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DESIGN, ANALYSIS AND SIMULATION

CMOS Current-Mode Circuits for Data Communications

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Cmos Current Mode Circuits For Data Communications

Fei Yuan



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CMOS Current-Mode Circuits for Data Communications Fei Yuan, 2007-04-26 Current mode circuits where information is represented by the branch currents of the circuits rather than the nodal voltages as of voltage mode circuits possess many unique and attractive characteristics over their voltage mode counterparts including a small nodal time constant high current swing in the presence of a low supply voltage reduced distortion a low input impedance a high output impedance less sensitive to switching noise and better ESD immunity CMOS current mode circuits have found increasing applications in telecommunication systems instrumentation analog signal processing multiprocessors high speed computer interfaces and the backplane of complex electronic systems This book deals with the analysis and design of continuous time CMOS current mode circuits for data communications over wire channels CMOS current mode sampled data networks such as switch current circuits and current mode logic circuits are excluded The book is organized as follows Chapter 1 examines the distinct characteristics of ideal voltage mode and current mode circuits The topology duality of these two classes of circuits is investigated using the concept of inter reciprocity and adjoint network A critical comparison of the input and output impedances bandwidth slew rate propagation delay signal swing supply voltage sensitivity and ESD sensitivity of voltage mode and current mode circuits is provided Chapter 2 investigates design techniques that improve the performance of low voltage current mode circuits including input impedance reduction output impedance boosting bandwidth enhancement mismatch compensation power consumption reduction and swing improvement Chapter 3 investigates the modeling of wire channels

CMOS Time-Mode Circuits and Systems Fei Yuan, 2018-09-03 Time mode circuits where information is represented by time difference between digital events offer a viable and technology friendly means to realize mixed mode circuits and systems in nanometer complementary metal oxide semiconductor CMOS technologies Various architectures of time based signal processing and design techniques of CMOS time mode circuits have emerged however an in depth examination of the principles of time based signal processing and design techniques of time mode circuits has not been available until now CMOS Time Mode Circuits and Systems Fundamentals and Applications is the first book to deliver a comprehensive treatment of CMOS time mode circuits and systems Featuring contributions from leading experts this authoritative text contains a rich collection of literature on time mode circuits and systems The book begins by presenting a critical comparison of voltage mode current mode and time mode signaling for mixed mode signal processing and then Covers the fundamentals of time mode signal processing such as voltage to time converters all digital phase locked loops and frequency synthesizers Investigates the performance characteristics architecture design techniques and implementation of time to digital converters Discusses time mode delta sigma based analog to digital converters placing a great emphasis on time mode quantizers Includes a detailed study of ultra low power integrated time mode temperature measurement systems CMOS Time Mode Circuits and Systems Fundamentals and Applications provides a valuable reference for circuit design

engineers hardware system engineers graduate students and others seeking to master this fast evolving field

Model and Design of Improved Current Mode Logic Gates Kirti Gupta, Neeta Pandey, Maneesha Gupta, 2019-11-22 This book presents MOSFET based current mode logic CML topologies which increase the speed and lower the transistor count supply voltage and power consumption The improved topologies modify the conventional PDN load and the current source sections of the basic CML gates Electronic system implementation involves embedding digital and analog circuits on a single die shifting towards mixed mode circuit design The high resolution low power and low voltage analog circuits are combined with high frequency complex digital circuits and the conventional static CMOS logic generates large current spikes during the switching also referred to as digital switching noise which degrade the resolution of the sensitive analog circuits via supply line and substrate coupling This problem is exacerbated further with scaling down of CMOS technology due to higher integration levels and operating frequencies In the literature several methods are described to reduce the propagation of the digital switching noise However in high resolution applications these methods are not sufficient The conventional CMOS static logic is no longer an effective solution and therefore an alternative with reduced current spikes or that draws a constant supply current must be selected The current mode logic CML topology with its unique property of requiring constant supply current is a promising alternative to the conventional CMOS static logic

CMOS Multichannel Single-Chip Receivers for Multi-Gigabit Optical Data Communications Paul Muller, Yusuf Leblebici, 2007-10-29 In the world of optical data communications this book will be an absolute must read It focuses on optical communications for short and very short distance applications and discusses the monolithic integration of optical receivers with processing elements in standard CMOS technologies What's more it provides the reader with the necessary background knowledge to fully understand the trade offs in short distance communication receiver design and presents the key issues to be addressed in the development of such receivers in CMOS technologies Moreover novel design approaches are presented

Design of High Voltage xDSL Line Drivers in Standard CMOS Bert Serneels, Michiel Steyaert, 2008-01-08 Design of high voltage xDSL line drivers in standard CMOS fits in the quest for highly efficient fully integrated xDSL modems for central office applications The book focusses on the line driver the most demanding building block of the xDSL modem for lowering power To reduce the cost the cheapest technology is selected standard CMOS without any extra process options to increase the nominal supply voltage The emphasis lies on the analysis design and implementation of high voltage highly efficient line drivers in mainstream CMOS Design of high voltage xDSL line drivers in standard CMOS covers the total design flow of monolithic CMOS high voltage circuits The book is essential reading for analog design engineers and researchers in the field and is also suitable as a text book for an advanced course on the subject

CMOS Active Inductors and Transformers Fei Yuan, 2008-06-17 Many new topologies and circuit design techniques have emerged recently to improve the performance of active inductors but a comprehensive treatment of the theory topology characteristics and design constraint of CMOS

active inductors and transformers and a detailed examination of their emerging applications in high speed analog signal processing and data communications over wire and wireless channels is not available This book is an attempt to provide an in depth examination and a systematic presentation of the operation principles and implementation details of CMOS active inductors and transformers and a detailed examination of their emerging applications in high speed analog signal processing and data communications over wire and wireless channels The content of the book is drawn from recently published research papers and are not available in a single cohesive book Equal emphasis is given to the theory of CMOS active inductors and transformers and their emerging applications Major subjects to be covered in the book include inductive characteristics in high speed analog signal processing and data communications spiral inductors and transformers modeling and limitations a historical perspective of device synthesis the topology characterization and implementation of CMOS active inductors and transformers and the application of CMOS active inductors and transformers in high speed analog and digital signal processing and data communications

Low Power Circuits for Emerging Applications in Communications, Computing, and Sensing Fei Yuan,2018-12-07 The book addresses the need to investigate new approaches to lower energy requirement in multiple application areas and serves as a guide into emerging circuit technologies It explores revolutionary device concepts sensors and associated circuits and architectures that will greatly extend the practical engineering limits of energy efficient computation The book responds to the need to develop disruptive new system architectures circuit microarchitectures and attendant device and interconnect technology aimed at achieving the highest level of computational energy efficiency for general purpose computing systems Features Discusses unique technologies and material only available in specialized journal and conferences Covers emerging applications areas such as ultra low power communications emerging bio electronics and operation in extreme environments Explores broad circuit operation ex analog RF memory and digital circuits Contains practical applications in the engineering field as well as graduate studies Written by international experts from both academia and industry

CMOS Current Amplifiers Kimmo Koli,Kari A.I. Halonen,2002-04-30 This current amplifier cookbook contains an extensive review of different current amplifier topologies realisable with modern CMOS integration technologies The book derives the seldom discussed issue of high frequency distortion performance for all reviewed amplifier topologies using as simple and intuitive mathematical methods as possible

CMOS Circuits for Passive Wireless Microsystems Fei Yuan,2010-10-28 This book provides a comprehensive treatment of CMOS circuits for passive wireless microsystems Major topics include an overview of passive wireless microsystems design challenges of passive wireless microsystems fundamental issues of ultra low power wireless communications radio frequency power harvesting ultra low power modulators and demodulators ultra low power temperature compensated current and voltage references clock generation and remote calibration and advanced design techniques for ultra low power analog signal processing

Circuit and Interconnect Design for RF and High Bit-rate Applications Hugo Veenstra,John R. Long,2008-06-04 Realizing maximum

performance from high bit rate and RF circuits requires close attention to IC technology circuit to circuit interconnections i.e. the interconnect and circuit design. This detailed book covers each of these topics from theory to practice with sufficient detail to help you produce circuits that are first time right. Many practical circuit examples are included to demonstrate the interplay between technology interconnect and circuit design. **RF Power Amplifiers for Mobile Communications** Patrick Reynaert, Michiel Steyaert, 2006-11-18. This book tackles both high efficiency and high linearity power amplifier PA design in low voltage CMOS. With its emphasis on theory design and implementation, the book offers a guide for those actively involved in the design of fully integrated CMOS wireless transceivers. Offering mathematical background as well as intuitive insight, the book is essential reading for RF design engineers and researchers and is also suitable as a text book.

Analysis and Design of Quadrature Oscillators Luis B. Oliveira, Jorge R. Fernandes, Igor M. Filanovsky, Chris J. M. Verhoeven, Manuel M. Silva, 2008-07-08. Modern RF receivers and transmitters require quadrature oscillators with accurate quadrature and low phase noise. Existing literature is dedicated mainly to single oscillators and is strongly biased towards LC oscillators. This book is devoted to quadrature oscillators and presents a detailed comparative study of LC and RC oscillators both at architectural and at circuit levels. It is shown that in cross coupled RC oscillators both the quadrature error and phase noise are reduced, whereas in LC oscillators the coupling decreases the quadrature error but increases the phase noise. Thus, quadrature RC oscillators can be a practical alternative to LC oscillators, especially when area and cost are to be minimized. The main topics of the book are cross coupled LC quasi sinusoidal oscillators, cross coupled RC relaxation oscillators, a quadrature RC oscillator mixer, and π integrator oscillators. The effect of mismatches on the phase error and the phase noise are thoroughly investigated. The book includes many experimental results obtained from different integrated circuit prototypes in the GHz range. A structured design approach is followed: a technology independent study with ideal blocks is performed initially, and then the circuit level design is addressed. This book can be used in advanced courses on RF circuit design. In addition to post graduate students and lecturers, this book will be of interest to design engineers and researchers in this area.

Application Specific Integrated Circuits Edward Fisher, 2019-04-17. The field of application specific integrated circuits (ASICs) is fast paced, being at the very forefront of modern nanoscale fabrication and presenting a deeply engaging career path. ASICs can provide us with high speed computation in the case of digital circuits. For example, central processing units, graphics processing units, field programmable gate arrays, and custom made digital signal processors are examples of ASICs and the transistors they are fabricated from. We can use that same technology, complementary metal oxide semiconductor processes, to implement high precision sensing or interfacing to the world through analog to digital converters, digital to analog converters, custom image sensors, and highly integrated micron scale sensors such as magnetometers, accelerometers, and microelectromechanical machines. ASIC technologies are now transitioning toward magnetoresistive and phase changing materials, also offering digital memory capacities that have aided our technological progress. Combining these domains, we have

moved toward big data analytics and the new era of artificial intelligence and machine learning This book provides a small selection of chapters covering aspects of ASIC development and the surrounding business model **Analog-Baseband Architectures and Circuits for Multistandard and Low-Voltage Wireless Transceivers** Pui-In Mak,Ben U Seng Pan,Rui Paulo Martins,2007-09-07 This book presents architectural and circuit techniques for wireless transceivers to achieve multistandard and low voltage compliance It provides an up to date survey and detailed study of the state of the art transceivers for modern single and multi purpose wireless communication systems The book includes comprehensive analysis and design of multimode reconfigurable receivers and transmitters for an efficient multistandard compliance **Broadband Opto-Electrical Receivers in Standard CMOS** Carolien Hermans,Michiel Steyaert,2007-06-13 Broadband Opto Electrical Receivers in Standard CMOS starts from the basic fundamentals necessary for the design of opto electronic interface circuits The book continues with an in depth analysis of the photodiode transimpedance amplifier TIA and limiting amplifier LA To thoroughly understand the light detection mechanisms in silicon first a one dimensional and second a two dimensional model is developed Analytical design equations are derived to guide the design of the amplifying circuits For the TIA the focus is on the sensitivity speed trade off For the LA a high gain bandwidth is pursued Several practical design examples reveal the subtleties and challenges encountered during the design of high performance analog circuits Broadband Opto Electrical Receivers in Standard CMOS covers the total design flow of monolithic CMOS optical receivers All material is experimentally verified with several CMOS implementations with ultimately a fully integrated Gbit/s optical receiver front end including photodiode TIA and LA *Low Power UWB CMOS Radar Sensors* Hervé Paulino,Joao Goes,Adolfo Steiger Garção,2008-04-30 Low Power UWB CMOS Radar Sensors deals with the problem of designing low cost CMOS radar sensors The radar sensor uses UWB signals in order to obtain a reasonable target separation capability while maintaining a maximum signal frequency below 2 GHz This maximum frequency value is well within the reach of current CMOS technologies The use of UWB signals means that most of the methodologies used in the design of circuits and systems that process narrow band signals can no longer be applied Low Power UWB CMOS Radar Sensors provides an analysis between the interaction of UWB signals the antennas and the processing circuits This analysis leads to some interesting conclusions on the types of antennas and types of circuits that should be used A methodology to compare the noise performance of UWB processing circuits is also derived This methodology is used to analyze and design the constituting circuits of the radar transceiver In order to validate the design methodology a CMOS prototype is designed and experimentally evaluated *Injection-Locking in Mixed-Mode Signal Processing* Fei Yuan,2019-05-17 This book provides readers with a comprehensive treatment of the principles circuit design techniques and applications of injection locking in mixed mode signal processing with an emphasis on CMOS implementation Major topics include An overview of injection locking the principle of injection locking in harmonic and non harmonic oscillators lock range enhancement techniques for harmonic oscillators lock range enhancement techniques for

non harmonic oscillators and the emerging applications of injection locking in mixed mode signal processing Provides a single source reference to the principles circuit design techniques and applications of injection locking in mixed mode signal processing Includes a rich collection of design techniques for increasing the lock range of oscillators under injection along with in depth examination of the pros and cons of these methods Enables a broad range of applications such as passive wireless microsystems forwarded clock parallel data links frequency synthesizers for wireless and wireline communications and low phase noise phase locked loops

Advances in Power Systems and Energy Management Amik Garg, Akash Kumar Bhoi, Padmanaban Sanjeevikumar, K. K. Kamani, 2017-11-28 This book is a collection of research articles and critical review articles describing the overall approach to energy management The book emphasizes the technical issues that drive energy efficiency in context of power systems This book contains case studies with and without solutions on modelling simulation and optimization techniques It covers some innovative topics such as medium voltage MV back to back BTB system cost optimization of a ring frame unit in textile industry rectenna for radio frequency RF energy harvesting ecology and energy dimension in infrastructural designs 2.4 kW three phase inverter for aircraft application study of automatic generation control AGC in a two area hydrothermal power system energy efficient and reliable depth based routing protocol for underwater wireless sensor network and power line communication using LabVIEW This book is primarily targeted at researchers and senior graduate students but is also highly useful for the industry professional and scientists

Precision Temperature Sensors in CMOS Technology Micheal A.P. Pertijs, Johan Huijsing, 2006-12-06 The low cost and direct digital output of CMOS smart temperature sensors are important advantages compared to conventional temperature sensors This book addresses the main problem that nevertheless prevents widespread application of CMOS smart temperature sensors their relatively poor absolute accuracy Several new techniques are introduced to improve this accuracy The effectiveness of these techniques is demonstrated using three prototypes The final prototype achieves an inaccuracy of 0.1 °C over the military temperature range which is a significant improvement in the state of the art Since smart temperature sensors have been the subject of academic and industrial research for more than two decades an overview of existing knowledge and techniques is also provided throughout the book In this introductory chapter the motivation and objectives of this work are described This is followed by a review of the basic operating principles of CMOS smart temperature sensors and a brief overview of previous work The challenges are then described that need to be met in order to improve the accuracy of CMOS smart temperature sensors while maintaining their cost advantage Finally the structure of the rest of the book is introduced

Full-Chip Nanometer Routing Techniques Tsung-Yi Ho, Yao-Wen Chang, Sao-Jie Chen, 2007-08-30 At 90 nm wires account for nearly 75% of the total delay in a circuit Even more insidious however is that among nearly 40% of these nets more than 50% of their total net capacitance are attributed to the cross coupling capacitance between neighboring signals At this point a new design and optimization paradigm based on real wires is required Nanometer routers must prevent and correct these effects

on the fly in order to reach timing closure From a manufacturability standpoint nanometer routers must explicitly deal with the ever increasing design complexity and be capable of adapting to the constraint requirements of timing signal integrity process antenna effect and new interconnect architecture such as X architecture In the nanometer era we must look into new generation routing technologies that combine high performance and capacity with the integration of congestion timing SI prevention and DFM algorithms as the best means of getting to design closure quickly In this book we present a novel multilevel full chip router namely mSIGMA for SIGNAL integrity and MANufacturability optimization And these routing technologies will ensure faster time to market and time to profitability

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