

DIGITAL SYSTEMS TESTING AND TESTABLE DESIGN

Miron Abramovici
Melvin A. Breuer
Arthur D. Friedman

Digital Systems Testing And Testable Design Solutions

**Laung-Terng Wang, Charles E.
Stroud, Nur A. Toub**



Digital Systems Testing And Testable Design Solutions:

Digital System Test and Testable Design Zainalabedin Navabi, 2010-12-10 This book is about digital system testing and testable design. The concepts of testing and testability are treated together with digital design practices and methodologies. The book uses Verilog models and testbenches for implementing and explaining fault simulation and test generation algorithms. Extensive use of Verilog and Verilog PLI for test applications is what distinguishes this book from other test and testability books. Verilog eliminates ambiguities in test algorithms and BIST and DFT hardware architectures and it clearly describes the architecture of the testability hardware and its test sessions. Describing many of the on-chip decompression algorithms in Verilog helps to evaluate these algorithms in terms of hardware overhead and timing and thus feasibility of using them for System on Chip designs. Extensive use of testbenches and testbench development techniques is another unique feature of this book. Using PLI in developing testbenches and virtual testers provides a powerful programming tool interfaced with hardware described in Verilog. This mixed hardware software environment facilitates description of complex test programs and test strategies.

Digital Systems Testing and Testable Design Miron Abramovici, Melvin A. Breuer, Arthur D. Friedman, 1990-01-01 A textbook in digital system testing and testable design. Incorporating a significant amount of new material related to recently developed technologies, this book offers comprehensive and state-of-the-art treatment of both testing and testable design.

Design of Systems on a Chip: Design and Test Ricardo Reis, Marcelo Soares Lubaszewski, Jochen A.G. Jess, 2007-05-06 This book is the second of two volumes addressing the design challenges associated with new generations of semiconductor technology. The various chapters are compiled from tutorials presented at workshops in recent years by prominent authors from all over the world. Technology productivity and quality are the main aspects under consideration to establish the major requirements for the design and test of upcoming systems on a chip.

System-on-Chip Methodologies & Design Languages Peter J. Ashenden, Jean Mermet, Ralf Seepold, 2013-03-14 System on Chip Methodologies: the Forum on Design Languages (FDL) held in Europe and the Asia Pacific Chip Design Language (APChDL) Conference. The papers cover a range of topics including design methods, specification and modeling languages, tool issues, formal verification, simulation and synthesis. The results presented in these papers will help researchers and practicing engineers keep abreast of developments in this rapidly evolving field.

SAT-Based Scalable Formal Verification Solutions Malay Ganai, Aarti Gupta, 2007-05-26 Functional verification has become an important aspect of the chip design process. Significant resources both in industry and academia are devoted to the design complexity and verification endeavors. SAT-Based Scalable Formal Verification Solutions discusses in detail several of the latest and interesting scalable SAT-based techniques including Hybrid SAT Solver, Customized Bounded Unbounded Model Checking, Distributed Model Checking, Proofs and Proof-based Abstraction Methods, Verification of Embedded Memory System, Multi-clock Systems and Synthesis for Verification Paradigm. These techniques have been designed and implemented in a verification platform Verisol formally.

called DiVer and have been used successfully in industry This book provides algorithmic details and engineering insights into devising scalable approaches for an effective realization It also includes the authors practical experiences and recommendations in verifying the large industry designs using VeriSol The book is primarily written for researchers scientists and verification engineers who would like to gain an in depth understanding of scalable SAT based verification techniques The book will also be of interest for CAD tool developers who would like to incorporate various SAT based advanced techniques in their products Computers, Software Engineering, and Digital Devices Richard C. Dorf,2018-10-03 In two editions spanning more than a decade The Electrical Engineering Handbook stands as the definitive reference to the multidisciplinary field of electrical engineering Our knowledge continues to grow and so does the Handbook For the third edition it has expanded into a set of six books carefully focused on a specialized area or field of study Each book represents a concise yet definitive collection of key concepts models and equations in its respective domain thoughtfully gathered for convenient access Computers Software Engineering and Digital Devices examines digital and logical devices displays testing software and computers presenting the fundamental concepts needed to ensure a thorough understanding of each field It treats the emerging fields of programmable logic hardware description languages and parallel computing in detail Each article includes defining terms references and sources of further information Encompassing the work of the world s foremost experts in their respective specialties Computers Software Engineering and Digital Devices features the latest developments the broadest scope of coverage and new material on secure electronic commerce and parallel computing **Cyber Physical Computing for IoT-driven Services** Vladimir Hahanov,2018-01-30 This book presents the cyber culture of micro macro cosmological and virtual computing The book shows how these work to formulate explain and predict the current processes and phenomena monitoring and controlling technology in the physical and virtual space The authors posit a basic proposal to transform description of the function truth table and structure adjacency matrix to a qubit vector that focuses on memory driven computing based on logic parallel operations performance The authors offer a metric for the measurement of processes and phenomena in a cyberspace and also the architecture of logic associative computing for decision making and big data analysis The book outlines an innovative theory and practice of design test simulation and diagnosis of digital systems based on the use of a qubit coverage vector to describe the functional components and structures Authors provide a description of the technology for SoC HDL model diagnosis based on Test Assertion Blocks Activated Graph Examples of cyber physical systems for digital monitoring and cloud management of social objects and transport are proposed A presented automaton model of cosmological computing explains the cyclical and harmonious evolution of matter energy essence and also a space time form of the Universe **The Electrical Engineering Handbook - Six Volume Set** Richard C. Dorf,2018-12-14 In two editions spanning more than a decade The Electrical Engineering Handbook stands as the definitive reference to the multidisciplinary field of electrical engineering Our knowledge continues to grow and so does the

Handbook For the third edition it has grown into a set of six books carefully focused on specialized areas or fields of study Each one represents a concise yet definitive collection of key concepts models and equations in its respective domain thoughtfully gathered for convenient access Combined they constitute the most comprehensive authoritative resource available Circuits Signals and Speech and Image Processing presents all of the basic information related to electric circuits and components analysis of circuits the use of the Laplace transform as well as signal speech and image processing using filters and algorithms It also examines emerging areas such as text to speech synthesis real time processing and embedded signal processing Electronics Power Electronics Optoelectronics Microwaves Electromagnetics and Radar delves into the fields of electronics integrated circuits power electronics optoelectronics electromagnetics light waves and radar supplying all of the basic information required for a deep understanding of each area It also devotes a section to electrical effects and devices and explores the emerging fields of microlithography and power electronics Sensors Nanoscience Biomedical Engineering and Instruments provides thorough coverage of sensors materials and nanoscience instruments and measurements and biomedical systems and devices including all of the basic information required to thoroughly understand each area It explores the emerging fields of sensors nanotechnologies and biological effects Broadcasting and Optical Communication Technology explores communications information theory and devices covering all of the basic information needed for a thorough understanding of these areas It also examines the emerging areas of adaptive estimation and optical communication Computers Software Engineering and Digital Devices examines digital and logical devices displays testing software and computers presenting the fundamental concepts needed to ensure a thorough understanding of each field It treats the emerging fields of programmable logic hardware description languages and parallel computing in detail Systems Controls Embedded Systems Energy and Machines explores in detail the fields of energy devices machines and systems as well as control systems It provides all of the fundamental concepts needed for thorough in depth understanding of each area and devotes special attention to the emerging area of embedded systems Encompassing the work of the world s foremost experts in their respective specialties The Electrical Engineering Handbook Third Edition remains the most convenient reliable source of information available This edition features the latest developments the broadest scope of coverage and new material on nanotechnologies fuel cells embedded systems and biometrics The engineering community has relied on the Handbook for more than twelve years and it will continue to be a platform to launch the next wave of advancements The Handbook s latest incarnation features a protective slipcase which helps you stay organized without overwhelming your bookshelf It is an attractive addition to any collection and will help keep each volume of the Handbook as fresh as your latest research

Design of 3D Integrated Circuits and Systems Rohit Sharma,2018-09-03 Three dimensional 3D integration of microsystems and subsystems has become essential to the future of semiconductor technology development 3D integration requires a greater understanding of several interconnected systems stacked over each other While this vertical growth

profoundly increases the system functionality it also exponentially increases the design complexity Design of 3D Integrated Circuits and Systems tackles all aspects of 3D integration including 3D circuit and system design new processes and simulation techniques alternative communication schemes for 3D circuits and systems application of novel materials for 3D systems and the thermal challenges to restrict power dissipation and improve performance of 3D systems Containing contributions from experts in industry as well as academia this authoritative text Illustrates different 3D integration approaches such as die to die die to wafer and wafer to wafer Discusses the use of interposer technology and the role of Through Silicon Vias TSVs Presents the latest improvements in three major fields of thermal management for multiprocessor systems on chip MPSoCs Explores ThruChip Interface TCI NAND flash memory stacking and emerging applications Describes large scale integration testing and state of the art low power testing solutions Complete with experimental results of chip level 3D integration schemes tested at IBM and case studies on advanced complementary metal oxide semiconductor CMOS integration for 3D integrated circuits ICs Design of 3D Integrated Circuits and Systems is a practical reference that not only covers a wealth of design issues encountered in 3D integration but also demonstrates their impact on the efficiency of 3D systems

System-on-Chip Test Architectures Laung-Terng Wang, Charles E. Stroud, Nur A. Touba, 2010-07-28 Modern electronics testing has a legacy of more than 40 years The introduction of new technologies especially nanometer technologies with 90nm or smaller geometry has allowed the semiconductor industry to keep pace with the increased performance capacity demands from consumers As a result semiconductor test costs have been growing steadily and typically amount to 40% of today's overall product cost This book is a comprehensive guide to new VLSI Testing and Design for Testability techniques that will allow students researchers DFT practitioners and VLSI designers to master quickly System on Chip Test architectures for test debug and diagnosis of digital memory and analog mixed signal designs Emphasizes VLSI Test principles and Design for Testability architectures with numerous illustrations examples Most up to date coverage available including Fault Tolerance Low Power Testing Defect and Error Tolerance Network on Chip NOC Testing Software Based Self Testing FPGA Testing MEMS Testing and System In Package SIP Testing which are not yet available in any testing book Covers the entire spectrum of VLSI testing and DFT architectures from digital and analog to memory circuits and fault diagnosis and self repair from digital to memory circuits Discusses future nanotechnology test trends and challenges facing the nanometer design era promising nanotechnology test techniques including Quantum Dots Cellular Automata Carbon Nanotubes and Hybrid Semiconductor Nanowire Molecular Computing Practical problems at the end of each chapter for students

Testability Concepts for Digital ICs F.P.M. Beenker, R.G. Bennetts, A.P. Thijssen, 2012-12-06 Preface Testing Integrated Circuits for manufacturing defects includes four basic disciplines First of all an understanding of the origin and behaviour of defects Secondly knowledge of IC design and IC design styles Thirdly knowledge of how to create a test program for an IC which is targeted on detecting these defects and finally understanding

of the hardware Automatic Test Equipment to run the test on All four items have to be treated managed and to a great extent integrated before the term IC quality gets a certain meaning and a test a certain measurable value The contents of this book reflects our activities on testability concepts for complex digital ICs as performed at Philips Research Laboratories in Eindhoven The Netherlands Based on the statements above we have worked along a long term plan which was based on four pillars 1 The definition of a test methodology suitable for future IC design styles 2 capable of handling improved defect models 3 supported by software tools and 4 providing an easy link to Automatic Test Equipment The reasoning we have followed was continuously focused on IC qUality Quality expressed in terms of the ability of delivering a customer a device with no residual manufacturing defects Bad devices should not escape a test The basis of IC quality is a thorough understanding of defects and defect models

Diagnose von Computern ,2013-04-17 *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

Proceedings of the Ninth Asian Test Symposium ,2000 These conference proceedings cover such topics as analogue and mixed signal tests memory built in self test and self diagnosis fault simulation and timing simulation fault analysis test generation functional testing and memory testing

Logic-timing Simulation and the Degradation Delay Model Manuel J. Bellido,Jorge Juan Chico,Manuel Valencia,2005 This book provides the reader with an extensive background in the field of logic timing simulation and delay modeling It includes detailed information on the challenges of logic timing simulation applications advantages and drawbacks The capabilities of logic timing are explored using the latest research results that are brought together from previously disseminated materials An important part of the book is devoted to the description of the OC Degradation Delay ModelOCO developed by the authors showing how the inclusion of dynamic effects in the modeling of delays greatly improves the application cases and accuracy of logic timing simulation These ideas are supported by simulation results extracted from a wide range of practical applications

Hardware Security and Trust Nicolas Sklavos,Ricardo Chaves,Giorgio Di Natale,Francesco Regazzoni,2017-01-11 This book provides a comprehensive introduction to hardware security from specification to implementation Applications discussed include embedded systems ranging from small RFID tags to satellites orbiting the earth The authors describe a design and synthesis flow which will transform a given

circuit into a secure design incorporating counter measures against fault attacks In order to address the conflict between testability and security the authors describe innovative design for testability DFT computer aided design CAD tools that support security challenges engineered for compliance with existing commercial tools Secure protocols are discussed which protect access to necessary test infrastructures and enable the design of secure access controllers

Advanced Circuits for Emerging Technologies Krzysztof Iniewski, 2012-04-17 The book will address the state of the art in integrated circuit design in the context of emerging systems New exciting opportunities in body area networks wireless communications data networking and optical imaging are discussed Emerging materials that can take system performance beyond standard CMOS like Silicon on Insulator SOI Silicon Germanium SiGe and Indium Phosphide InP are explored Three dimensional 3 D CMOS integration and co integration with sensor technology are described as well The book is a must for anyone serious about circuit design for future technologies The book is written by top notch international experts in industry and academia The intended audience is practicing engineers with integrated circuit background The book will be also used as a recommended reading and supplementary material in graduate course curriculum Intended audience is professionals working in the integrated circuit design field Their job titles might be design engineer product manager marketing manager design team leader etc The book will be also used by graduate students Many of the chapter authors are University Professors

Economics of Electronic Design, Manufacture and Test M. Abadir, T. Ambler, 2013-06-29 The general understanding of design is that it should lead to a manufacturable product Neither the design nor the process of manufacturing is perfect As a result the product will be faulty will require testing and fixing Where does economics enter this scenario Consider the cost of testing and fixing the product If a manufactured product is grossly faulty or too many of the products are faulty the cost of testing and fixing will be high Suppose we do not like that We then ask what is the cause of the faulty product There must be something wrong in the manufacturing process We trace this cause and fix it Suppose we fix all possible causes and have no defective products We would have eliminated the need for testing Unfortunately things are not so perfect There is a cost involved with finding and eliminating the causes of faults We thus have two costs the cost of testing and fixing we will call it cost 1 and the cost of finding and eliminating causes of faults call it cost 2 Both costs in some way are included in the overall cost of the product If we try to eliminate cost 1 cost 2 goes up and vice versa An economic system of production will minimize the overall cost of the product Economics of Electronic Design Manufacture and Test is a collection of research contributions derived from the Second Workshop on Economics of Design Manufacture and Test written for inclusion in this book

Verification, Validation, and Testing of Engineered Systems Avner Engel, 2010-11-19 Systems Verification Validation and Testing VVT are carried out throughout systems lifetimes Notably quality cost expended on performing VVT activities and correcting system defects consumes about half of the overall engineering cost Verification Validation and Testing of Engineered Systems provides a comprehensive compendium of VVT activities and corresponding VVT methods for

implementation throughout the entire lifecycle of an engineered system In addition the book strives to alleviate the fundamental testing conundrum namely What should be tested How should one test When should one test And when should one stop testing In other words how should one select a VVT strategy and how it be optimized The book is organized in three parts The first part provides introductory material about systems and VVT concepts This part presents a comprehensive explanation of the role of VVT in the process of engineered systems Chapter 1 The second part describes 40 systems development VVT activities Chapter 2 and 27 systems post development activities Chapter 3 Corresponding to these activities this part also describes 17 non testing systems VVT methods Chapter 4 and 33 testing systems methods Chapter 5 The third part of the book describes ways to model systems quality cost time and risk Chapter 6 as well as ways to acquire quality data and optimize the VVT strategy in the face of funding time and other resource limitations as well as different business objectives Chapter 7 Finally this part describes the methodology used to validate the quality model along with a case study describing a system s quality improvements Chapter 8 Fundamentally this book is written with two categories of audience in mind The first category is composed of VVT practitioners including Systems Test Production and Maintenance engineers as well as first and second line managers The second category is composed of students and faculties of Systems Electrical Aerospace Mechanical and Industrial Engineering schools This book may be fully covered in two to three graduate level semesters although parts of the book may be covered in one semester University instructors will most likely use the book to provide engineering students with knowledge about VVT as well as to give students an introduction to formal modeling and optimization of VVT strategy

Metrology and Diagnostic Techniques for Nanoelectronics Zhiyong Ma, David G. Seiler, 2017-03-27 Nanoelectronics is changing the way the world communicates and is transforming our daily lives Continuing Moore s law and miniaturization of low power semiconductor chips with ever increasing functionality have been relentlessly driving R D of new devices materials and process capabilities to meet performance power and cost requirements This book covers up to date advances in research and industry practices in nanometrology critical for continuing technology scaling and product innovation It holistically approaches the subject matter and addresses emerging and important topics in semiconductor R D and manufacturing It is a complete guide for metrology and diagnostic techniques essential for process technology electronics packaging and product development and debugging a unique approach compared to other books The authors are from academia government labs and industry and have vast experience and expertise in the topics presented The book is intended for all those involved in IC manufacturing and nanoelectronics and for those studying nanoelectronics process and assembly technologies or working in device testing characterization and diagnostic techniques

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