

Computable Analysis An Introduction Texts In Theoretical Computer Science An Eatcs Series

Computable Calculus treats the fundamental topic of calculus in a novel way that is more in tune with today's computer age. Comprising 11 chapters and an accompanying CD-ROM, the book presents mathematical analysis that has been created to deal with constructively defined concepts. The book's "show your work" approach makes it easier to understand the pitfalls of various computations and, more importantly, how to avoid these pitfalls. The accompanying CD-ROM has self-contained programs that interact with the text, providing for easy grasp of the new concepts and enabling readers to write their own demonstration programs. Contains software on CD ROM: The accompanying software demonstrates, through simulation and exercises, how each concept of calculus can be associated with a program for the 'ideal computer' Using this software readers will be able to write their own demonstration programs

This book constitutes the refereed proceedings of the first International Conference on Computability in Europe, CiE 2005, held in Amsterdam, The Netherlands in June 2005. The 68 revised full papers presented were carefully reviewed and selected from 144 submissions. Among them are papers corresponding to two tutorials, six plenary talks and papers of six special sessions involving mathematical logic and computer science at the

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same time as offering the methodological foundations for models of computation. The papers address many aspects of computability in Europe with a special focus on new computational paradigms. These include first of all connections between computation and physical systems (e.g., quantum and analog computation, neural nets, molecular computation), but also cover new perspectives on models of computation arising from basic research in mathematical logic and theoretical computer science.

A comprehensive introduction to interval logic and duration calculus for modelling, analysing and verifying real-time systems. The Duration Calculus (DC) represents a logical approach to formal design of real-time systems. In DC real numbers are used to model time and Boolean-valued (i.e. $\{0,1\}$ -valued) functions over time to model states of real-time systems. The duration of a state in a time interval is the accumulated presence time of the state in the interval. DC extends interval logic to a calculus to specify and reason about properties of state durations. The text covers theory (completeness, decidability, undecidability, model-checking), results, as well as case studies (Deadline Driven Scheduler).

This volume constitutes the refereed proceedings of the 36th International Symposium on Mathematical Foundations of Computer Science, MFCS 2011, held in Warsaw, Poland, in August 2011. The 48 revised full papers presented together with 6 invited talks were carefully reviewed and selected from 129 submissions. Topics covered include algorithmic game theory,

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algorithmic learning theory, algorithms and data structures, automata, grammars and formal languages, bioinformatics, complexity, computational geometry, computer-assisted reasoning, concurrency theory, cryptography and security, databases and knowledge-based systems, formal specifications and program development, foundations of computing, logic in computer science, mobile computing, models of computation, networks, parallel and distributed computing, quantum computing, semantics and verification of programs, and theoretical issues in artificial intelligence.

This volume, with a foreword by Sir Roger Penrose, discusses the foundations of computation in relation to nature. It focuses on two main questions: What is computation? How does nature compute? The contributors are world-renowned experts who have helped shape a cutting-edge computational understanding of the universe. They discuss computation in the world from a variety of perspectives, ranging from foundational concepts to pragmatic models to ontological conceptions and philosophical implications. The volume provides a state-of-the-art collection of technical papers and non-technical essays, representing a field that assumes information and computation to be key in understanding and explaining the basic structure underpinning physical reality. It also includes a new edition of Konrad Zuse's *OC Calculating Space* (the MIT translation), and a panel discussion transcription on the topic, featuring worldwide experts in quantum mechanics, physics, cognition, computation

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and algorithmic complexity. The volume is dedicated to the memory of Alan M Turing OCo the inventor of universal computation, on the 100th anniversary of his birth, and is part of the Turing Centenary celebrations. This book constitutes the refereed proceedings of the 5th International Conference on Unconventional Computation, UC 2006, held in York, UK, in September 2006. The 17 revised full papers presented together with four invited full papers were carefully reviewed and selected for inclusion in the book. All current aspects of unconventional computation are addressed - theory as well as experiments and applications.

Finite model theory, as understood here, is an area of mathematical logic that has developed in close connection with applications to computer science, in particular the theory of computational complexity and database theory. One of the fundamental insights of mathematical logic is that our understanding of mathematical phenomena is enriched by elevating the languages we use to describe mathematical structures to objects of explicit study. If mathematics is the science of patterns, then the media through which we discern patterns, as well as the structures in which we discern them, command our attention. It is this aspect of logic which is most prominent in model theory, "the branch of mathematical logic which deals with the relation between a formal language and its interpretations". No wonder, then, that mathematical logic, and finite model theory in particular, should find manifold applications in computer science: from specifying programs to querying databases, computer

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science is rife with phenomena whose understanding requires close attention to the interaction between language and structure. This volume gives a broad overview of some central themes of finite model theory: expressive power, descriptive complexity, and zero-one laws, together with selected applications to database theory and artificial intelligence, especially constraint databases and constraint satisfaction problems. The final chapter provides a concise modern introduction to modal logic, which emphasizes the continuity in spirit and technique with finite model theory. This book provides an overview of the theoretical underpinnings of modern probabilistic programming and presents applications in e.g., machine learning, security, and approximate computing. Comprehensive survey chapters make the material accessible to graduate students and non-experts. This title is also available as Open Access on Cambridge Core.

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branches of analysis, and researchers have studied computability and complexity questions arising from real and complex analysis, functional analysis, and the theory of differential equations, up to (geometric) measure theory and topology. This handbook represents the first coherent cross-section through most active research topics on the more theoretical side of the field. It contains 11 chapters grouped into parts on computability in analysis; complexity, dynamics, and randomness; and constructivity, logic, and descriptive complexity. All chapters are written by leading experts working at the cutting edge of the respective topic. Researchers and graduate students in the areas of theoretical computer science and mathematical logic will find systematic introductions into many branches of computable analysis, and a wealth of information and references that will help them to navigate the modern research literature in this field.

This volume contains the papers presented at the 30th Symposium on Mathematical Foundations of Computer Science (MFCS 2005) held in Gdansk, Poland from August 29th to September 2nd, 2005.

Modern cryptology increasingly employs mathematically rigorous concepts and methods from complexity theory. Conversely, current research topics in complexity theory are often motivated by questions and problems from cryptology. This book takes account of this situation, and therefore its subject is what may be dubbed "cryptocomplexity", a kind of symbiosis of these two areas. This book is written for undergraduate and graduate students of computer science, mathematics,

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and engineering, and can be used for courses on complexity theory and cryptology, preferably by stressing their interrelation. Moreover, it may serve as a valuable source for researchers, teachers, and practitioners working in these fields. Starting from scratch, it works its way to the frontiers of current research in these fields and provides a detailed overview of their history and their current research topics and challenges.

The workshop on Computability and Complexity in Analysis, CCA 2000, was hosted by the Department of Computer Science of the University of Wales Swansea, September 17-19, 2000. It was the fourth workshop in a successful series of workshops: CCA'95 in Hagen, Germany, CCA'96 in Trier, Germany, and CCA'98 in Brno, Czech Republic. About 40 participants from the countries United Kingdom, Germany, Japan, Italy, Russia, France, Denmark, Greece, and Ireland contributed to the success of this meeting. Altogether, 28 talks were presented in Swansea. These proceedings include 23 papers which represent a cross-section through recent research on computability and complexity in analysis. The workshop succeeded in bringing together people interested in computability and complexity aspects of analysis and in exploring connections with numerical methods, physics and, of course, computer science. It was rounded off by a number of talks and papers on exact computer arithmetic and by a competition of various implemented systems. A report on this competition has been included in these proceedings. We would like to thank the authors for their contributions and the referees for their careful work, and we hope for

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further inspiring and constructive meetings of the same kind. April 2001 Jens Blanck Vasco Brattka Peter Hertling Organization CCA2000 was hosted by the Department of Computer Science of the University of Wales Swansea and took place on September 17{19, 2000.

This book constitutes the refereed proceedings of the Third International Conference on Computability in Europe, CiE 2007, held in Sienna, Italy, in June 2007. The 50 revised full papers presented together with 36 invited papers were carefully reviewed and selected from 167 submissions.

This book presents recent developments in automatic text analysis. Providing an overview of linguistic modeling, it collects contributions of authors from a multidisciplinary area that focus on the topic of automatic text analysis from different perspectives. It includes chapters on cognitive modeling and visual systems modeling, and contributes to the computational linguistic and information theoretical grounding of automatic text analysis.

This two-volume set LNAI 12166 and 12167 constitutes the refereed proceedings of the 10th International Joint Conference on Automated Reasoning, IJCAR 2020, held in Paris, France, in July 2020.* In 2020, IJCAR was a merger of the following leading events, namely CADE (International Conference on Automated Deduction), FroCoS (International Symposium on Frontiers of Combining Systems), ITP (International Conference on Interactive Theorem Proving), and TABLEAUX (International Conference on Analytic Tableaux and

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Related Methods). The 46 full research papers, 5 short papers, and 11 system descriptions presented together with two invited talks were carefully reviewed and selected from 150 submissions. The papers focus on the following topics: Part I: SAT; SMT and QBF; decision procedures and combination of theories; superposition; proof procedures; non classical logics Part II: interactive theorem proving/ HOL; formalizations; verification; reasoning systems and tools *The conference was held virtually due to the COVID-19 pandemic. Chapter 'Constructive Hybrid Games is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

This volume presents the refereed proceedings from the 14th International Symposium on Static Analysis. The papers address all aspects of static analysis, including abstract domains, abstract interpretation, abstract testing, compiler optimizations, control flow analysis, data flow analysis, model checking, program specialization, security analysis, theoretical analysis frameworks, type-based analysis, and verification systems.

This book constitutes the proceedings of the 16th International Conference on Unconventional Computation and Natural Computation, UCNC 2017, held in Fayetteville, AR, USA in June 2017. The 14 papers presented in this volume were carefully reviewed and selected from 21 submissions. The UCNC series of international conferences is genuinely interdisciplinary and it covers theory as well as experiments and applications. It is concerned with various proposals for

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computation that go beyond the Turing model, human designed computation inspired by nature, and with the computational nature of processes taking place in nature. Typical, but not exclusive, topics are:

hypercomputation; chaos and dynamical systems based computing; granular, fuzzy and rough computing; mechanical computing; cellular, evolutionary, molecular, neural, and quantum computing; membrane computing; amorphous computing, swarm intelligence; artificial immune systems; physics of computation; chemical computation; evolving hardware; the computational nature of self-assembly, developmental processes, bacterial communication, and brain processes.

The unconventional computing is a niche for interdisciplinary science, cross-bred of computer science, physics, mathematics, chemistry, electronic engineering, biology, material science and nanotechnology. The aims of this book are to uncover and exploit principles and mechanisms of information processing in and functional properties of physical, chemical and living systems to develop efficient algorithms, design optimal architectures and manufacture working prototypes of future and emergent computing devices. This first volume presents theoretical foundations of the future and emergent computing paradigms and architectures. The topics covered are computability, (non-)universality and complexity of computation; physics of computation, analog and quantum computing; reversible and asynchronous devices; cellular automata and other mathematical machines; P-systems and cellular computing; infinity and

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spatial computation; chemical and reservoir computing.

The book is the encyclopedia, the first ever complete authoritative account, of the theoretical and experimental findings in the unconventional computing written by the world leaders in the field. All chapters are self-contains, no specialist background is required to appreciate ideas, findings, constructs and designs presented. This treatise in unconventional computing appeals to readers from all walks of life, from high-school pupils to university professors, from mathematicians, computers scientists and engineers to chemists and biologists.

Languages and Tools for Hybrid Systems Design is a survey of languages and tools for the design and verification of hybrid systems. The book reviews and compares hybrid system tools by highlighting their differences in terms of their underlying semantics, expressive power and mathematical mechanisms. The review concludes with a comparative summary, which suggests the need for a unifying approach to hybrid systems design. As a step in this direction, the case is made for a semantic-aware interchange format, which would enable the use of joint techniques, make a formal comparison between different approaches possible, and facilitate exporting and importing design representations. Languages and Tools for Hybrid Systems Design is also intended to equip researchers, application developers and managers with key references and resource material for the successful development of hybrid systems.

This book constitutes the refereed proceedings of the Turing Centenary Conference and the 8th Conference on Computability in Europe, CiE 2012, held in Cambridge,

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UK, in June 2012. The 53 revised papers presented together with 6 invited lectures were carefully reviewed and selected with an acceptance rate of under 29,8%. The CiE 2012 Turing Centenary Conference will be remembered as a historic event in the continuing development of the powerful explanatory role of computability across a wide spectrum of research areas. The papers presented at CiE 2012 represent the best of current research in the area, and forms a fitting tribute to the short but brilliant trajectory of Alan Mathison Turing. Both the conference series and the association promote the development of computability-related science, ranging over mathematics, computer science and applications in various natural and engineering sciences such as physics and biology, and also including the promotion of related non-scientific fields such as philosophy and history of computing.

This book constitutes the proceedings of the 12th International Workshop on Numerical Software Verification, NSV 2019, held in New York City, NY, USA, in July 2019 - colocated with the International Conference on Computer Aided Verification, CAV 2019. The 5 full papers presented together with 2 short papers, 3 abstracts of invited talks, and 2 tutorial papers were carefully reviewed and selected from numerous submissions. The NSV 2017 workshop is dedicated to the development of logical and mathematical techniques for the reasoning about programmability and reliability. Computable Analysis An Introduction Springer Science & Business Media

An introduction to the methods of designing algorithms

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for hard computing tasks, concentrating mainly on approximate, randomized, and heuristic algorithms, and on the theoretical and experimental comparison of these approaches according to the requirements of the practice. This is the first book to systematically explain and compare all the main possibilities of attacking hard computing problems. It also closes the gap between theory and practice by providing at once a graduate textbook and a handbook for practitioners dealing with hard computing problems.

This book constitutes the refereed proceedings of the 9th Conference on Computability in Europe, CiE 2013, held in Milan, Italy, in July 2013. The 48 revised papers presented together with 1 invited lecture and 2 tutorials were carefully reviewed and selected with an acceptance rate of under 31,7%. Both the conference series and the association promote the development of computability-related science, ranging over mathematics, computer science and applications in various natural and engineering sciences such as physics and biology, and also including the promotion of related non-scientific fields such as philosophy and history of computing.

Ordinal Computability discusses models of computation obtained by generalizing classical models, such as Turing machines or register machines, to transfinite working time and space. In particular, recognizability, randomness, and applications to other areas of mathematics are covered.

This compilation of papers presented at the 2000 European Summer Meeting of the Association for Symbolic Logic marks the centennial anniversary of Hilbert's famous lecture. Held in the same hall at La Sorbonne where Hilbert first presented his famous problems, this meeting carries special significance to the Mathematics and Logic communities. The pr

This Festschrift is in honor of Ker-I Ko, Professor in the Stony

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Brook University, USA. Ker-I Ko was one of the founding fathers of computational complexity over real numbers and analysis. He and Harvey Friedman devised a theoretical model for real number computations by extending the computation of Turing machines. He contributed significantly to advancing the theory of structural complexity, especially on polynomial-time isomorphism, instance complexity, and relativization of polynomial-time hierarchy. Ker-I also made many contributions to approximation algorithm theory of combinatorial optimization problems. This volume contains 17 contributions in the area of complexity and approximation. Those articles are authored by researchers over the world, including North America, Europe and Asia. Most of them are co-authors, colleagues, friends, and students of Ker-I Ko. Since their inception, the Perspectives in Logic and Lecture Notes in Logic series have published seminal works by leading logicians. Many of the original books in the series have been unavailable for years, but they are now in print once again. This volume, the nineteenth publication in the Lecture Notes in Logic series, collects the proceedings of the European Summer Meeting of the Association for Symbolic Logic, held in Paris, France in July 2000. This meeting marked the centennial anniversary of Hilbert's famous lecture and was held in the same hall at La Sorbonne where Hilbert presented his problems. Three long articles, based on tutorials given at the meeting, present accessible expositions of developing research in model theory, computability, and set theory. The eleven subsequent papers present work from the research frontier in all areas of mathematical logic. This book constitutes the refereed proceedings of the International Symposium on Logical Foundations of Computer Science, LFCS 2020, held in Deerfield Beach, FL, USA, in January 2020. The 17 revised full papers were carefully reviewed and selected from 30 submissions. The scope of the

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Symposium is broad and includes constructive mathematics and type theory; homotopy type theory; logic, automata, and automatic structures; computability and randomness; logical foundations of programming; logical aspects of computational complexity; parameterized complexity; logic programming and constraints; automated deduction and interactive theorem proving; logical methods in protocol and program verification; logical methods in program specification and extraction; domain theory logics; logical foundations of database theory; equational logic and term rewriting; lambda and combinatory calculi; categorical logic and topological semantics; linear logic; epistemic and temporal logics; intelligent and multiple-agent system logics; logics of proof and justification; non-monotonic reasoning; logic in game theory and social software; logic of hybrid systems; distributed system logics; mathematical fuzzy logic; system design logics; other logics in computer science.

This book constitutes the refereed proceedings of the First International Conference on Formal Methods in Macro-Biology, FMMB 2014, held in Nouméa, New Caledonia, in September 2014. The 7 revised full and 3 short papers presented together with 7 invited presentations were carefully reviewed and selected from 17 submissions. The scientific program consists of papers on a wide variety of topics, including ecological systems, medical applications, logical frameworks, and discrete continuous and hybrid models for the analysis of biological systems at macroscopic levels.

This open access book constitutes the proceeding of the 28th International Conference on Automated Deduction, CADE 28, held virtually in July 2021. The 29 full papers and 7 system descriptions presented together with 2 invited papers were carefully reviewed and selected from 76 submissions. CADE is the major forum for the presentation of research in all aspects of automated deduction, including foundations,

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applications, implementations, and practical experience. The papers are organized in the following topics: Logical foundations; theory and principles; implementation and application; ATP and AI; and system descriptions.

This book constitutes the proceedings of the 20th International Conference on Foundations of Software Science and Computation Structures, FOSSACS 2017, which took place in Uppsala, Sweden in April 2017, held as Part of the European Joint Conferences on Theory and Practice of Software, ETAPS 2017. The 32 papers presented in this volume were carefully reviewed and selected from 101 submissions. They were organized in topical sections named: coherence spaces and higher-order computation; algebra and coalgebra; games and automata; automata, logic and formal languages; proof theory; probability; concurrency; lambda calculus and constructive proof; and semantics and category theory.

This book constitutes the refereed proceedings of the 6th International Conference on Abstract State Machines, Alloy, B, TLA, VDM, and Z, ABZ 2016, held in Southampton, UK, in June 2016. The 20 full and 11 short papers presented in this volume were carefully reviewed and selected from 60 submissions. They record the latest research developments in state-based formal methods Abstract State Machines, Alloy, B, Circus, Event-B, TLS+, VDM and Z.

The 8th International Conference on Unconventional Computation, UC 2009, was held in Ponta Delgada during September 7–11, 2009, and was organized - der the auspices of the European Association for Theoretical Computer Science (EATCS) by the University of Azores (Ponta Delgada, Portugal) and the Centre for Discrete Mathematics and Theoretical Computer Science (Auckland, New Zealand). The venue was the University of Azores, with its modern and well-equipped auditoria, next to the magnificient rectory, and

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surrounded by a pleasant and peaceful garden. The university is located in the city of Ponta Delgada, on São Miguel Island, in the Archipelago of the Azores. São Miguel is famous for its beautiful landscapes and exceptional volcanic lakes. Depending on the surrounding countryside, some appear peaceful and relaxing, while others are more dramatic. Ponta Delgada has many magnificent buildings of tremendous architectural value portraying the urban architecture of the sixteenth to nineteenth centuries. The majority of these are presently used to accommodate various - litical, administrative, religious and cultural offices. There are several churches that are authentic works of art, with Gothic structures and Manueline exteriors. Others are in the baroque style, with interior embroideries in gold thread and rare wood pieces. Famous paintings are also easily found in Ponta Delgada. The International Conference on Unconventional Computation (UC) series is devoted to all aspects of unconventional computation — theory as well as experiments and applications. (See <https://www.cs.auckland.ac.nz/CDMTCS/conferences/uc/>).

This open access book constitutes the proceedings of the 29th European Symposium on Programming, ESOP 2020, which was planned to take place in Dublin, Ireland, in April 2020, as Part of the European Joint Conferences on Theory and Practice of Software, ETAPS 2020. The actual ETAPS 2020 meeting was postponed due to the Corona pandemic. The papers deal with fundamental issues in the specification, design, analysis, and implementation of programming languages and systems.

Merging fundamental concepts of analysis and recursion theory to a new exciting theory, this book provides a solid fundament for studying various aspects of computability and complexity in analysis. It is the result of an introductory course given for several years and is written in a style

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suitable for graduate-level and senior students in computer science and mathematics. Many examples illustrate the new concepts while numerous exercises of varying difficulty extend the material and stimulate readers to work actively on the text.

A collection of essays celebrating the influence of Alan Turing's work in logic, computer science and related areas. This book constitutes the refereed proceedings of the 11th Conference on Computability in Europe, CiE 2015, held in Bucharest, Romania, in June/July 2015. The 26 revised papers presented were carefully reviewed and selected from 64 submissions and included together with 10 invited papers in this proceedings. The conference CiE 2015 has six special sessions: two sessions, Representing Streams and Reverse Mathematics, were introduced for the first time in the conference series. In addition to this, new developments in areas frequently covered in the CiE conference series were addressed in the further special sessions on Automata, Logic and Infinite Games; Bio-inspired Computation; Classical Computability Theory; as well as History and Philosophy of Computing.

Restricted-orientation convexity is the study of geometric objects whose intersections with lines from some fixed set are connected. This notion generalizes standard convexity and several types of nontraditional convexity. The authors explore the properties of this generalized convexity in multidimensional Euclidean space, and describe restricted-orientation analogs of lines, hyperplanes, flats, halfspaces, and identify major properties of standard convex sets that also hold for restricted-orientation convexity. They then introduce the notion of strong restricted-orientation convexity, which is an alternative generalization of convexity, and show that its properties are also similar to that of standard convexity.

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