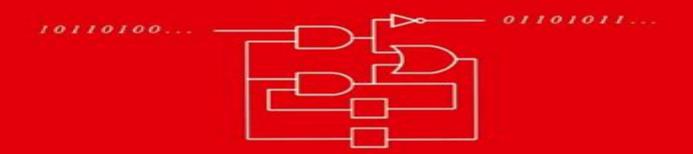
# SEQUENTIAL LOGIC TESTING AND VERIFICATION

Abhijit Ghosh
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Kluwer Academic Publishers

# **Sequential Logic Testing And Verification**

N. K. Jha, S. Gupta

#### **Sequential Logic Testing And Verification:**

Sequential Logic Testing and Verification Abhijit Ghosh, Srinivas Devadas, A. Richard Newton, 1991-11-30 Sequential Logic Testing and Verification Abhijit Ghosh, Srinivas Devadas, A. Richard Newton, 2012-12-06 In order to design and build computers that achieve and sustain high performance it is essential that reliability issues be considered care fully The problem has several aspects Certainly considering reliability implies that an engineer must be able to analyze how design decisions affect the incidence of failure For instance in order design reliable integritted circuits it is necessary to analyze how decisions regarding design rules affect the yield i e the percentage of functional chips obtained by the manufacturing process Of equal importance in producing reliable computers is the detection of failures in its Very Large Scale Integrated VLSI circuit components caused by errors in the design specification implementation or manufacturing processes Design verification involves the checking of the specification of a design for correctness prior to carrying out an implementation Implementation verification ensures that the manual design or automatic synthesis process is correct i e the mask level description correctly implements the specification Manufacture test involves the checking of the complex fabrication process for correctness i e ensuring that there are no manufacturing defects in the integrated circuit It should be noted that all the above verification mechanisms deal not only with verifying the functionality of the integrated circuit but also its performance

Computer Logic, Testing, and Verification John Paul Roth, 1980 An Introduction to Logic Circuit Testing Parag K. Lala, 2022-06-01 An Introduction to Logic Circuit Testing provides a detailed coverage of techniques for test generation and testable design of digital electronic circuits systems. The material covered in the book should be sufficient for a course or part of a course in digital circuit testing for senior level undergraduate and first year graduate students in Electrical Engineering and Computer Science The book will also be a valuable resource for engineers working in the industry This book has four chapters Chapter 1 deals with various types of faults that may occur in very large scale integration VLSI based digital circuits Chapter 2 introduces the major concepts of all test generation techniques such as redundancy fault coverage sensitization and backtracking Chapter 3 introduces the key concepts of testability followed by some ad hoc design for testability rules that can be used to enhance testability of combinational circuits Chapter 4 deals with test generation and response evaluation techniques used in BIST built in self test schemes for VLSI chips Table of Contents Introduction Fault Detection in Logic Circuits Design for Testability Built in Self Test References *Digital Logic Testing and Simulation* Alexander Miczo, 2003-10-10 Your road map for meeting today s digital testing challenges Today digital logic devices are common in products that impact public safety including applications in transportation and human implants Accurate testing has become more critical to reliability safety and the bottom line Yet as digital systems become more ubiquitous and complex the challenge of testing them has become more difficult As one development group designing a RISC stated the work required to test a chip of this size approached the amount of effort required to design it A valued reference for nearly two decades

Digital Logic Testing and Simulation has been significantly revised and updated for designers and test engineers who must meet this challenge There is no single solution to the testing problem Organized in an easy to follow sequential format this Second Edition familiarizes the reader with the many different strategies for testing and their applications and assesses the strengths and weaknesses of the various approaches The book reviews the building blocks of a successful testing strategy and guides the reader on choosing the best solution for a particular application Digital Logic Testing and Simulation Second Edition covers such key topics as Binary Decision Diagrams BDDs and cycle based simulation Tester architectures Standard Test Interface Language STIL Practical algorithms written in a Hardware Design Language HDL Fault tolerance Behavioral Automatic Test Pattern Generation ATPG The development of the Test Design Expert TDX the many obstacles encountered and lessons learned in creating this novel testing approach Up to date and comprehensive Digital Logic Testing and Simulation is an important resource for anyone charged with pinpointing faulty products and assuring quality safety and profitability Testing and Diagnosis of VLSI and ULSI F. Lombardi, M.G. Sami, 2012-12-06 This volume contains a collection of papers presented at the NATO Advanced Study Institute on Testing and Diagnosis of VLSI and ULSI held at Villa Olmo Como Italy June 22 July 3 1987 High Density technologies such as Very Large Scale Integration VLSI Wafer Scale Integration WSI and the not so far promises of Ultra Large Scale Integration ULSI have exasperated the problema associated with the testing and diagnosis of these devices and systema Traditional techniques are fast becoming obsolete due to unique requirements such as limited controllability and observability increasing execution complexity for test vector generation and high cost of fault simulation to mention just a few New approaches are imperative to achieve the highly sought goal of the three months turn around cycle time for a state of the art computer chip The importance of testing and diagnostic processes is of primary importance if costs must be kept at acceptable levels The objective of this NATO ASI was to present analyze and discuss the various facets of testing and diagnosis with respect to both theory and practice. The contents of this volume reflect the diversity of approaches currently available to reduce test and diagnosis time. These approaches are described in a concise yet clear way by renowned experts of the field Their contributions are aimed at a wide readership the uninitiated researcher will find the tutorial chapters very rewarding The expert will be introduced to advanced techniques in a very comprehensive manner EDA for IC System Design, Verification, and Testing Louis Scheffer, Luciano Lavagno, Grant Martin, 2018-10-03 Presenting a comprehensive overview of the design automation algorithms tools and methodologies used to design integrated circuits the Electronic Design Automation for Integrated Circuits Handbook is available in two volumes The first volume EDA for IC System Design Verification and Testing thoroughly examines system level design microarchitectural design logical verification and testing Chapters contributed by leading experts authoritatively discuss processor modeling and design tools using performance metrics to select microprocessor cores for IC designs design and verification languages digital simulation hardware acceleration and emulation and much more Save on the complete set

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 **Logic Verification and Test Generation** for VLSI Circuits Ruey-sing Wei,1986 **Principles of Testing Electronic Systems** Samiha Mourad, Yervant Zorian, 2000-07-25 A pragmatic approach to testing electronic systems As we move ahead in the electronic age rapid changes in technology pose an ever increasing number of challenges in testing electronic products Many practicing engineers are involved in this arena but few have a chance to study the field in a systematic way learning takes place on the job By covering the fundamental disciplines in detail Principles of Testing Electronic Systems provides design engineers with the much needed knowledge base Divided into five major parts this highly useful reference relates design and tests to the development of reliable electronic products shows the main vehicles for design verification examines designs that facilitate testing and investigates how testing is applied to random logic memories FPGAs and microprocessors Finally the last part offers coverage of advanced test solutions for today s very deep submicron designs The authors take a phenomenological approach to the subject matter while providing readers with plenty of opportunities to explore the foundation in detail Special features include An explanation of where a test belongs in the design flow Detailed discussion of scan path and ordering of scan chains BIST solutions for embedded logic and memory blocks Test methodologies for FPGAs A chapter on testing system on a chip Numerous references Timing Analysis and Optimization of Sequential Circuits Naresh Maheshwari, S. Sapatnekar, 2012-12-06 Recent years have seen rapid strides in the level of sophistication of VLSI circuits On the

performance front there is a vital need for techniques to design fast low power chips with minimum area for increasingly complex systems while on the economic side there is the vastly increased pressure of time to market These pressures have made the use of CAD tools mandatory in designing complex systems Timing Analysis and Optimization of Sequential Circuits describes CAD algorithms for analyzing and optimizing the timing behavior of sequential circuits with special reference to performance parameters such as power and area A unified approach to performance analysis and optimization of sequential circuits is presented. The state of the art in timing analysis and optimization techniques is described for circuits using edge triggered or level sensitive memory elements Specific emphasis is placed on two methods that are true sequential timing optimizations techniques retiming and clock skew optimization Timing Analysis and Optimization of Sequential Circuits covers the following topics Algorithms for sequential timing analysis Fast algorithms for clock skew optimization and their applications Efficient techniques for retiming large sequential circuits Coupling sequential and combinational optimizations Timing Analysis and Optimization of Sequential Circuits is written for graduate students researchers and professionals in the Verification Techniques for System-Level Design Masahiro area of CAD for VLSI and VLSI circuit design Fujita, Indradeep Ghosh, Mukul Prasad, 2010-07-27 This book will explain how to verify SoC Systems on Chip logic designs using formal and semiformal verification techniques The critical issue to be addressed is whether the functionality of the design is the one that the designers intended Simulation has been used for checking the correctness of SoC designs as in functional verification but many subtle design errors cannot be caught by simulation Recently formal verification giving mathematical proof of the correctness of designs has been gaining popularity For higher design productivity it is essential to debug designs as early as possible which this book facilitates This book covers all aspects of high level formal and semiformal verification techniques for system level designs First book that covers all aspects of formal and semiformal high level higher than RTL design verification targeting SoC designs Formal verification of high level designs RTL or higher Verification techniques are discussed with associated system level design methodology **Electronic Materials Handbook** ,1989-11-01 Volume 1 Packaging is an authoritative reference source of practical information for the design or process engineer who must make informed day to day decisions about the materials and processes of microelectronic packaging Its 117 articles offer the collective knowledge wisdom and judgement of 407 microelectronics packaging experts authors co authors and reviewers representing 192 companies universities laboratories and other organizations This is the inaugural volume of ASMAs all new ElectronicMaterials Handbook series designed to be the Metals Handbook of electronics technology In over 65 years of publishing the Metals Handbook ASM has developed a unique editorial method of compiling large technical reference books ASMAs access to leading materials technology experts enables to organize these books on an industry consensus basis Behind every article Is an author who is a top expert in its specific subject area This multi author approach ensures the best most timely information throughout Individually selected panels of 5 and 6 peers review each

article for technical accuracy generic point of view and completeness Volumes in the Electronic Materials Handbook series are multidisciplinary to reflect industry practice applied in integrating multiple technology disciplines necessary to any program in advanced electronics Volume 1 Packaging focusing on the middle level of the electronics technology size spectrum offers the greatest practical value to the largest and broadest group of users Future volumes in the series will address topics on larger integrated electronic assemblies and smaller semiconductor materials and devices size levels

Introduction to VLSI Systems Ming-Bo Lin, 2011-11-28 With the advance of semiconductors and ubiquitous computing the use of system on a chip SoC has become an essential technique to reduce product cost With this progress and continuous reduction of feature sizes and the development of very large scale integration VLSI circuits addressing the harder problems requires fundamental understanding of circuit and layout design issues Furthermore engineers can often develop their physical intuition to estimate the behavior of circuits rapidly without relying predominantly on computer aided design CAD tools Introduction to VLSI Systems A Logic Circuit and System Perspective addresses the need for teaching such a topic in terms of a logic circuit and system design perspective To achieve the above mentioned goals this classroom tested book focuses on Implementing a digital system as a full custom integrated circuit Switch logic design and useful paradigms that may apply to various static and dynamic logic families The fabrication and layout designs of complementary metal oxide semiconductor CMOS VLSI Important issues of modern CMOS processes including deep submicron devices circuit optimization interconnect modeling and optimization signal integrity power integrity clocking and timing power dissipation and electrostatic discharge ESD Introduction to VLSI Systems builds an understanding of integrated circuits from the bottom up paying much attention to logic circuit layout and system designs Armed with these tools readers can not only comprehensively understand the features and limitations of modern VLSI technologies but also have enough background to adapt to this ever changing field Design, Analysis and Test of Logic Circuits Under Uncertainty Smita Krishnaswamy, Igor L. Markov, John P. Hayes, 2012-09-21 Logic circuits are becoming increasingly susceptible to probabilistic behavior caused by external radiation and process variation In addition inherently probabilistic quantum and nano technologies are on the horizon as we approach the limits of CMOS scaling Ensuring the reliability of such circuits despite the probabilistic behavior is a key challenge in IC design one that necessitates a fundamental probabilistic reformulation of synthesis and testing techniques This monograph will present techniques for analyzing designing and testing logic circuits with probabilistic behavior **Testing of Digital Systems** N. K. Jha, S. Gupta, 2003-05-08 Device testing represents the single largest manufacturing expense in the semiconductor industry costing over 40 billion a year The most comprehensive and wide ranging book of its kind Testing of Digital Systems covers everything you need to know about this vitally important subject Starting right from the basics the authors take the reader through automatic test pattern generation design for testability and built in self test of digital circuits before moving on to more advanced topics such as IDDQ testing functional

testing delay fault testing memory testing and fault diagnosis The book includes detailed treatment of the latest techniques including test generation for various fault models discussion of testing techniques at different levels of integrated circuit hierarchy and a chapter on system on a chip test synthesis Written for students and engineers it is both an excellent senior graduate level textbook and a valuable reference <u>Digital System Design</u> EduGorilla Prep Experts, 2024-07-27 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels Post-Silicon and Runtime **Verification for Modern Processors** Ilya Wagner, Valeria Bertacco, 2010-11-25 The purpose of this book is to survey the state of the art and evolving directions in post silicon and runtime verification. The authors start by giving an overview of the state of the art in verification particularly current post silicon methodologies in use in the industry both for the domain of processor pipeline design and for memory subsystems They then dive into the presentation of several new post silicon verification solutions aimed at boosting the verification coverage of modern processors dedicating several chapters to this topic The presentation of runtime verification solutions follows a similar approach This is an area of processor design that is still in its early stages of exploration and that holds the promise of accomplishing the ultimate goal of achieving complete correctness guarantees for microprocessor based computation The authors conclude the book with a look towards the future of late stage verification and its growing role in the processor life cycle **Design of Embedded Control Systems** Marian Andrzej Adamski, Andrei Karatkevich, Marek Wegrzyn, 2006-11-22 A set of original results in the eld of high level design of logical control devices and systems is presented in this book These concern different aspects of such important and long term design problems including the following which seem to be the main ones First the behavior of a device under design must be described properly and some adequate formal language should be chosen for that Second effective algorithms should be used for checking the prepared description for correctness for its syntactic and semantic veri cationattheinitialbehaviorlevel Third the problem of logic circuit implementation must be solved using some concrete technological base of cient methods of logic synthesis test and veri cation should be developed for that Fourth the task of the communication between the control device and controlled objects and maybe between different control devices waitsforits solution Allthese problems are harden ough and cannot be successfully solved without efficient methods and algorithms oriented toward computer implementation Some of these are described in this book The languages used for behavior description have been descended usually from two well known abstract models which became classic Petri nets and nite state machines FSMs Anyhow more detailed versions are developed and described in the book which enable to give more complete information concerningspeci equalities of the regarded systems. For example, the model of parallel automaton is presented which unlike the conventional nite automaton can be placed simultaneously into several places called partial As a base for

Reference Buddy D. Ratner, Jack E. Lemons, John Semmlow, W. Bosseau Murray, Reinaldo Perez, Isaac Bankman, Stanley Dunn, Yoshito Ikada, Prabhas V. Moghe, Alkis Constantinides, Joseph Dyro, Richard Kyle, Bernhard Preim, Sverre Grimnes, Frederick J. Schoen, Daniel A. Vallero, Orjan G. Martinsen, Allan S. Hoffman, 2009-03-23 A one stop Desk Reference for Biomedical Engineers involved in the ever expanding and very fast moving area this is a book that will not gather dust on the shelf It brings together the essential professional reference content from leading international contributors in the biomedical engineering field Material covers a broad range of topics including Biomechanics and Biomaterials Tissue Engineering and Biosignal Processing A fully searchable Mega Reference Ebook providing all the essential material needed by Biomedical and Clinical Engineers on a day to day basis Fundamentals key techniques engineering best practice and rules of thumb together in one quick reference Over 2 500 pages of reference material including over 1 500 pages not included in the print edition

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