

SECOND EDITION

DIGITAL INTEGRATED CIRCUITS

A DESIGN PERSPECTIVE

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ANANTHA CHANDRAKASAN
BORIVOJE NIKOLIĆ

Unique in approach, this text offers comprehensive coverage of new design methodologies and implementation strategies of digital ICs and brings to the forefront a number of new issues that impact the reliability, cost, performance, and power dissipation of chips now reaching the 100-nm realm. This means increased importance in circuit design of deep submicron transistor effects, interconnect, signal integrity, high-performance and low-power design, timing and clock distribution. In contrast to the first edition, the present text focuses entirely on CMOS ICs. While introducing these changes, the text preserves the spirit and goals of the first edition—that is, it successfully bridges the gap between the circuit and system visions on digital design.

Beginning with solid discussions on the operation of electronic devices and in-depth analysis of the nucleus of digital design—the inverter—the text gradually channels this knowledge into the design of more complex modules such as gates, controllers, adders, multipliers, and memories. Actual design examples and layouts are interspersed throughout the text. Besides numerous examples, each chapter also contains a number of problems or brain teasers that provoke thinking and understanding while reading. Fully worked-out design problems are available from the web site: (<http://bwrc.eecs.berkeley.edu/icBook>).

The text is intended for use in digital circuit design courses conducted for undergraduate and postgraduate students of electronics.



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Sung-Mo Kang, Yusuf Leblebici, 1999

Solutions Manual to Accompany Analysis and Design of Digital Integrated

Circuits David A. Hodges, Yu Chen, Horace G. Jackson, 1983

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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 Building Embedded Systems Changyi Gu, 2016-05-26 Develop the software and hardware you never think about We re talking about the nitty gritty behind the buttons on your microwave inside your thermostat inside the keyboard used to type this description and even running the monitor on which you are reading it now Such stuff is termed embedded systems and this book shows how to design and develop embedded systems at a professional level Because yes many people quietly make a successful career doing just that Building embedded systems can be both fun and intimidating Putting together an embedded system requires skill sets from multiple engineering disciplines from software and hardware in particular Building Embedded Systems is a book about helping you do things in the right way from the beginning of your first project Programmers who know software will learn what they need to know about hardware Engineers with hardware knowledge likewise will learn about the software side Whatever your background is Building Embedded Systems is the perfect book to fill in any knowledge gaps and get you started in a career programming for everyday devices Author Changyi Gu brings more than fifteen years of experience in working his way up the ladder in the field of embedded systems He brings knowledge of numerous approaches to embedded systems design including the System on Programmable Chips SOPC approach that is currently growing to dominate the field His knowledge and experience make Building Embedded Systems an excellent book for anyone wanting to enter the field or even just to do some embedded programming as a side project What You Will Learn Program embedded systems at the hardware level Learn current industry practices in firmware development Develop practical knowledge of embedded hardware options Create tight integration between software and hardware Practice a work flow leading to successful outcomes Build from transistor level to the system level Make sound choices between performance and cost Who This Book Is For Embedded system engineers and intermediate electronics enthusiasts who are seeking tighter integration between software and hardware Those who favor the System on a Programmable Chip SOPC approach will in particular benefit from this book Students in both Electrical Engineering and Computer Science can also benefit from this book and the real life industry practice it provides

Big Data and Visual Analytics Sang C. Suh, Thomas Anthony, 2018-01-15 This book provides users with cutting edge methods and technologies in the area of big data and visual analytics as well as an insight to the big data and data analytics research conducted by world renowned researchers in this field The authors present comprehensive educational resources on big data and visual analytics covering state of the art techniques on data analytics data and information visualization and visual analytics Each chapter covers specific topics related to big data and data analytics as virtual data machine security of big data big data applications high performance computing cluster and big data implementation techniques Every chapter includes a description of an unique contribution to the area of big data and visual analytics This book is a valuable resource for researchers and professionals working in the area of big data data analytics and information visualization Advanced level

students studying computer science will also find this book helpful as a secondary textbook or reference

Innovative Computing 2025, Volume 4 Hao-Shang Ma,Hwa-Young Jeong,Yu-Wei Chan,Hsuan-Che Yang,2025-07-12 This book comprises select proceedings of the 7th International Conference on Innovative Computing which was held in Bangkok Thailand Jan 19 23 2025 IC 2025 focusing on cutting edge research carried out in the areas of information technology science and engineering Some of the themes covered in this book are cloud communications and networking high performance computing architecture for secure and interactive IoT satellite communication wearable network and system infrastructure management etc The essays are written by leading international experts making it a valuable resource for researchers and practicing engineers alike

Books in Print ,1994

Computer-Aided Design of Analog Integrated Circuits and Systems Rob A. Rutenbar,Georges G. E. Gielen,2002-05-06 The tools and techniques you need to break the analog design bottleneck Ten years ago analog seemed to be a dead end technology Today System on Chip SoC designs are increasingly mixed signal designs With the advent of application specific integrated circuits ASIC technologies that can integrate both analog and digital functions on a single chip analog has become more crucial than ever to the design process Today designers are moving beyond hand crafted one transistor at a time methods They are using new circuit and physical synthesis tools to design practical analog circuits new modeling and analysis tools to allow rapid exploration of system level alternatives and new simulation tools to provide accurate answers for analog circuit behaviors and interactions that were considered impossible to handle only a few years ago To give circuit designers and CAD professionals a better understanding of the history and the current state of the art in the field this volume collects in one place the essential set of analog CAD papers that form the foundation of today s new analog design automation tools Areas covered are Analog synthesis Symbolic analysis Analog layout Analog modeling and analysis Specialized analog simulation Circuit centering and yield optimization Circuit testing Computer Aided Design of Analog Integrated Circuits and Systems is the cutting edge reference that will be an invaluable resource for every semiconductor circuit designer and CAD professional who hopes to break the analog design bottleneck

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Analog Signal Processing Ramón Pallás-Areny,John G. Webster,1999-02-05 A proven cost effective approach to solving analog signal processing design problems Most design problems involving analog circuits require a great deal of creativity to solve But as the authors of this groundbreaking guide demonstrate finding solutions to most analog signal processing problems does not have to be that difficult Analog Signal Processing presents an original five step design oriented approach to solving analog signal processing problems using standard ICs as building blocks Unlike most authors who prescribe a bottom up approach Professors Pall s Areny and Webster cast design problems first in functional terms and then develop possible solutions using available ICs focusing on circuit performance rather than internal structure The five steps of their approach move from signal classification definition of desired functions and description of analog domain conversions to error classification and error analysis Featuring 90

worked examples many of them drawn from actual implementations and more than 130 skill building chapter end problems Analog Signal Processing is both a valuable working resource for practicing design engineers and a textbook for advanced courses in electronic instrumentation design *Engineering Education* ,1990 *Scientific and Technical Aerospace Reports* ,1995 **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

Books in Print Supplement ,1994 *The Publishers' Trade List Annual* ,1985 **Electronic Chips & Systems Design Languages** Jean Mermet,2013-03-09 Electronic Chips Systems Design Languages outlines and describes the latest advances in design languages The challenge of System on a Chip SOC design requires designers to work in a multi lingual environment which is becoming increasingly difficult to master It is therefore crucial for them to learn almost in real time from the experiences of their colleagues in the use of design languages and how these languages have become more advanced to cope with system design System designers as well as students willing to become system designers often do not have the time to attend all scientific events where they could learn the necessary information This book will bring them a selected digest of the best contributions and industry strength case studies All the levels of abstraction that are relevant from the informal user requirements down to the implementation specifications are addressed by different contributors The author together with colleague authors who provide valuable additional experience presents examples of actual industrial world applications Furthermore the academic concepts presented in this book provide excellent theories to student readers and the concepts described are up to date and in so doing provide most suitable root information for Ph D postgraduates Books in Series in the United States ,1966 *American Book Publishing Record Cumulative 1993* R R Bowker Publishing,1994-03 Cited in BCL3 Sheehy and Walford Compiled from the 12 monthly issues of the ABPR this edition of the annual cumulation lists by Dewey sequence some 41 700 titles for books published or distributed in the US Entry information is derived from MARC II tapes and books submitted to R R Bowker an **Variation-Aware Analog Structural Synthesis** Trent McConaghy,Pieter Palmers,Gao Peng,Michiel Steyaert,Georges Gielen,2009-07-13 This book describes new tools for front end analog designers starting with global variation aware sizing and extending to novel variation aware topology design The tools aid design through automation but more importantly they also aid designer insight through automation We now describe four design tasks each more general than the previous and how this book contributes design aids and insight aids to

each The first designer task targeted is global robust sizing This task is supported by a design tool that does automated globally reliable variation aware sizing SANGRIA and an insight aiding tool that extracts designer interpretable whitebox models that relate sizings to circuit performance CAFFEINE SANGRIA searches on several levels of problem difficulty simultaneously from lower cheap to evaluate exploration layers to higher full evaluation exploitation layers structural homotopy SANGRIA makes maximal use of circuit simulations by performing scalable data mining on simulation results to choose new candidate designs CAFFEINE accomplishes its task by treating function induction as a tree search problem It constrains its tree search space via a canonical functional form grammar and searches the space with grammatically constrained genetic programming The second designer task is topology selection topology design Topology selection tools must consider a broad variety of topologies such that an appropriate topology is selected must easily adapt to new semiconductor process nodes and readily incorporate new topologies Topology design tools must allow designers to creatively explore new topology ideas as rapidly as possible

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