advantages. The speakers in this minisymposium will present some of the attractive aspects of constructive representations.

Organizer: Vadim Shapiro
Cornell University

3:15 **CNRG: A Constructive Model for Non-Regularized Geometric Structures**
Jarek R. Rossignac, IBM Thomas J. Watson Research Center and Aristides A.G. Requicha, University of Southern California

3:45 **Constructive Variational-Class Geometry**
Neil F. Stewart, University of Montreal, Canada

4:15 **Brep-Index: Unifying Boundary and Volume-based Representations**
George Vanecek, Jr., Purdue University, West Lafayette

4:45 **Real Functions for Representation of Rigid Solids**
Vadim Shapiro, organizer

Monday Evening, November 4

7:30-9:30 PM

Concurrent Sessions
(Contributed Presentations)

CP2/Ballroom 1

Intersections

Chair: Jeannine Moseley, ICAD, Inc., Cambridge, MA

7:30 **Intersecting Offset Curves by Recursive Subdivision**
Jeannine Mosely, ICAD, Inc., Cambridge, MA

7:50 **An Hybrid Surface-plane Intersection Method with Parametric Domain Clipping**
Marc Daniel and Alain Nicolas, Ecole Nationale Superieure de Mecanique, France

8:10 **New Algorithms for Conic Intersection of Natural Quadrics**
John K. Johnstone and Ching-Kuang Shene, Johns Hopkins University

8:30 **New Algorithms for Curve-Curve and Curve-Surface Intersections**
James Demmel and Dinesh Manocha, University of California, Berkeley

CP3/Ballroom 2

Surfaces 1

Chair: Casper G.C. van Dijk, Delft University of Technology, The Netherlands

7:30 **Intuitive Interactive Free-form Surface Design**
Casper G.C. van Dijk, Delft University of Technology, The Netherlands

7:50 **Marked Domain Methods for the Design of Sculptured Objects**
Helaman R.P. Ferguson, Supercomputer Research Center; *Alyn Rockwood*, Arizona State University; and Jordan Cox, Purdue University, West Lafayette

8:10 **The Convolution Approach to N-sided Surface Patches**
Alyn Rockwood and Sareddy Madhukar, Arizona State University

8:30 **G^2 Continuous Transition Surfaces with an Application to Filling of Polygonal Holes**
Markus Schichtel, Darmstadt University of Technology, Germany

CP4/Ballroom 3

Visualization

Chair: Dieter Lasser, Universität Kaiserslautern, Germany

7:30 **Applications of Trivariate Representations in Surface and Solid Definition and Design**
Dieter Lasser, Universität Kaiserslautern, Germany

7:50 **Knotty: A B-spline Visualization Program**
Jonathan Yen, Hewlett-Packard Laboratories

8:10 **Spatial Visualization Difficulty Inhibits Application of Geometric Modeling to Engineering Design**
Douglass J. Wilde, Stanford University

8:30 **Interpolation and Approximation with Rational B-Spline Curves and Surfaces**
Franz-Josef Schneider, Darmstadt University of Technology, Germany

8:50 **Interpolation and Approximation with Circular Splines in $\mathbb{R}^3$**
Gerald Seemann, Darmstadt University of Technology, Germany

CP5/Xavier Room

Motion Planning

Chair: Bahram Ravani, University of California, Davis

7:30 **A Geometric Algorithm for Constructing Motion Interpolants**
Q.J. Ge and *Bahram Ravani*, University of California, Davis

7:50 **Interference Detection for Curves Through Simplifying Geometric Reduction**
John D. Weld, AT&T Bell Laboratories

8:10 **Robot Path Planning Using BSP Trees**
Alade O. Tokuta, University of South Florida

Tuesday Morning, November 5

8:00/Ballroom Foyer

Registration Opens

8:30/Ballroom 1
IP4/Chair: Ramon F. Sarraga, General Motors Research Laboratories

Solid Modeling Research at Cranfield

The speaker will discuss recent and ongoing work in four areas. Geometry and user interface concerns the provision of simple automatic blending facilities in solid modelers by the use of cyclide surfaces and deformable Bezier surfaces. The approximation of trimmed surface regions will also be discussed in this context. The intention is to make solid modelers easier to use for the definition of 'sculptured' objects by widening the class of geometric entities implemented and providing design facilities which are intuitive for the user. Recent work in form features has covered two different approaches to automated feature recognition and an investigation of representational issues for form features. This last topic has led to a proposal for a non-manifold part model which shares some of the advantages of the CSG and boundary representation approaches to solid modeling. Communications concerns work on both static (neutral file) and dynamic (procedural) interfaces to solid modeling systems. The former is closely linked with the developing international standard STEP. Finally two applications will be described: collision checking in the simulation of robot motion, and a feature-based advisory system for assembly.

Michael J. Pratt
Department of Applied Computing and Mathematics, Cranfield Institute of Technology
United Kingdom

9:15/Ballroom 1
IP5/Chair: Ramon F. Sarraga, General Motors Research Laboratories

On the Application of Higher-Dimensional Methods in Computer-Aided Geometric Design

Certain surfaces in geometric design are easy to understand conceptually, yet are difficult to represent or analyze with traditional tools. Examples include the equi-distance surface that consists of all points at equal minimum distance from two given geometric objects. We describe an approach to representing such surfaces exactly and to interrogating them uniformly. We use auxiliary variables to express geometric relationships, and so represent surfaces as the natural projection of manifolds in higher-dimensional space.

The skeleton (medial-axis transform) of a domain is composed of trimmed equi-distance surfaces, and its exact construction seems impossible unless the surfaces are obtained using the higher-dimensional method. After discussing briefly some applications in engineering, we show that the skeleton is related to cyclographic maps, a concept from classical geometry, and that it is also related to a partial differential equation.

Christoph M. Hoffmann
Computer Science Department
Purdue University

10:00-10:30/Courtyard

Coffee

10:30-12:30

Concurrent Sessions
(Minisymposia and Contributed)

CP6/Ballroom 1

Surfaces 2

Chair: Kenji Iino, Stanford University

10:30 Interpolation Point Regeneration Method for Surface Design
Kenji Iino and Douglass J. Wilde, Stanford University

10:50 New Methods to Control the Shape of Smooth Free-Form Surfaces
Teiji Takamura and Koichi Konno, Richo Co. Ltd., Japan and Hiroaki Ohiyokura, Keio University, Japan

11:10 Practical Quality Control Tools for Curves and Surfaces
Scott G. Small, Boeing Computer Services

11:30 Joining Smooth Patches at a Vertex to Form a Surface
Jorg Peters, IBM Thomas J. Watson Research Center

11:50 Curvature Continuous Surface Fitting
Tony DeRose and *Michael Lounsbery*, University of Washington

12:10 A Rational Spline with Interval and Point Tension
John A. Gregory, Brunel University, United Kingdom

CP7/Xavier Room

Design Automation

Chair: Jame D. Emery, Allied-Signal Inc.

10:30 Applications of Geometry to Manufacturing and Tolerancing
James D. Emery, Allied-Signal Inc.

10:50 Rule Based Geometric Design: Enabling Design Automation
Ernest J. Mintel, Pratt & Whitney

11:10 Development of a CAM System for Machining Stamping Die Structures
Mikio Satoh and Yoshiki Muta, Toyota Motor Corporation, Japan

11:30 Relational Techniques in Geometric Design for Manufacturability
Lee A. Barford, Hewlett-Packard Laboratories

MS6/Ballroom 2

Design Optimization

Modern CAD systems often provide the capability for engineers to modify designs by changing design parameters without providing clues as to how these parameters should be modified. Design optimization allows quantifiable design objectives to guide the modification of these parameters. Examples of design objectives include maximizing part strength, minimizing part weight part, and minimizing manufacturing cost. Quantitative objectives allow the computer to perform the tedious iterative adjustments of design parameters which have been traditionally carried out interactively at CAD terminals.

The goals of this minisymposium are to explore optimization as a technique for generating better designs while simultaneously reducing the cost of producing them, apprise conference participants of current efforts involving design optimization, and to stimulate discussion about current and future design paradigms.

Organizer: Thomas A. Grandine
The Boeing Company

10:30 Functionality in Blend Design
Malcolm I.G. Bloor and Michael J. Wilson, University of Leeds, United Kingdom

11:00 Design Optimization
Evin J. Cramer, The Boeing Company

11:30 Optimization of Aerodynamic Shapes
Ilan Kroo, Stanford University

12:00 Purpose, Process, and Properties
David R. Ferguson, Boeing Computer Services

MS7/Ballroom 3

Interpolation of Trivariate Scattered Data

Scattered data measurements occur frequently and it is often required to interpolate or approximate the data. Because of the many possible configurations in three dimensions, as well as the variety of applications, this is a particularly difficult problem. Schemes which take advantage of the data gathering methodology may have superior properties. Assessment of the efficacy of methods for trivariate interpolation requires special visulaization techniques.

The purpose of this minisymposium is to survey trivariate scattered data interpolation and to discuss recent ideas concerning methods and their evaluation from a user perspective.

Organizer: Richard Franke
Naval Postgraduate School

10:30 Introduction to Trivariate Scattered Data Interpolation
Gregory M. Nielson, Arizona State University

11:00 Interpolation of Trivariate Tracked Data
David Lane, Arizona State University

11:30 Comparison of Methods for Trivariate Scattered Data Interpolation
John Tvedt, Arizona State University

12:00 Trivariate Scattered Data Approximation - What the User Needs
Philip W. Smith, IMSL

Tuesday Afternoon, November 5

12:30

Lunch

2:00-4:00

Concurrent Sessions
(Minisymposia and Contributed)

CP8/Ballroom 1

Curve Shape

Chair: W. Weston Meyer, General Motors Research Laboratories

2:00 Monotone Interpolation by Cubic Spline
W. Weston Meyer, General Motors Research Laboratories

2:20 Designing Bezier Conic Segments with Monotone Curvature
William H. Frey and David A. Field, GM Research Laboratories

2:40 Optimized Fairing of Digitized Curves
Mark Feldman, Camax Systems, Inc., Minneapolis

3:00 The MVC Curve: A Fair Curve for Geometric Design
Henry P. Moreton and Carlo H. Sequin, University of California, Berkeley

3:20 Interpolation by Elastica
Emery Jou, University of Maryland, College Park

3:40 **Curvature Integration Through Constrained Optimization**
Alan K. Jones, Boeing Computer Services

CP9/Xavier Room

Implicits and Algebraics

Chair: Miriam Laura Lucian, Boeing Commercial Airplane Group

2:00 **Conic Lofted Surfaces**
Miriam Laura Lucian, Boeing Commercial Airplane Group

2:20 **Convexity Preserving Interpolation by Algebraic Curves**
David Levin, Tel Aviv University, Israel and *Edmond Nadler*, Wayne State University

2:40 **Physically-based Particle Systems for Implicit Surfaces**
Luiz Henrique de Figueiredo andJonas de Miranda Gomes, IMPA-Instituto de Matematica Pura e Aplicada, Brasil

3:00 **On Geometric Modeling with Quintic Implicit Algebraic Surfaces**
Chanderjit Bajaj andInsung Ihm, Purdue University, West Lafayette

3:20 **Parameterization in Finite Precision**
Chanderjit Bajaj and Andrew V. Royappa, Purdue University, West Lafayette

3:40 **Modeling with Implicitly Defined Curves and Surfaces**
Michael Schmidt, Darmstadt University of Technology, Germany

CP10/Ballroom 3

Math Fundamentals

Chair: William L. Anderson, Elements Research, Inc., Palo Alto

2:00 **Salient Elements for Representation of Irregular Geometry**
William L. Anderson, Elements Research, Inc., Palo Alto

2:20 **Computation of the Real Solutions of Nonlinear Polynomial Systems**
Nicholas M. Patrikalakis and Evan C. Sherbrooke, Massachusetts Institute of Technology

2:40 **Real Zeros of Polynomials Over Real Algebraic Numbers**
Charles Ching-an Cheng and Takis Sakkalis, Oakland University

3:00 **Polynomia Multivariata et Polytopia Multidimensa**
Bruce Jeffrey Layman, Westinghouse Hanford Company

3:20 **AXICS - the 3-D Algebra**
Michael F. Smith, AXICS, Salina, CA

MS8/Ballroom 2

Motional Issues in Computer Aided Design, Manufacture, and Inspection(Part 1 of 2)

Advances in computer-aided design, manufacturing, and inspection are key to increased productivity and quality. Existing processes for part manufacture (e.g. metal forming, casting and numerically controlled milling) are being complemented by new methods such as wire electric discharge machining and stereolithography. The topic of this minisymposium is the computational aspects of several geometric problems that arise as a result of motion between the tool and workpiece in automated manufacture. In particular, algorithms for determining visibility/accessibility, tool motion generation/representation and interference checking will be discussed.

Organizer: Debasish Dutta
University of Michigan, Ann Arbor

2:00 **Complete and Partial Visibility in Mold and Die Design**
Anthony C. Woo, University of Michigan, Ann Arbor

2:30 **Computing Global Accessibility Directions for the Faces of a Solid**
Aristides A.G. Requicha andAntonia J. Spyridi, University of Southern California

3:00 **Interference Checking in Numerically Controlled Machining of Sculptured Surfaces**
Michael J. Pratt, Cranfield Institute of Technology, United Kingdom

3:30 **Geometric Modeling for Rapid Prototyping Application**
Friedrich B. Prinz, Carnegie Mellon University

4:00-4:30/Courtyard

Coffee

4:30-6:30

Concurrent Sessions
(Minisymposia and Contributed)

CP11/Ballroom 1

Singular Geometries

Chair: Franz-Erich Wolter, Massachusetts Institute of Technology

4:30 **Curvature Computations for Degenerate Surface Patches**
Franz-Erich Wolter, Massachusetts Institute of Technology

4:50 **Curvature Computations for Degenerate Points of Surface-Surface Intersection Curves and for Fillet-Related Curves**
Isaac Lef, Schlumberger CAD/CAM

5:10 **Defining Curvature at a Parametric Singularity**
Timothy L. Strotman, Structural Dynamics Research Corporation

5:30 **Degenerate Gordon Surface with Unique Normal**
J. Smid, Electronic Data Systems; W. Meyer, General Motors Research Laboratories; V. Razenj and P. Shih, Electronic Data Systems

5:50 **Tangent, Normal, and Visibility Cones for Bezier Surfaces**
Deok-Soo Kim, Schlumberger Technologies CAD/CAM

6:10 **Degenerate Normal Vector Detection on Parametric Surfaces**
Deok-Soo Kim, Schlumberger Technologies CAD/CAM

MS9/Ballroom 2

Motional Issues in Computer Aided Design, Manufacture, and Inspection (Part 2 of 2)

(See page 7, Minisymposium 8 for description)
Organizer: Debasish Dutta
University of Michigan, Ann Arbor

4:30 **Algorithmic and Algebraic Aspects of Computing Swept Volumes**
Ralph Martin, University of Wales College of Cardiff, United Kingdom

5:00 **A Geometric Algorithm for Tool Motion Generation in Wire Cut Electric Discharge Machining**
Bahram Ravani, University of California, Davis

5:30 **Representing Swept Volumes of Polyhedra**
Kumaraguru Sambandan, Schlumberger Technologies and K.K. Wang, Cornell University

MS10/Ballroom 3

Piecewise Polynomial Surfaces for the Modeling of Complex Shapes

Conventional modeling techniques are often insufficient for the modeling of complex shapes. Several new techniques that recently been developed to overcome these insufficiencies. The speakers in this minisymposium will discuss several aspects of these new techniques, including the direct manipulation of geometric attributes on spline curves and surfaces, hierarchical spline surfaces, triangular B-splines, and S-patches and generalized B-splines of arbitrary topology.
Organizer: Hans-Peter Seidel
University of Waterloo, Canada

4:30 **Direct Manipulation of Geometric Attributes on Spline Curves and Surfaces**
Richard H. Bartels and Barry M. Fowler, University of Waterloo, Canada

5:00 **Hierarchical Spline Surfaces**
David R. Forsey, University of British Columbia, Canada

5:30 **Triangular B-splines**
Hans-Peter Seidel, organizer and Philip Fong

6:00 **S-patches and Generalized B-splines of Arbitrary Topology**
Tony D. DeRose and Charles Loop, University of Washington, Seattle

MS11/Xavier Room

Providing a Computational Representation of Space with Binary Space Partitioning Trees

Bsp trees provide a computational representation of a d-dimensional space by recursively partitioning the space by hyperplanes. Any polyhedral domain can be represented by a subset of the cells of a bsp tree, including unbounded and non-manifold polytopes. Due to the simplicity of recursive partitioning, bsp tree algorithms, when compared to those for boundary representations, are simpler, more efficient, and more numerically robust. This minisymposium will explore the most recent work on bsp trees including representing all k-dimensional faces of a d-polytope by k-dimensional bsp trees, $0 <= k <= d$, analytic solutions to the area visibility problem (needed for area lights and cameras), and conversion from a discrete pixel or voxel representation to a continuous space hierarchical bsp tree representation.
Organizer: Bruce F. Naylor
AT&T Bell Laboratories

4:30 **Boolean Set Operations on Polytopes**
William Thibault, California State University, Hayward

5:00 **Area Visibility Calculations**
Donald S. Fussell, University of Texas, Austin

5:30 **Representation of Volumetric Data**
Kalpathi R. Subramanian, University of Texas, Austin

6:00 **Multiple Dimensioned Bsp Trees**
Bruce F. Naylor, organizer

Conference Program

Wednesday Morning, November 6

8:00/Ballroom Foyer

Registration Opens

8:30/Ballroom 1
IP6/Chair: Harry McLaughlin, Rensselaer Polytechnic Institute

Approximate Conversion and Merging of Trimmed Spline Surface Patches

In exchanging data between different geometric modelling systems conversions of curve and surface representations are used to compensate for differences in the types of polynomial bases, maximum polynomial degrees, and mesh sizes. In addition, merging of a set of free formed surface patches is used to reduce the number of the surface patches so that the volume of the data can be diminished. In general, merging or reducing operations can be carried out only approximatively.

The speaker will discuss several methods for approximate spline conversion. With help of new generic geometric oriented boundary curves the same methods can be extended to merging spline surface patches. The proposed methods are not only applicable to spline surface patches, they can also be used for conversion and merging trimmed curves on the set of patches. The methods, work for rational and for integral spline representations.

Josef Hoschek
Fachbereich Mathematik
Darmstadt Institute of Technology
Germany

9:15/Ballroom 1
IP7/Chair: Harry McLaughlin, Rensselaer Polytechnic Institute

Geometry Processing and Multidimensional Interpolation

Computer Aided Geometric Design is the representation and design of curves, surfaces and volumes in an interactive computer graphics environment. GAGD has many application in engineering and in science. Geometry Processing is the calculation of geometric aspects of curves, surfaces and volumes. We discuss current research on several topics in Geometry Processing, with engineering applications, including curvature analysis, surface/surface intersections and offset surfaces. Multidimensional interpolation arises in many scientific applications such as pressures on an aircraft wing. We discuss current research on several multidimensional interpolants including "surfaces defined on surfaces", with application such as geological data fitting and criminal data representations. Many of the themes of this presentation are continued in the afternoon demonstrations at Arizona State University.

Robert E. Barnhill
Department of Computer Science
Arizona State University

10:00-10:30/Courtyard

Coffee

10:30-12:30

Concurrent Sessions
(Minisymposia and Contributed)

MS12/Ballroom 1

Geometric Modeling in Grid Generation

Numerical grid generation plays a key role in computational simulation of large scale physical field problems of engineering design and applications. Field problems pervade a broad spectrum of engineering applications, including oil exploration, aircraft and ship design, engine design, automobile design, thermodynamic systems, electromagnetic field applications, nuclear systems, and chemical processing systems.

During the last few years, numerical grid generation has evolved as a critical link in the numerical solutions of the partial differential equations of fluid mechanics. The accuracy of the numerical algorithm depends not onlyon the formal order of approximation but also on the distribution of grid points in the computational domain.

The speakers in this minisymposium will present current research in the area of numerical grid generation with respect to the role of geometric design.

Organizer: Bharat K. Soni
Mississippi State University

10:30 Computational Geometry for Airplane Design Optimization
Robert E. Smith, NASA Langley Research Center and Ideen Sadrehaghighi, Old Dominion University

11:00 Practical Aspects of Geometric Modeling in Grid Generation
Bharat K. Soni, Organizer

11:30 Applications of NURBS to EAGLE Grid Generation System
Yong-Hyun Yoon, Korea Air Force Academy, South Korea and Joe F. Thompson, Mississippi State University

12:00 Towards an Integrated Geometry Processor and Surface Grid Generator
Raymond Ching-Chuung Luh, NASA Ames Research Center

MS13/Ballroom 2

Discrete Solid Models for Modeling and CAD/CAE Applications

Discrete solid models represent complex objects in terms of collections of simple geometric entities. For example, a faceted solid model approximates curved surfaces with planar facets, and a cell decomposition subdivides an object into simple solids (cells). Although these representation schemes have always been mentioned in the solid modeling literature, researchers have only recently focused on developing robust algorithms for building and manipulating these models.

Discrete models can be used either as primary representation schemes (replacing or collaborating with CSG and Breps) or as a secondary representations for automating engineering analysis applications (e.g., finite element analysis, mass properties calculations, and face area evaluation). This minisymposium will address both areas and will focus on topological validity and geometric accuracy of discrete solid models, computational complexity of the algorithms, and practical aspects of discrete solid modeling software.

Organizers: Nickolas S. Sapidis, Casara Corporation, and General Motors Research Laboratories, and Renato Perucchio, University of Rochester

10:30 Applications of the Symmetric Axis Transform in CAD
Lee R. Nackman and Vijay Srinivasan, IBM Thomas J. Watson Research Center

11:00 Efficient Algorithms for the Intersection of Polygonal and Polyhedral Cellular Decompositions
Amitava Maulik, Rensselaer Polytechnic Institute

11:30 Combining Recursive Spatial Decompositions and Delaunay Tetrahedrizations for Discretizing Solid Models
Nickolas S. Sapidis and Renato Perucchio, co-organizers

12:00 An Overview of Hierarchical Spatial Data Structures for Geometric Modeling
Hanan Samet, University of Maryland, College Park

12:30 Generating the Discrete Medial Axis
Xinhua Yu, Lingxian Dong, *Alan Knight*, and John Goldak Carleton University, Canada

MS14/Xavier Room

Loop Detection of Surface Intersections

The summary for this minisymposium has not reached SIAM at the time this program went to press.

Organizer: Thomas Sederberg
Brigham Young University

Titles and speakers to be announced.

CP12/Ballroom 3

Rational Curves and Surfaces

Chair: Les A. Piegl, University of South Florida

10:30 On the G1 Continuity Between Rational Bezier Patches
Wenhui Du, Thompson Digital Image, France

10:50 Method for Fitting Rational Cubic NURBS Curves to 3-D Data
Jin J. Chou and *Les A. Piegl*, University of South Florida

11:10 Curve Interpolation on Quadric Surfaces
Wenping Wang and Barry Joe, University of Alberta, Canada

11:30 Smooth Transitions for Rational B-Spline Curves and Surfaces
Sharat Shetty, Axia Systems, Inc. and Phillip R. White, University of Toledo

11:50 Linear Fractional Reparameterizations of Rational Spline Curves
Richard E. Rice, Applied Geometry Corporation, Seattle

12:10 Rational Representation and Approximation of Polyconic Lofted Surfaces
David Hoitsma and Mansuk Lee, Grumman Aircraft Systems

Wednesday Afternoon, November 6

12:30

Lunch

2:00-4:00/Arizona State University

CAGD Demos

4:00

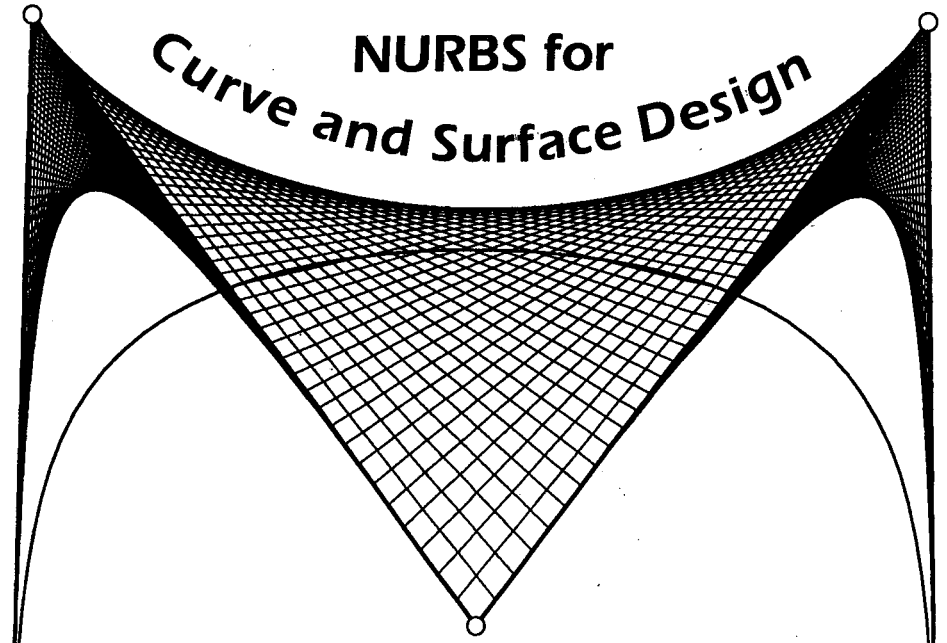
Balance of the afternoon free

6:30/Courtyard

Western Buffet Dinner

Sheraton Tempe Mission Palms Hotel

NURBS for Curve and Surface Design



Edited by Gerald Farin

Researchers, system programmers, and graduate students in CAGD, CAD/CAM and computer graphics will find this book uniquely suited to their field of work. Very recent results are included, and the book has been carefully refereed. New NURB techniques and developments are included–the most important being curve/surface from the CAD/CAM industry.

About the Editor

Dr. Farin is Associate Professor in the Computer Science Department at Arizona State University. He is also executive editor of Computer Aided Geometric Design, an international research journal.

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Order Code OT26

Short Course participants will automatically receive a copy of this book.

Conference Program

Thursday Morning, November 7

8:00/Ballroom Foyer

Registration Opens

8:30/Ballroom 1
IP8/Chair: Rosemary E. Chang, Silicon Graphics

The Future of Computer Graphics

The summary describing the scope of this invited presentation has not reached SIAM at the time the program went to press.

James Clark
Silicon Graphics

9:15/Ballroom 1
IP9/Chair: Rosemary E. Chang, Silicon Graphics

Interactive Visualization and Animation of 2-D and 3-D Fluid Flow Simulations

At the Army High Performance Computing Research Center (AHPCRC) at theUniversity of Minnesota, we are developing a system of equipment and software for the simulation and visualization of fluid flows in 2 or 3 dimensions. Our goal is to simplify the process of performing a computational experiment and visualizing the resulting data so that these experiments can be performed on a routine basis. We can think of the system we are building as a numerical laboratory.

We have built software that generates images of the fluid flow from disk files which represent the computed flow in a compressed format. Our simulation can generate this raw data continuously at a rate of about 1 MByte/sec. The data collects on the file systems of Iris workstations which can render a 2-D image of any flow quantity for a mesh of one million cells in 3 or 4 seconds. Rendering of images of 3-D flows is much slower due to the much more computationally intensive volume visualization techniques we are using. Once images of the flow are rendered in the desired format, they may be written onto special raw disk partitions for fast interactive playback on the Iris monitor. At present we have achieved sustained animation rates of about 12 MByte/sec. The visualization techniques and interactive animation systems we are developing at the AHPCRC will be illustrated by showing a number of representative movies generated on our systems representing both 2-D and 3-D fluid flows.

Paul R. Woodward
Army High Performance Computing Research Center, University of Minnesota, Minneapolis

10:00-10:30/Courtyard

Coffee

10:30-12:30

Concurrent Sessions
(Minisymposia and Contributed)

MS15/Ballroom 1

Variational Design

Computer aided geometric design has emerged from the need of free form surfaces in CAD/CAM technologies. It has become a major research topic in computer science with direct applications for all engineering sciences in the last few years.

A central problem of geometric modelling is the construction of "technically smooth" surface representations (i.e. the data should be directly usable in numerically controlled processing).

The purpose of this minisymposium is to present methods and algorithms for generating smooth curves and surfaces that minimize an appropriate variational problem involving higher order derivatives.

Organizer: Hans Hagen
Universit ät Kaiserslautern, Germany

10:30 On the Computing of Plane Elastica
Guido Brunnett, University of Wisconsin, Madison

11:00 A C^2 Quartic Spline with Minimal Variation
Thomas A. Foley andBernd Hamann, Arizona State University

11:30 Variational Design of Curves and Surfaces
Hans Hagen, organizer

12:00 Minimum Variation Criterion for Surface Representation
Gregory M. Nielson, Arizona State University

MS16/Ballroom 3

Issues in Physical System Simulation - Integrating Physics Model Specification, Geometry, Symbolic Mathematics, and Control

Computers have been used for years to simulate physical systems such as fluid flows, rigid-body dynamics, and electric circuits. While many of the component technologies needed for simulation, such as geometric modeling and symbolic mathematics, have matured individually, they have not yet been integrated when applied to simulation. This means that the cost of creating simulation software is still very high. It appears that the time is right for this situation to change. The speakers in this minisymposium will address the software architecture issues in integrating geometric modelling, algebraic reasoning, numerical analysis, and compiler code generation and optimization into simulators of physical systems.

Organizer: James Cremer
Cornell University

10:30 SIMULAID: An Environment for High Level Specification and Automatic Generation of Physical Systems Simulators
Richard Palmer, Cornell University

11:00 Generation of Rigid-body Dynamics Simulators Using SIMULAID
James Cremer, organizer

11:30 Geometry Processing in the Rigid-body Dynamics Simulator NEWTON
George Vanecek, Jr., Purdue University, West Lafayette

12:00 Control of Complex Mechanisms
Joseph Kearney, University of Iowa

CP13/Ballroom 2

Triangulations and Grids

Chair: Carol Hazlewood, Southwest Texas State University

10:30 Triangulations on a Hypercube
Carol Hazlewood, Southwest Texas State University

10:50 Polygonization of Higher-Dimensional Surfaces
Jung-Hong Chuang, Chiao Tung University, Republic of Chinaand Christoph M. Hoffmann, Purdue University, West Lafayette

11:10 Vertex Based Data Dependent Triangulations
Jeffrey L. Brown, University of North Carolina, Wilmington

11:30 Coping with Inconsistencies: A New Approach to Produce Quality Triangulations of Polygonal Domains with Holes for the Finite Element Method
Elefterios A. Melissaratos and Diane L. Souvaine, Rutgers University

11:50 Three-Dimensional Composite Grid Generation Using Bezier Family of Curves and Surfaces
Ramana G. Venkata, Stanford University

CP14/Xavier Room

Graphics

Chair: John Loustau, Hunter College of the City University of New York

10:30 Automated Selection of Optimal Intermediate Surfaces for Two-Part Texture Mappings
John Loustau and N. Leon Moser, Hunter College of the City University of New York

10:50 Modeling Diffraction Grating Surfaces Using Matrix Tracing
Lisa Nafziger and Sudhanshu K. Semwal, University of Colorado, Colorado Springs

11:10 Stochastic Fields for Computer Graphics Modeling
Ken-ichi Anjyo, Hitachi Ltd., Japan

11:30 A Dynamics Simulation Environment for Implicit Objects using Discrete Models
Luiz Velho, IMPA-Instituto de Matematica Pura e Aplicada, Brazil and University of Toronto, Canada; and Jonas deMiranda Gomes, IMPA-Institute de Matematica Pura e Aplicada, Brazil

Thursday Afternoon, November 7

12:30

Lunch

2:00-4:00

Concurrent Sessions
(Minisymposia and Contributed)

MS17/Ballroom 1

Interactive Modeling of Geological Surfaces

The modeling of three dimensional shapes is a common task in geology. In the past the results were strongly two dimensional. However, there has been much activity in applying CAGD techniques to the modeling of three dimensional geological shapes.

In this minisymposium, the speakers will examine the geological requirements for geometric modeling, suitable CAGD techniques, the presentation of the surfaces and graphical techniques to assist the subsequent analysis.

Organizer: Rosemary E. Chang
Silicon Graphics

Titles and speakers to be announced.

MS18/Ballroom 2

Modelling Implicitly Defined Surfaces and Volumes (Part 1 of 2)

Many surfaces S and bodies B can be implicitly characterized as sets: $S = \{x \in \mathbb{R}^3 | H(x) = 0\}$, $B = \{x \in \mathbb{R}^3 | H(x) \leq 0\}$ an appropriate function of process $H: \mathbb{R}^3 \rightarrow \mathbb{R}^1$. Recently, several methods have been developed that yield polygonal and polytope meshes for approximating S and B, respectively. These new methods are of interest to workers in computer graphics and mesh generation for PDE's, integral equations and algebraic-differential equations.

The speakers are pioneers of these methods. They will present algorithms and results and discuss significant applications.

Organizers: Eugene Allgower, Colorado State University and Geovan Tavares, Pontificia Universidade Catolica do Rio de Janeiro, Brazil

2:00 Implicit Definition of Smooth, Articulated Shapes
Jules Bloomenthal, Xerox Palo Alto Research Center

2:30 Visualizing Surfaces in Four Dimensions
Christoph M. Hoffmann and *Jianhua Zhou*, Purdue University, West Lafayette

3:00 Title to be announced
Phillip H. Schmidt, University of Akron

3:30 A Modelling Environment Based on Simplicial Methods
Geovan Tavares, Pontificia Universidade Catolica, Brazil

CP15/Ballroom 3

Bezier and B-Spline

Chair: Ron Goldman, Rice University

2:00 An Extension of Chaiken's Algorithm
Ron Goldman and Joe Warren, Rice University

2:20 Subdivision of Bezier Triangles into Rational Bezier Rectangles
Kenji Iino and Douglass J. Wilde, Stanford University

2:40 B-Spline Style Interpolating Surfaces
Marshall Walker, York University, Canada

3:00 Specifying the Arc Length of Bezier Curve
John A. Roulier, University of Connecticut, Storrs

3:20 Proportional Bezier Curves
John M. Eisenlohr, S.R.D.C., Milford, OH

3:40 Some B-Spline Algorithms via Blossoming
E.T.Y. Lee, Boeing Commercial Airplane Group

CP16/Xavier Room

Solids 2

Chair: Holly K. Ault, Worcester Polytechnic Institute

2:00 Design of 3D Cam Surfaces Using Quintic Blending Functions
Holly K. Ault, Claudine M. Gagnon, and Kenneth E. Truesdale, Worcester Polytechnic Institute

2:20 Designbase V4: A Solid/Surface Integrated Modeling System
Hiroshi Toriya, Ricoh Company Ltd., Japan; *Masaaki Kagawa*, Ricoh Corporation, Santa Clara, CA; and Hiroaki Chiyokura, Keio University, Japan

2:40 Practical Applications of Algebraic Topology to Geometric Design
Dale A. Lear, Applied Geometry Corporation, Seattle

3:00 Feature-Based Finite Element Mesh Generation for Functional Surfaces
James C. Cavendish, William H. Frey and Samuel P. Marin, General Motors Research Laboratories

3:20 Cut Locus and Medial Axis in Global Shape Interrogation and Representation
Franz-Erich Wolter, Massachusetts Institute of Technology

4:00-4:30/Courtyard

Coffee

4:30-6:30

Concurrent Sessions

(Minisymposia and Contributed)

MS19/Ballroom 2

Modelling Implicitly Defined Surfaces and Volumes (Part 2 of 2)

(See page 11, Minisymposium 18 for description)

Organizers: Eugene Allgower, Colorado State University and Geovan Tavares, Pontificia Universidade Catolica do Rio de Janeiro, Brazil

4:30 Simplicial Pivoting Algorithms for Approximating Surfaces and Volumes
Kurt Georg and Eugene L. Allgower, Colorado State University

5:00 A Topological Data Structure for Surface Representation
Helio Lopes and Geovan Tavares, organizer, Pontificia Universidade Catolica do Rio de Janeiro, Brazil

5:30> Arbitrary Crack Representation using Solid Modeling
Luiz F. Martha, Pontificia Universidade Catolica do Rio de Janeiro, Brazil; Paul A. Wawrzynek and Anthony R. Ingraffea, Cornell University

6:00 Building Deformable Models Using Implicit Surfaces
Brian Wyvill, University of Calgary, Canada

MS20/Ballroom 3

Surface Reconstruction from Unorganized Point Sets

The problem of constructing mathematical descriptions of objects given incomplete data is nearly ubiquitous in science and engineering. A simple example of this occurs when trying to fit a curve to a collection of datapoints. Although there exist good solutions for certain types of reconstruction, an important class of reconstruction problems has received little attention. This class is characterized by the lack of organization of the input data. A prototypical problem in the class can be described as follows: given a relatively dense unordered set of points assumed to be distributed on or near some unknown "target" surface (such as a human heart or an automobile body) in three dimensions, construct a compact surface representation of the target. This problem arises naturally in many applications including medical imaging, machine vision, industrial engineering, and geometric modeling. A principal difficulty is that neither the topology nor the geometry of the target are known in advance: both must be inferred automatically from the input data.

This minisymposium will motivate the investigation of the problem class, and describe the work of two research groups involved in developing algorithms to solve such problems.

Organizer: Tony D. DeRose
University of Washington

4:30 Introductory Remarks: Applications of Surface Reconstruction
Tony D. DeRose, organizer

4:45 Determining Surface Topology from Unorganized Data
Hughes Hoppe, University of Washington

5:10 Fitting a Surface of Known Topology to Unorganized Data
Werner Stuetzle, University of Washington

5:35 Least Squares Fitting of Piecewise Implicit Surfaces to Unorganized Data
Joe Warren, Rice University

6:05 Implicit Surface Fitting for Medical Imaging Applications
Doug Moore, Rice University

CP17/Ballroom 1

Solids 3

Chair: James R. Miller, University of Kansas

4:30 Feature-Based Modeling Using a Dual CSG-BRep Engine
James R. Miller, University of Kansas

4:50 Representation and Operations for Non-manifold Topology Based on Coupling Entities
Yasushi Yamaguchi, Tokyo Denki University, Japan and Fumihiko Kimura, University of Tokyo, Japan

5:10 Geometric Relationships for Feature Recognition Via Neural Nets
Thomas J. Peters, University of Connecticut, Storrs

5:30 Towards Robust Solid Boolean Operations
Xiangping Chen and Warren N. Waggenspack, Jr., Louisiana State University, Baton Rouge

5:50 Separation for B-rep-CSG Conversion
Vadim Shapiro, Cornell University and Donald L. Vossler, McDonnell Douglas Corporation

CP18/Xavier Room

Geometry Processing

Chair: Mark S. Mummy, Applied Geometry Corporation, Seattle

4:30 Recovering the Parameter for Points on Conics
Mark S. Mummy, Applied Geometry Corporation, Seattle

4:50 Geometry Processing Associated with Complex Configurations in Computational Fluid Dynamics
Bharat K. Soni, Mississippi State University

5:10 Offsetting Surfaces in a NURBS Environment
Louis J. Nachman, Oakland University

5:30 A Nonparametric, Incremental Method for Surface Tracking
S. Ramakrishna and S. Chaudhuri, Indian Institute of Technology, India; and S. Chatterjee, University of California, San Diego

PROGRAM-AT-A-GLANCE

	Monday, November 4	Tuesday, November 5	Wednesday, November 6	Thursday, November 7	Friday, November 8
7:30 AM	Registration Opens *Ballroom Foyer*				
8:00		Registration Opens *Ballroom Foyer*	Registration Opens *Ballroom Foyer*	Registration Opens *Ballroom Foyer*	Registration Opens *Ballroom Foyer*
8:15	Welcoming Remarks **Lattie Coor, President, Arizona State University** *Ballroom 1*				
8:30	IP1 A Remarkable Class of Quintic Curves **Rida T. Farouki** *Ballroom 1* IP2 Approximation Methods in Algebraic Geometry **Thomas W. Sederberg** *Ballroom 1*	IP4 Solid Modeling Research at Cranfield **Michael J. Pratt** *Ballroom 1* IP5 On the Application of Higher-Dimensional Methods in Computer-Aided Geometric Design **Christoph M. Hoffmann** *Ballroom 1*	IP6 Approximate Conversion and Merging of Trimmed Spline Surface Patches **Josef Hoschek** *Ballroom 1* IP7 Geometry Processing and Multidimensional Interpolation **Robert E. Barnhill** *Ballroom 1*	IP8 The Future of Computer Graphics **James Clark** *Ballroom 1* IP9 Interactive Visualization and Animation of 2-D and 3-D Fluid Flow Simulations **Paul R. Woodward** *Ballroom 1*	IP10 Linear and Circular Visibility for Workpiece Orientation and Operations **Tony C. Woo** *Ballroom 1* IP11 Tolerancing Theory **Aristides Requicha** *Ballroom 1*
10:00	Coffee *Courtyard*	Coffee *Courtyard*	Coffee *Courtyard*	Coffee *Courtyard*	Coffee *Courtyard*
10:30	**Concurrent Sessions** (Minisymposia and Contributed) MS1 Rational Curves and Surfaces **Organizer: Gerald E. Farin** *Ballroom 1* MS2 Nonmanifold Data Structures and Subdivisions of the Three-dimensional Space **Organizers: Paulo C.P. Carvalho and Jonas de M. Gomes** *Ballroom 3* CP1 Solids 1 *Ballroom 2*	**Concurrent Sessions** (Minisymposia and Contributed) CP6 Surfaces 2 *Ballroom 1* CP7 Design Automation **Xavier Room** MS6 Design Optimization **Organizer: Thomas A. Grandine** *Ballroom 2* MS7 Interpolation of Trivariate Scattered Data **Organizer: Richard Franke** *Ballroom 3*	**Concurrent Sessions** (Minisymposia and Contributed) MS12 Geometric Modeling in Grid Generation **Organizer: Bharat K. Soni** *Ballroom 1* MS13 Discrete Solid Models for Modeling and CAD/CAE Applications **Organizers: Nickolas S. Sapidis and Renato Perucchio** *Ballroom 2* MS14 Loop Detection of Surface Intersections **Organizer: Thomas Sederberg** *Xavier Room* CP12 Rational Curves and Surfaces *Ballroom 3*	**Concurrent Sessions** (Minisymposia and Contributed) MS15 Variational Design **Organizer: Hans Hagen** *Ballroom 1* MS16 Issues in Physical System Simulation–Integrating Physics Model Specification, Geometry, Symbolic Mathematics, and Control **Organizer: James Cremer** *Ballroom 3* CP13 Triangulations and Grids *Ballroom 2* CP14 Graphics *Xavier Room*	**Concurrent Sessions** (Minisymposia and Contributed) MS21 Free Form Volumes in Solid Modeling **Organizer: Dieter Lasser** *Ballroom 1* MS22 Applications of Algebraic Geometry in CAGD **Organizer: Richard R. Patterson** *Ballroom 3* MS23 Cyclides **Organizer: John K. Johnstone** *Ballroom 2* CP19 Surfaces 3 *Xavier Room*
12:30 PM	Lunch	Lunch	Lunch	Lunch	Lunch
2:00	IP3 Product Models with Built-in Physics David Gossard	**Concurrent Sessions** (Minisymposia and Contributed) CP8 Curve Shape	**CAGD Demos at Arizona State University**	**Concurrent Sessions** (Minisymposia and Contributed) Modeling of	**Concurrent Sessions** (Minisymposia and Contributed) MS24

	David Gossard *Ballroom 1*	CP8 Curve Shape *Ballroom 1* CP9 Implicits and Algebraics *Xavier Room* CP10 Math Fundamentals *Ballroom 3* MS8 Motional Issues in Computer-Aided Design, Manufacture and Inspection (Part 1 of 2) Organizer: Debasish Dutta *Ballroom 2*		MS17 Interactive Modeling of Geological Surfaces Organizer: Rosemary E. Chang *Ballroom 1* MS18 Modeling Implicitly Defined Surfaces and Volumes (Part 1 of 2) Organizers: Eugene Allgower and Geovan Tavares *Ballroom 2* CP15 Bezier and B-Spline *Ballroom 3* CP16 Solids 2 *Xavier Room*	MS24 Geometry in Engineering at Bechtel–Three Aspects Organizer: William D. Blackwell *Ballroom 2* MS25 Gaussian-Blending Curve, Surfaces, and Volumes (One-hour Presentation) Ardeshir Goshtasby *Ballroom 3* CP20 Curve Methods *Ballroom 1*
2:45	Coffee *Courtyard*				
3:15	**Concurrent Sessions** (Minisymposia) 3:15 to 5:15 Monday Only MS3 Techniques from CAGD using Base Points Organizer: Joe Warren *Ballroom 1* MS4 Calculating and Simulating Vehicle Lights Organizer: Burkhardt Wordenweber *Ballroom 2* MS5 Advances in Constructive Representations Organizer: Vadim Shapiro *Ballroom 3*				
4:00		Coffee *Courtyard*	Balance of the afternoon Free	Coffee *Courtyard*	**Conference Adjourns**
4:30		**Concurrent Sessions** (Minisymposia and Contributed) CP11 Singular Geometries *Ballroom 1* MS9 Motional Issues in Computer-Aided Design, Manufacture and Inspection (Part 2 of 2) Organizer: Debasish Dutta *Ballroom 2* MS10 Piecewise Polynomial Surfaces for the Modeling of Complex Shapes Organizer: Hans-Peter Seidel *Ballroom 3* MS11 Providing a Computational Representation of Space with Binary Space Partitioning Trees Organizer: Bruce F. Naylor *Xavier Room*		**Concurrent Sessions** (Minisymposia and Contributed) MS19 Modeling Implicitly Defined Surfaces and Volumes (Part 2 of 2) Organizers: Eugene Allgower and Geovan Tavares *Ballroom 2* MS20 Surface Reconstruction from Unorganized Point Sets Organizer: Tony D. DeRose *Ballroom 3* CP17 Solids 3 *Ballroom 1* CP18 Geometry Processing *Xavier Room*	
6:30			Western Buffet Dinner *Courtyard, Sheraton Tempe Mission Palms Hotel*		
7:30	**Concurrent Sessions** (Contributed Presentations) CP2 Intersections *Ballroom 1* CP3 Surfaces 1 *Ballroom 2* CP4 Visualization *Ballroom 3* CP5 Motion Planning *Xavier Room*				CP = Contributed Presentation IP = Invited Presentation MS = Minisymposium

Friday Morning, November 8

8:00/Ballroom Foyer

Registration Opens

8:30/Ballroom 1
IP10/Chair: David R. Ferguson, Boeing Computer Services

Linear and Circular Visibility for Workpiece Orientation and Operations

Consider a point p on a surface S of a workpiece and another point q on a tool. Two points p and q are linearly visible to each other if the line segment pq admits no other intersection. Likewise, they are circularly visible if the counter-clockwise arc qp hits from its exterior. In this presentation, linear and circular visibilities are shown to support the development of efficient algorithms for workpiece orientations and operations.

Visibility is presented on the unit Gaussian sphere, on which the combination of workpiece geometry and tool geometry yields maps that carry desirable properties (such as convexity, complementarity and duality). Applications of these linear visibility maps to material removal (via machining), deposition (via SLA), deformation (by stamping), and contact (for coordinate measurements) will be illustrated. Rotary worktables and robots with rotary joints offer circular visibility between the processor and the workpiece. Characterization by centers of rotation with a Circular Visibility Diagram will also be introduced.

Tony C. Woo
Department of Industrial and Operations Engineering, The University of Michigan

9:15/Ballroom 1
IP11/Chair: David R. Ferguson, Boeing Computer Services

Tolerancing Theory

This talk summarizes the current theoretical understanding of "mechanical" tolerances, which serve to specify geometric uncertainties in solid objects. A revised version of a theory initially proposed in the early 1990s is outlined, and open problems are discussed.

Aristides Requicha
Department of Computer Science and Institute for Robotics and Intelligent Systems, University of Southern California

10:00-10:30/Courtyard

Coffee

10:30-12:30

Concurrent Sessions
(Minisymposia and Contributed)

MS21/Ballroom 1

Free Form Volumes in Solid Modeling

Free form volumes are given by trivariate representations defined with respect to cubical, tetrahedral, pentahedral, pyramidal or even more general parameter spaces, with basis functions given by monomials, lagrange or bernstein polynomials for example. Trivariate B-spline representations are possible as well. The range of applications of trivariate representations is various and includes surface and solid definition and design, interpolation, approximation, and rendering of physical data.

The speakers will address modeling and rendering of trivariaterepresentations, volumes defined via piecewise algebraic surfaces and via single-valued surfaces and visualization techniques.

Organizer: Dieter Lasser
Universität Kaiserslautern, Germany

10:30 Modelling and Rendering with Piecewise Algebraic Surfaces
Wolfgang Dahmen, Freie Universitat Berlin, Germany

11:00 Display of Free-form Volumes by Scanning and Accumulation
Alyn Rockwood, Arizona State University

11:30 Single-valued Surfaces for Defining Free Form Volumes
Javier Sanchez-Reyes, E.T.S.E.I.B., Spain

MS22/Ballroom 3

Applications of Algebraic Geometry in CAGD

A curve or surface can be defined as the roots of an algebraic equation. This implicit definition is especially useful when it is necessary to test points to decide whether they lie on or to one side of the curve or surface. For implicit curves and surfaces to be as useful as parametric ones, methods are needed for modeling with them. Algebraic geometry is being mined for ways to manipulate them through the coefficients of the equation. The speakers will address the problems of fitting surfaces to data, subdividing surfaces, designing with piecewise algebraic curves, and testing points against the equation.

Organizer: Richard R. Patterson
Indiana University-Purdue University, Indianapolis

10:30 Surface Fitting Using Implicit and Parametric Surface Patches
Chanderjit Bajaj, Purdue University, West Lafayette

11:00 A Subdivision Method for Algebraic Surfaces
Joe Warren, Rice University

11:30 Algebraic Spline Curves
Marco Paluszny, Universidad Central de Venezuela and *Richard R. Patterson*, organizer

12:00 Computing with Algebraic Numbers
Takis Sakkalis, Oakland University

MS23/Ballroom 2

Cyclides

In the search for a wider library of shapes for solid modeling, researchers are starting to consider the cyclide. The cyclide is a tractable class of (usually) quartic surfaces, an extension of the popular torus primitive, with many useful properties. Early work on the cyclide in geometric modeling centered around its use as a surface patch. One of the main advantages of the cyclide is that it is a natural blending surface. This minisymposium will cover all of the major aspects of the cyclide, including geometry, patching, blending, and generalizations to a larger class of surfaces.

Organizer: John K. Johnstone
Johns Hopkins University

10:30 Circles and the Geometry of Cyclides
John K. Johnstone, organizer

11:00 Patching with Cyclides
Ralph Martin, University of Wales, United Kingdom

11:30 Variable Radius Blending and Dupin Cyclides
Debasish Dutta, University of Michigan, Ann Arbor

12:00 The Future of Cyclides in CAGD
Michael J. Pratt, Cranfield Institute of Technology, United Kingdom

CP19/Xavier Room

Surfaces 3

Chair: Michael Kallay, Electronic Data Systems

10:30 Surface Fairing by Optimization
Michael Kallay, Electronic Data Systems

10:50 A G1 [Bi-]Quintic Interpolant for G2 Minimum Energy Networks
Henry P. Moreton and Carlo H. Sequin, University of California, Berkeley

11:10 A New Clough-Toucher Type Triangle Based Interpolant
Gerald Farin and *Praveen Kashyap*, Arizona State University

11:30 Weighted Multivariate Splines
L. Bos, *D. Holland* and K. Salkauskas, University of Calgary, Canada

Friday Afternoon, November 8

12:30

Lunch

2:00-4:00

Concurrent Sessions
(Minisymposia and Contributed)

MS24/Ballroom 2

Geometry in Engineering at Bechtel - Three Aspects

The speakers in this minisymposium will present three aspects of the use of geometry at Bechtel.

The right triangle is the basis for unified graphic and mathematical representation of basic shapes. This concept led to a unique Bechtel computer-generated video illustrating geometric shapes in series with perfectly uniform transitions from beginning to end.

Perimeter/surface efficiency is a chacteristic of shape independent of size that can reduce surface costs and improve utilization of materials. This characteristic is formulated, and its usefulness demonstrated by several engineering applications.

The geometry of travel across a rectangular grid is key to reducing travel time and distance. This geometry is illustrated, and examples are given in the layout of underground storage vaults, semiconductor manufacturing plants, and in the plan for the new city of Jubail.

Organizer: William D. Blackwell
Bechtel National, Inc., San Francisco

2:00 Geometry in Engineering at Bechtel
William D. Blackwell, organizer

2:30 Computer Aspects of Video Presentations
Kenneth P. Ciroline, Bechtel National, Inc., San Francisco

Conference Program

MS25 One-hour Presentation/Ballroom 3

Gaussian-Blending Curve, Surfaces, and Volumes

A new representation for parametric curves, surfaces, and volumes is described using 1-D, 2-D, and 3-D Gaussian functions, respectively. The standard deviations of the Gaussians behave like tension parameters and may be used to control the shape of a generated, curve, surface, or volume. With thisrepresentation, it is possible to fit open/closed curves, surfaces, and volumes to scattered data. The proposed representation has potential applications in design of free-form curves, surfaces, and volumes. Currently, this representation is being used to visualize surfaces and volumes in 3-D medical images. This minisymposium will, in general, cover the design and representation of 1-D, 2-D, and 3-D geometric models in the context of Gaussian-blending curves, surfaces, and volumes.

Geometric design is the main topic of the current SIAM conference. The proposed minisymposium describes new and powerful methods in geometric design. Gaussian functions have not been used previously to define parametric curves, surfaces, and volumes and, therefore, results reported in this minisymposium will be totally new. Audiences in the areas of curves, surfaces, and volumes will be interested in this minisymposium.

Ardeshir Goshtasby
University of Illinois, Chicago

CP20/Ballroom I

Curve Methods

Chair: Ilona O'Neil, Rensselaer Polytechnic Institute

2:00 **Convexity of Data with Errors**
Ilona O'Neil, Rensselaer Polytechnic Institute

2:20 **Monotone Linear Rational Interpolation**
Richard D. Fuhr and Michael Kallay, Electronic Data Systems

2:40 **Best Interpolation in a Strip**
A.L. Dontchev, Mathematical Reviews

3:00 **On Approximating Piecewise Linear Curves**
B.K. Natarajan, Hewlett Packard Laboratories

3:20 **Geometric Characterization of Parametric Cubic Curves: Hodograph Perspective**
Deok-Soo Kim, Schlumberger Technologies CAD/CAM

4:00

Conference Adjourns

Transportation

▲ By Air ▼

Official Carrier for Continental USA and Canada

American Airlines is the official carrier for this conference. In a special arrangement for this conference, you can fly to Tempe, Arizona, at a discounted rate from November 1-11, 1991, inclusive.

For those attendees traveling from points in the United States, American Airlines is offering a 45% discount off regular day coach airfares. For those in Canada, the discount is 35%. Each rate requires seven (7) days advance purchase.

But you may be able to obtain an even lower airfare. American Airlines also is offering a five percent (5%) discount off any published airfare (including First Class and Ultra Saver fares) for which you qualify, i.e., you must satisfy all rules and restrictions on the fares quoted. Discounts can range from 40% to 70% off regular coach fares.

To make reservations for either of the above discounted fares:

- Call American Airlines Convention Desk at the toll free number 800-433-1790 seven days a week from 8:00 AM to 11:00 PM (EST). Be sure to mention the SIAM Account Number S07Z1CN. American Airlines will mail your tickets to your home or office.

- You may use your corporate or university travel agent to purchase your ticket. Your agent should call the American Airlines Convention Desk to make your reservation. Make sure your agent mentions the discounts and uses the SIAM Account Number: **S07Z1CN.**

▲ By Car ▼

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3. After going over the bridge you will be traveling south on Mill Avenue.

4. The hotel is located on Mill and 5th Streets. Turn left (east) onto 5th Street. The Sheraton Tempe Mission Palms is on your left side after turning onto 5th Street.

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▲ Car Rental ▼

Dollar-Rent-A-Car is the official car rental agency for the SIAM Conference on Geometric Design. The following rates will apply to cars rented at the airport, subject to the conditions listed below:

Type of Car	Daily Rate	Weekly Rate
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2. You must be 21 years of age and have a valid U.S. or International Driver's License.

3. You must have one of the following credit cards to rent a car: American Express, MasterCard, Visa, or Diner's Club.

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from points in Canada

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Attention: Karen Bell
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Make sure to give the SIAM account code: **CCSIA6**, and mention that you are attending the SIAM Conference on Geometric Design, November 4-8, 1991, in Tempe, Arizona.

Please make your car rental reservations in advance. On-site availability cannot be guaranteed.

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Geometry Processing for Design and Manufacturing

Edited by Robert E. Barnhill

NEW from SIAM

Topics in geometry processing have many important applications, such as surface-surface intersections and offset surfaces, which are useful for manufacturing (automotive, aeronautical, etc.). Leading experts have written papers included in this book that highlight the most recent methods fundamental for geometric modelling.

Industrial and governmental applied mathematicians and engineers will be interested in this book. A background in advanced calculus and some knowledge about applications is suggested.

Contents

About the Editor

Dr. Barnhill is Chairman and Professor of Computer Science at Arizona State University.

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Arrivals and Departures: Your room will be reserved for you until 6:00 PM. If later arrival is anticipated, please guarantee your reservation by credit card or advance deposit. Check-out time is 12:00 noon.

Location: The hotel is located in the heart of historic Old Town Tempe, Arizona. It is just fifteen minutes from the Sky Harbor International Airport and twenty minutes from downtown Phoenix. Adjacent to Arizona State University, the hotel is only 150 yards from the Sun Devil Football Stadium, home of the ASU football team, the NFL Phoenix Cardinals team and the renowned Fiesta Bowl. Across the street from the hotel is a shopping complex filled with quaint shops, galleries, restaurants and entertainment.

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Restaurants and Lounges: The hotel has three restaurants to serve just about anything that you may be looking for. The Arches serves breakfast, lunch and dinner. The Cloister, a gourmet dining room, features superb continental cuisine, with selections prepared tableside. The Galleria Lobby Lounge is open Monday through Friday 4:30 PM - 12:00 PM. There are complimentary hors d'oeuvres and entertainment from 4:30 PM - 8:30 PM.

SIAM Conferences, Meetings, Symposia, Tutorials, and Workshops

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1991

December 2-4, 1991
Fourth International Conference on Numerical Combustion
Trade Winds Hotel, St. Petersburg, FL
Cosponsored by INRIA

Co-organizers: John D. Buckmaster, University of Illinois, Urbana, and Mitchell Smooke, Yale University

1992

January 27-29, 1992
Third ACM-SIAM Symposium on Discrete Algorithms
Clarion Hotel, Orlando, FL
Sponsored by ACM-SIGACT and SIAM Activity Group on Discrete Mathematics

Organizer: Greg Frederickson, Purdue University

May 11-13, 1992
Fourth SIAM Conference on Optimization
Hyatt Regency Hotel, Chicago, IL
Sponsored by SIAM Activity Group on Optimization

Abstract deadline: 10/11/91

Co-organizers: Jorge Moré, Argonne National Laboratory, and Jorge Nocedal, Northwestern University

June 8-11, 1992
Sixth SIAM Conference on Discrete Mathematics
University of British Columbia
Vancouver, Canada
Sponsored by SIAM Activity Group on Discrete Mathematics

Abstract deadline: 11/15/91

Organizer: Pavol Hell, Simon Fraser University, Canada

July 19-24, 1992
SIAM Annual Meeting
(SIAM's 40th Anniversary)
Century Plaza Hotel, Los Angeles, CA

Abstract deadline: 1/6/92

Organizer: James M. Hyman, Los Alamos National Laboratory

September 16-18, 1992
Second SIAM Conference on Control in the 90's: Achievements, Opportunities, and Challenges
Radisson Hotel Metrodome
Minneapolis, MN
Sponsored by SIAM Activity Group on Control and Systems Theory

Abstract deadline: 2/14/92

Organizer: Kevin A. Grasse, University of Oklahoma, Norman

October 16-19, 1992
Second SIAM Conference on Dynamical Systems
Snowbird Resort Hotel, Salt Lake City, UT
Sponsored by SIAM Activity Group on Dynamical Systems

Abstract deadline: 3/13/92

Co-organizers: Peter W. Bates, Brigham Young University, and Christopher K.R.T. Jones, Brown University

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The registration desk will be open as listed below.

Saturday, November 2	6:00pm - 9:00pm
Sunday, November 3	8:00am - 9:00pm
Monday, November 4	7:30am - 5:30pm
Tuesday, November 5	8:00am - 5:30pm
Wednesday, November 6	8:00am - 5:30pm
Thursday, November 7	8:00am - 5:30pm
Friday, November 8	8:00am - 3:30pm

▲ Get-Togethers ▼

SIAM Welcoming Reception
Sunday, November 3
7:00 PM - 9:00 PM
Cash Bar

Western Buffet Dinner
Wednesday, November 6
6:30 PM - 8:00 PM
Sheraton Tempe Mission Palms, Courtyard

This is a great time to get together with your colleagues and listen to the sounds of the Mariachi band while enjoying a buffet dinner consisting of barbeque beef ribs, grilled chicken, potato salad, cole slaw, Texas toast, corn on the cob, Texas beans, and assorted desserts. Assorted sodas and beer will be available. Vegetarian meals will be available upon request. Cost $29.00

▲ Attention Participants ▼

All presenters, either in a minisymposium or in a contributed session, should submit an extended abstract, not more than one-page long, typed single spaced on 8-1/2" x 11" bond paper.

Abstract Format: 1) Center the title of your abstract in upper/lower case, 1" from the top of the page; 2) leave two lines, and type your name and affiliation; 3) leave two lines and begin typing your abstract, flush left, leaving 1" margins in both left and right of the page.

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Registration Fees:

		*SIAG/ GD	SIAM Member	Non-Member	Student
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Conference	Advance	$130	$135	$170	$ 35
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*Members of SIAM Activity Group on Geometric Design

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▲ Special Note ▼

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Texaco Inc.
United Technologies Corporation

Hotel Reservation Form

SIAM Conference on Geometric Design

November 4-8, 1991
Sheraton Tempe Mission Palms
Tempe, Arizona

PLEASE SEND ME A CONFIRMATION NOTICE
Specially discounted rooms are being held for our exclusive use until October 7, 1991. After that date reservations will depend on availability. Your reservation is not confirmed until acknowledged in writing by the hotel or verified by phone. When making reservations by phone, be certain to identify yourself as an attendee at the SIAM Conference on Geometric Design. Telephone: (602) 894-1400.

Name _____ Phone _____
FIRST MIDDLE INITIAL LAST

Address _____

City _____ State _____ Zip _____

Please reserve [ ] Single ($78) [ ] Double ($88)

Arrival Date _____ Arrival Time _____ Check Out Date _____

Guarantee my room for late arrival (after 6:00 PM) [ ] Yes [ ] No

I choose to pay by:* [ ] AMEX [ ] VISA [ ] MC [ ] Check (Late Arrivals Only)

Credit Card No. _____ Exp. Date _____ Deposit $ _____

Signature _____

If you list your credit card number, please enclose this card in an envelope and mail to: Reservations, The Sheraton Tempe Mission Palms Hotel, 60 East Fifth Street., Tempe, AZ 85281.

* You only need to list your credit card number if you want to guarantee your room for late arrival.

Advance Registration Form

SIAM Conference on Geometric Design

November 4-8, 1991
Sheraton Tempe Mission Palms, Tempe, Arizona

Advance registration form must be received at the SIAM office by October 25, 1991. Please make check payable to SIAM.

REGISTRATION FEES		SIAG* GD	SIAM Member	Non-Member	Student
Short Course	Advance	$125	$125	$140	$75
	On-Site	$140	$140	$160	$95
Conference	Advance	$130	$135	$170	$35
	On-Site	$140	$160	$200	$35

Registration Fee:

Shourt Course	$ _____	$ _____	$ _____	$ _____
Conference	$ _____	$ _____	$ _____	$ _____
Buffet Dinner** ($29)	$ _____	$ _____	$ _____	$ _____
Total	$ _____	$ _____	$ _____	$ _____

*Members of SIAM Activity Group on Geometric Design
**Vegetarian Meal Requested ☐

Please Print
Name _____
FIRST MIDDLE
LAST

Organization _____

Department _____

Address _____

City _____ State _____ Zip _____

Telephone Number _____

Fax No. _____ e-mail _____

Local Address in Tempe _____

I wish to pay by [ ] AMEX [ ] VISA [ ] MC [ ] Personal Check

Credit Card No. _____

Expiration Date _____

Signature _____

Detach form and enclose with payment in the envelope provided (domestic mail only), or mail to: SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688. Telephone: (215) 382-9800 FAX: (215) 386-7999; E-Mail: siamconfs@wharton.upenn.edu

From _____

_____

_____

Reservations
Sheraton Tempe Mission Palms Hotel
60 East Fifth Street
Tempe, Arizona 85281

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