Curves And Surfaces For Computer Graphics

Curves and Surfaces provides information pertinent to the fundamental aspects of approximation theory with emphasis on approximation of images, surface compression, wavelets, and tomography. This book covers a variety of topics, including error estimates for multiquadratic interpolation, spline manifolds, and vector spline approximation. Organized into 77 chapters, this book begins with an overview of the method, based on a local Taylor expansion of the curve, for computing the parameter values. This text then presents a vector approximation based on general spline function theory. Other chapters consider a nonparametric technique for estimating under random censorship the amplitude of a change point in change point hazard models. This book discusses as well the algorithm for ray tracing rational parametric surfaces based on inversion and implicitization. The final chapter deals with the results concerning the norm of the interpolation operator and error estimates for a square domain. This book is a valuable resource for mathematicians.

This book describes how to reconstruct 3D surfaces from images, using geometry, with applications to computer vision.

New approaches in knot insertion and deletion to understanding, analyzing, and rendering B-spline curves and surfaces.

The Essentials of CAGD

The NURBS Book

Curves and Surfaces for Computer-aided Design

A Computer Algebra Approach

Curves and Surfaces for CAGD

The growing importance of animation and 3D design has caused computer-aided geometric design (CAGD) to be of interest to a wide audience of programmers and designers. This interactive software/book tutorial teaches fundamental CAGD concepts and discusses the growing number of applications in such areas as geological modeling, molecular modeling, commercial advertising, and animation. Using interactive examples and animations to illustrate the mathematical concepts, this hands-on multimedia tutorial enables users without a substantial mathematical background to quickly gain intuition about CAGD. Interactive Curves and Surfaces guides you in Learning the uses of CAGD as it is applied in computer graphics and engineering. Creating curved lines and surfaces using Bezier curves, B-Splines, and parametric surface patches. Understanding the mathematical tools behind the generation of these objects, and the development of computer-based CAGD algorithms. Experimenting with powerful interactive test benches to explore the behavior and characteristics of the most popular CAGD curves. Application oriented readers will find this animated tutorial presentation more accessible than the standard formal texts on the subject. Computer disk contains: "data sets, as well as all of the C routines found in the book."

Implicit objects have gained increasing importance in geometric modeling, visualisation, animation, and computer graphics, because their geometric properties provide a good alternative to traditional parametric objects. This book presents the mathematics, computational methods and data structures, as well as the algorithms needed to render implicit curves and surfaces, and shows how implicit objects can easily describe smooth, intricate, and articulatable shapes, and hence why they are being increasingly used in graphical applications. Divided into two parts, the first introduces the mathematics of implicit curves and surfaces, as well as the data structures suited to store their sampled or discrete approximations, and the second deals with different computational methods for sampling implicit curves and surfaces, with particular reference to how these are applied to functions in 2D and 3D spaces.

Knot Insertion and Deletion Algorithms for B-Spline Curves and Surfaces

The Bezier Curve, Surfaces and Computer Graphics

Handbook of Computer Aided Geometric Design

Modeling of Curves and Surfaces with MATLAB®

Curves and Surfaces in Computer Vision and Graphics II

This volume contains the papers presented at 6th Conference on Geometric Modeling and Processing (GMP 2010) held in Castro Urdiales, Spain during June16–18,2010. GeometricModelingandProcessingisabiannualinternational conference series on geometric modeling, simulation and computing. Previously, GMPhasbeenheldinHongKong(2000),Saitama,Japan(2002),Beijing,China (2004), Pittsburgh, USA (2006) and Hangzhou, China (2008). GMP 2010 received a total of 30 submissions that were reviewed by three to four Program Committee members on average. While the number of subm- sions dropped signi?cantly from previous years, the quality did not and was still quite high overall. Based on the reviews received, the committee decided to - cept 20 papers for inclusion in the proceedings. Additionally, extended versions of selected papers were considered for a special issue of Computer-Aided - sign (CAD) and Computer-Aided Geometric Design (CAGD). The paper topics spanned a wide variety and include: – Solutions of transcendental equations – Volume parameterization – Smooth curves and surfaces – Isogeometric analysis – Implicit surfaces – Computational geometry Many people helped make this conference happen and we are grateful for their help. We would especially like to thank the Conference Chair, all of the authors who submitted papers, the ProgramCommittee members who reviewed the papers and all of the participants at the conference.

This state-of-the-art study of the techniques used for designing curves and surfaces for computer-aided design applications focuses on the principle that fair shapes are always free of unessential features and are simple in design. The authors define fairness mathematically, demonstrate how newly developed curve and surface schemes guarantee fairness, and assist the user in identifying and removing shape aberrations in a surface model without destroying the principal shape characteristics of the model. Aesthetic aspects of geometric modeling are of vital importance in industrial design and modeling, particularly in the automobile and aerospace industries. Any engineer working in computer-aided design, computer-aided manufacturing, or computer-aided engineering will want to add this volume to his or her library. Researchers who have a familiarity with basic techniques in computer-aided graphic design and some knowledge of differential geometry will find this book a helpful reference. It is essential reading for statisticians working on approximation or smoothing of data with mathematical curves or surfaces.

This book provides a comprehensive coverage of the fields Geometric Modeling, Computer-Aided Design, and Scientific Visualization, or Computer-Aided Geometric Design. Leading international experts have contributed, thus creating a one-of-a-kind collection of authoritative articles. There are chapters outlining basic theory in tutorial style, as well as application-oriented articles. Aspects which are covered include: Historical outline Curve and surface methods Scientific Visualization Implicit methods Reverse engineering. This book is meant to be a reference text for researchers in the field as well as an introduction to graduate students wishing to get some exposure to this subject.

Curves and Surfaces in Computer Vision and Graphics III

Interactive Curves and Surfaces

Visual Motion of Curves and Surfaces

Designing Fair Curves and Surfaces

A Multimedia Tutorial on CAGD

This book contains various types of mathematical descriptions of curves and surfaces, such as Ferguson, Coons, Spline, Bézier and B-spline curves and surfaces. The materials are classified and arranged in a unified way so that beginners can easily understand the whole spectrum of parametric curves and surfaces. This book will be useful to many researchers, designers, teachers, and students who are working on curves and surfaces. The book can be used as a textbook in computer aided design classes.

The Bézier curve is an important part of almost every computer-graphics illustration program and computer-aided design system in use today. It is used in many ways, from designing the curves and surfaces of automobiles to defining the shape of letters in type fonts. And because it is numerically the most stable of all the polynomial-based curves used in these applications, the Bézier curve is the ideal standard for representing the more complex piecewise polynomial curves. In the early 1960s, Peter Bézier (pronounced

NURBS (Non-uniform Rational B-Splines) are the computer graphics industry standard for curve and surface description. They are now incorporated into all standard computer-aided design and drafting programs (for instance, Autocad). They are also extensively used in all aspects of computer graphics including much of the modeling used for special effects in film and animation, consumer products, robot control, and automobile and aircraft design. So, the topic is particularly important at this time because NURBS are really at the peak of interest as applied to computer graphics and CAD of all kind.

An Introduction to the Curves and Surfaces of Computer-aided Design

Curves and Surfaces for Computer ...

Advances in Geometric Modeling and Processing

An Introduction to Splines for Use in Computer Graphics and Geometric Modeling

Theory and Algorithms

Requires only a basic knowledge of mathematics and is geared toward the general educated specialists. Includes a gallery of color images and Mathematica code listings.

The central problem considered in this introduction for graduate students is the determination of rational parametrizability of an algebraic curve and, in the positive case, the computation of a good rational parametrization. This amounts to determining the genus of a curve: its complete singularity structure, computing regular points of the curve in small coordinate fields, and constructing linear systems of curves with prescribed intersection multiplicities. The book discusses various optimality criteria for rational parametrizations of algebraic curves.

Putting the G into CAGD, the authors provide a much-needed practical and basic introduction to computer-aided geometric design. This book will help readers understand and use the elements of computer-aided geometric design, curves and surfaces, without the mathematical baggage that is necessary only for more advanced work. Though only minimal background in mathematics is needed to understand the bookís concepts, the book covers an amazing array of topics such as Bezier and B-spline curves and their corresponding surfaces, subdivision surfaces, and NURBS (Non-Uniform Rational B-Splines). Also included are techniques such as interpolation and least squares methods.

Curves and Surfaces in Computer Vision and Graphics

Curves and Surfaces

16-18 November 1992, Boston, Massachusetts

With Historical Perspective

The book provides an introduction to Differential Geometry of Curves and Surfaces. The theory of curves starts with a discussion of possible definitions of the concept of curve, proving in particular the classification of 1-dimensional manifolds. We then present the classical local theory of parametrized plane and space curves (curves in n-dimensional space are discussed in the complementary material): curvature, torsion, Frenet's formulas and the fundamental theorem of the local theory of curves. Then, after a self-contained presentation of degree theory for continuous self-maps of the circumference, we study the global theory of plane curves, introducing winding and rotation numbers, and proving the Jordan curve theorem for curves of class C2, and Hopf theorem on the rotation number of closed simple curves. The local theory of surfaces begins with a comparison of the concept of parametrized (i.e., immersed) surface with the concept of regular (i.e., embedded) surface. We then develop the basic differential geometry of surfaces in R3: definitions, examples, differentiable maps and functions, tangent vectors (presented both as vectors tangent to curves in the surface and as derivations on germs of differentiable functions; we shall consistently use both approaches in the whole book) and orientation. Next we study the several notions of curvature on a surface, stressing both the geometrical meaning of the objects introduced and the algebraic/analytical methods needed to study them via the Gauss map, up to the proof of Gauss' Teorema Egregium. Then we introduce vector fields on a surface (flow, first integrals, integral curves) and geodesics (definition, basic properties, geodesic curvature, and, in the complementary material, a full proof of minimizing properties of geodesics and of the Hopf-Rinow theorem for surfaces). Then we shall present a proof of the celebrated Gauss-Bonnet theorem, both in its local and in its global form, using basic properties (fully proved in the complementary material) of triangulations of surfaces. As an application, we shall prove the Poincaré-Hopf theorem on zeroes of vector fields. Finally, the last chapter will be devoted to several important results on the global theory of surfaces, like for instance the characterization of surfaces with constant Gaussian curvature, and the orientability of compact surfaces in R3.

Curves and Surfaces for Computer GraphicsSpringer Science & Business Media

A leading expert in CAGD, Gerald Farin covers the representation, manipulation, and evaluation of geometric shapes in this the Third Edition of Curves and Surfaces for Computer Aided Geometric Design. The book offers an introduction to the field that emphasizes Bernstein-Bezier methods and presents subjects in an informal, readable style, making this an ideal text for an introductory course at the advanced undergraduate or graduate level. The Third Edition includes a new chapter on Topology, offers new exercises and sections within most chapters, combines the material on Geometric Continuity into one chapter, and updates existing materials and references. Implementation techniques are addressed for practitioners by the inclusion of new C programs for many of the fundamental algorithms. The C programs are available on a disk included with the text. System Requirements: IBM PC or compatibles, DOS version 2.0 or higher. Covers representation, manipulation, and evaluation of geometric shapes Emphasizes Bernstein-Bezier methods Written in an informal, easy-to-read style

Curves and Surfaces for Computer Aided Geometric

Curves and Surfaces for Computer Graphics

Buch

Modeling of Curves and Surfaces in CAD/CAM

Curves and Surfaces in Geometric Modeling

This book covers combinatorial data structures and algorithms, algebraic issues in geometric computing, approximation of curves and surfaces, and computational topology. Each chapter fully details and provides a tutorial introduction to important concepts and results. The focus is on methods which are both well founded mathematically and efficient in practice. Coverage includes references to presented techniques.

As the field of computer graphics develops, techniques for modeling complex curves and surfaces are increasingly important. A major technique is the use of parametric splines in which a curve is defined by piecing together a succession of curve segments, and surfaces are defined by stitching together a mosaic of surface patches. An Introduction to Splines for Use in Computer Graphics and Ge computer scientist. Assuming only a background in beginning calculus, the authors present the material using many examples and illustrations with the goal of building the reader's intuition. Based on courses given at the University of California, Berkeley, and the University of Waterloo, as well as numerous ACM Siggraph tutorials, the book includes the most recent advances in computer-aided ge accessible to the computer graphics and geometric modeling communities.

This fifth edition has been fully updated to cover the many advances made in CAGD and curve and surface theory since 1997, when the fourth edition appeared. Material has been restructured into theory and applications chapters. The theory material has been streamlined using the blossoming approach: the applications material includes least squares techniques in addition to the traditional inter means you get the informal, friendly style and unique approach that has made Curves and Surfaces for CAGD: A Practical Guide a true classic. The book's unified treatment of all significant methods of curve and surface design is heavily focused on the movement from theory to application. The author provides complete C implementations of many of the theories he discusses, ranging from the tr their advantages, disadvantages, and interrelationships, and in the process you'll see why this book has emerged as a proven resource for thousands of other professionals and academics. Provides authoritative and accessible information for those working with or developing computer-aided geometric design applications. Covers all significant CAGD curve and surface design techniques-from the subdivision and triangular meshes. Presents topical programming exercises useful to professionals and students alike.

Shape Preserving Representations in Computer-aided Geometric Design

A Practical Guide

Curves and Surfaces for Computer-Aided Geometric Design

Curves and Surfaces for Computer-aided Design

Computer Aided Geometric Design

Presents recent important advances in the field of computer-aided geometric design in the study of shape-preserving representations of curves and surfaces. The volume's dozen papers are organized into five sections on: shape preserving representations of curves, optimality of B-bases, blossoming and geometric approach, shape preserving representations of surfaces, and trigonometric bases for the representation of curves and surfaces. The index spans the admissible (in design algorithms for spline curves) to the weak Chebyshev space and system. Contributors hail from six European countries. Annotation copyrighted by Book News, Inc., Portland, OR

This introductory textbook puts forth a clear and focused point of view on the differential geometry of curves and surfaces. Following the modern point of view on differential geometry, the book emphasizes the global aspects of the subject. The excellent collection of examples and exercises (with hints) will help students in learning the material. Advanced undergraduates and graduate students will find this a nice entry point to differential geometry. In order to study the global properties of curves and surfaces, it is necessary to have more sophisticated tools than are usually found in textbooks on the topic. In particular, students must have a firm grasp on certain topological theories. Indeed, this monograph treats the Gauss-Bonnet theorem and discusses the Euler characteristic. The authors also cover Alexandrov's theorem on embedded compact surfaces in $\mathbb{R}^3$ with constant mean curvature. The last chapter addresses the global geometry of curves, including periodic space curves and the four-vertices theorem for plane curves that are not necessarily convex. Besides being an introduction to the lively subject of curves and surfaces, this book can also be used as an entry to a wider study of differential geometry. It is suitable as the text for a first-year graduate course or an advanced undergraduate course.

"Curves and Surfaces in Geometric Modeling: Theory and Algorithms offers a theoretically unifying understanding of polynomial curves and surfaces as well as an effective approach to implementation that you can apply to your own work as a graduate student, scientist, or practitioner." "The focus here is on blossoming - the process of converting a polynomial to its polar form - as a natural, purely geometric

explanation of the behavior of curves and surfaces. This insight is important for more than just its theoretical elegance - the author demonstrates the value of blossoming as a practical algorithmic tool for generating and manipulating curves and surfaces that meet many different criteria. You'll learn to use this and other related techniques drawn from affine geometry for computing and adjusting control points, deriving the continuity conditions for splines, creating subdivision surfaces, and more." "It will be an essential acquisition for readers in many different areas, including computer graphics and animation, robotics, virtual reality, geometric modeling and design, medical imaging, computer vision, and motion planning."--BOOK JACKET.Title Summary field provided by Blackwell North America, Inc. All Rights Reserved

12-14 November 1991, Boston, Massachusetts

Curves and Surfaces in Computer Aided Geometric Design

Shape Interrogation for Computer Aided Design and Manufacturing

An Introduction to NURBS

Implicit Curves and Surfaces: Mathematics, Data Structures and Algorithms

This text on geometry is devoted to various central geometrical topics including: graphs of functions, transformations, (non-)Euclidean geometries, curves and surfaces as well as their applications in a variety of disciplines. This book presents elementary methods for analytical modeling and demonstrates the potential for symbolic computational tools to support the development of analytical solutions. The author systematically examines several powerful tools of MATLAB® including 2D and 3D animation of geometric images with shadows and colors and transformations using matrices. With over 150 stimulating exercises and problems, this text integrates traditional differential and non-Euclidean geometries with more current computer systems in a practical and user-friendly format. This text is an excellent classroom resource or self-study reference for undergraduate students in a variety of disciplines.

This fifth edition has been fully updated to cover the many advances made in CAGD and curve and surface theory since 1997, when the fourth edition appeared. Material has been restructured into theory and applications chapters. The theory material has been streamlined using the blossoming approach: the applications material includes least squares techniques in addition to the traditional interpolation methods. In all other respects, it is, thankfully, the same. This means you get the informal, friendly style and unique approach that has made Curves and Surfaces for CAGD: A Practical Guide a true classic. The book's unified treatment of all significant methods of curve and surface design is heavily focused on the movement from theory to application. The author provides complete C implementations of many of the theories he discusses, ranging from the traditional to the leading-edge. You'll gain a deep, practical understanding of their advantages, disadvantages, and interrelationships, and in the process you'll see why this book has emerged as a proven resource for thousands of other professionals and academics. * Provides authoritative and accessible information for those working with or developing computer-aided geometric design applications. * Covers all significant CAGD curve and surface design techniques-from the traditional to the experimental. * Includes a new chapter on recursive subdivision and triangular meshes. * Presents topical programming exercises useful to professionals and students alike. * Offers complete C implementations of many of the book's examples via a companion Web site.

1 Aims and Features of This Book The contents of this book were originally planned to be included in a book entitled Geometric Modeling and CAD/CAM to be written by M. Hosaka and F. Kimura, but since the draft of my part of the book was finished much earlier than Kimura's, we decided to publish this part separately at first. In it, geometrically oriented basic methods and tools used for analysis and synthesis of curves and surfaces used in CAD/CAM, various expressions and manipulations of free-form surface patches and their connection, interference as well as their quality evaluation are treated. They are important elements and procedures of geometric models. And construction and utilization of geometric models which include free-form surfaces are explained in the application examples, in which the methods and the techniques described in this book were used. In the succeeding book which Kimura is to write, advanced topics such as data structures of geometric models, non-manifold models, geometric inference as well as tolerance problems and product models, process planning and so on are to be included. Consequently, the title of this book is changed to Modeling of Curves and Surfaces in CAD/CAM. Features of this book are the following. Though there are excellent text books in the same field such as G. Farin's Curves and Surfaces for CAD/CAM[1] and C. M.

Effective Computational Geometry for Curves and Surfaces

13-15 February 1990, Santa Clara, California

6th International Conference, GMP 2010, Castro Urdiales, Spain, June 16-18, 2010, Proceedings

Shape Quality in Geometric Modeling and Computer-Aided Design

Rational Algebraic Curves

Computer Aided Geometric Design covers the proceedings of the First International Conference on Computer Aided Geometric Design, held at the University of Utah on March 18-21, 1974. This book is composed of 15 chapters and starts with reviews of the properties of surface patch equation and the use of computers in geometrical design. The next chapters deal with the principles of smooth interpolation over triangles and without twist constraints, as well as the graphical representation of surfaces over triangles and rectangles. These topics are followed by discussions of the B-spline curves and surfaces; mathematical and practical possibilities of UNISURF; nonlinear splines; and some piecewise polynomial alternatives to splines under tension. Other chapters explore the smooth parametric surfaces, the space curve as a folded edge, and the interactive computer graphics application of the parametric bi-cubic surface to engineering design problems. The final chapters look into the three-dimensional human-machine communication and a class of local interpolating splines. This book will prove useful to design engineers.

Shape interrogation is the process of extraction of information from a geometric model. It is a fundamental component of Computer Aided Design and Manufacturing (CAD/CAM) systems. The authors focus on shape interrogation of geometric models bounded by free-form surfaces. Free-form surfaces, also called sculptured surfaces, are widely used in the bodies of ships, automobiles and aircraft, which have both functionality and attractive shape requirements. Many electronic devices as well as consumer products are designed with aesthetic shapes, which involve free-form surfaces. This book provides the mathematical fundamentals as well as algorithms for various shape interrogation methods including nonlinear polynomial solvers, intersection problems, differential geometry of intersection curves, distance functions, curve and surface interrogation, umbilics and lines of curvature, geodesics, and offset curves and surfaces. This book will be of interest both to graduate students and professionals.

Until recently B-spline curves and surfaces (NURBS) were principally of interest to the computer aided design community, where they have become the standard for curve and surface description. Today we are seeing expanded use of NURBS in modeling objects for the visual arts, including the film and entertainment industries, art, and sculpture. NURBS are now also being used for modeling scenes for virtual reality applications. These applications are expected to increase. Consequently, it is quite appropriate for The.N'URBS Book to be part of the Monographs in Visual Communication Series. B-spline curves and surfaces have been an enduring element throughout my professional life. The first edition of Mathematical Elements for Computer Graphics, published in 1972, was the first computer aided design/interactive computer graphics textbook to contain material on B-splines. That material was obtained through the good graces of Bill Gordon and Louie Knapp while they were at Syracuse University. A paper of mine, presented during the Summer of 1977 at a Society of Naval Architects and Marine Engineers meeting on computer aided ship surface design, was arguably the first to examine the use of B-spline curves for ship design. For many, B-splines, rational B-splines, and NURBS have been a bit mysterious.