

Ultra Low-Power Electronics and Design

Edited by
Enrico Macii

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Ultra Low Power Electronics And Design

E. Macii



Ultra Low Power Electronics And Design:

Ultra Low-Power Electronics and Design E. Macii, 2004 Power consumption is a key limitation in many high speed and high data rate electronic systems today ranging from mobile telecom to portable and desktop computing systems especially when moving to nanometer technologies Ultra Low Power Electronics and Design offers to the reader the unique opportunity of accessing in an easy and integrated fashion a mix of tutorial material and advanced research results contributed by leading scientists from academia and industry covering the most hot and up to date issues in the field of the design of ultra low power devices systems and applications *Ultra Low-Power Electronics and Design* E. Macii, 2007-05-08 Power consumption is a key limitation in many high speed and high data rate electronic systems today ranging from mobile telecom to portable and desktop computing systems especially when moving to nanometer technologies Ultra Low Power Electronics and Design offers to the reader the unique opportunity of accessing in an easy and integrated fashion a mix of tutorial material and advanced research results contributed by leading scientists from academia and industry covering the most hot and up to date issues in the field of the design of ultra low power devices systems and applications Ultra Low Power Electronics and Adiabatic Solutions Hervé Fanet, 2016-08-16 The improvement of energy efficiency in electronics and computing systems is currently central to information and communication technology design low cost cooling autonomous portable systems and functioning on recovered energy all need to be continuously improved to allow modern technology to compute more while consuming less This book presents the basic principles of the origins and limits of heat dissipation in electronic systems Mechanisms of energy dissipation the physical foundations for understanding CMOS components and sophisticated optimization techniques are explored in the first half of the book before an introduction to reversible and quantum computing Adiabatic computing and nano relay technology are then explored as new solutions to achieving improvements in heat creation and energy consumption particularly in renewed consideration of circuit architecture and component technology Concepts inspired by recent research into energy efficiency are brought together in this book providing an introduction to new approaches and technologies which are required to keep pace with the rapid evolution of electronics Ultra Low Power Bioelectronics Rahul Sarpeshkar, 2010-02-22 This book provides for the first time a broad and deep treatment of the fields of both ultra low power electronics and bioelectronics It discusses fundamental principles and circuits for ultra low power electronic design and their applications in biomedical systems It also discusses how ultra energy efficient cellular and neural systems in biology can inspire revolutionary low power architectures in mixed signal and RF electronics The book presents a unique unifying view of ultra low power analog and digital electronics and emphasizes the use of the ultra energy efficient subthreshold regime of transistor operation in both Chapters on batteries energy harvesting and the future of energy provide an understanding of fundamental relationships between energy use and energy generation at small scales and at large scales A wealth of insights and examples from brain implants cochlear implants bio

molecular sensing cardiac devices and bio inspired systems make the book useful and engaging for students and practicing engineers

Low-Power Electronics Design Christian Piquet, 2018-10-03 The power consumption of integrated circuits is one of the most problematic considerations affecting the design of high performance chips and portable devices The study of power saving design methodologies now must also include subjects such as systems on chips embedded software and the future of microelectronics Low Power Electronics Design covers all major aspects of low power design of ICs in deep submicron technologies and addresses emerging topics related to future design This volume explores in individual chapters written by expert authors the many low power techniques born during the past decade It also discusses the many different domains and disciplines that impact power consumption including processors complex circuits software CAD tools and energy sources and management The authors delve into what many specialists predict about the future by presenting techniques that are promising but are not yet reality They investigate nanotechnologies optical circuits ad hoc networks e textiles as well as human powered sources of energy Low Power Electronics Design delivers a complete picture of today s methods for reducing power and also illustrates the advances in chip design that may be commonplace 10 or 15 years from now

Ultra-Low Power Integrated Circuit Design Nianxiong Nick Tan, Dongmei Li, Zhihua Wang, 2013-10-23 This book describes the design of CMOS circuits for ultra low power consumption including analog radio frequency RF and digital signal processing circuits DSP The book addresses issues from circuit and system design to production design and applies the ultra low power circuits described to systems for digital hearing aids and capsule endoscope devices Provides a valuable introduction to ultra low power circuit design aimed at practicing design engineers Describes all key building blocks of ultra low power circuits from a systems perspective Applies circuits and systems described to real product examples such as hearing aids and capsule endoscopes

Ultra-Low-Voltage Design of Energy-Efficient Digital Circuits Nele Reynders, Wim Dehaene, 2015-04-14 This book focuses on increasing the energy efficiency of electronic devices so that portable applications can have a longer stand alone time on the same battery The authors explain the energy efficiency benefits that ultra low voltage circuits provide and provide answers to tackle the challenges which ultra low voltage operation poses An innovative design methodology is presented verified and validated by four prototypes in advanced CMOS technologies These prototypes are shown to achieve high energy efficiency through their successful functionality at ultra low supply voltages

Semiconductor Devices and Technologies for Future Ultra Low Power Electronics D. Nirmal, J. Ajayan, Patrick J. Fay, 2021-12-09 This book covers the fundamentals and significance of 2 D materials and related semiconductor transistor technologies for the next generation ultra low power applications It provides comprehensive coverage on advanced low power transistors such as NCFETs FinFETs TFETs and flexible transistors for future ultra low power applications owing to their better subthreshold swing and scalability In addition the text examines the use of field effect transistors for biosensing applications and covers design considerations and compact modeling of advanced low power transistors such as NCFETs

FinFETs and TFETs TCAD simulation examples are also provided FEATURES Discusses the latest updates in the field of ultra low power semiconductor transistors Provides both experimental and analytical solutions for TFETs and NCFETs Presents synthesis and fabrication processes for FinFETs Reviews details on 2 D materials and 2 D transistors Explores the application of FETs for biosensing in the healthcare field This book is aimed at researchers professionals and graduate students in electrical engineering electronics and communication engineering electron devices nanoelectronics and nanotechnology microelectronics and solid state circuits

Ultra-Low Input Power Conversion Circuits based on Tunnel-FETs David Cavalheiro,Francesc Moll,Stanimir Valtchev,2022-09-01 The increasing demand in electronic portability imposes low power consumption as a key metric to analog and digital circuit design Tunnel FET TFET devices have been explored mostly in digital circuits showing promising results for ultra low power and energy efficient circuit applications The TFET presents a low inverse sub threshold slope SS that allows a low leakage energy consumption desirable in many digital circuits especially memories In this book the TFET is explored as an alternative technology also for ultra low power and voltage conversion and management circuits suitable for weak energy harvesting EH sources The TFET distinct electrical characteristics under reverse bias conditions require changes in conventional circuit topologies In this book ultra low input power conversion circuits based on TFETs are designed and analyzed evaluating their performance as rectifiers charge pumps and power management circuits PMC for RF and DC EH sources

Design of Ultra-Low Power Impulse Radios Alyssa Apsel,Xiao Wang,Rajeev Dokania,2013-10-29 This book covers the fundamental principles behind the design of ultra low power radios and how they can form networks to facilitate a variety of applications within healthcare and environmental monitoring since they may operate for years off a small battery or even harvest energy from the environment These radios are distinct from conventional radios in that they must operate with very constrained resources and low overhead This book provides a thorough discussion of the challenges associated with designing radios with such constrained resources as well as fundamental design concepts and practical approaches to implementing working designs Coverage includes integrated circuit design timing and control considerations fundamental theory behind low power and time domain operation and network communication protocol considerations

MOS Devices for Low-Voltage and Low-Energy Applications Yasuhisa Omura,Abhijit Mallik,Naoto Matsuo,2017-02-28 Helps readers understand the physics behind MOS devices for low voltage and low energy applications Based on timely published and unpublished work written by expert authors Discusses various promising MOS devices applicable to low energy environmental and biomedical uses Describes the physical effects quantum tunneling of MOS devices Demonstrates the performance of devices helping readers to choose right devices applicable to an industrial or consumer environment Addresses some Ge based devices and other compound material based devices for high frequency applications and future development of high performance devices Seemingly innocuous everyday devices such as smartphones tablets and services such as on line gaming or internet keyword searches consume vast amounts of energy Even

when in standby mode all these devices consume energy The upcoming Internet of Things IoT is expected to deploy 60 billion electronic devices spread out in our homes cars and cities Britain is already consuming up to 16 per cent of all its power through internet use and this rate is doubling every four years According to The UK's Daily Mail May 2015 if usage rates continue all of Britain's power supply could be consumed by internet use in just 20 years In 2013 U S data centers consumed an estimated 91 billion kilowatt hours of electricity corresponding to the power generated by seventeen 1000 megawatt nuclear power plants Data center electricity consumption is projected to increase to roughly 140 billion kilowatt hours annually by 2020 the equivalent annual output of 50 nuclear power plants Natural Resources Defense Council USA Feb 2015 All these examples stress the urgent need for developing electronic devices that consume as little energy as possible The book MOS Devices for Low Voltage and Low Energy Applications explores the different transistor options that can be utilized to achieve that goal It describes in detail the physics and performance of transistors that can be operated at low voltage and consume little power such as subthreshold operation in bulk transistors fully depleted SOI devices tunnel FETs multigate and gate all around MOSFETs Examples of low energy circuits making use of these devices are given as well The book MOS Devices for Low Voltage and Low Energy Applications is a good reference for graduate students researchers semiconductor and electrical engineers who will design the electronic systems of tomorrow Dr Jean Pierre Colinge Taiwan Semiconductor Manufacturing Company TSMC The authors present a creative way to show how different MOS devices can be used for low voltage and low power applications They start with Bulk MOSFET following with SOI MOSFET FinFET gate all around MOSFET Tunnel FET and others It is presented the physics behind the devices models simulations experimental results and applications This book is interesting for researchers graduate and undergraduate students The low energy field is an important topic for integrated circuits in the future and none can stay out of this Prof Joao A Martino University of Sao Paulo Brazil

Microelectronics, Electromagnetics and Telecommunications Suresh Chandra Satapathy, N Bheema Rao, S Srinivas Kumar, C Dharma Raj, V Malleswara Rao, G V K Sarma, 2015-12-24 This volume contains 73 papers presented at ICMEET 2015 International Conference on Microelectronics Electromagnetics and Telecommunications The conference was held during 18-19 December 2015 at Department of Electronics and Communication Engineering GITAM Institute of Technology GITAM University Visakhapatnam INDIA This volume contains papers mainly focused on Antennas Electromagnetics Telecommunication Engineering and Low Power VLSI Design

Circuit Design for Modern Applications A. Andrew Roobert, M. Venkatesh, Shiromani Balmukund Rahi, G. Lakshmi Priya, Samuel Tensingh, 2025-02-05 This book offers a clear exploration of cutting edge semiconductor circuit technologies and their practical applications It covers topics like advanced transistor design low power consumption techniques and high performance circuit design Circuit Design for Modern Applications explores the recent innovations in semiconductor technology Bandgap reference circuits quad model transistors voltage-controlled oscillators LDO regulators power amplifiers low noise amplifiers operational amplifiers low

power CNTFET based quaternary multipliers and STT MRAM based cache memory for multicore systems are discussed It points out the difficulties in designing CMOS analog and RF circuits for mmWave applications and looks into newly developed field effect transistors for an alternate solution Innovative devices such as III V material based HEMTs and junctionless FETs are discussed The book also looks at creative ways to improve circuit performance and energy efficiency which is a useful resource for academics researchers and industry experts working in semiconductors This book will help the readers to stay on the cutting edge of contemporary circuit design technologies covering various topics from fundamental circuit design to high performance circuits

Intelligent Green Technologies for Sustainable Smart Cities Suman Lata Tripathi,Souvik Ganguli,Abhishek Kumar,Tengiz Magradze,2022-09-14 Intelligent Green Technologies for Sustainable Smart Cities Presenting the concepts and fundamentals of smart cities and developing green technologies this volume written and edited by a global team of experts also goes into the practical applications that can be utilized across multiple disciplines and industries for both the engineer and the student Smart cities and green technologies are quickly becoming two of the most important areas of development facing today s engineers scientists students and other professionals Written by a team of experts in these fields this outstanding new volume tackles the problem of detailing advances in smart city development green technologies and where the two areas intersect to create innovation and revolutionary solutions This group of hand selected and vetted papers deals with the fundamental concepts of adapting artificial intelligence machine learning techniques with green technologies and many other advances in concepts related to these key areas Including the most recent research and developments available this book is an extraordinary source of knowledge for students engineers seeking the latest research and facilities and other professionals working in the area of green technologies and challenges and solutions in urban planning and smart city development

Adaptive Digital Circuits for Power-Performance Range beyond Wide Voltage Scaling Saurabh Jain,Longyang Lin,Massimo Alioto,2020-02-27 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 immediately usable by the reader all the scripts necessary to create automated design flows based on commercial tools are provided and explained

TFET Integrated Circuits Navneet Gupta,Adam Makosiej,Amara Amara,Andrei Vladimirescu,Costin Anghel,2020-11-06

This book describes the physical operation of the Tunnel Field effect Transistor TFET and circuits built with this device Whereas the majority of publications on TFETs describe in detail the device its characteristics variants and performance this will be the first book addressing TFET integrated circuits TFET ICs The authors describe the peculiarities of TFET ICs and their differences with MOSFETs They also develop and analyze a number of logic circuits and memories The discussion also includes complex circuits combining CMOS and TFET as well as a potential fabrication process in Silicon *High Performance Embedded Architectures and Compilers* André Seznec, Michael O'Boyle, Joel Emer, Margaret Martonosi, Theo Ungerer, 2009-01-12 This book constitutes the refereed proceedings of the Fourth International Conference on High Performance Embedded Architectures and Compilers HiPEAC 2009 held in Paphos Cyprus in January 2009 The 27 revised full papers presented together with 2 invited keynote paper were carefully reviewed and selected from 97 submissions The papers are organized in topical sections on dynamic translation and optimisation low level scheduling parallelism and resource control communication mapping for CMPs power cache issues as well as parallel embedded applications **Digital Systems and Applications** Vojin G. Oklobdzija, 2017-12-19 New design architectures in computer systems have surpassed industry expectations Limits which were once thought of as fundamental have now been broken Digital Systems and Applications details these innovations in systems design as well as cutting edge applications that are emerging to take advantage of the fields increasingly sophisticated capabilities This book features new chapters on parallelizing iterative heuristics stream and wireless processors and lightweight embedded systems This fundamental text Provides a clear focus on computer systems architecture and applications Takes a top level view of system organization before moving on to architectural and organizational concepts such as superscalar and vector processor VLIW architecture as well as new trends in multithreading and multiprocessing includes an entire section dedicated to embedded systems and their applications Discusses topics such as digital signal processing applications circuit implementation aspects parallel I O algorithms and operating systems Concludes with a look at new and future directions in computing Features articles that describe diverse aspects of computer usage and potentials for use Details implementation and performance enhancing techniques such as branch prediction register renaming and virtual memory Includes a section on new directions in computing and their penetration into many new fields and aspects of our daily lives Handbook of Research on Advanced Hybrid Intelligent Techniques and Applications Bhattacharyya, Siddhartha, Banerjee, Pinaki, Majumdar, Dipankar, Dutta, Paramartha, 2015-11-03 Conventional computational methods and even the latest soft computing paradigms often fall short in their ability to offer solutions to many real world problems due to uncertainty imprecision and circumstantial data Hybrid intelligent computing is a paradigm that addresses these issues to a considerable extent The Handbook of Research on Advanced Hybrid Intelligent Techniques and Applications highlights the latest research on various issues relating to the hybridization of artificial intelligence practical applications and best methods for implementation Focusing on key interdisciplinary computational

intelligence research dealing with soft computing techniques pattern mining data analysis and computer vision this book is relevant to the research needs of academics IT specialists and graduate level students Compact Models and Performance Investigations for Subthreshold Interconnects Rohit Dhiman,Rajeevan Chandel,2014-11-07 The book provides a detailed analysis of issues related to sub threshold interconnect performance from the perspective of analytical approach and design techniques Particular emphasis is laid on the performance analysis of coupling noise and variability issues in sub threshold domain to develop efficient compact models The proposed analytical approach gives physical insight of the parameters affecting the transient behavior of coupled interconnects Remedial design techniques are also suggested to mitigate the effect of coupling noise The effects of wire width spacing between the wires wire length are thoroughly investigated In addition the effect of parameters like driver strength on peak coupling noise has also been analyzed Process voltage and temperature variations are prominent factors affecting sub threshold design and have also been investigated The process variability analysis has been carried out using parametric analysis process corner analysis and Monte Carlo technique The book also provides a qualitative summary of the work reported in the literature by various researchers in the design of digital sub threshold circuits This book should be of interest for researchers and graduate students with deeper insights into sub threshold interconnect models in particular In this sense this book will best fit as a text book and or a reference book for students who are initiated in the area of research and advanced courses in nanotechnology interconnect design and modeling

Whispering the Strategies of Language: An Emotional Journey through **Ultra Low Power Electronics And Design**

In a digitally-driven world wherever screens reign supreme and immediate conversation drowns out the subtleties of language, the profound strategies and psychological subtleties hidden within words usually get unheard. Yet, nestled within the pages of **Ultra Low Power Electronics And Design** a charming literary treasure sporting with natural thoughts, lies an exceptional journey waiting to be undertaken. Published by an experienced wordsmith, this marvelous opus invites viewers on an introspective journey, gently unraveling the veiled truths and profound affect resonating within the fabric of each and every word. Within the psychological depths of this poignant review, we will embark upon a sincere exploration of the book's primary subjects, dissect its interesting writing fashion, and yield to the effective resonance it evokes strong within the recesses of readers' hearts.

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Ultra Low Power Electronics And Design Introduction

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