
Testing and Reliable Design of CMOS Circuits

**Niraj K. Jha
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Testing And Reliable Design Of Cmos Circuits:

Testing and Reliable Design of CMOS Circuits Niraj K. Jha, Sandip Kundu, 2012-12-06 In the last few years CMOS technology has become increasingly dominant for realizing Very Large Scale Integrated VLSI circuits. The popularity of this technology is due to its high density and low power requirement. The ability to realize very complex circuits on a single chip has brought about a revolution in the world of electronics and computers. However, the rapid advancements in this area pose many new problems in the area of testing. Testing has become a very time-consuming process. In order to ease the burden of testing, many schemes for designing the circuit for improved testability have been presented. These design for testability techniques have begun to catch the attention of chip manufacturers. The trend is towards placing increased emphasis on these techniques. Another byproduct of the increase in the complexity of chips is their higher susceptibility to faults. In order to take care of this problem, we need to build fault-tolerant systems. The area of fault-tolerant computing has steadily gained in importance. Today many universities offer courses in the areas of digital system testing and fault-tolerant computing. Due to the importance of CMOS technology, a significant portion of these courses may be devoted to CMOS testing. This book has been written as a reference text for such courses offered at the senior or graduate level. Familiarity with logic design and switching theory is assumed. The book should also prove to be useful to professionals working in the semiconductor industry.

Design and Test Technology for Dependable Systems-on-Chip Ubar, Raimund, Raik, Jaan, Vierhaus, Heinrich Theodor, 2010-12-31 This book covers aspects of system design and efficient modelling and also introduces various fault models and fault mechanisms associated with digital circuits integrated into System on Chip SoC, Multi-Processor System on Chip MPSoC or Network on Chip NoC.

Introduction to Microelectronics to Nanoelectronics Manoj Kumar Majumder, Vijay Rao Kumbhare, Aditya Japa, Brajesh Kumar Kaushik, 2020-11-24 Focussing on micro and nanoelectronics design and technology, this book provides thorough analysis and demonstration starting from semiconductor devices to VLSI fabrication, designing analog and digital on-chip interconnect modeling, culminating with emerging non-silicon nano-devices. It gives detailed description of both theoretical as well as industry standard HSPICE Verilog Cadence simulation-based real-time modeling approach with focus on fabrication of bulk and nano-devices. Each chapter of this proposed title starts with a brief introduction of the presented topic and ends with a summary indicating the futuristic aspect including practice questions. Aimed at researchers and senior undergraduate/graduate students in electrical and electronics engineering, microelectronics, nanoelectronics, and nanotechnology, this book provides broad and comprehensive coverage from Microelectronics to Nanoelectronics, including design in analog and digital electronics. Includes HDL and VLSI design going into the nanoelectronics arena. Discusses devices, circuit analysis, design methodology, and real-time simulation based on industry standard HSPICE tool. Explores emerging devices such as FinFETs, Tunnel FETs, TFETs, and CNTFETs, including their circuit co-designing. Covers real-time illustration using industry standard Verilog, Cadence, and Synopsys simulations. 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 **Handbook of VLSI Chip**

Design and Expert Systems A. F. Schwarz, 2014-05-10 Handbook of VLSI Chip Design and Expert Systems provides information pertinent to the fundamental aspects of expert systems which provides a knowledge based approach to problem solving This book discusses the use of expert systems in every possible subtask of VLSI chip design as well as in the interrelations between the subtasks Organized into nine chapters this book begins with an overview of design automation which can be identified as Computer Aided Design of Circuits and Systems CAD/CAS This text then presents the progress in artificial intelligence with emphasis on expert systems Other chapters consider the impact of design automation which exploits the basic capabilities of computers to perform complex calculations and to handle huge amounts of data with a high speed and accuracy This book discusses as well the characterization of microprocessors The final chapter deals with interactive I/O devices This book is a valuable resource for system design experts circuit analysts and designers logic designers device engineers technologists and application specific designers

The Electrical Engineering Handbook, Second Edition Richard C. Dorf, 1997-09-26 In 1993 the first edition of The Electrical Engineering Handbook set a new standard for breadth and depth of coverage in an engineering reference work Now this classic has been substantially revised and updated to include the latest information on all the important topics in electrical engineering today Every electrical engineer should have an opportunity to expand his expertise with this definitive guide In a single volume this handbook provides a complete reference to answer the questions encountered by practicing engineers in industry government or academia This well organized book is divided into 12 major sections that encompass the entire field of electrical engineering including circuits signal processing electronics electromagnetics electrical effects and devices and energy and the emerging trends in the fields of communications digital devices computer engineering systems and biomedical engineering A compendium of physical chemical material and mathematical data completes this comprehensive resource Every major topic is thoroughly covered and every important concept is defined described and illustrated Conceptually challenging but carefully explained articles are equally valuable to the practicing engineer researchers and students A distinguished advisory board and contributors including many of the leading authors professors and researchers in the field today assist noted author and professor Richard Dorf in offering complete coverage of this rapidly expanding field No other single volume available today offers this combination of broad coverage and depth of exploration of the topics The Electrical Engineering Handbook will be an invaluable resource for electrical engineers for years to come

VLSI Design of Neural Networks Ulrich Ramacher, Ulrich Rückert, 2012-12-06 The early era of neural network hardware design starting at 1985 was mainly technology driven Designers used almost exclusively analog signal processing concepts for the recall mode Learning was deemed not to cause a problem because the number of implementable synapses was still so low that the determination of weights and thresholds could be left to conventional computers Instead designers tried to directly map neural parallelity into hardware The architectural concepts were accordingly simple and produced the so called

interconnection problem which in turn made many engineers believe it could be solved by optical implementation in adequate fashion only Furthermore the inherent fault tolerance and limited computation accuracy of neural networks were claimed to justify that little effort is to be spend on careful design but most effort be put on technology issues As a result it was almost impossible to predict whether an electronic neural network would function in the way it was simulated to do This limited the use of the first neuro chips for further experimentation not to mention that real world applications called for much more synapses than could be implemented on a single chip at that time Meanwhile matters have matured It is recognized that isolated definition of the effort of analog multiplication for instance would be just as inappropriate on the part of the chip designer as determination of the weights by simulation without allowing for the computing accuracy that can be achieved on the part of the user

High-Level VLSI Synthesis Raul Camposano, Wayne Wolf, 2012-12-06 The time has come for high level synthesis When research into synthesizing hardware from abstract program like descriptions started in the early 1970 s there was no automated path from the register transfer design produced by high level synthesis to a complete hardware implementation As a result it was very difficult to measure the effectiveness of high level synthesis methods it was also hard to justify to users the need to automate architecture design when low level design had to be completed manually Today s more mature CAD techniques help close the gap between an automatically synthesized design and a manufacturable design Market pressures encourage designers to make use of any and all automated tools Layout synthesis logic synthesis and specialized datapath generators make it feasible to quickly implement a register transfer design in silicon leaving designers more time to consider architectural improvements As IC design becomes more automated customers are increasing their demands today s leading edge designers using logic synthesis systems are training themselves to be tomorrow s consumers of high level synthesis systems The need for very fast turnaround a competitive fabrication market which makes small quantity ASIC manufacturing possible and the ever growing complexity of the systems being designed all make higher level design automation inevitable

Modern VLSI Design Wayne Wolf, 2008-12-21 The Number 1 VLSI Design Guide Now Fully Updated for IP Based Design and the Newest Technologies Modern VLSI Design Fourth Edition offers authoritative up to the minute guidance for the entire VLSI design process from architecture and logic design through layout and packaging Wayne Wolf has systematically updated his award winning book for today s newest technologies and highest value design techniques Wolf introduces powerful new IP based design techniques at all three levels gates subsystems and architecture He presents deeper coverage of logic design fundamentals clocking and timing and much more No other VLSI guide presents as much up to date information for maximizing performance minimizing power utilization and achieving rapid design turnarounds

Principles of VLSI System Planning Allen M. Dewey, Stephen W. Director, 2012-12-06 This book describes a new type of computer aided VLSI design tool called a VLSI System Planning that is meant to aid designers during the early or conceptual state of design During this stage of design the objective is to define

a general design plan or approach that is likely to result in an efficient implementation satisfying the initial specifications or to determine that the initial specifications are not realizable A design plan is a collection of high level design decisions As an example the conceptual design of digital filters involves choosing the type of algorithm to implement e g finite impulse response or infinite impulse response the type of polynomial approximation e g Equiripple or Chebyshev the fabrication technology e g CMOS or BiCMOS and so on Once a particular design plan is chosen the detailed design phase can begin It is during this phase that various synthesis simulation layout and test activities occur to refine the conceptual design gradually filling more detail until the design is finally realized The principal advantage of VLSI System Planning is that the increasingly expensive resources of the detailed design process are more efficiently managed Costly redesigns are minimized because the detailed design process is guided by a more credible consistent and correct design plan

Hierarchical Modeling for VLSI Circuit Testing

Debashis Bhattacharya, John P. Hayes, 2012-12-06 Test generation is one of the most difficult tasks facing the designer of complex VLSI based digital systems Much of this difficulty is attributable to the almost universal use in testing of low gate level circuit and fault models that predate integrated circuit technology It is long been recognized that the testing problem can be alleviated by the use of higher level methods in which multigate modules or cells are the primitive components in test generation however the development of such methods has proceeded very slowly To be acceptable high level approaches should be applicable to most types of digital circuits and should provide fault coverage comparable to that of traditional low level methods The fault coverage problem has perhaps been the most intractable due to continued reliance in the testing industry on the single stuck line SSL fault model which is tightly bound to the gate level of abstraction This monograph presents a novel approach to solving the foregoing problem It is based on the systematic use of multibit vectors rather than single bits to represent logic signals including fault signals A circuit is viewed as a collection of high level components such as adders multiplexers and registers interconnected by n bit buses To match this high level circuit model we introduce a high level bus fault that in effect replaces a large number of SSL faults and allows them to be tested in parallel However by reducing the bus size from n to one we can obtain the traditional gate level circuit and models

On-Line Testing for VLSI Michael Nicolaidis, Yervant Zorian, Dhiraj Pradhan, 2013-03-09 Test functions fault detection diagnosis error correction repair etc that are applied concurrently while the system continues its intended function are defined as on line testing In its expanded scope on line testing includes the design of concurrent error checking subsystems that can be themselves self checking fail safe systems that continue to function correctly even after an error occurs reliability monitoring and self test and fault tolerant designs On Line Testing for VLSI contains a selected set of articles that discuss many of the modern aspects of on line testing as faced today The contributions are largely derived from recent IEEE International On Line Testing Workshops Guest editors Michael Nicolaidis Yervant Zorian and Dhiraj Pradhan organized the articles into six chapters In the first chapter the editors introduce a large number of approaches with an expanded

bibliography in which some references date back to the sixties On Line Testing for VLSI is an edited volume of original research comprising invited contributions by leading researchers *SOC (System-on-a-Chip) Testing for Plug and Play Test Automation* Krishnendu Chakrabarty, 2013-04-17 System on a Chip SOC integrated circuits composed of embedded cores are now commonplace Nevertheless there remain several roadblocks to rapid and efficient system integration Test development is seen as a major bottleneck in SOC design and manufacturing capabilities Testing SOC is especially challenging in the absence of standardized test structures test automation tools and test protocols In addition long interconnects high density and high speed designs lead to new types of faults involving crosstalk and signal integrity SOC System on a Chip Testing for Plug and Play Test Automation is an edited work containing thirteen contributions that address various aspects of SOC testing SOC System on a Chip Testing for Plug and Play Test Automation is a valuable reference for researchers and students interested in various aspects of SOC testing 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 Automatic Programming Applied to VLSI CAD Software: A Case Study Dorothy E. Setliff, Rob A. Rutenbar, 2012-12-06 This book and the research it describes resulted from a simple observation we made sometime in 1986 Put simply we noticed that many VLSI design tools looked alike That is at least at the overall software architecture level the algorithms and data structures required to solve problem X looked much like those required to solve problem X Unfortunately this resemblance is often of little help in actually writing the software for problem X given the software for problem X In the VLSI CAD world technology changes rapidly enough that design software must continually strive to keep up And of course VLSI design software and engineering design software in general is often exquisitely sensitive to some aspects of the domain technology in which it operates Modest changes in

functionality have an unfortunate tendency to require substantial and time consuming internal software modifications Now observing that large engineering software systems are technology dependent is not particularly clever However we believe that our approach to xiv Preface dealing with this problem took an interesting new direction We chose to investigate the extent to which automatic programming ideas could be used to synthesize such software systems from high level specifications This book is one of the results of that effort *Approximate Computing* Weiqiang Liu,Fabrizio Lombardi,2022-08-22 This book explores the technological developments at various levels of abstraction of the new paradigm of approximate computing The authors describe in a single source the state of the art covering the entire spectrum of research activities in approximate computing bridging device circuit architecture and system levels Content includes tutorials reviews and surveys of current theoretical experimental results design methodologies and applications developed in approximate computing for a wide scope of readership and specialists Serves as a single source reference to state of the art of approximate computing Covers broad range of topics from circuits to applications Includes contributions by leading researchers from academia and industry

Microcircuit Reliability Bibliography ,1978 *Research in Progress* ,1982 **A Survey of High-Level Synthesis Systems** Robert A. Walker,Raul Camposano,2012-12-06 After long years of work that have seen little industrial application high level synthesis is finally on the verge of becoming a practical tool The state of high level synthesis today is similar to the state of logic synthesis ten years ago At present logic synthesis tools are widely used in digital system design In the future high level synthesis will play a key role in mastering design complexity and in truly exploiting the potential of ASIs and PLDs which demand extremely short design cycles Work on high level synthesis began over twenty years ago Since substantial progress has been made in understanding the basic then problems involved although no single universally accepted theoretical framework has yet emerged There is a growing number of publications devoted to high level synthesis specialized workshops are held regularly and tutorials on the topic are commonly held at major conferences This book gives an extensive survey of the research and development in high level synthesis In Part I a short tutorial explains the basic concepts used in high level synthesis and follows an example design throughout the synthesis process In Part II current high level synthesis systems are surveyed [The Cumulative Book Index](#) ,1990 A world list of books in the English language

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