

## Vlsi Circuit Design Methodology Demystified A Conceptual Taxonomy

This book focuses on recent break-throughs in the development of a variety of photonic devices, serving distances ranging from mm to many km, together with their electronic counter-parts, e.g. the drivers for lasers, the amplifiers following the detectors and most important, the relevant advanced VLSI circuits. It explains that as a consequence of the increasing dominance of optical interconnects for high performance workstation clusters and supercomputers their complete design has to be revised. This book thus covers for the first time the whole variety of interdependent subjects contributing to green photonics and electronics, serving communication and energy harvesting. Alternative approaches to generate electric power using organic photovoltaic solar cells, inexpensive and again energy efficient in production are summarized. In 2015, the use of the internet consumed 5-6% of the raw electricity production in developed countries. Power consumption increases rapidly and without some transformational change will use, by the middle of the next decade at the latest, the entire electricity production. This apocalyptic outlook led to a redirection of the focus of data

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center and HPC developers from just increasing bit rates and capacities to energy efficiency. The high speed interconnects are all based on photonic devices. These must and can be energy efficient but they operate in an electronic environment and therefore have to be considered in a wide scope that also requires low energy electronic devices, sophisticated circuit designs and clever architectures. The development of the next generation of high performance exaFLOP computers suffers from the same problem: Their energy consumption based on present device generations is essentially prohibitive.

The book provides a comprehensive coverage of different aspects of low power circuit synthesis at various levels of design hierarchy; starting from the layout level to the system level. For a seamless understanding of the subject, basics of MOS circuits has been introduced at transistor, gate and circuit level; followed by various low-power design methodologies, such as supply voltage scaling, switched capacitance minimization techniques and leakage power minimization approaches. The content of this book will prove useful to students, researchers, as well as practicing engineers.

This book provides a comprehensive overview of the VLSI design process. It covers end-to-end system on chip (SoC) design, including design methodology, the design environment, tools, choice of design components, handoff procedures,

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and design infrastructure needs. The book also offers critical guidance on the latest UPF-based low power design flow issues for deep submicron SOC designs, which will prepare readers for the challenges of working at the nanotechnology scale. This practical guide will provide engineers who aspire to be VLSI designers with the techniques and tools of the trade, and will also be a valuable professional reference for those already working in VLSI design and verification with a focus on complex SoC designs. A comprehensive practical guide for VLSI designers; Covers end-to-end VLSI SoC design flow; Includes source code, case studies, and application examples.

Based on the authors' expansive collection of notes taken over the years, Nano-CMOS Circuit and Physical Design bridges the gap between physical and circuit design and fabrication processing, manufacturability, and yield. This innovative book covers: process technology, including sub-wavelength optical lithography; impact of process scaling on circuit and physical implementation and low power with leaky transistors; and DFM, yield, and the impact of physical implementation. Discover a fresh approach to efficient and insight-driven analog integrated circuit design in nanoscale-CMOS with this hands-on guide. Expert authors present a sizing methodology that employs SPICE-generated lookup tables, enabling close agreement between hand analysis and simulation. This enables the exploration

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of analog circuit tradeoffs using the gm/ID ratio as a central variable in script-based design flows, and eliminates time-consuming iterations in a circuit simulator. Supported by downloadable MATLAB code, and including over forty detailed worked examples, this book will provide professional analog circuit designers, researchers, and graduate students with the theoretical know-how and practical tools needed to acquire a systematic and re-use oriented design style for analog integrated circuits in modern CMOS.

Top-down approach to practical, tool-independent, digital circuit design, reflecting how circuits are designed.

Must-have reference on electronic packaging technology! The electronics industry is shifting towards system packaging technology due to the need for higher chip circuit density without increasing production costs. Electronic packaging, or circuit integration, is seen as a necessary strategy to achieve a performance growth of electronic circuitry in next-generation electronics. With the implementation of novel materials with specific and tunable electrical and magnetic properties, electronic packaging is highly attractive as a solution to achieve denser levels of circuit integration. The first part of the book gives an overview of electronic packaging and provides the reader with the fundamentals of the most important packaging techniques such as wire bonding, tap automatic

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bonding, flip chip solder joint bonding, microbump bonding, and low temperature direct Cu-to-Cu bonding. Part two consists of concepts of electronic circuit design and its role in low power devices, biomedical devices, and circuit integration. The last part of the book contains topics based on the science of electronic packaging and the reliability of packaging technology.

This book was written to arm engineers qualified and knowledgeable in the area of VLSI circuits with the essential knowledge they need to get into this exciting field and to help those already in it achieve a higher level of proficiency. Few people truly understand how a large chip is developed, but an understanding of the whole process is necessary to appreciate the importance of each part of it and to understand the process from concept to silicon. It will teach readers how to become better engineers through a practical approach of diagnosing and attacking real-world problems.

VLSI is an important area of electronic and computer engineering. However, there are few textbooks available for undergraduate/postgraduate study of VLSI design automation and chip layout. VLSI Physical Design Automation: Theory and Practice fills the void and is an essential introduction for senior undergraduates, postgraduates and anyone starting work in the field of CAD for VLSI. It covers all aspects of physical design, together with such related areas as automatic cell generation, silicon

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compilation, layout editors and compaction. A problem-solving approach is adopted and each solution is illustrated with examples. Each topic is treated in a standard format: Problem Definition, Cost Functions and Constraints, Possible Approaches and Latest Developments. Special features: The book deals with all aspects of VLSI physical design, from partitioning and floorplanning to layout generation and silicon compilation; provides a comprehensive treatment of most of the popular algorithms; covers the latest developments and gives a bibliography for further research; offers numerous fully described examples, problems and programming exercises.

Asynchronous Circuit Design for VLSI Signal Processing is a collection of research papers on recent advances in the area of specification, design and analysis of asynchronous circuits and systems. This interest in designing digital computing systems without a global clock is prompted by the ever growing difficulty in adopting global synchronization as the only efficient means to system timing. Asynchronous circuits and systems have long held interest for circuit designers and researchers alike because of the inherent challenge involved in designing these circuits, as well as developing design techniques for them. The frontier research in this area can be traced back to Huffman's publications 'The Synthesis of Sequential Switching Circuits' in 1954 followed by Unger's book, 'Asynchronous Sequential Switching Circuits' in 1969 where a theoretical foundation for handling logic hazards was established. In the last few years a growing number of researchers have joined force in unveiling the mystery of

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designing correct asynchronous circuits, and better yet, have produced several alternatives in automatic synthesis and verification of such circuits. This collection of research papers represents a balanced view of current research efforts in the design, synthesis and verification of asynchronous systems.

Algorithms for VLSI Physical Design Automation is a core reference text for graduate students and CAD professionals. It provides a comprehensive treatment of the principles and algorithms of VLSI physical design. Algorithms for VLSI Physical Design Automation presents the concepts and algorithms in an intuitive manner. Each chapter contains 3-4 algorithms that are discussed in detail. Additional algorithms are presented in a somewhat shorter format. References to advanced algorithms are presented at the end of each chapter. Algorithms for VLSI Physical Design Automation covers all aspects of physical design. The first three chapters provide the background material while the subsequent chapters focus on each phase of the physical design cycle. In addition, newer topics like physical design automation of FPGAs and MCMs have been included. The author provides an extensive bibliography which is useful for finding advanced material on a topic. Algorithms for VLSI Physical Design Automation is an invaluable reference for professionals in layout, design automation and physical design. Design and optimization of integrated circuits are essential to the creation of new semiconductor chips, and physical optimizations are becoming more prominent as a result of semiconductor scaling. Modern chip design has become so complex that it is

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largely performed by specialized software, which is frequently updated to address advances in semiconductor technologies and increased problem complexities. A user of such software needs a high-level understanding of the underlying mathematical models and algorithms. On the other hand, a developer of such software must have a keen understanding of computer science aspects, including algorithmic performance bottlenecks and how various algorithms operate and interact. "VLSI Physical Design: From Graph Partitioning to Timing Closure" introduces and compares algorithms that are used during the physical design phase of integrated-circuit design, wherein a geometric chip layout is produced starting from an abstract circuit design. The emphasis is on essential and fundamental techniques, ranging from hypergraph partitioning and circuit placement to timing closure.

Very Large Scale Integration (VLSI) has become a necessity rather than a specialization for electrical and computer engineers. This unique text provides Engineering and Computer Science students with a comprehensive study of the subject, covering VLSI from basic design techniques to working principles of physical design automation tools to leading edge application-specific array processors. Beginning with CMOS design, the author describes VLSI design from the viewpoint of a digital circuit engineer. He develops physical pictures for CMOS circuits and demonstrates the top-down design methodology using two design projects - a microprocessor and a field programmable gate array. The author then discusses VLSI

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testing and dedicates an entire chapter to the working principles, strengths, and weaknesses of ubiquitous physical design tools. Finally, he unveils the frontiers of VLSI. He emphasizes its use as a tool to develop innovative algorithms and architecture to solve previously intractable problems. VLSI Design answers not only the question of "what is VLSI," but also shows how to use VLSI. It provides graduate and upper level undergraduate students with a complete and congregated view of VLSI engineering.

Although it is now possible to integrate many millions of transistors on a single chip, traditional digital circuit technology is now reaching its limits, facing problems of cost and technical efficiency when scaled down to ever-smaller feature sizes. The analysis of biological neural systems, especially for visual processing, has allowed engineers to better understand how complex networks can effectively process large amounts of information, whilst dealing with difficult computational challenges. Analog and parallel processing are key characteristics of biological neural networks. Analog VLSI circuits using the same features can therefore be developed to emulate brain-style processing. Using standard CMOS technology, they can be cheaply manufactured, permitting efficient industrial and consumer applications in robotics and mobile electronics. This book explores the theory, design and implementation of analog VLSI circuits, inspired by visual motion processing in biological neural networks. Using a novel approach pioneered by the author himself, Stocker explains in detail the construction of a series

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of electronic chips, providing the reader with a valuable practical insight into the technology. Analog VLSI Circuits for the Perception of Visual Motion: analyses the computational problems in visual motion perception; examines the issue of optimization in analog networks through high level processes such as motion segmentation and selective attention; demonstrates network implementation in analog VLSI CMOS technology to provide computationally efficient devices; sets out measurements of final hardware implementation; illustrates the similarities of the presented circuits with the human visual motion perception system; includes an accompanying website with video clips of circuits under real-time visual conditions and additional supplementary material. With a complete review of all existing neuromorphic analog VLSI systems for visual motion sensing, Analog VLSI Circuits for the Perception of Visual Motion is a unique reference for advanced students in electrical engineering, artificial intelligence, robotics and computational neuroscience. It will also be useful for researchers, professionals, and electronics engineers working in the field.

This Second Edition focuses on emerging topics and advances in the field of VLSI interconnections In the decade since High-Speed VLSI Interconnections was first published, several major developments have taken place in the field. Now, updated to reflect these advancements, this Second Edition includes new information on copper interconnections, nanotechnology circuit interconnects, electromigration in the copper interconnections, parasitic inductances, and RLC models for comprehensive analysis of

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interconnection delays and crosstalk. Each chapter is designed to exist independently or as a part of one coherent unit, and several appropriate exercises are provided at the end of each chapter, challenging the reader to gain further insight into the contents being discussed. Chapter subjects include: \* Preliminary Concepts \* Parasitic Resistances, Capacitances, and Inductances \* Interconnection Delays \* Crosstalk Analysis \* Electromigration-Induced Failure Analysis \* Future Interconnections High-Speed VLSI Interconnections, Second Edition is an indispensable reference for high-speed VLSI designers, RF circuit designers, and advanced students of electrical engineering.

This book gathers a collection of papers by international experts presented at the International Conference on NextGen Electronic Technologies (ICNETS2-2017), which cover key developments in the field of electronics and communication engineering. ICNETS2 encompassed six symposia covering all aspects of the electronics and communications domains, including relevant nano/micro materials and devices. This book showcases the latest research in very-large-scale integration (VLSI) Design: Circuits, Systems and Applications, making it a valuable resource for all researchers, professionals, and students working in the core areas of electronics and their applications, especially in digital and analog VLSI circuits and systems. As the increased demand for high-speed communication creates an interest in the development of optical networks, intelligent all optical networks have

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emerged as the next generation for reliable and fast connections. Intelligent Systems for Optical Networks Design: Advancing Techniques is a comprehensive collection of research focused on theoretical and practical aspects of intelligent methodologies as applied to real world problems. This reference source is useful for research and development engineers, scholars, and students interested in the latest development in the area of intelligent systems for optical networks design.

Low-Power Digital VLSI Design: Circuits and Systems addresses both process technologies and device modeling. Power dissipation in CMOS circuits, several practical circuit examples, and low-power techniques are discussed. Low-voltage issues for digital CMOS and BiCMOS circuits are emphasized. The book also provides an extensive study of advanced CMOS subsystem design. A low-power design methodology is presented with various power minimization techniques at the circuit, logic, architecture and algorithm levels. Features: Low-voltage CMOS device modeling, technology files, design rules Switching activity concept, low-power guidelines to engineering practice Pass-transistor logic families Power dissipation of I/O circuits Multi- and low-VT CMOS logic, static power reduction circuit techniques State of the art design of low-voltage BiCMOS and CMOS circuits Low-power techniques in CMOS SRAMS and DRAMS Low-power on-

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chip voltage down converter design Numerous advanced CMOS subsystems (e.g. adders, multipliers, data path, memories, regular structures, phase-locked loops) with several design options trading power, delay and area Low-power design methodology, power estimation techniques Power reduction techniques at the logic, architecture and algorithm levels More than 190 circuits explained at the transistor level.

This book provides broad and comprehensive coverage of the entire EDA flow. EDA/VLSI practitioners and researchers in need of fluency in an "adjacent" field will find this an invaluable reference to the basic EDA concepts, principles, data structures, algorithms, and architectures for the design, verification, and test of VLSI circuits. Anyone who needs to learn the concepts, principles, data structures, algorithms, and architectures of the EDA flow will benefit from this book. Covers complete spectrum of the EDA flow, from ESL design modeling to logic/test synthesis, verification, physical design, and test - helps EDA newcomers to get "up-and-running" quickly Includes comprehensive coverage of EDA concepts, principles, data structures, algorithms, and architectures - helps all readers improve their VLSI design competence Contains latest advancements not yet available in other books, including Test compression, ESL design modeling, large-scale floorplanning, placement, routing, synthesis of clock and

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power/ground networks - helps readers to design/develop testable chips or products Includes industry best-practices wherever appropriate in most chapters - helps readers avoid costly mistakes

This book presents selected, high-quality research papers from the International Conference on Electronic Systems and Intelligent Computing (ESIC 2020), held at NIT Yupia, Arunachal Pradesh, India, on 2 – 4 March 2020. Discussing the latest challenges and solutions in the field of smart computing, cyber-physical systems and intelligent technologies, it includes papers based on original theoretical, practical and experimental simulations, developments, applications, measurements, and testing. The applications and solutions featured provide valuable reference material for future product development.

Number 12 in the successful series of Analog Circuit Design provides valuable information and excellent overviews of analogue circuit design, CAD and RF systems. The series is an ideal reference for those involved in analogue and mixed-signal design.

Written in a simple, easy to understand style, this book will teach PLL users how to use new clock technology in their work in order to create innovative applications. • Investigates the clock frequency concept from a different perspective--at an application level • Teaches engineers to use this new clocking

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technology to create innovations in chip/system level, through real examples extracted from commercial products

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The second of two volumes in the Electronic Design Automation for Integrated Circuits Handbook, Second Edition, Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology thoroughly examines real-time logic (RTL) to GDSII (a file format used to transfer data of semiconductor physical layout) design flow, analog/mixed signal design, physical verification, and technology computer-aided design (TCAD). Chapters contributed by leading experts authoritatively discuss design for manufacturability (DFM) at the nanoscale, power supply network design and analysis, design modeling, and much more. New to This Edition: Major updates appearing in the initial phases of the design flow, where the level of abstraction keeps rising to support more functionality with lower non-recurring engineering (NRE) costs Significant revisions reflected in the final phases of the design flow, where the complexity due to smaller and smaller geometries is compounded by the slow progress of shorter wavelength lithography New coverage of cutting-edge applications and approaches realized in the decade since publication of the previous edition—these are illustrated by new chapters on 3D circuit integration

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and clock design Offering improved depth and modernity, Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology provides a valuable, state-of-the-art reference for electronic design automation (EDA) students, researchers, and professionals.

Introducing a new, pioneering approach to integrated circuit design Nanometer Frequency Synthesis Beyond Phase-Locked Loop introduces an innovative new way of looking at frequency that promises to open new frontiers in modern integrated circuit (IC) design. While most books on frequency synthesis deal with the phase-locked loop (PLL), this book focuses on the clock signal. It revisits the concept of frequency, solves longstanding problems in on-chip clock generation, and presents a new time-based information processing approach for future chip design. Beginning with the basics, the book explains how clock signal is used in electronic applications and outlines the shortcomings of conventional frequency synthesis techniques for dealing with clock generation problems. It introduces the breakthrough concept of Time-Average-Frequency, presents the Flying-Adder circuit architecture for the implementation of this approach, and reveals a new circuit device, the Digital-to-Frequency Converter (DFC). Lastly, it builds upon these three key components to explain the use of time rather than level to represent information in signal processing. Provocative, inspiring, and chock-full of ideas for future innovations, the book features: A new way of thinking about the fundamental concept of clock frequency A new circuit architecture for frequency

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synthesis: the Flying-Adder direct period synthesis A new electronic component: the Digital-to-Frequency Converter A new information processing approach: time-based vs. level-based Examples demonstrating the power of this technology to build better, cheaper, and faster systems Written with the intent of showing readers how to think outside the box, Nanometer Frequency Synthesis Beyond the Phase-Locked Loop is a must-have resource for IC design engineers and researchers as well as anyone who would like to be at the forefront of modern circuit design.

A systematic description of microelectronic device design. Topics range from the basics to low-power and ultralow-voltage designs, subthreshold current reduction, memory subsystem designs for modern DRAMs, and various on-chip supply-voltage conversion techniques. It also covers process and device issues as well as design issues relating to systems, circuits, devices and processes, such as signal-to-noise and redundancy. Low Power Design Methodologies presents the first in-depth coverage of all the layers of the design hierarchy, ranging from the technology, circuit, logic and architectural levels, up to the system layer. The book gives insight into the mechanisms of power dissipation in digital circuits and presents state of the art approaches to power reduction. Finally, it introduces a global view of low power design methodologies and how these are being captured in the latest design automation environments. The individual chapters are written by the leading researchers in the area, drawn from both industry and academia. Extensive references are included at the end of each chapter.

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Audience: A broad introduction for anyone interested in low power design. Can also be used as a text book for an advanced graduate class. A starting point for any aspiring researcher.

IIZUKA '96, the 4th International Conference on Soft Computing, emphasized the integration of the components of soft computing to promote the research work on post-digital computers and to realize the intelligent systems. At the conference, new developments and results in soft computing were introduced and discussed by researchers from academic, governmental, and industrial institutions. This volume presents the opening lectures by Prof. Lotfi A. Zadeh and Prof. Walter J. Freeman, the plenary lectures by seven eminent researchers, and about 200 carefully selected papers drawn from more than 20 countries. It documents current research and in-depth studies on the conception, design, and application of intelligent systems.

This book discusses novel intelligent-system algorithms and methods in cybernetics, presenting new approaches in the field of cybernetics and automation control theory. It constitutes the proceedings of the Cybernetics and Automation Control Theory Methods in Intelligent Algorithms Section of the 8th Computer Science On-line Conference 2019 (CSOC 2019), held on-line in April 2019.

Covering both the classical and emerging nanoelectronic technologies being used in mixed-signal design, this book addresses digital, analog, and memory components. Winner of the Association of American Publishers' 2016 PROSE Award in the

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Textbook/Physical Sciences & Mathematics category. Nanoelectronic Mixed-Signal System Design offers professionals and students a unified perspective on the science, engineering, and technology behind nanoelectronics system design. Written by the director of the NanoSystem Design Laboratory at the University of North Texas, this comprehensive guide provides a large-scale picture of the design and manufacturing aspects of nanoelectronic-based systems. It features dual coverage of mixed-signal circuit and system design, rather than just digital or analog-only. Key topics such as process variations, power dissipation, and security aspects of electronic system design are discussed. Top-down analysis of all stages--from design to manufacturing Coverage of current and developing nanoelectronic technologies--not just nano-CMOS Describes the basics of nanoelectronic technology and the structure of popular electronic systems Reveals the techniques required for design excellence and manufacturability

This book is the first in a set of forthcoming books focussed on state-of-the-art development in the VLSI Signal Processing area. It is a response to the tremendous research activities taking place in that field. These activities have been driven by two factors: the dramatic increase in demand for high speed signal processing, especially in consumer electronics, and the evolving microelectronic technologies. The available technology has always been one of the main factors in determining algorithms, architectures, and design strategies to be followed. With every new technology, signal

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processing systems go through many changes in concepts, design methods, and implementation. The goal of this book is to introduce the reader to the main features of VLSI Signal Processing and the ongoing developments in this area. The focus of this book is on:

- Current developments in Digital Signal Processing (DSP) processors and architectures - several examples and case studies of existing DSP chips are discussed in Chapter 1.
- Features and requirements of image and video signal processing architectures - both applications specific integrated circuits (ASICs) and programmable image processors are studied in Chapter 2.
- New market areas for signal processing - especially in consumer electronics such as multimedia, teleconferencing, and movie on demand.
- Impact of arithmetic circuitry on the performance of DSP processors - several topics are discussed in Chapter 3 such as: number representation, arithmetic algorithms and circuits, and implementation.

As the frequency of communication systems increases and the dimensions of transistors are reduced, more and more stringent performance requirements are placed on analog circuits. This is a trend that is bound to continue for the foreseeable future and while it does, understanding performance trade-offs will constitute a vital part of the analog design process. It is the insight and intuition obtained from a fundamental understanding of performance conflicts and trade-offs, that ultimately provides the designer with the basic tools necessary for effective and creative analog design. Trade-offs in Analog Circuit Design, which is devoted to the understanding of trade-offs in

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analog design, is quite unique in that it draws together fundamental material from, and identifies interrelationships within, a number of key analog circuits. The book covers ten subject areas: Design methodology, Technology, General Performance, Filters, Switched Circuits, Oscillators, Data Converters, Transceivers, Neural Processing, and Analog CAD. Within these subject areas it deals with a wide diversity of trade-offs ranging from frequency-dynamic range and power, gain-bandwidth, speed-dynamic range and phase noise, to tradeoffs in design for manufacture and IC layout. The book has by far transcended its original scope and has become both a designer's companion as well as a graduate textbook. An important feature of this book is that it promotes an intuitive approach to understanding analog circuits by explaining fundamental relationships and, in many cases, providing practical illustrative examples to demonstrate the inherent basic interrelationships and trade-offs. Trade-offs in Analog Circuit Design draws together 34 contributions from some of the world's most eminent analog circuits-and-systems designers to provide, for the first time, a comprehensive text devoted to a very important and timely approach to analog circuit design.

Designers of high-speed integrated circuits face a bewildering array of choices and too often spend frustrating days tweaking gates to meet speed targets. Logical Effort: Designing Fast CMOS Circuits makes high speed design easier and more methodical, providing a simple and broadly applicable method for estimating the delay resulting from factors such as topology, capacitance, and gate sizes. The brainchild of circuit and computer graphics pioneers Ivan Sutherland and Bob Sproull, "logical effort" will change the way you approach design

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challenges. This book begins by equipping you with a sound understanding of the method's essential procedures and concepts-so you can start using it immediately. Later chapters explore the theory and finer points of the method and detail its specialized applications. Features Explains the method and how to apply it in two practically focused chapters. Improves circuit design intuition by teaching simple ways to discern the consequences of topology and gate size decisions. Offers easy ways to choose the fastest circuit from among an array of potential circuit designs. Reduces the time spent on tweaking and simulations-so you can rapidly settle on a good design. Offers in-depth coverage of specialized areas of application for logical effort: skewed or unbalanced gates, other circuit families (including pseudo-NMOS and domino), wide structures such as decoders, and irregularly forking circuits. Presents a complete derivation of the method-so you see how and why it works.

This book offers the first comprehensive coverage of digital design techniques to expand the power-performance tradeoff well beyond that allowed by conventional wide voltage scaling. Compared to conventional fixed designs, the approach described in this book makes digital circuits more versatile and adaptive, allowing simultaneous optimization at both ends of the power-performance spectrum. Drop-in solutions for fully automated and low-effort design based on commercial CAD tools are discussed extensively for processors, accelerators and on-chip memories, and are applicable to prominent applications (e.g., IoT, AI, wearables, biomedical). Through the higher power-performance versatility techniques described in this book, readers are enabled to reduce the design effort through reuse of the same digital design instance, across a wide range of applications. All concepts the authors discuss are demonstrated by dedicated testchip designs and experimental results. To make the results

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immediately usable by the reader, all the scripts necessary to create automated design flows based on commercial tools are provided and explained.

Praise for CMOS: Circuit Design, Layout, and Simulation Revised Second Edition from the Technical Reviewers "A refreshing industrial flavor. Design concepts are presented as they are needed for 'just-in-time' learning. Simulating and designing circuits using SPICE is emphasized with literally hundreds of examples. Very few textbooks contain as much detail as this one.

Highly recommended!" --Paul M. Furth, New Mexico State University "This book builds a solid knowledge of CMOS circuit design from the ground up. With coverage of process integration,

layout, analog and digital models, noise mechanisms, memory circuits, references, amplifiers, PLLs/DLLs, dynamic circuits, and data converters, the text is an excellent reference for both experienced and novice designers alike." --Tyler J. Gomm, Design Engineer, Micron

Technology, Inc. "The Second Edition builds upon the success of the first with new chapters that cover additional material such as oversampled converters and non-volatile memories. This is becoming the de facto standard textbook to have on every analog and mixed-signal

designer's bookshelf." --Joe Walsh, Design Engineer, AMI Semiconductor CMOS circuits from design to implementation CMOS: Circuit Design, Layout, and Simulation, Revised Second

Edition covers the practical design of both analog and digital integrated circuits, offering a vital, contemporary view of a wide range of analog/digital circuit blocks, the BSIM model, data converter architectures, and much more. This edition takes a two-path approach to the topics:

design techniques are developed for both long- and short-channel CMOS technologies and then compared. The results are multidimensional explanations that allow readers to gain deep insight into the design process. Features include: Updated materials to reflect CMOS

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technology's movement into nanometer sizes Discussions on phase- and delay-locked loops, mixed-signal circuits, data converters, and circuit noise More than 1,000 figures, 200 examples, and over 500 end-of-chapter problems In-depth coverage of both analog and digital circuit-level design techniques Real-world process parameters and design rules The book's Web site, CMOSedu.com, provides: solutions to the book's problems; additional homework problems without solutions; SPICE simulation examples using HSPICE, LTspice, and WinSpice; layout tools and examples for actually fabricating a chip; and videos to aid learning Power consumption of VLSI (Very Large Scale Integrated) circuits has been growing at an alarmingly rapid rate. This increase in power consumption, coupled with the increasing demand for portable/hand-held electronics, has made power consumption a dominant concern in the design of VLSI circuits today. Traditionally, dynamic (switching) power has dominated the total power consumption of an IC. However, due to current scaling trends, leakage power has now become a major component of the total power consumption in VLSI circuits. Leakage power reduction is especially important in portable/hand-held electronics such as cell-phones and PDAs. This book presents two techniques aimed at reducing leakage power in digital VLSI ICs. The first technique reduces leakage through the selective use of high threshold voltage sleep transistors. The second technique reduces leakage by applying the optimal Reverse Body Bias (RBB) voltage. This book also shows readers how to turn the leakage problem into an opportunity, through the use of sub-threshold logic.

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