Algorithmic Foundations Of Robotics Viii Selected Contributions Of The Eighth International Workshop On The Algorithmic Foundations Of Robotics Springer Tracts In Advanced Robotics

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Proceedings - 1997

Algorithmic Foundations of Robotics V - Jean-Daniel Boissonnat 2003-09-11
Selected contributions to the Workshop WAFR 2002, held December 15-17, 2002, Nice, France. This fifth biannual Workshop on Algorithmic Foundations of Robotics focuses on algorithmic issues related to robotics and automation. The design and analysis of robot algorithms raises fundamental questions in computer science, computational geometry, mechanical modeling, operations research, control theory, and associated fields. The highly selective program highlights significant new results such as algorithmic models and complexity bounds. The validation of algorithms, design concepts, or techniques is the common thread running through this focused collection.

American Book Publishing Record - 2004

Factor Graphs for Robot Perception - Frank Dellaert 2017-08-15
Reviews the use of factor graphs for the modeling and solving of large-scale inference problems in robotics. Factor graphs are introduced as an economical representation within which to formulate the different inference problems, setting the stage for the subsequent sections on practical methods to solve them.

Machine Habitus - Massimo Airoldi 2021-12-13
We commonly think of society as made of and by humans, but with the proliferation of machine learning and AI technologies, this is clearly no longer the case. Billions of automated systems tacitly contribute to the social construction of reality by drawing algorithmic distinctions between the visible and the invisible, the relevant and the irrelevant, the likely and the unlikely – on and beyond platforms. Drawing on the work of Pierre Bourdieu, this book develops an original sociology of algorithms as social agents, actively participating in social life. Through a wide range of examples, Massimo Airoldi shows how society shapes algorithmic code, and how this culture in the code guides the practical behaviour of the code in the culture, shaping society in turn. The 'machine habitus' is the generative mechanism at work throughout myriads of feedback loops linking humans with artificial social agents, in the context of digital infrastructures and pre-digital social structures. Machine Habitus will be of great interest to students and scholars in sociology, media and cultural studies, science and technology studies and information technology, and to anyone interested in the growing role of algorithms and AI in our social and cultural life.

Mathematics for Machine Learning - Marc Peter Deisenroth 2020-04-23
The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.

Proceedings, ACM Multimedia ... - 2002

Mathematical Reviews - 2008

Numerical Algorithms - Justin Solomon 2015-06-24
Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics presents a new approach to numerical analysis for modern computer scientists. Using examples from a broad base of computational tasks, including data processing, computational photography, and animation, the textbook introduces numerical modeling and algorithmic desig

Foundations of Data Science - Avrim Blum 2020-01-23
This book provides an introduction to the mathematical and algorithmic foundations of data science, including machine learning, high-dimensional geometry, and analysis of large networks. Topics include the counterintuitive nature of data in high dimensions, important linear algebraic techniques such as singular value decomposition, the theory of random walks and Markov chains, the fundamentals of and important algorithms for machine learning, algorithms and analysis for clustering, probabilistic models for large networks, representation learning including topic modelling and non-negative matrix factorization, wavelets and compressed sensing. Important probabilistic techniques are developed including the law of large numbers, tail inequalities, analysis of random projections, generalization guarantees in machine learning, and moment methods for analysis of phase transitions in large random graphs. Additionally, important structural and complexity measures are discussed such as matrix norms and VC-dimension. This book is suitable for both undergraduate and graduate courses in the design and analysis of algorithms for data.

Planning Algorithms - Steven M. LaValle 2006-05-29
Planning algorithms are impacting technical disciplines and industries

around the world, including robotics, computer-aided design, manufacturing, computer graphics, aerospace applications, drug design, and protein folding. This coherent and comprehensive book unifies material from several sources, including robotics, control theory, artificial intelligence, and algorithms. The treatment is centered on robot motion planning, but integrates material on planning in discrete spaces. A major part of the book is devoted to planning under uncertainty, including decision theory, Markov decision processes, and information spaces, which are the 'configuration spaces' of all sensor-based planning problems. The last part of the book delves into planning under differential constraints that arise when automating the motions of virtually any mechanical system. This text and reference is intended for students, engineers, and researchers in robotics, artificial intelligence, and control theory as well as computer graphics, algorithms, and computational biology.

2003 IEEE/RSJ International Conference on Intelligent Robots and Systems - 2003

Probabilistic Robotics - Sebastian Thrun 2005-08-19
An introduction to the techniques and algorithms of the newest field in robotics. Probabilistic robotics is a new and growing area in robotics, concerned with perception and control in the face of uncertainty. Building on the field of mathematical statistics, probabilistic robotics endows robots with a new level of robustness in real-world situations. This book introduces the reader to a wealth of techniques and algorithms in the field. All algorithms are based on a single overarching mathematical foundation. Each chapter provides example implementations in pseudo code, detailed mathematical derivations, discussions from a practitioner's perspective, and extensive lists of exercises and class projects. The book's Web site, www.probabilistic-robotics.org, has additional material. The book is relevant for anyone involved in robotic software development and scientific research. It will also be of interest to applied statisticians and engineers dealing with real-world sensor data.

Algorithmic Foundations of Robotics XIV - Steven M. LaValle 2021-03-12
This proceedings book helps bring insights from this array of technical sub-topics together, as advanced robot algorithms draw on the combined expertise of many fields—including control theory, computational geometry and topology, geometrical and physical modeling, reasoning under uncertainty, probabilistic algorithms, game theory, and theoretical computer science. Intelligent robots and autonomous systems depend on algorithms that efficiently realize functionalities ranging from perception to decision making, from motion planning to control. The works collected in this SPAR book represent the state of the art in algorithmic robotics. They originate from papers accepted to the 14th International Workshop on the Algorithmic Foundations of Robotics (WAFR), traditionally a biannual, single-track meeting of leading researchers in the field of robotics. WAFR has always served as a premiere venue for the publication of some of robotics' most important, fundamental, and lasting algorithmic contributions, ensuring the rapid circulation of new ideas. Though an in-person meeting was planned for June 15–17, 2020, in Oulu, Finland, the event ended up being canceled owing to the infeasibility of international travel during the global COVID-19 crisis.

Robotics - Pankaj K. Agarwal 1998
This volume gathers together cutting-edge research from the Third Workshop on Algorithmic Foundations of Robotics and gives a solid overview of the state of the art in robot algorithms. The papers cover core problems in robotics, such as motion planning, sensor-based planning, manipulation, and assembly planning. They also examine the application of robotic algorithms in domains like molecular modeling, geometric modeling, and computer-assisted surgery.

Learning to Learn - Sebastian Thrun 2012-12-06
Over the past three decades or so, research on machine learning and data mining has led to a wide variety of algorithms that learn general functions from experience. As machine learning is maturing, it has begun to make the successful transition from academic research to various practical applications. Generic techniques such as decision trees and artificial neural networks, for example, are now being used in various

commercial and industrial applications. Learning to Learn is an exciting new research direction within machine learning. Similar to traditional machine-learning algorithms, the methods described in Learning to Learn induce general functions from experience. However, the book investigates algorithms that can change the way they generalize, i.e., practice the task of learning itself, and improve on it. To illustrate the utility of learning to learn, it is worthwhile comparing machine learning with human learning. Humans encounter a continual stream of learning tasks. They do not just learn concepts or motor skills, they also learn bias, i.e., they learn how to generalize. As a result, humans are often able to generalize correctly from extremely few examples - often just a single example suffices to teach us a new thing. A deeper understanding of computer programs that improve their ability to learn can have a large practical impact on the field of machine learning and beyond. In recent years, the field has made significant progress towards a theory of learning to learn along with practical new algorithms, some of which led to impressive results in real-world applications. Learning to Learn provides a survey of some of the most exciting new research approaches, written by leading researchers in the field. Its objective is to investigate the utility and feasibility of computer programs that can learn how to learn, both from a practical and a theoretical point of view.

Algorithmic Foundations of Robotics IX - David Hsu 2010-11-18
Robotics is at the cusp of dramatic transformation. Increasingly complex robots with unprecedented autonomy are finding new applications, from medical surgery, to construction, to home services. Against this background, the algorithmic foundations of robotics are becoming more crucial than ever, in order to build robots that are fast, safe, reliable, and adaptive. Algorithms enable robots to perceive, plan, control, and learn. The design and analysis of robot algorithms raise new fundamental questions that span computer science, electrical engineering, mechanical engineering, and mathematics. These algorithms are also finding applications beyond robotics, for example, in modeling molecular motion and creating digital characters for video games and architectural simulation. The Workshop on Algorithmic Foundations of Robotics

(WAFR) is a highly selective meeting of leading researchers in the field of robot algorithms. Since its creation in 1994, it has published some of the field's most important and lasting contributions. This book contains the proceedings of the 9th WAFR, held on December 13-15, 2010 at the National University of Singapore. The 24 papers included in this book span a wide variety of topics from new theoretical insights to novel applications.

A Mathematical Introduction to Robotic Manipulation - Richard M. Murray 2017-12-14
A Mathematical Introduction to Robotic Manipulation presents a mathematical formulation of the kinematics, dynamics, and control of robot manipulators. It uses an elegant set of mathematical tools that emphasizes the geometry of robot motion and allows a large class of robotic manipulation problems to be analyzed within a unified framework. The foundation of the book is a derivation of robot kinematics using the product of the exponentials formula. The authors explore the kinematics of open-chain manipulators and multifingered robot hands, present an analysis of the dynamics and control of robot systems, discuss the specification and control of internal forces and internal motions, and address the implications of the nonholonomic nature of rolling contact are addressed, as well. The wealth of information, numerous examples, and exercises make A Mathematical Introduction to Robotic Manipulation valuable as both a reference for robotics researchers and a text for students in advanced robotics courses.

Algorithmic Foundations of Robotics VIII - Gregory S. Chirikjian 2010-02-04
This book contains selected contributions to WAFR, the highly-competitive meeting on the algorithmic foundations of robotics. They address the unique combination of questions that the design and analysis of robot algorithms inspires.

Robot Dynamics And Control - Mark W Spong 2008-08-04
This self-contained introduction to practical robot kinematics and dynamics includes a comprehensive treatment of robot control. It

provides background material on terminology and linear transformations, followed by coverage of kinematics and inverse kinematics, dynamics, manipulator control, robust control, force control, use of feedback in nonlinear systems, and adaptive control. Each topic is supported by examples of specific applications. Derivations and proofs are included in many cases. The book includes many worked examples, examples illustrating all aspects of the theory, and problems.

Robotics Research - Cédric Pradalier 2011-05-02
This volume presents a collection of papers presented at the 14th International Symposium of Robotic Research (ISRR). ISRR is the biennial meeting of the International Foundation of Robotic Research (IFRR) and its 14th edition took place in Lucerne, Switzerland, from August 31st to September 3rd, 2009. As for the previous symposia, ISRR 2009 followed up on the successful concept of a mixture of invited contributions and open submissions. Half of the 48 presentations were therefore invited contributions from outstanding researchers selected by the IFRR officers, and half were chosen among the 66 submissions after peer review. This selection process resulted in a truly excellent technical program which, we believe, featured some of the very best of robotic research. Out of the 48 presentations, the 42 papers which were finally submitted for publication are organized in 8 sections that encompass the major research orientations in robotics: Navigation, Control & Planning, Human-Robot Interaction, Manipulation and Humanoids, Learning, Mapping, Multi-Robot Systems, and Micro-Robotics. They represent an excellent snapshot of cutting-edge research in robotics and outline future directions.
Advanced Robotics - 1996

Algorithms in Structural Molecular Biology - Bruce R. Donald 2011-06-01
An overview of algorithms important to computational structural biology that addresses such topics as NMR and design and analysis of proteins. Using the tools of information technology to understand the molecular machinery of the cell offers both challenges and opportunities to computational scientists. Over the past decade, novel algorithms have been developed both for analyzing biological data and for synthetic biology problems such as protein engineering. This book explains the algorithmic foundations and computational approaches underlying areas of structural biology including NMR (nuclear magnetic resonance); X-ray crystallography; and the design and analysis of proteins, peptides, and small molecules. Each chapter offers a concise overview of important concepts, focusing on a key topic in the field. Four chapters offer a short course in algorithmic and computational issues related to NMR structural biology, giving the reader a useful toolkit with which to approach the fascinating yet thorny computational problems in this area. A recurrent theme is understanding the interplay between biophysical experiments and computational algorithms. The text emphasizes the mathematical foundations of structural biology while maintaining a balance between algorithms and a nuanced understanding of experimental data. Three emerging areas, particularly fertile ground for research students, are highlighted: NMR methodology, design of proteins and other molecules, and the modeling of protein flexibility. The next generation of computational structural biologists will need training in geometric algorithms, provably good approximation algorithms, scientific computation, and an array of techniques for handling noise and uncertainty in combinatorial geometry and computational biophysics. This book is an essential guide for young scientists on their way to research success in this exciting field.

Deutsche Nationalbibliographie und Bibliographie der im Ausland erschienenen deutschsprachigen Veröffentlichungen - 2008

Fundamentals of Deep Learning - Nikhil Buduma 2017-05-25
With the reinvigoration of neural networks in the 2000s, deep learning has become an extremely active area of research, one that's paving the way for modern machine learning. In this practical book, author Nikhil Buduma provides examples and clear explanations to guide you through major concepts of this complicated field. Companies such as Google, Microsoft, and Facebook are actively growing in-house deep-learning

teams. For the rest of us, however, deep learning is still a pretty complex and difficult subject to grasp. If you're familiar with Python, and have a background in calculus, along with a basic understanding of machine learning, this book will get you started. Examine the foundations of machine learning and neural networks Learn how to train feed-forward neural networks Use TensorFlow to implement your first neural network Manage problems that arise as you begin to make networks deeper Build neural networks that analyze complex images Perform effective dimensionality reduction using autoencoders Dive deep into sequence analysis to examine language Learn the fundamentals of reinforcement learning

Algorithmic Foundations of Robotics - Ken Goldberg 1995-05-10
Algorithms, the heart of robotics, form the connection between data collected by sensors and the robotís activities. They also serve as a medium to describe the foundations and principles of robotics.Paper Topics Include: Motion Planning * Navigation * Manipulation * Grasping * Assembly * Controllability * Recognizability * Learning and Distributed Control * Task-Specific Manipulator Design * Simulation of Linkages and Collisions * Completeness and Complexity Measures * Computational Algebra and Geometry

Responsible Artificial Intelligence - Virginia Dignum 2019-11-04
In this book, the author examines the ethical implications of Artificial Intelligence systems as they integrate and replace traditional social structures in new sociocognitive-technological environments. She discusses issues related to the integrity of researchers, technologists, and manufacturers as they design, construct, use, and manage artificially intelligent systems; formalisms for reasoning about moral decisions as part of the behavior of artificial autonomous systems such as agents and robots; and design methodologies for social agents based on societal, moral, and legal values. Throughout the book the author discusses related work, conscious of both classical, philosophical treatments of ethical issues and the implications in modern, algorithmic systems, and she combines regular references and footnotes with suggestions for further reading. This short overview is suitable for undergraduate

students, in both technical and non-technical courses, and for interested and concerned researchers, practitioners, and citizens.
Intelligent Autonomous Vehicles 2004 (IAV 2004) - J. Santos-Victor 2005

Genetic Algorithms and Robotics - Yuval Davidor 1991
Classical optimization methodologies fall short in very large and complex domains. In this book is suggested a different approach to optimization, an approach which is based on the 'blind' and heuristic mechanisms of evolution and population genetics. The genetic approach to optimization introduces a new philosophy to optimization in general, but particularly to engineering. By introducing the ?genetic? approach to robot trajectory generation, much can be learned about the adaptive mechanisms of evolution and how these mechanisms can solve real world problems. It is suggested further that optimization at large may benefit greatly from the adaptive optimization exhibited by natural systems when attempting to solve complex optimization problems, and that the determinism of classical optimization models may sometimes be an obstacle in nonlinear systems.This book is unique in that it reports in detail on an application of genetic algorithms to a real world problem, and explains the considerations taken during the development work. Futhermore, it addresses robotics in two new aspects: the optimization of the trajectory specification which has so far been done by human operators and has not received much attention for both automation and optimization, and the introduction of a heuristic strategy to a field predominated by deterministic strategies.

Camera-Aided Robot Calibration - Hangi Zhuang 1996-06-27
Robot calibration is the process of enhancing the accuracy of a robot by modifying its control software. This book provides a comprehensive treatment of the theory and implementation of robot calibration using computer vision technology. It is the only book to cover the entire process of vision-based robot calibration, including kinematic modeling, camera calibration, pose measurement, error parameter identification, and compensation. The book starts with an overview of available

techniques for robot calibration, with an emphasis on vision-based techniques. It then describes various robot-camera systems. Since cameras are used as major measuring devices, camera calibration techniques are reviewed. Camera-Aided Robot Calibration studies the properties of kinematic modeling techniques that are suitable for robot calibration. It summarizes the well-known Denavit-Hartenberg (D-H) modeling convention and indicates the drawbacks of the D-H model for robot calibration. The book develops the Complete and Parametrically Continuous (CPC) model and the modified CPC model, that overcome the D-H model singularities. The error models based on these robot kinematic modeling conventions are presented. No other book available addresses the important, practical issue of hand/eye calibration. This book summarizes current research developments and demonstrates the pros and cons of various approaches in this area. The book discusses in detail the final stage of robot calibration - accuracy compensation - using the identified kinematic error parameters. It offers accuracy compensation algorithms, including the intuitive task-point redefinition and inverse-Jacobian algorithms and more advanced algorithms based on optimal control theory, which are particularly attractive for highly redundant manipulators. Camera-Aided Robot Calibration defines performance indices that are designed for off-line, optimal selection of measurement configurations. It then describes three approaches: closed-form, gradient-based, and statistical optimization. The included case study presents experimental results that were obtained by calibrating common industrial robots. Different stages of operation are detailed, illustrating the applicability of the suggested techniques for robot calibration. Appendices provide readers with preliminary materials for easier comprehension of the subject matter. Camera-Aided Robot Calibration is a must-have reference for researchers and practicing engineers-the only one with all the information!

Multisensor, Multisource Information Fusion--architectures, Algorithms, and Applications ... - 2006

Algorithms and Law - Martin Ebers 2020-07-23

Exploring issues from big-data to robotics, this volume is the first to comprehensively examine the regulatory implications of AI technology.

Reinforcement Learning, second edition - Richard S. Sutton 2018-11-13

The significantly expanded and updated new edition of a widely used text on reinforcement learning, one of the most active research areas in artificial intelligence. Reinforcement learning, one of the most active research areas in artificial intelligence, is a computational approach to learning whereby an agent tries to maximize the total amount of reward it receives while interacting with a complex, uncertain environment. In Reinforcement Learning, Richard Sutton and Andrew Barto provide a clear and simple account of the field's key ideas and algorithms. This second edition has been significantly expanded and updated, presenting new topics and updating coverage of other topics. Like the first edition, this second edition focuses on core online learning algorithms, with the more mathematical material set off in shaded boxes. Part I covers as much of reinforcement learning as possible without going beyond the tabular case for which exact solutions can be found. Many algorithms presented in this part are new to the second edition, including UCB, Expected Sarsa, and Double Learning. Part II extends these ideas to function approximation, with new sections on such topics as artificial neural networks and the Fourier basis, and offers expanded treatment of off-policy learning and policy-gradient methods. Part III has new chapters on reinforcement learning's relationships to psychology and neuroscience, as well as an updated case-studies chapter including AlphaGo and AlphaGo Zero, Atari game playing, and IBM Watson's wagering strategy. The final chapter discusses the future societal impacts of reinforcement learning.

Multiagent Systems - Yoav Shoham 2008-12-15

Multiagent systems combine multiple autonomous entities, each having diverging interests or different information. This overview of the field offers a computer science perspective, but also draws on ideas from game theory, economics, operations research, logic, philosophy and linguistics. It will serve as a reference for researchers in each of these

fields, and be used as a text for advanced undergraduate or graduate courses. The authors emphasize foundations to create a broad and rigorous treatment of their subject, with thorough presentations of distributed problem solving, game theory, multiagent communication and learning, social choice, mechanism design, auctions, cooperative game theory, and modal logics of knowledge and belief. For each topic, basic concepts are introduced, examples are given, proofs of key results are offered, and algorithmic considerations are examined. An appendix covers background material in probability theory, classical logic, Markov decision processes and mathematical programming.

Modern Robotics - Kevin M. Lynch 2017-05-25
This introduction to robotics offers a distinct and unified perspective of the mechanics, planning and control of robots. Ideal for self-learning, or for courses, as it assumes only freshman-level physics, ordinary differential equations, linear algebra and a little bit of computing background. Modern Robotics presents the state-of-the-art, screw-theoretic techniques capturing the most salient physical features of a robot in an intuitive geometrical way. With numerous exercises at the end of each chapter, accompanying software written to reinforce the concepts in the book and video lectures aimed at changing the classroom experience, this is the go-to textbook for learning about this fascinating subject.

Algorithm Design - Jon Kleinberg 2012-02-28
This is the eBook of the printed book and may not include any media, website access codes, or print supplements that may come packaged with the bound book. Algorithm Design introduces algorithms by looking at the real-world problems that motivate them. The book teaches students a range of design and analysis techniques for problems that arise in computing applications. The text encourages an understanding of the algorithm design process and an appreciation of the role of algorithms in the broader field of computer science. August 6, 2009 Author, Jon Kleinberg, was recently cited in the New York Times for his statistical analysis research in the Internet age.

Foundations of Robotics - Tsuneo Yoshikawa 1990

Foundations of Robotics presents the fundamental concepts and methodologies for the analysis, design, and control of robot manipulators. It explains the physical meaning of the concepts and equations used, and it provides, in an intuitively clear way, the necessary background in kinetics, linear algebra, and control theory. Illustrative examples appear throughout. The author begins by discussing typical robot manipulator mechanisms and their controllers. He then devotes three chapters to the analysis of robot manipulator mechanisms. He covers the kinematics of robot manipulators, describing the motion of manipulator links and objects related to manipulation. A chapter on dynamics includes the derivation of the dynamic equations of motion, their use for control and simulation and the identification of inertial parameters. The final chapter develops the concept of manipulability. The second half focuses on the control of robot manipulators. Various position-control algorithms that guide the manipulator's end effector along a desired trajectory are described Two typical methods used to control the contact force between the end effector and its environments are detailed For manipulators with redundant degrees of freedom, a technique to develop control algorithms for active utilization of the redundancy is described. Appendixes give compact reviews of the function atan2, pseudo inverses, singular-value decomposition, and Lyapunov stability theory. Tsuneo Yoshikawa teaches in the Division of Applied Systems Science in Kyoto University's Faculty of Engineering.

Intelligent Planning for Mobile Robotics: Algorithmic Approaches - Tiwari, Ritu 2012-09-30
Robotics is an ever-expanding field and intelligent planning continues to play a major role. Given that the intention of mobile robots is to carry out tasks independent from human aid, robot intelligence is needed to make and plan out decisions based on various sensors. Planning is the fundamental activity that implements this intelligence into the mobile robots to complete such tasks. Understanding problems, challenges, and solutions to path planning and how it fits in is important to the realm of robotics. Intelligent Planning for Mobile Robotics: Algorithmic Approaches presents content coverage on the basics of artificial

intelligence, search problems, and soft computing approaches. This collection of research provides insight on both robotics and basic algorithms and could serve as a reference book for courses related to robotics, special topics in AI, planning, applied soft computing, applied AI, and applied evolutionary computing. It is an ideal choice for research students, scholars, and professors alike.

<u>Fundamentals of Robotics</u> - Robert Joseph Schilling 1990
A complete overview of the fundamentals of robotics. Case study examples of educational, industrial and generic robots are discussed. Class demonstration software is provided with the laboratory manual. (vs. Craig, Fu, and Asada).

Solving Polynomial Equations - Alicia Dickenstein 2006-01-27
The subject of this book is the solution of polynomial equations, that is, s-tems of (generally) non-linear algebraic equations. This study is at the heart of several areas of mathematics and its applications. It has provided the - tivation for advances in di?erent branches of mathematics such as algebra, geometry, topology, and numerical analysis. In recent years, an explosive - velopment of algorithms and software has made it possible to solve many problems which had been intractable up to then and greatly expanded the areas of applications to include robotics, machine vision, signal processing, structural molecular biology, computer-aided design and geometric modelling, as well as certain areas of statistics, optimization and game theory, and b- logical networks. At the same time, symbolic computation has proved to be an invaluable tool for experimentation and conjecture in pure mathematics. As a consequence, the interest in e?ective algebraic geometry and computer algebrahasextendedwellbeyonditsoriginalconstituencyofpureandapplied mathematicians and computer scientists, to encompass many other scientists and engineers. While the core of the subject remains algebraic geometry, it also calls upon many other aspects of mathematics and theoretical computer science, ranging from numerical methods, di?erential equations and number theory to discrete geometry, combinatorics and complexity theory.
Thegoalofthisbookistoprovideageneralintroduction tomodernma- ematical aspects in computing with multivariate polynomials and in solving algebraic systems.