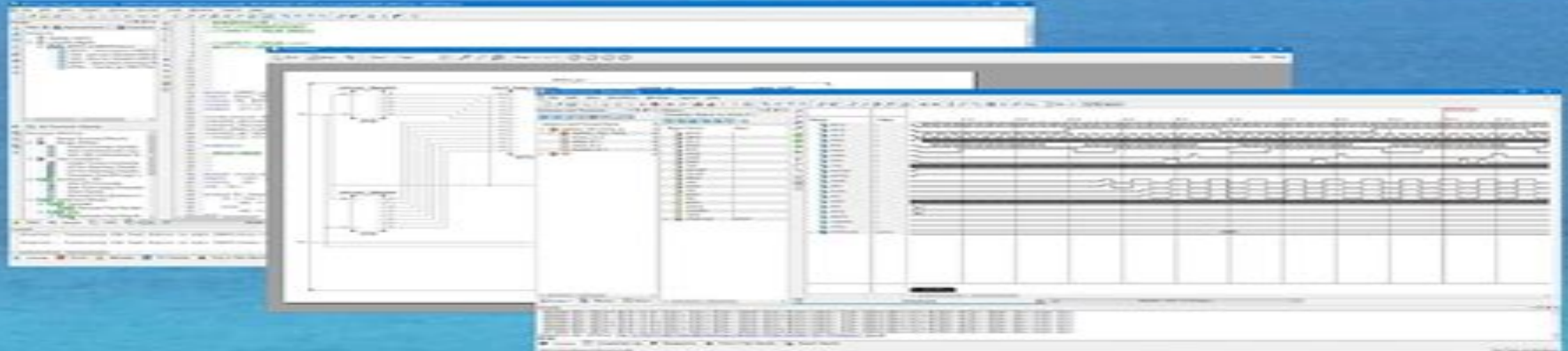


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# Mos Device And Circuit Design

**Narain D. Arora**



## **Mos Device And Circuit Design:**

MOS Device and Circuit Design Oliver J. McCarthy, 1982 Good No Highlights No Markup all pages are intact Slight Shelfwear may have the corners slightly dented may have slight color changes slightly damaged spine MOS Integrated Circuits American Micro-systems, inc, 1979 **MOS Device and Circuit Design** Oliver J. McCarthy, 1982 Good No Highlights No Markup all pages are intact Slight Shelfwear may have the corners slightly dented may have slight color changes slightly damaged spine **MOS/LSI Design and Application** William N. Carr, Jack P. Mize, 1972 *CMOS Analog Design Using All-Region MOSFET Modeling* Márcio Cherem Schneider, Carlos Galup-Montoro, 2010-01-28 Covering the essentials of analog circuit design this book takes a unique design approach based on a MOSFET model valid for all operating regions rather than the standard square law model Opening chapters focus on device modeling integrated circuit technology and layout whilst later chapters go on to cover noise and mismatch and analysis and design of the basic building blocks of analog circuits such as current mirrors voltage references voltage amplifiers and operational amplifiers An introduction to continuous time filters is also provided as are the basic principles of sampled data circuits especially switched capacitor circuits The final chapter then reviews MOSFET models and describes techniques to extract design parameters With numerous design examples and exercises also included this is ideal for students taking analog CMOS design courses and also for circuit designers who need to shorten the design cycle **Hot Carrier Design Considerations for MOS Devices and Circuits** Cheng Wang, 2012-12-06 As device dimensions decrease hot carrier effects which are due mainly to the presence of a high electric field inside the device are becoming a major design concern On the one hand the detrimental effects such as transconductance degradation and threshold shift need to be minimized or if possible avoided altogether On the other hand performance such as the programming efficiency of nonvolatile memories or the carrier velocity inside the devices need to be maintained or improved through the use of submicron technologies even in the presence of a reduced power supply As a result one of the major challenges facing MOS design engineers today is to harness the hot carrier effects so that without sacrificing product performance degradation can be kept to a minimum and a reliable design obtained To accomplish this the physical mechanisms responsible for the degradations should first be experimentally identified and characterized With adequate models thus obtained steps can be taken to optimize the design so that an adequate level of quality assurance in device or circuit performance can be achieved This book addresses these hot carrier design issues for MOS devices and circuits and is used primarily as a professional guide for process development engineers device engineers and circuit designers who are interested in the latest developments in hot carrier degradation modeling and hot carrier reliability design techniques It may also be considered as a reference book for graduate students who have some research interests in this exciting yet sometime controversial field **Advanced MOS Devices and their Circuit Applications** Ankur Beohar, Ribu Mathew, Abhishek Kumar Upadhyay, Santosh Kumar Vishvakarma, 2024-01-08 This text comprehensively

discusses the advanced MOS devices and their circuit applications with reliability concerns Further an energy efficient Tunnel FET based circuit application will be investigated in terms of the output voltage power efficiency energy consumption and performances using the device circuit co design approach The book Discusses advanced MOS devices and their circuit design for energy efficient systems on chips SoCs Covers MOS devices materials and related semiconductor transistor technologies for the next generation ultra low power applications Examines the use of field effect transistors for biosensing circuit applications and covers reliability design considerations and compact modeling of advanced low power MOS transistors Includes research problem statements with specifications and commercially available industry data in the appendix Presents Verilog A model based simulations for circuit analysis The volume provides detailed discussions of DC and analog RF characteristics effects of trap assisted tunneling TAT for reliability analysis spacer underlap engineering methodology doping profile analysis and work function techniques It further covers novel MOS devices including FinFET Graphene field effect transistor Tunnel FETS and Flash memory devices It will serve as an ideal design book for senior undergraduate students graduate students and academic researchers in the fields including electrical engineering electronics and communication engineering computer engineering materials science nanoscience and nanotechnology

MOSFET Modeling for Circuit Analysis and Design Carlos Galup-Montoro, Mrcio Cherem Schneider, 2007 This is the first book dedicated to the next generation of MOSFET models Addressed to circuit designers with an in depth treatment that appeals to device specialists the book presents a fresh view of compact modeling having completely abandoned the regional modeling approach Both an overview of the basic physics theory required to build compact MOSFET models and a unified treatment of inversion charge and surface potential models are provided The needs of digital analog and RF designers as regards the availability of simple equations for circuit designs are taken into account Compact expressions for hand analysis or for automatic synthesis valid in all operating regions are presented throughout the book All the main expressions for computer simulation used in the new generation compact models are derived Since designers in advanced technologies are increasingly concerned with fluctuations the modeling of fluctuations is strongly emphasized A unified approach for both space matching and time noise fluctuations is introduced *Charge Pump Circuit Design* Feng Pan, Tapan

Samaddar, 2010-08-10 Charge pumps are finding increased attention and diversified usage in the new era of nanometer generation chips used in different systems This book explains the different architectures and requirements for an efficient charge pump design and explains each step in detail It s filled with extra hands on design information potential pitfalls to avoid and practical ideas harnessed from the authors extensive experience designing charge pumps **Compact Models**

**for Integrated Circuit Design** Samar K. Saha, 2018-09-03 Compact Models for Integrated Circuit Design Conventional Transistors and Beyond provides a modern treatise on compact models for circuit computer aided design CAD Written by an author with more than 25 years of industry experience in semiconductor processes devices and circuit CAD and more than 10

years of academic experience in teaching compact modeling courses this first of its kind book on compact SPICE models for very large scale integrated VLSI chip design offers a balanced presentation of compact modeling crucial for addressing current modeling challenges and understanding new models for emerging devices Starting from basic semiconductor physics and covering state of the art device regimes from conventional micron to nanometer this text Presents industry standard models for bipolar junction transistors BJTs metal oxide semiconductor MOS field effect transistors FETs FinFETs and tunnel field effect transistors TFETs along with statistical MOS models Discusses the major issue of process variability which severely impacts device and circuit performance in advanced technologies and requires statistical compact models Promotes further research of the evolution and development of compact models for VLSI circuit design and analysis Supplies fundamental and practical knowledge necessary for efficient integrated circuit IC design using nanoscale devices Includes exercise problems at the end of each chapter and extensive references at the end of the book Compact Models for Integrated Circuit Design Conventional Transistors and Beyond is intended for senior undergraduate and graduate courses in electrical and electronics engineering as well as for researchers and practitioners working in the area of electron devices However even those unfamiliar with semiconductor physics gain a solid grasp of compact modeling concepts from this book

Mosfet in Circuit Design: Metal-oxide-semiconductor Field-effect Transistors for Discrete and Integrated-circuit Technology Robert H. Crawford, 1967

**Nanoscale VLSI** Rohit Dhiman, Rajeevan Chandel, 2020-10-03 This book describes methodologies in the design of VLSI devices circuits and their applications at nanoscale levels The book begins with the discussion on the dominant role of power dissipation in highly scaled devices The 15 Chapters of the book are classified under four sections that cover design modeling and simulation of electronic magnetic and compound semiconductors for their applications in VLSI devices circuits and systems This comprehensive volume eloquently presents the design methodologies for ultra low power VLSI design potential post CMOS devices and their applications from the architectural and system perspectives The book shall serve as an invaluable reference book for the graduate students Ph D M S M Tech Scholars researchers and practicing engineers working in the frontier areas of nanoscale VLSI design

**BiCMOS Technology and Applications** Antonio R. Alvarez, 2012-12-06 BiCMOS Technology and Applications Second Edition provides a synthesis of available knowledge about the combination of bipolar and MOS transistors in a common integrated circuit BiCMOS In this new edition all chapters have been updated and completely new chapters on emerging topics have been added In addition BiCMOS Technology and Applications Second Edition provides the reader with a knowledge of either CMOS or Bipolar technology design a reference with which they can make educated decisions regarding the viability of BiCMOS in their own application BiCMOS Technology and Applications Second Edition is vital reading for practicing integrated circuit engineers as well as technical managers trying to evaluate business issues related to BiCMOS As a textbook this book is also appropriate at the graduate level for a special topics course in BiCMOS A general knowledge in device physics processing and circuit design is

assumed Given the division of the book it lends itself well to a two part course one on technology and one on design This will provide advanced students with a good understanding of tradeoffs between bipolar and MOS devices and circuits

*Analysis and Design of MOSFETs* Juin Jei Liou,Adelmo Ortiz-Conde,F. Garcia-Sanchez,1998-09-30 Analysis and Design of MOSFETs Modeling Simulation and Parameter Extraction is the first book devoted entirely to a broad spectrum of analysis and design issues related to the semiconductor device called metal oxide semiconductor field effect transistor MOSFET These issues include MOSFET device physics modeling numerical simulation and parameter extraction The discussion of the application of device simulation to the extraction of MOSFET parameters such as the threshold voltage effective channel lengths and series resistances is of particular interest to all readers and provides a valuable learning and reference tool for students researchers and engineers Analysis and Design of MOSFETs Modeling Simulation and Parameter Extraction extensively referenced and containing more than 180 illustrations is an innovative and integral new book on MOSFETs design technology

**Mosfet Modeling For Vlsi Simulation: Theory And Practice** Narain Arora,2007-02-14 A reprint of the classic text this book popularized compact modeling of electronic and semiconductor devices and components for college and graduate school classrooms and manufacturing engineering over a decade ago The first comprehensive book on MOS transistor compact modeling it was the most cited among similar books in the area and remains the most frequently cited today The coverage is device physics based and continues to be relevant to the latest advances in MOS transistor modeling This is also the only book that discusses in detail how to measure device model parameters required for circuit simulations The book deals with the MOS Field Effect Transistor MOSFET models that are derived from basic semiconductor theory Various models are developed ranging from simple to more sophisticated models that take into account new physical effects observed in submicron transistors used in today s 1993 MOS VLSI technology The assumptions used to arrive at the models are emphasized so that the accuracy of the models in describing the device characteristics are clearly understood Due to the importance of designing reliable circuits device reliability models are also covered Understanding these models is essential when designing circuits for state of the art MOS ICs

MOSFET Models for VLSI Circuit Simulation Narain D. Arora,2012-12-06 Metal Oxide Semiconductor MOS transistors are the basic building block of MOS integrated circuits I C Very Large Scale Integrated VLSI circuits using MOS technology have emerged as the dominant technology in the semiconductor industry Over the past decade the complexity of MOS IC s has increased at an astonishing rate This is realized mainly through the reduction of MOS transistor dimensions in addition to the improvements in processing Today VLSI circuits with over 3 million transistors on a chip with effective or electrical channel lengths of 0.5 microns are in volume production Designing such complex chips is virtually impossible without simulation tools which help to predict circuit behavior before actual circuits are fabricated However the utility of simulators as a tool for the design and analysis of circuits depends on the adequacy of the device models used in the simulator This problem is further aggravated by the technology

trend towards smaller and smaller device dimensions which increases the complexity of the models There is extensive literature available on modeling these short channel devices However there is a lot of confusion too Often it is not clear what model to use and which model parameter values are important and how to determine them After working over 15 years in the field of semiconductor device modeling I have felt the need for a book which can fill the gap between the theory and the practice of MOS transistor modeling This book is an attempt in that direction

*Charge-Based MOS Transistor Modeling*  
Christian C. Enz, Eric A. Vittoz, 2006-08-21

Modern large scale analog integrated circuits ICs are essentially composed of metal oxide semiconductor MOS transistors and their interconnections As technology scales down to deep sub micron dimensions and supply voltage decreases to reduce power consumption these complex analog circuits are even more dependent on the exact behavior of each transistor High performance analog circuit design requires a very detailed model of the transistor describing accurately its static and dynamic behaviors its noise and matching limitations and its temperature variations The charge based EKV Enz Krummenacher Vittoz MOS transistor model for IC design has been developed to provide a clear understanding of the device properties without the use of complicated equations All the static dynamic noise non quasi static models are completely described in terms of the inversion charge at the source and at the drain taking advantage of the symmetry of the device Thanks to its hierarchical structure the model offers several coherent description levels from basic hand calculation equations to complete computer simulation model It is also compact with a minimum number of process dependant device parameters Written by its developers this book provides a comprehensive treatment of the EKV charge based model of the MOS transistor for the design and simulation of low power analog and RF ICs Clearly split into three parts the authors systematically examine the basic long channel intrinsic charge based model including all the fundamental aspects of the EKV MOST model such as the basic large signal static model the noise model and a discussion of temperature effects and matching properties the extended charge based model presenting important information for understanding the operation of deep submicron devices the high frequency model setting out a complete MOS transistor model required for designing RF CMOS integrated circuits Practising engineers and circuit designers in the semiconductor device and electronics systems industry will find this book a valuable guide to the modelling of MOS transistors for integrated circuits It is also a useful reference for advanced students in electrical and computer engineering

*Matching Properties of Deep Sub-Micron MOS Transistors*  
Jeroen A. Croon, Willy M Sansen, Herman E. Maes, 2006-06-20

Matching Properties of Deep Sub Micron MOS Transistors examines this interesting phenomenon Microscopic fluctuations cause stochastic parameter fluctuations that affect the accuracy of the MOSFET For analog circuits this determines the trade off between speed power accuracy and yield Furthermore due to the down scaling of device dimensions transistor mismatch has an increasing impact on digital circuits The matching properties of MOSFETs are studied at several levels of abstraction A simple and physics based model is presented that accurately describes the mismatch in the drain current The model is

illustrated by dimensioning the unit current cell of a current steering D/A converter. The most commonly used methods to extract the matching properties of a technology are benchmarked with respect to model accuracy, measurement accuracy and speed, and physical contents of the extracted parameters. The physical origins of microscopic fluctuations and how they affect MOSFET operation are investigated. This leads to a refinement of the generally applied 1/f area law. In addition, the analysis of simple transistor models highlights the physical mechanisms that dominate the fluctuations in the drain current and transconductance. The impact of process parameters on the matching properties is discussed. The impact of gate line edge roughness is investigated, which is considered to be one of the roadblocks to the further down scaling of the MOS transistor. Matching Properties of Deep Sub Micron MOS Transistors is aimed at device physicists, characterization engineers, technology designers, circuit designers or anybody else interested in the stochastic properties of the MOSFET. *Digital CMOS Circuit Design* Silvia Annaratone, 2012-12-06 *Charge-Based MOS Transistor Modeling* Christian C. Enz, Eric A. Vittoz, 2006-08-14. Modern large scale analog integrated circuits (ICs) are essentially composed of metal oxide semiconductor (MOS) transistors and their interconnections. As technology scales down to deep sub micron dimensions and supply voltage decreases to reduce power consumption, these complex analog circuits are even more dependent on the exact behavior of each transistor. High performance analog circuit design requires a very detailed model of the transistor describing accurately its static and dynamic behaviors, its noise and matching limitations, and its temperature variations. The charge based EKV Enz-Krummenacher-Vittoz MOS transistor model for IC design has been developed to provide a clear understanding of the device properties without the use of complicated equations. All the static, dynamic, noise, non quasi static models are completely described in terms of the inversion charge at the source and at the drain, taking advantage of the symmetry of the device. Thanks to its hierarchical structure, the model offers several coherent description levels from basic hand calculation equations to complete computer simulation model. It is also compact with a minimum number of process dependant device parameters. Written by its developers, this book provides a comprehensive treatment of the EKV charge based model of the MOS transistor for the design and simulation of low power analog and RF ICs. Clearly split into three parts, the authors systematically examine the basic long channel intrinsic charge based model, including all the fundamental aspects of the EKV MOST model, such as the basic large signal static model, the noise model, and a discussion of temperature effects and matching properties; the extended charge based model, presenting important information for understanding the operation of deep submicron devices; the high frequency model, setting out a complete MOS transistor model required for designing RF CMOS integrated circuits. Practising engineers and circuit designers in the semiconductor device and electronics systems industry will find this book a valuable guide to the modelling of MOS transistors for integrated circuits. It is also a useful reference for advanced students in electrical and computer engineering.



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