CHARACTERIZATION METHODS FOR SUBMICRON MOSFETs

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Characterization Methods For Submicron Mosfets

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Characterization Methods For Submicron Mosfets:

Characterization Methods for Submicron MOSFETs Hisham Haddara,2012-12-06 It is true that the Metal Oxide Semiconductor Field Eeffect Transistor MOSFET is a key component in modern microelectronics It is also true that there is a lack of comprehensive books on MOSFET characterization in gen eral However there is more than that as to the motivation and reasons behind writing this book During the last decade device physicists researchers and engineers have been continuously faced with new elements which made the task of MOSFET characterization more and more crucial as well as difficult The progressive miniaturization of devices has caused several phenomena to emerge and modify the performance of scaled down MOSFETs Localized degradation induced by hot carrier injection and Random Telegraph Signal RTS noise generated by individual traps are examples of these phenomena Therefore it was inevitable to develop new models and new characterization methods or at least adapt the existing ones to cope with the special nature of these new phenomena The need for more deep and extensive characterization of MOSFET param eters has further increased as the applications of this device have gained ground in many new fields in which its performance has become more and more sensi tive to the properties of its Si Si0 interface MOS transistors have crossed 2 the borders of high speed electronics where they operate at GHz frequencies Moreover MOSFETs are now widely employed in the subthreshold regime in neural circuits and biomedical applications **Characterization Methods for Submicron Mosfets** Hisham Haddara,1996-01-31 The Metal Oxide Semiconductor Field Effect Transistor MOSFET is a key component in modern microelectronics During the last decade device physicists researchers and engineers have been continuously faced with new elements making the task of MOSFET characterization increasingly crucial as well as more difficult The progressive miniaturization of devices has caused several phenomena to emerge and modify the performance of scaled down MOSFETs Localized degradation induced by hot carrier injection and Random Telegraph Signal RTS noise generated by individual traps are examples It was thus unavoidable to develop new models and new characterization methods or at least adapt the existing ones to cope with the special nature of these new phenomena Characterization Methods for Submicron MOSFETs deals with techniques which show high potential for characterization of submicron devices Throughout the book the focus is on the adaptation of such methods to resolve measurement problems relevant to VLSI devices and new materials especially Silicon on Insulator SOI Characterization Methods for Submicron MOSFETs was written to provide help to device engineers and researchers to enable them to cope with the challenges they face Without adequate device characterization new physical phenomena and new types of defects or damage may not be well identified or dealt with leading to an undoubted obstruction of the device development cycle Audience Researchers and graduate students familiar with MOS device physics working in the field of device characterization and modeling Also intended for industrial engineers working in device development seeking to enlarge their understanding of measurement methods The book additionally addresses device based characterization for material and

process engineers and for circuit designers A valuable reference that may be used as a text for advanced courses on the subject **Leakage Current and Defect Characterization of Short Channel MOSFETs** Guntrade Roll,2012 The continuous improvement in semiconductor technology requires field effect transistor scaling while maintaining acceptable leakage currents This study analyzes the effect of scaling on the leakage current and defect distribution in peripheral DRAM transistors The influence of important process changes such as the high k gate patterning and encapsulation as well as carbon co implants in the source drain junction are investigated by advanced electrical measurements and TCAD simulation A complete model for the trap assisted leakage currents in the silicon bulk of the transistors is presented **Symbolic Analysis in Analog Integrated Circuit Design** Henrik Floberg,2012-12-06 Symbolic Analysis in Analog Integrated Circuit Design provides an introduction to computer aided circuit analysis and presents systematic methods for solving linear i e small signal and nonlinear circuit problems which are illustrated by concrete examples Computer aided symbolic circuit analysis is useful in analog integrated circuit design Analytic expressions for the network transfer functions contain information that is not provided by a numerical simulation result However these expressions are generally extremely long and difficult to interpret therefore it is necessary to be able to approximate them guided by the magnitude of the individual circuit parameters Engineering has been described as the art of making approximations The inclusion of symbolic analysis in analog circuit design reduces the implied risk of ambiguity during the approximation process A systematic method based on the nullor concept is used to obtain the basic feedback transistor amplifier configurations Approximate expressions for the locations of poles and zeros for linear networks are obtained using the extended pole splitting technique An unusual feature in Symbolic Analysis in Analog Integrated Circuit Design is the consistent use of the transadmittance element with finite linear or nonlinear or infinite i e nullor gain as the only requisite circuit element The describing function method is used to obtain approximate symbolic expressions for the harmonic distortion generated by a soft or hard transconductance nonlinearity embedded in an arbitrary linear network The design and implementation of a program i e CASCA for symbolic analysis of time continuous networks is described The algorithms can also be used to solve other linear problems e g the analysis of time discrete switched capacitor networks Symbolic Analysis in Analog Integrated Circuit Design serves as an excellent resource for students and researchers as well as for industry designers who want to familiarize themselves with circuit analysis This book may also be used for advanced courses on the subject **Distortion Analysis of Analog Integrated Circuits** Piet Wambacq,Willy M.C. Sansen,2013-04-17 The analysis and prediction of nonlinear behavior in electronic circuits has long been a topic of concern for analog circuit designers The recent explosion of interest in portable electronics such as cellular telephones cordless telephones and other applications has served to reinforce the importance of these issues The need now often arises to predict and optimize the distortion performance of diverse electronic circuit configurations operating in the gigahertz frequency range where nonlinear reactive effects often dominate However there

have historically been few sources available from which design engineers could obtain information on analysis tech niques suitable for tackling these important problems I am sure that the analog circuit design community will thus welcome this work by Dr Wambacq and Professor Sansen as a major contribution to the analog circuit design literature in the area of distortion analysis of electronic circuits I am personally looking forward to having a copy readily available for reference when designing integrated circuits for communication systems *Progress in SOI Structures and Devices Operating at Extreme Conditions* Francis Balestra,Alexei N. Nazarov,Vladimir S. Lysenko,2012-12-06 A review of the electrical properties performance and physical mechanisms of the main silicon on insulator SOI materials and devices Particular attention is paid to the reliability of SOI structures operating in harsh conditions The first part of the book deals with material technology and describes the SIMOX and ELTRAN technologies the smart cut technique SiCOI structures and MBE growth The second part covers reliability of devices operating under extreme conditions with an examination of low and high temperature operation of deep submicron MOSFETs and novel SOI technologies and circuits SOI in harsh environments and the properties of the buried oxide The third part deals with the characterization of advanced SOI materials and devices covering laser recrystallized SOI layers ultrashort SOI MOSFETs and nanostructures gated diodes and SOI devices produced by a variety of techniques The last part reviews future prospects for SOI structures analyzing wafer bonding techniques applications of oxidized porous silicon semi insulating silicon materials self organization of silicon dots and wires on SOI and some new physical phenomena **Highly Linear Integrated Wideband Amplifiers** Henrik Sjöland,2012-12-06 Highly Linear Integrated Wideband Amplifiers Design and Analysis Techniques for Frequencies from Audio to RF deals with the complicated issues involved in the design of high linearity integrated wideband amplifiers for different operating frequencies The book demonstrates these principles using a number of high performance designs New topologies for high linearity are presented as well as a novel method for estimating the intermodulation distortion of a wideband signal One of the most exciting results presented is an enhanced feedback configuration called feedback boosting that is capable of very low distortion Also important is a statistical method for relating the intermodulation distortion of a wideband signal to the total harmonic distortion THD of a single tone The THD as opposed to the intermodulation distortion of the wideband signal is easy to measure and use as a design parameter Three different applications where high linearity is needed are identified namely audio power amplifiers wideband IF amplifiers and RF power amplifiers For these applications high performance integrated amplifier designs using novel topologies are presented together with measurement results The audio amplifiers are built in CMOS and are capable of driving 8Omega loudspeaker loads directly without using any external components One of the designs can operate on a supply voltage down to 1 5V Both bipolar and CMOS wideband IF amplifiers are built they are fully differential and have linearity from DC to 20 MHz Finally an RF power amplifier is built in CMOS without using inductors in order to investigate what performance can be achieved without them Highly Linear Integrated Wideband

Amplifiers Design and Analysis Techniques for Frequencies from Audio to RF is an excellent reference for researchers and designers of integrated amplifiers and may be used as a text for advanced courses on the topic   Matching Properties of Deep Sub-Micron MOS Transistors Jeroen A. Croon,Willy M. C. Sansen,Herman E. Maes,2005-03-24 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 bench marked 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 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   New Approaches and Methods for MOS Device Characterization and Design with Gate Lengths to 100 Nm John Scarpulla,1988   *JJAP* ,1999   *Noise in Devices and Circuits* ,2003   **Japanese Journal of Applied Physics** ,2005   **The Design of Low-Voltage, Low-Power Sigma-Delta Modulators** Shahriar Rabii,Bruce A. Wooley,1999 Oversampling techniques based on sigma delta modulation are widely used to implement the analog digital interfaces in CMOS VLSI technologies This approach is relatively insensitive to imperfections in the manufacturing process and offers numerous advantages for the realization of high resolution analog to digital A D converters in the low voltage environment that is increasingly demanded by advanced VLSI technologies and by portable electronic systems In The Design of Low Voltage Low Power Sigma Delta Modulators an analysis of power dissipation in sigma delta modulators is presented and a low voltage implementation of a digital audio performance A D converter based on the results of this analysis is described Although significant power savings can typically be achieved in digital circuits by reducing the power supply voltage the power dissipation in analog circuits actually tends to increase with decreasing supply voltages Oversampling architectures are a potentially power efficient means of implementing high resolution A D converters because they reduce the number and complexity of the analog circuits in comparison with Nyquist rate converters In fact it is shown that the power dissipation of a sigma delta modulator can

approach that of a single integrator with the resolution and bandwidth required for a given application In this research the influence of various parameters on the power dissipation of the modulator has been evaluated and strategies for the design of a power efficient implementation have been identified The Design of Low Voltage Low Power Sigma Delta Modulators begins with an overview of A D conversion emphasizing sigma delta modulators It includes a detailed analysis of noise in sigma delta modulators analyzes power dissipation in integrator circuits and addresses practical issues in the circuit design and testing of a high resolution modulator The Design of Low Voltage Low Power Sigma Delta Modulators will be of interest to practicing engineers and researchers in the areas of mixed signal and analog integrated circuit design **Characterization of Structural and Electronic Properties of Nanoscale Semiconductor Device Structures Using Cross-sectional Scanning Probe Microscopy** Paul Arthur Rosenthal,2002 **Electron Technology** ,1999 **IEICE Transactions on Communications, Electronics, Information, and Systems** ,1991 **Electron-beam, X-ray, and Ion-beam Techniques for Submicrometer Lithographies III** Alfred Wagner,1984 *Submicron Research* Gladys McConkey,Hillary Rettig,1984 *Physics Briefs* ,1993 **Process and Device Technology for N-channel MOSFETs with Channel Lengths to 100 Nanometers** Thomas Christopher Mele,1988

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