
Chapter 4 Circuit Characterization And Performance Estimation

Mm-wave Circuit Design in 16nm FinFET for 6G Applications
Substrate Noise Coupling in Analog/RF Circuits
Microscale Heat Conduction in Integrated Circuits and Their Constituent Films
ESD Design and Analysis Handbook
Microwave Circuits for 24 GHz Automotive Radar in Silicon-based Technologies
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Design Techniques for Integrated CMOS Class-D Audio Amplifiers
RF Circuits for 5G Applications
Innovative Applications of Nanowires for Circuit Design

A Characterization and Evaluation of MOS Integrated Circuit Current Sources
Antennas and Propagation for Body-Centric Wireless Communications, Second Edition
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Mm-wave Circuit Design in 16nm FinFET
for 6G Applications CRC Press

Responding to recent developments and a growing VLSI circuit manufacturing market, Technology Computer Aided Design: Simulation for VLSI MOSFET examines advanced MOSFET processes

and devices through TCAD numerical simulations. The book provides a balanced summary of TCAD and MOSFET basic concepts, equations, physics, and new technologies related to TCAD and MOSFET. A firm grasp of these concepts allows for the design of better models, thus streamlining the design process, saving time and money. This book places emphasis on the importance of modeling and simulations of VLSI MOS transistors and TCAD software. Providing background

concepts involved in the TCAD simulation of MOSFET devices, it presents concepts in a simplified manner, frequently using comparisons to everyday-life experiences. The book then explains concepts in depth, with required mathematics and program code. This book also details the classical semiconductor physics for understanding the principle of operations for VLSI MOS transistors, illustrates recent developments in the area of MOSFET and other electronic devices, and analyzes the

evolution of the role of modeling and simulation of MOSFET. It also provides exposure to the two most commercially popular TCAD simulation tools Silvaco and Sentaurus. • Emphasizes the need for TCAD simulation to be included within VLSI design flow for nano-scale integrated circuits • Introduces the advantages of TCAD simulations for device and process technology characterization • Presents the fundamental physics and mathematics incorporated in the TCAD tools • Includes popular commercial TCAD simulation tools (Silvaco and Sentaurus) • Provides characterization of performances of VLSI MOSFETs through TCAD tools • Offers familiarization to compact modeling for VLSI circuit simulation R&D cost and time for electronic product development is drastically reduced by taking advantage of TCAD tools, making it indispensable for modern VLSI device technologies. They provide a means to characterize the MOS transistors and improve the VLSI circuit simulation procedure. The comprehensive information and systematic approach to design, characterization, fabrication, and computation of VLSI MOS transistor through TCAD tools presented in this book

provides a thorough foundation for the development of models that simplify the design verification process and make it cost effective.

Substrate Noise Coupling in Analog/RF Circuits Springer Science & Business Media

The ability to provide highly accurate performance evaluations of photovoltaic devices has never been more important given the recent, and anticipated, progress in photovoltaics. The lowest possible measurement uncertainties are required for reliably assessing technological advances and reducing investment uncertainty. As the further reduction of these uncertainties within conventional solar cell measurements is often hindered by the measurement setups themselves, innovative approaches in the development of new measurement facilities are vital. This thesis addresses such demand by applying ultrashort laser pulses for highly accurate solar cell characterization. Based on a detailed investigation of pulse-solar cell interaction, a setup for spectral responsivity measurements is developed. This cutting-edge measurement setup substantially

outperforms current state-of-the-art facilities in terms of measurement accuracy. Furthermore, a novel measurement approach is presented that takes advantage of spectrally shaped supercontinuum radiation. Imitating standard solar spectra with the shaped supercontinuum radiation promises a quicker and more accurate measurement of the solar cell's short circuit current than is presently possible using conventional methods.

Microscale Heat Conduction in Integrated Circuits and Their Constituent Films Lab on the Web

This book introduces several battery management problems and provides solutions using model-based approaches. It provides detailed coverage of battery management problems, including battery impedance estimation, battery capacity estimation, state of charge estimation, state of health estimation, battery thermal management, and optimal charging algorithms. The book introduces important battery management problems in a modularized fashion, decoupling each battery management problem from others as much as possible, allowing you to focus

on understanding a particular topic rather than having to understand all aspects of a battery management system. You will get the necessary background to understand, implement and improve battery fuel gauges in electric vehicles, and general state of health of the battery; use proven models and algorithms to estimate the thermal properties of a battery; and know the basics of smart battery charger design. You will also be equipped to accurately estimate battery features of vehicles, such as state of charge, expected charging time, and state of health, to make customized charging waveforms for each vehicle. The book teaches you how to create simulation environments to test and validate algorithms against model uncertainty and measurement noise. In addition, the importance of benchmarking battery management algorithms is covered, and several bench marking metrics are presented. Included MATLAB codes give you an easy way to test the algorithms using realistic data and to develop and test alternative solutions. This is a useful and timely guide for battery engineers at all levels, as well as research scientists

and advanced students working in this robust and rapidly advancing area.

ESD Design and Analysis Handbook
Springer

This groundbreaking book is the first to give an introduction to microwave de-embedding, showing how it is the cornerstone for waveform engineering. The authors of each chapter clearly explain the theoretical concepts, providing a foundation that supports linear and non-linear measurements, modelling and circuit design. Recent developments and future trends in the field are covered throughout, including successful strategies for low-noise and power amplifier design. This book is a must-have for those wishing to understand the full potential of the microwave de-embedding concept to achieve successful results in the areas of measurements, modelling, and design at high frequencies. With this book you will learn: The theoretical background of high-frequency de-embedding for measurements, modelling, and design Details on applying the de-embedding concept to the transistor's linear, non-linear, and noise behaviour The impact of de-embedding on low-noise and power

amplifier design The recent advances and future trends in the field of high-frequency de-embedding Presents the theory and practice of microwave de-embedding, from the basic principles to recent advances and future trends Written by experts in the field, all of whom are leading researchers in the area Each chapter describes theoretical background and gives experimental results and practical applications Includes forewords by Giovanni Ghione and Stephen Maas
Microwave Circuits for 24 GHz Automotive Radar in Silicon-based Technologies Aspen Publishing

This invaluable textbook covers the theory and circuit design techniques to implement CMOS (Complementary Metal-Oxide Semiconductor) class-D audio amplifiers integrated circuits. The first part of the book introduces the motivation and fundamentals of audio amplification. The loudspeaker's operation and main audio performance metrics explains the limitations in the amplification process. The second part of this book presents the operating principle and design procedure of the class-D amplifier main architectures to provide the performance tradeoffs. The

circuit design procedures involved in each block of the class-D amplifier architecture are highlighted. The third part of this book discusses several important design examples introducing state-of-the-art architectures and circuit design techniques to improve the audio performance, power consumption, and efficiency of standard class-D audio amplifiers.

Lab on the Web Springer Science & Business Media

This book tackles the challenges of designing mm-wave circuits in 16nm FinFET, from the elementary transistor level to a measured D-band transmitter. The design of crucial building blocks such as oscillators and power amplifiers are covered through theoretical limitations, design methodology and measurement. Offers first book on design of mm-wave circuits above 100GHz in an advanced 16nm FinFET digital technology; Covers fundamentals of transistor layout, circuit implementation and measurements; Provides single-source reference to information otherwise only available in disparate literature.

Technology Computer Aided Design

Springer Science & Business Media
For the first time, this up-to-date text combines the main issues of the hardware description language VHDL-AMS aimed at model representation of mixed-signal circuits and systems, characterization methods and tools for the extraction of model parameters, and modelling methodologies for accurate high-level behavioural models.

Resistive Random Access Memory (RRAM) Springer Nature

This book illustrates a variety of circuit designs on plastic foils and provides all the information needed to undertake successful designs in large-area electronics. The authors demonstrate architectural, circuit, layout, and device solutions and explain the reasons and the creative process behind each. Readers will learn how to keep under control large-area technologies and achieve robust, reliable circuit designs that can face the challenges imposed by low-cost low-temperature high-throughput manufacturing.

Test and Design-for-Testability in Mixed-Signal Integrated Circuits Springer Nature
CMOS PLLs and VCOs for 4G Wireless is

the first book devoted to the subject of CMOS PLL and VCO design for future broadband 4th generation wireless devices. These devices will be handheld-centric, requiring very low power consumption and small footprint. They will be able to work across multiple bands and multiple standards covering WWAN (GSM,WCDMA) ,WLAN(802.11 a/b/g) and WPAN(Bluetooth) with different modulations, channel bandwidths , phase noise requirements ,etc. As such, this book discusses design, modeling and optimization techniques for low power fully integrated broadband PLLs and VCOs in deep submicron CMOS. First, the PLL and VCO performances are studied in the context of the chosen multi-band multi-standard, radio architecture and the adopted frequency plan. Next a thorough study of the design requirements for broadband PLL/VCO design is conducted together with modeling techniques for noise sources in a PLL and VCO focusing on optimization of integrated phase noise for multi-carrier OFDM 64-QAM type applications. Design examples for multi-standard 802.11a/b/g as well as for GSM/WCDMA are fully described and

experimental results from 0.18 micron CMOS test chips have demonstrated the validity of the proposed design and optimization techniques. Equally important the work describes techniques for robust high volume production of RF radios in general and for integrated PLL/VCO design in particular including issues such as supply sensitivity, ground bounce and calibration mechanisms. CMOS PLLs and VCOs for 4G Wireless will be of interest to graduate students in electrical and computer engineering, design managers and RFIC designers in wireless semiconductor companies.

CMOS PLLs and VCOs for 4G Wireless

Springer Science & Business Media

As MOS devices are scaled to meet increasingly demanding circuit specifications, process variations have a greater effect on the reliability of circuit performance. For this reason, statistical techniques are required to design integrated circuits with maximum yield. *Statistical Modeling for Computer-Aided Design of MOS VLSI Circuits* describes a statistical circuit simulation and optimization environment for VLSI circuit designers. The first step toward

accomplishing statistical circuit design and optimization is the development of an accurate CAD tool capable of performing statistical simulation. This tool must be based on a statistical model which comprehends the effect of device and circuit characteristics, such as device size, bias, and circuit layout, which are under the control of the circuit designer on the variability of circuit performance. The distinctive feature of the CAD tool described in this book is its ability to accurately model and simulate the effect in both intra- and inter-die process variability on analog/digital circuits, accounting for the effects of the aforementioned device and circuit characteristics. *Statistical Modeling for Computer-Aided Design of MOS VLSI Circuits* serves as an excellent reference for those working in the field, and may be used as the text for an advanced course on the subject.

Robust Battery Management System Design With MATLAB Springer Science & Business Media

Predicting noise in RF systems at the design stage is extremely important. This book concentrates on developing noise

simulation techniques for RF circuits. The authors present a novel approach of performing noise analysis for RF circuits. *Model Engineering in Mixed-Signal Circuit Design* BoD - Books on Demand

Carbon Nanotube Field Effect Transistor (CNFET) technology has received a lot of attention in the past few years as a promising extension to silicon-CMOS for future digital logic integrated circuits. While recent research has advanced CNFET technology past many important milestones, robust and scalable solutions must be developed to realize the full potential of CNFETs. Thus, this thesis aims to develop a suite of techniques, spanning from material synthesis to circuit solutions, compatible with very-large-scale integration (VLSI). Specifically, to enable the real-world engineering of carbon nanotube integrated circuits, this thesis presents (1) wafer-scale aligned CNT growth, (2) wafer-scale CNT Transfer, (3) wafer-scale device and circuit fabrication techniques, and (4) ACCNT, a VLSI-compatible circuit design solution to surmounting the problem of metallic CNTs. These techniques culminated in the successful demonstration of CNT

transistors, inverters, and NAND logic gates on a wafer scale. Furthermore, this thesis sheds light on important design considerations for the demonstration of a simple CNT "computer" and suggests a few critical directions for future work in the field of carbon nanotube technology. In contributing the above, this thesis hopes to propel carbon nanotube technology forward towards the vision of robust, large-scale integrated circuits using high-density carbon nanotubes.

Introduction to Circuit Complexity Springer Science & Business Media

Now in a newly updated and revised edition, this timely resource provides you with complete and current details on the theory, design, and applications of wireless antennas for on-body electronic systems. The Second Edition offers readers brand new material on advances in physical phantom design and production, recent developments in simulation methods and numerical phantoms, descriptions of methods for simulation of moving bodies, and the use of the body as a transmission channel. You also find a completely revised chapter on channel characterization and antenna design at

microwave frequencies. This cutting-edge volume brings you the state-of-the-art in existing applications like Bluetooth headsets together with detailed treatment of techniques, tools, and challenges in developing on-body antennas for an array of medical, emergency response, law enforcement, personal entertainment, and military applications on the horizon. The book briefs you on energy propagation around and into the body and how to estimate performance of on-body wireless links, and then dives into the nuts-and-bolts of designing antenna systems that deliver the goods. It covers on-body communication channels at microwave frequency bands and at low frequency bands, as well as ultra wideband systems for WPANs and WBANs. You get details on body-centric UWB antennas and channels, as well as advances in wearable mobile, EBG, and "smart fabric" antennas for cellular and WLAN communications. Chapters on telemedicine applications, such as remote diagnoses, and implantable medical devices cover crucial propagation issues and other obstacles that need to be addressed. Rounding out the coverage is a section on antenna

design for body-sensor networks and their emerging military and space applications. Packed with hands-on guidance from noted experts, this volume will be indispensable for your efforts in designing and improving body-centric communication systems.

Algorithms for Synthesis and Testing of Asynchronous Circuits Stanford University

An advanced textbook giving a broad, modern view of the computational complexity theory of boolean circuits, with extensive references, for theoretical computer scientists and mathematicians.

CMOS Voltage References John Wiley & Sons

Nanowires are an important sector of circuit design whose applications in very-large-scale integration design (VLSI) have huge impacts for bringing revolutionary advancements in nanoscale devices, circuits, and systems due to improved electronic properties of the nanowires. Nanowires are potential devices for VLSI circuits and system applications and are highly preferred in novel nanoscale devices due to their high mobility and high-driving capacity. Although the

knowledge and resources for the fabrication of nanowires is currently limited, it is predicted that, with the advancement of technology, conventional fabrication flow can be used for nanoscale devices, specifically nanowires. Innovative Applications of Nanowires for Circuit Design provides relevant theoretical frameworks that include device physics, modeling, circuit design, and the latest developments in experimental fabrication in the field of nanotechnology. The book covers advanced modeling concepts of nanowires along with their role as a key enabler for innovation in GLSI devices, circuits, and systems. While highlighting topics such as design, simulation, types and applications, and performance analysis of nanowires, this book is ideally intended for engineers, practitioners, stakeholders, academicians, researchers, and students interested in electronics engineering, nanoscience, and nanotechnology.

On-Chip Inductance in High Speed Integrated Circuits Artech House

There are continuous efforts focussed on improving road traffic safety worldwide. Numerous vehicle safety features have

been invented and standardized over the past decades. Particularly interesting are the driver assistance systems, since these can considerably reduce the number of accidents by supporting drivers' perception of their surroundings. Many driver assistance features rely on radar-based sensors. Nowadays the commercially available automotive front-end sensors are comprised of discrete components, thus making the radar modules highly-priced and suitable for integration only in premium class vehicles. Realization of low-cost radar front-end circuits would enable their implementation in inexpensive economy cars, considerably contributing to traffic safety. Cost reduction requires high-level integration of the microwave front-end circuitry, specifically analog and digital circuit blocks co-located on a single chip. Recent developments of silicon-based technologies, e.g. CMOS and SiGe:C bipolar, make them suitable for realization of microwave sensors. Additionally, these technologies offer the necessary integration capability. However, the required output power and temperature stability, necessary for automotive radar

sensor products, have not yet been achieved in standard digital CMOS technologies. On the other hand, SiGe bipolar technology offers excellent high-frequency characteristics and necessary output power for automotive applications, but has lower potential for realization of digital blocks than CMOS.

Electronic Commerce Artech House

The editors and authors present a wealth of knowledge regarding the most relevant aspects in the field of MOS transistor modeling. The variety of subjects and the high quality of content of this volume make it a reference document for researchers and users of MOSFET devices and models. The book can be recommended to everyone who is involved in compact model developments, numerical TCAD modeling, parameter extraction, space-level simulation or model standardization. The book will appeal equally to PhD students who want to understand the ins and outs of MOSFETs as well as to modeling designers working in the analog and high-frequency areas. [Review of Radio Science](#) Artech House Electrostatic Discharge is a pervasive issue in the semiconductor industry

affecting both manufacturers and users of semiconductors. This easy-to-read, practical handbook presents an overview of ESD as it effects electronic circuits and provides a concise introduction for students, engineers, circuit designers and failure analysts.

[Monolithic Integration in E-Mode GaN Technology](#) Springer Science & Business Media

This unique new book is your single resource for all issues related to intermodulation and multi-tone distortion in microwave and wireless circuits. Beginning with an overview of the general concepts of distortion in microwave and wireless devices, it delves into the theory and practical aspects of nonlinear distortion, tools for nonlinear analysis, mathematical representations of wireless

circuits and devices, and design methods for minimizing distortion.

[Noise Analysis of Radio Frequency Circuits](#) IGI Global

A triennial summation of the state of the art in radio science This book is the fourth in the modern series of triennial reviews prepared by the International Union of Radio Science to further communication and understanding of the status and future of radio science, both for those working in the field, and for those who want to know what is of current importance in this area. The International Union of Radio Science, URSI (Union Radio-Scientifique Internationale), has divided the subject of "Radio Science" according to the ten topics of the Scientific Commissions that make up URSI. This volume consists of thirty-eight original, peer-reviewed papers.

Each paper provides a critical, in-depth review of-and, in many cases, tutorial on-advances and research that have been of significant importance within the area of interest of the Commissions during the past three to four years. Among the topics covered are: Electromagnetic metrology Fields and waves Signals and systems Electronics and photonics Electromagnetic noise and interference Wave propagation and remote sensing Ionospheric radio and propagation Waves in plasmas Radio astronomy Electromagnetics in biology and medicine With an included CD-ROM of the full book text, allowing the user to do full-text searching of all the papers, the Review of Radio Science: 1999—2002 is a resource of vital importance to anyone working in, or with an interest in, radio science.

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