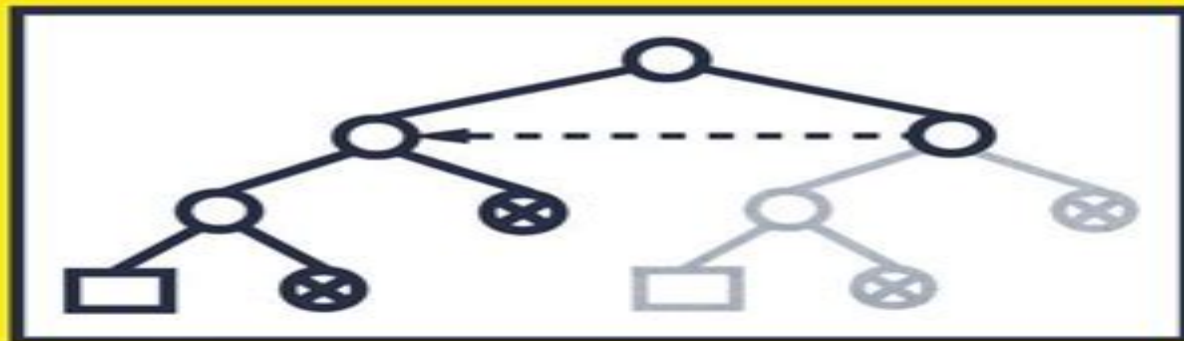# Efficient Branch and Bound Search with Application to Computer-Aided Design

Xinghao Chen
Michael L. Bushnell

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Efficient Branch And Bound Search With Application To Computer Aided Design

Armin Biere

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Efficient Branch and Bound Search with Application to Computer-Aided Design Xinghao Chen,Michael L. Bushnell,2012-12-06 Branch and bound search has been known for a long time and has been widely used in solving a variety of problems in computer aided design CAD and many important optimization problems In many applications the classic branch and bound search methods perform duplications of computations or rely on the search decision trees which keep track of the branch and bound search processes In CAD and many other technical fields the computational cost of constructing branch and bound search decision trees in solving large scale problems is prohibitive and duplications of computations are intolerable Efficient branch and bound methods are needed to deal with today s computational challenges Efficient branch and bound methods must not duplicate computations Efficient Branch and Bound Search with Application to Computer Aided Design describes an efficient branch and bound method for logic justification which is fundamental to automatic test pattern generation ATPG redundancy identification logic synthesis minimization verification and other problems in CAD The method is called justification equivalence based on the observation that justification processes may share identical subsequent search decision sequences With justification equivalence duplication of computations is avoided in the dynamic branch and bound search process without using search decision trees Efficient Branch and Bound Search with Application to Computer Aided Design consists of two parts The first part containing the first three chapters provides the theoretical work The second part deals with applications particularly ATPG for sequential circuits This book is particularly useful to readers who are interested in the design and test of digital circuits **VLSI Architecture for Signal, Speech, and Image Processing** Durgesh Nandan,Basant Kumar Mohanty,Sanjeev Kumar,Rajeev Kumar Arya,2022-11-03 This new volume introduces various VLSI very large scale integration architecture for DSP filters speech filters and image filters detailing their key applications and discussing different aspects and technologies used in VLSI design models and architectures and more The volume explores the major challenges with the aim to develop real time hardware architecture designs that are compact and accurate It provides useful research in the field of computer arithmetic and can be applied for various arithmetic circuits for their digital implementation schemes and for performance considerations **Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits** M. Bushnell,Vishwani Agrawal,2006-04-11 The modern electronic testing has a forty year history Test professionals hold some fairly large conferences and numerous workshops have a journal and there are over one hundred books on testing Still a full course on testing is offered only at a few universities mostly by professors who have a research interest in this area Apparently most professors would not have taken a course on electronic testing when they were students Other than the computer engineering curriculum being too crowded the major reason cited for the absence of a course on electronic testing is the lack of a suitable textbook For VLSI the foundation was provided by semiconductor device techn ogy circuit design and electronic testing In a computer

engineering curriculum therefore it is necessary that foundations should be taught before applications The field of VLSI has expanded to systems on a chip which include digital memory and mixed signalsubsystems To our knowledge this is the first textbook to cover all three types of electronic circuits We have written this textbook for an undergraduate foundations course on electronic testing Obviously it is too voluminous for a one semester course and a teacher will have to select from the topics We did not restrict such freedom because the selection may depend upon the individual expertise and interests Besides there is merit in having a larger book that will retain its usefulness for the owner even after the completion of the course With equal tenacity we address the needs of three other groups of readers **Computer-Aided Design of Analog Integrated Circuits and Systems** Rob A. Rutenbar,Georges G. E. Gielen,2002-05-06 The tools and techniques you need to break the analog design bottleneck Ten years ago analog seemed to be a dead end technology Today System on Chip SoC designs are increasingly mixed signal designs With the advent of application specific integrated circuits ASIC technologies that can integrate both analog and digital functions on a single chip analog has become more crucial than ever to the design process Today designers are moving beyond hand crafted one transistor at a time methods They are using new circuit and physical synthesis tools to design practical analog circuits new modeling and analysis tools to allow rapid exploration of system level alternatives and new simulation tools to provide accurate answers for analog circuit behaviors and interactions that were considered impossible to handle only a few years ago To give circuit designers and CAD professionals a better understanding of the history and the current state of the art in the field this volume collects in one place the essential set of analog CAD papers that form the foundation of today s new analog design automation tools Areas covered are Analog synthesis Symbolic analysis Analog layout Analog modeling and analysis Specialized analog simulation Circuit centering and yield optimization Circuit testing Computer Aided Design of Analog Integrated Circuits and Systems is the cutting edge reference that will be an invaluable resource for every semiconductor circuit designer and CAD professional who hopes to break the analog design bottleneck Formal Equivalence Checking and Design Debugging Shi-Yu Huang,Kwang-Ting (Tim) Cheng,2012-12-06 Formal Equivalence Checking and Design Debugging covers two major topics in design verification logic equivalence checking and design debugging The first part of the book reviews the design problems that require logic equivalence checking and describes the underlying technologies that are used to solve them Some novel approaches to the problems of verifying design revisions after intensive sequential transformations such as retiming are described in detail The second part of the book gives a thorough survey of previous and recent literature on design error diagnosis and design error correction This part also provides an in depth analysis of the algorithms used in two logic debugging software programs ErrorTracer and AutoFix developed by the authors From the Foreword With the adoption of the static sign off approach to verifying circuit implementations the application specific integrated circuit ASIC industry will experience the first radical methodological revolution since the adoption of logic synthesis Equivalence checking is one of the two critical elements of

this methodological revolution This book is timely for either the designer seeking to better understand the mechanics of equivalence checking or for the CAD researcher who wishes to investigate well motivated research problems such as equivalence checking of retimed designs or error diagnosis in sequential circuits Kurt Keutzer University of California Berkeley   *Reasoning in Boolean Networks* Wolfgang Kunz,Dominik Stoffel,2013-03-09 Reasoning in Boolean Networks provides a detailed treatment of recent research advances in algorithmic techniques for logic synthesis test generation and formal verification of digital circuits The book presents the central idea of approaching design automation problems for logic level circuits by specific Boolean reasoning techniques While Boolean reasoning techniques have been a central element of two level circuit theory for many decades Reasoning in Boolean Networks describes a basic reasoning methodology for multi level circuits This leads to a unified view on two level and multi level logic synthesis The presented reasoning techniques are applied to various CAD problems to demonstrate their usefulness for today s industrially relevant problems Reasoning in Boolean Networks provides lucid descriptions of basic algorithmic concepts in automatic test pattern generation logic synthesis and verification and elaborates their intimate relationship to provide further intuition and insight into the subject Numerous examples are provide for ease in understanding the material Reasoning in Boolean Networks is intended for researchers in logic synthesis VLSI testing and formal verification as well as for integrated circuit designers who want to enhance their understanding of basic CAD methodologies   **The Traveling Salesman Problem** David L. Applegate,Robert E. Bixby,Vašek Chvátal,William J. Cook,2011-09-19 This book presents the latest findings on one of the most intensely investigated subjects in computational mathematics the traveling salesman problem It sounds simple enough given a set of cities and the cost of travel between each pair of them the problem challenges you to find the cheapest route by which to visit all the cities and return home to where you began Though seemingly modest this exercise has inspired studies by mathematicians chemists and physicists Teachers use it in the classroom It has practical applications in genetics telecommunications and neuroscience The authors of this book are the same pioneers who for nearly two decades have led the investigation into the traveling salesman problem They have derived solutions to almost eighty six thousand cities yet a general solution to the problem has yet to be discovered Here they describe the method and computer code they used to solve a broad range of large scale problems and along the way they demonstrate the interplay of applied mathematics with increasingly powerful computing platforms They also give the fascinating history of the problem how it developed and why it continues to intrigue us   **Nonlinear System Identification** Oliver Nelles,2020-09-09 This book provides engineers and scientists in academia and industry with a thorough understanding of the underlying principles of nonlinear system identification It equips them to apply the models and methods discussed to real problems with confidence while also making them aware of potential difficulties that may arise in practice Moreover the book is self contained requiring only a basic grasp of matrix algebra signals and systems and statistics Accordingly it can also serve as an introduction to linear system

identification and provides a practical overview of the major optimization methods used in engineering The focus is on gaining an intuitive understanding of the subject and the practical application of the techniques discussed The book is not written in a theorem proof style instead the mathematics is kept to a minimum and the ideas covered are illustrated with numerous figures examples and real world applications In the past nonlinear system identification was a field characterized by a variety of ad hoc approaches each applicable only to a very limited class of systems With the advent of neural networks fuzzy models Gaussian process models and modern structure optimization techniques a much broader class of systems can now be handled Although one major aspect of nonlinear systems is that virtually every one is unique tools have since been developed that allow each approach to be applied to a wide variety of systems **Electric Power Research Trends** Michael C. Schmidt,2007 The world is becoming increasingly electrified For the foreseeable future coal will continue to be the dominant fuel used for electric power production The low cost and abundance of coal is one of the primary reasons for this Electric power transmission a process in the delivery of electricity to consumers is the bulk transfer of electrical power Typically power transmission is between the power plant and a substation near a populated area Electricity distribution is the delivery from the substation to the consumers Due to the large amount of power involved transmission normally takes place at high voltage 110 kV or above Electricity is usually transmitted over long distance through overhead power transmission lines Underground power transmission is used only in densely populated areas due to its high cost of installation and maintenance and because the high reactive power gain produces large charging currents and difficulties in voltage management A power transmission system is sometimes referred to colloquially as a grid however for reasons of economy the network is rarely a true grid Redundant paths and lines are provided so that power can be routed from any power plant to any load centre through a variety of routes based on the economics of the transmission path and the cost of power Much analysis is done by transmission companies to determine the maximum reliable capacity of each line which due to system stability considerations may be less than the physical or thermal limit of the line Deregulation of electricity companies in many countries has led to renewed interest in reliable economic design of transmission networks This new book presents leading edge research on electric power and its generation transmission and efficiency *Fuzzy Decision Making in Modeling and Control* Jo?o M. C. Sousa,Uzay Kaymak,2002 Decision making and control are two fields with distinct methods for solving problems and yet they are closely related This book bridges the gap between decision making and control in the field of fuzzy decisions and fuzzy control and discusses various ways in which fuzzy decision making methods can be applied to systems modeling and control Fuzzy decision making is a powerful paradigm for dealing with human expert knowledge when one is designing fuzzy model based controllers The combination of fuzzy decision making and fuzzy control in this book can lead to novel control schemes that improve the existing controllers in various ways The following applications of fuzzy decision making methods for designing control systems are considered Fuzzy decision making for enhancing fuzzy modeling

The values of important parameters in fuzzy modeling algorithms are selected by using fuzzy decision making Fuzzy decision making for designing signal based fuzzy controllers The controller mappings and the defuzzification steps can be obtained by decision making methods Fuzzy design and performance specifications in model based control Fuzzy constraints and fuzzy goals are used Design of model based controllers combined with fuzzy decision modules Human operator experience is incorporated for the performance specification in model based control The advantages of bringing together fuzzy control and fuzzy decision making are shown with multiple examples from real and simulated control systems **Recent Advances In Information Science And Technology** Nikos E Mastorakis,1998-10-12 Recent Advances in Information Science and Technology brings you a balanced state of the art presentation of the latest concepts methods algorithms techniques procedures and applications of the fascinating field of Computer Science and Engineering Written by eminent leading international experts the contributors provide up to date aspects of topics discussed and present fresh original insights into their own experience with Information Science and Technology This rich anthology of papers which compose this volume contains the latest developments and reflects the experience of many eminent researchers working in different environments universities research centers and industry The book is composed of five parts Software Engineering in which new trends and recent scientific results in software engineering data structures algorithms knowledge based systems VLSI design computer languages and industrial computer applications are presented Signal Processing in which modern topics in signal processing identification recognition speech processing and detection are included Multi Dimensional m D Systems Theory and Applications which contains new research results in m D systems theory and impressive applications of multidimensional systems mainly in signal processing Communication Systems containing modern topics of communication as Digital systems of communication computer networks theory ATM networks optical networks hybrid fibber coaxial networks Internet etc Modern Numerical Techniques and Related Topics which covers some aspects of the modern computation science and technology **Asian Test Symposium** ,2005 *Computer-Aided Design, Engineering, and Manufacturing* Cornelius T. Leondes,2019-08-21 In the competitive business arena organizations must continually strive to create new and better products faster more efficiently and more cost effectively than competitors to gain and keep the competitive advantage Computer aided design CAD computer aided engineering CAE and computer aided manufacturing CAM are now the industry standard in all major industries The seven volumes in Computer Aided Design Engineering and Manufacturing Systems Techniques and Manufacturing provide a comprehensive treatment of the techniques and applications of CAD CAE and CAM Handbook of Satisfiability Armin Biere,2009 Satisfiability SAT related topics have attracted researchers from various disciplines logic applied areas such as planning scheduling operations research and combinatorial optimization but also theoretical issues on the theme of complexity and much more they all are connected through SAT My personal interest in SAT stems from actual solving The increase in power of modern SAT solvers over the past 15 years has been phenomenal It

has become the key enabling technology in automated verification of both computer hardware and software Bounded Model Checking BMC of computer hardware is now probably the most widely used model checking technique The counterexamples that it finds are just satisfying instances of a Boolean formula obtained by unwinding to some fixed depth a sequential circuit and its specification in linear temporal logic Extending model checking to software verification is a much more difficult problem on the frontier of current research One promising approach for languages like C with finite word length integers is to use the same idea as in BMC but with a decision procedure for the theory of bit vectors instead of SAT All decision procedures for bit vectors that I am familiar with ultimately make use of a fast SAT solver to handle complex formulas Decision procedures for more complicated theories like linear real and integer arithmetic are also used in program verification Most of them use powerful SAT solvers in an essential way Clearly efficient SAT solving is a key technology for 21st century computer science I expect this collection of papers on all theoretical and practical aspects of SAT solving will be extremely useful to both students and researchers and will lead to many further advances in the field Edmund Clarke FORE Systems University Professor of Computer Science and Professor of Electrical and Computer Engineering at Carnegie Mellon University winner of the 2007 A M Turing Award   **Theory and Applications of Satisfiability Testing - SAT 2009** Oliver Kullmann,2009-06-19 This book constitutes the refereed proceedings of the 12th International Conference on Theory and Applications of Satisfiability Testing SAT 2009 held in Swansea UK in June July 2009 The 34 revised full papers presented together with 11 revised short papers and 2 invited talks were carefully selected from 86 submissions The papers are organized in topical sections on applications of SAT complexity theory structures for SAT resolution and SAT translations to CNF techniques for conflict driven SAT Solvers solving SAT by local search hybrid SAT solvers automatic adaption of SAT solvers stochastic approaches to SAT solving QBFs and their representations optimization algorithms distributed and parallel solving   **Principles and Practice of Constraint Programing-CP 2013** Christian Schulte,2013-09-07 This book constitutes the refereed conference proceedings of the 18th International Conference on Principles and Practice of Constraint Programming CP 2013 held in Uppsala Sweden in September 2013 The 61 revised papers presented together with 3 invited talks were carefully selected from 138 submissions The scope of the conference is on all aspects of computing with constraints including theory algorithms environments languages models and systems applications such as decision making resource allocation and agreement technologies   **Field Programmable Logic and Application** Jürgen Becker,Marco Platzner,Serge Vernalde,2004-08-11 This book contains the papers presented at the 14th International Conference on Field Programmable Logic and Applications FPL held during August 30th September 1st 2004 The conference was hosted by the Interuniversity Micro Electronics Center IMEC in Leuven Belgium The FPL series of conferences was founded in 1991 at Oxford University UK and has been held annually since in Oxford 3 times Vienna Prague Darmstadt London Tallinn Glasgow Villach Belfast Montpellier and Lisbon It is the largest and oldest conference in reconfigurable computing and brings

together academic researchers industry experts users and newcomers in an informal welcoming atmosphere that encourages productive exchange of ideas and knowledge between the delegates The fast and exciting advances in field programmable logic are increasing steadily with more and more application potential and need New ground has been broken in architectures design techniques partial run time reconfiguration and applications of field programmable devices in several different areas Many of these recent innovations are reported in this volume The size of the FPL conferences has grown significantly over the years FPL in 2003 saw 216 papers submitted The interest and support for FPL in the programmable logic community continued this year with 285 scientific papers submitted demonstrating a 32% increase when compared to the year before The technical program was assembled from 78 selected regular papers 45 additional short papers and 29 posters resulting in this volume of proceedings The program also included three invited plenary keynote presentations from Xilinx Gilder Technology Report and Altera and three embedded tutorials from Xilinx the Universit at Karlsruhe TH and the University of Oslo **10th Anniversary Compendium of Papers from Asian Test Symposium** ,2001 <u>Fourth European Symposium on Computer Aided Process Engineering, ESCAPE 4</u> F. A. Perris,1994 The ESCAPE symposia address the applications of computer aids to all aspects of process engineering The primary objective is the interchange of information on industrial needs new technology developments and research opportunities With industrialists and academia contibuting from all over the world this set of proceedings provides an overview of current international computer aided process engineering CAPE This book is intended for chemical and process engineers design engineers and computer aided specialists *Multi-Chip Module Test Strategies* Yervant Zorian,2012-12-06 MCMs today consist of complex and dense VLSI devices mounted into packages that allow little physical access to internal nodes The complexity and cost associated with their test and diagnosis are major obstacles to their use Multi Chip Module Test Strategies presents state of the art test strategies for MCMs This volume of original research is designed for engineers interested in practical implementations of MCM test solutions and for designers looking for leading edge test and design for testability solutions for their next designs Multi Chip Module Test Strategies consists of eight contributions by leading researchers It is designed to provide a comprehensive and well balanced coverage of the MCM test domain Multi Chip Module Test Strategies has also been published as a special issue of the Journal of Electronic Testing Theory and Applications JETTA Volume 10 Numbers 1 and 2

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