Curves And Surfaces For Cagd Fifth Edition A Practical Guide The Morgan Kaufmann Series In Computer Graphics

The aim of the book is to provide a good foundation of Computer-Aided Geometric Design to students who are doing under-graduate courses in engineering, especially Mechanical Engineering, Computer Science, Geometric Modeling and CAD/CAM. This book is organized in two parts. Part-I deals with the basics of differential geometry of curves and surface, a good understanding of which is essential prerequisite to what follows in the Part-II. Part-II is devoted entirely to the geometric designs of curves and surfaces, which are used in the development of computer graphics and profiles and hulls of ships, aircraft wings, satellites (to name a few large scale products) as also telephones, mobile phones, fancy flower vases (to name a few small-scale products). Concepts introduced are illustrated with examples, which are completely worked out. A list of problems is also given at the end of each chapter

Carefully refereed and edited papers on the most current developments in the theory and applications of curves and surfaces. This volume, with its companion volume, contains a selection of papers presented at the Third International Conference on Curves and Surfaces which was held in June 1996 at Chamonix, France. Each book contains several invited survey lectures prepared by leading experts in the fields of approximation theory, computer- aided geometric design, numerical analysis, and wavelets. In addition, each book includes a number of closely related full-length research papers which have been refereed and meticulously edited. These books should be of great interest to mathematicians, engineers, and computer scientists working in the field of Approximation Theory, Computer-Aided Geometric Design (CAGD), Computer Graphics, Numerical Analysis, CAD/CAM, and application areas.

As an introduction to fundamental geometric concepts and tools needed for solving problems of a geometric nature using a computer, this book fills the gap between standard geometry books, which are primarily theoretical, and applied books on computer graphics, computer vision, or robotics that do not cover the underlying geometric concepts in detail. Gallier offers an introduction to affine, projective, computational, and Euclidean geometry, basics of differential geometry and Lie groups, and explores many of the practical applications of geometry. Some of these include computer vision, efficient communication, error correcting codes, cryptography, motion interpolation, and robot kinematics. This comprehensive text covers most of the geometric background needed for conducting research in computer graphics, geometric modeling, computer vision, and robotics and as such will be of interest to a wide audience including computer scientists, mathematicians, and 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.

Implicit Curves and Surfaces in CAGD.

Shape Quality in Geometric Modeling and Computer-Aided Design

Geometric Modeling with Splines

Curves and Surfaces in CAGD '89

Designing Fair Curves and Surfaces

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 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 interacting 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.

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 textbook in computer aided design classes.

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 inte 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 t 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 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.

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

From Projective Geometry to Practical Use

A Multimedia Tutorial on CAGD

For Computer Science and Engineering

Curve and Surface Modeling

Handbook of Computer Aided Geometric Design

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 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

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.

Ideal as a comprehensive introduction to fundamental algorithms for basic curves and surfaces, or for a deeper understanding of entities with which readers may be familiar, this book presents a simple approach to the entire structure of algorithms.

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.

Modeling of Curves and Surfaces in CAD/CAM

Curves and Surfaces for Computer-aided Geometric Design

Proceedings of a Conference Held at the Mathematisches Forschungsinstitut Oberwolfach, F.R.G., 16-22 April 1989

Basics Of Computer Aided Geometric Design: An Algorithmic Approach

Practical Linear Algebra

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.

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.

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 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. A valuable resource for engineers working in CAD, CAM, or computer-aided engineering.

Curves and Surfaces for CAGD, 5th Edition

Curves and Surfaces for Computer Graphics

A Geometry Toolbox

Special curves and surfaces in CAGD '89

Curves and Surfaces with Applications in CAGD

Written by researchers who have helped found and shape the field, this book is a definitive introduction to geometric modeling. The authors present all of the necessary techniques for curve and surface representations in computer-aided modeling with a focus on how the techniques are used in design. They achieve a balance between mathematical rigor

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 Geometric Modeling discusses the use of splines from the point of view of the 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 geometric modeling and design to make spline modeling techniques generally 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 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.

Computational Geometry: Curve and Surface Modeling provides information pertinent to the fundamental aspects of computational geometry. This book discusses the geometric properties of parametric polynomial curves by using the theory of affine invariants for algebraic curves. Organized into eight chapters, this book begins with an overview of the objects studies in computational geometry, namely surfaces and curves. This text then explores the developments in the theory and application of spline functions, which began with cubic spline functions. Other chapters consider the mechanical background of the cubic spline functions, which is the wooden spline with small deflection. This book discusses as well that in mathematical lofting the information of a geometric shape is given by a set of data points, while in geometric design other ways of representations are available. The final chapter deals with the concepts in the theory of algebraic curves. This book is a valuable resource for mathematicians.

An Introduction

Effective Computational Geometry for Curves and Surfaces

An Introduction to NURBS

The Essentials of CAGD

Theory and Algorithms

Abstract: "We review the role of implicit algebraic curves and surfaces in computer-aided geometric design, and discuss its possible evolution. Implicit curves and surfaces offer certain strengths that complement the strength of parametric curves and surfaces. After reviewing basic facts from algebraic geometry, we explore the problems of converting between implicit and parametric forms. Wh always possible in principle, a number of practical problems have forced the field to explore alternatives. We review some of these alternatives, based on two fundamental ideas.

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 applications of the presented techniques.

"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, pu 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 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

Non-Uniform Rational B-Splines have become the de facto standard in CAD/CAM and computer graphics. This well-known book covers NURBS from their geometric beginnings to their industrial applications. The second edition incorporates new results and a chapter on Pythagorean curves, a development that shows promise in applications such as NC machining

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

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

Shape Interrogation for Computer Aided Design and Manufacturing

The Essentials of Cagd

A Practical Guide

Computer disk contains: "data sets, as well as all of the C routines found in the book."

This book provides a solid and uniform derivation of the various properties Bezier and B-spline representations have, and shows the beauty of the underlying rich mathematical structure. The book focuses on the core concepts of Computer Aided Geometric Design and provides a clear and illustrative presentation of the basic principles, as well as a treatment of advanced material including multivariate splines, some subdivision techniques and constructions of free form surfaces with arbitrary smoothness. The text is beautifully illustrated with many excellent figures to emphasize the geometric constructive aspect of this book.

The mathematical foundation of free form surface representations and constructions is an emerging field covering many interesting research problems and numerous important applications. This book contains selected presentations from the CAGD Conference at Oberwolfach, with new developments of mathematical methods and efficient algorithms for the representation of curves and surfaces. The contributions focus on the following topics: rational splines, scattered data interpolation, multivariate splines, interpolating with geometric constraints, algorithms for graphic representations.

Mathematical Methods in Computer Aided Geometric Design covers the proceedings of the 1988 International Conference by the same title, held at the University of Oslo, Norway. This text contains papers based on the survey lectures, along with 33 full-length research papers. This book is composed of 39 chapters and begins with surveys of scattered data interpolation, spline elastic manifolds, geometry processing, the properties of Bézier curves, and Gröbner basis methods for multivariate splines. The next chapters deal with the principles of box splines, smooth piecewise quadric surfaces, some applications of hierarchical segmentations of algebraic curves, nonlinear parameters of splines, and algebraic aspects of geometric continuity. These topics are followed by discussions of shape preserving representations, box-spline surfaces, subdivision algorithm parallelization, interpolation systems, and the finite element method. Other chapters explore the concept and applications of uniform bivariate hermite interpolation, an algorithm for smooth interpolation, and the three B-spline constructions. The concluding chapters consider the three B-spline constructions, design tools for shaping spline models, approximation of surfaces constrained by a differential equation, and a general subdivision theorem for Bézier triangles. This book will prove useful to mathematicians and advance mathematics students.

Interactive Curves and Surfaces
With Historical Perspective
NURBS for Curve & Surface Design
Curves and Surfaces in Computer Aided Geometric Design
Mathematical Methods in Computer Aided Geometric Design II

Linear algebra is growing in importance. 3D entertainment, animations in movies and video games are developed using linear algebra. Animated characters are generated using equations straight out of this book. Linear algebra is used to extract knowledge from the massive amounts of data generated from modern technology. The Fourth Edition of this popular text introduces linear algebra in a comprehensive, geometric, and algorithmic way. The authors start with the fundamentals in 2D and 3D, then move on to higher dimensions, expanding on the fundamentals and introducing new topics, which are necessary for many real-life applications and the development of abstract thought. Applications are introduced to motivate topics. The subtitle, A Geometry Toolbox, hints at the book's geometric approach, which is supported by many sketches and figures. Furthermore, the book covers applications of triangles, polygons, conics, and curves. Examples demonstrate each topic in action. This practical approach to a linear algebra course, whether through classroom instruction or self-study, is unique to this book. New to the Fourth Edition: Ten new application sections. A new section on change of basis. This concept now appears in several places. Chapters 14-16 on higher dimensions are notably revised. A deeper look at polynomials in the gallery of spaces. Introduces the QR decomposition and its relevance to least squares. Similarity and diagonalization are given more attention, as are eigenfunctions. A longer thread on least squares, running from orthogonal projections to a solution via SVD and the pseudoinverse. More applications for PCA have been added. More examples, exercises, and more on the kernel and general linear spaces. A list of applications has been added in Appendix A. The book gives instructors the option of tailoring the course for the primary interests of their students: mathematics, engineering, science, computer graphics, and geometric modeling.

Mathematical Methods in Computer Aided Geometric Design II covers the proceedings of the 1991 International Conference on Curves, Surfaces, CAGD, and Image Processing, held at Biri, Norway. This book contains 48 chapters that include the topics of blossoming, cyclides, data fitting and interpolation, and finding intersections of curves and surfaces. Considerable chapters explore the geometric continuity, geometrical optics, image and signal processing, and modeling of geological structures. The remaining chapters discuss the principles of multiresolution analysis, NURBS, offsets, radial basis functions, rational splines, robotics, spline and Bézier methods for curve and surface modeling, subdivision, terrain modeling, and wavelets. This book will prove useful to mathematicians, computer scientists, and advance mathematics students.

Focusing on the manipulation and representation of geometrical objects, this book explores the application of geometry to computer graphics and computer-aided design (CAD). Over 300 exercises are included, some new to this edition, and many of which encourage the reader to implement the techniques and algorithms discussed through the use of a computer package with graphing and computer algebra capabilities. A dedicated website also offers further resources and useful links.

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.

A Dynamic Programming Approach to Curves and Surfaces for Geometric Modeling
Applied Geometry for Computer Graphics and CAD
Implicit Curves and Surfaces: Mathematics, Data Structures and Algorithms
Geometric Methods and Applications
Curves and Surfaces in Geometric Modeling

The Geometry Toolbox takes a novel and particularly visual approach to teaching the basic concepts of two- and three-dimensional geometry. It explains the geometry essential for today's computer modeling, computer graphics, and animation systems. While the basic theory is completely covered, the emphasis of the book is not on abstract proofs but rather on examples and algorithms. The Geometry Toolbox is the ideal text for professionals who want to get acquainted with the latest geometric tools. The chapters on basic curves and surfaces form an ideal stepping stone into the world of graphics and modeling. It is also a unique textbook for a modern introduction to linear algebra and matrix theory.

1 Aims and Features of This Book The contents of t. his book were originally planned t. o be included in a book en titled Geometric IIlodeling 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 qualit. y eval uation 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 meth ods 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. Conse quently, 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[I] and C. M.

Curves and Surfaces for Computer-Aided Geometric Design
Computational Geometry
Theory and Application of Convex Curves and Surfaces in CAGD
The Geometry Toolbox for Graphics and Modeling
Bézier and B-Spline Techniques