



Fei Yuan

CMOS Active Inductors and Transformers

Principle, Implementation, and Applications

 Springer

Cmos Active Inductors And Transformers Principle Implementation And Applications

Xiang Xie



Cmos Active Inductors And Transformers Principle Implementation And Applications:

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 *Emerging VLSI Devices, Circuits and Architectures* Anu Gupta, Jai Gopal Pandey, Nitin Chaturvedi, Devesh Dwivedi, 2024-10-18 This book constitutes the proceedings of the 27th International Symposium on VLSI Design and Test VDAT 2023 The 32 regular papers and 16 short papers presented in this book are carefully reviewed and selected from 220 submissions They are organized in topical sections as follows Low Power Integrated Circuits and Devices FPGA Based Design and Embedded Systems Memory Computing and Processor Design CAD for VLSI Emerging Integrated Circuits and Systems VLSI Testing and Security and System Level Design *Proceedings of the International e-Conference on Intelligent Systems and Signal Processing* Falgun Thakkar, Geetali Saha, Celia Shahnaz, Yu-Chen Hu, 2021-08-13 This book provides insights into the Third International Conference on Intelligent Systems and Signal Processing eISSP 2020 held By Electronics Communication Engineering Department of G H Patel College of Engineering Technology Gujarat India during 28 30 December 2020 The book comprises contributions by the research scholars and academicians covering the topics in signal processing and communication engineering applied electronics and emerging technologies Internet of Things IoT robotics machine learning deep learning and artificial intelligence The main emphasis of the book is on dissemination of information experience and research results on the current topics of interest through in depth discussions and contribution of researchers from all over world The book is useful for research community academicians industrialists and postgraduate students across the globe *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

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 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

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

Recent Innovations in Computing Pradeep Kumar Singh, Yashwant Singh, Maheshkumar H. Kolekar, Arpan Kumar Kar, Jitender Kumar Chhabra, Abhijit Sen, 2021-01-12 This book features selected papers presented at the 3rd International Conference on Recent Innovations in Computing ICRIC 2020 held on 20 21 March 2020 at the Central University of Jammu India and organized by the university's Department of Computer Science Information Technology It includes the latest research in the areas of software engineering cloud computing computer networks and Internet technologies artificial intelligence information security database and distributed computing and digital India

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

Dissertation Abstracts International, 2001 **On-chip Automatic Tuning of CMOS Active Inductors for Use in Radio Frequency Integrated Circuit (RFIC) Applications** Kyle Joshua Lyson, 2006 The lack of high quality factor integrated inductors is a significant impediment to realizing high performance Radio Frequency Integrated Circuits RFICs within conventional digital CMOS While passive spiral inductors continue to improve with different approaches and

fabrication techniques they tend to be large and lossy. Therefore an accurate inductance with high quality factor and small chip area would be an extremely useful component for RFIC designers. The focus of this thesis is realizing accurate high quality factor inductance using an active circuit approach for implementation in RFIC applications. It is demonstrated that when implemented in a conventional digital CMOS process the standard active inductor topology suffers greatly in terms of performance and stability over the transistor process corners and thus some form of an automatic tuning approach is necessary for these devices to be used reliably. Consequently a master slave tuning circuit was designed and included in order to tune the active inductor over the process corners of the AMIS C5 process. Simulated results are presented that verify the functionality of the proposed active inductor topology. In addition simulation results utilizing an automatically tuned inductor within a two way lumped element Wilkinson power divider demonstrates the utility of the chosen approach. Considerations for adapting this approach for use in a scaled CMOS process are discussed.

Process Voltage Temperature Compensated On-chip CMOS Active Inductors for Wilkinson Power Dividing Applications William Louis Bucossi, 2008. Few academic or industry feasibility studies have been published on the implementation of Active Inductors in a standard CMOS IC process as an alternative to the physically large and typically quite lossy spiral inductors. Development efforts at the simulation level have achieved only limited success in creating an Active Inductor topology that exhibits the quality and inductive tolerance necessary for the large scale high volume production common to most IC components. This thesis focuses on manufacturing and characterizing the basic component circuitry necessary for the implementation of a lumped element Wilkinson power divider using active inductors and develops a compensation scheme to control the parameters of merit in the active inductor across a useful process voltage and temperature operating window. Hardware results presented reinforce the need to actively compensate the Active Inductor structure implemented in a 0.6 μm AMIS C5 CMOS process. Simulation results presented show the benefits of a compensated Active Inductor incorporated into a typical RF network.

Improved Control System for Process, Voltage, and Temperature Compensation of CMOS Active Inductors Reinhold Frederick William Hollender (III.), 2011. Wireless communications play an increasingly large role in today's society. Today many wireless functions are necessarily integrated into chips and other small packages to support miniaturized wireless devices such as cell phones, laptops, netbooks, etc. These Radio Frequency Integrated Circuits (RFICs) often require inductances to perform their function. Most RFICs utilize spiral inductors. Spiral inductors have their properties defined by their physical dimensions, often taking up large areas of IC real estate. There has been research into replacing these spiral inductors with active elements to reduce their size. However, these active inductors are based on parasitic elements that can vary significantly over temperature, supply voltage, and processing variations of the wafers themselves. This professional paper documents an improved control scheme to maintain correct active inductor behavior over process voltage and temperature variations in applications where the active inductor is used in a Wilkinson power divider.

Noise-cancelling CMOS Active Inductor for RF Applications Santosh Vema Krishna Murthy, Dalhousie University. Department of Electrical and Computer Engineering. Electrical Engineering Program, 2010

The Study of CMOS Based VCO with Active Inductor and Its Design Methodology Sy-Min Chueng, 2012 Active Inductors are useful in reducing the large chip area typically consumed by spiral inductors as well as providing larger inductance values and higher quality factors that otherwise cannot be achieved by spiral inductors Integrated inductors find application in many radio frequency RF front end integrated circuits including impedance matching filtering biasing and in oscillator circuits Nonetheless because of the interdependent relationship of the self resonant frequency and quality factor it is often difficult to meet desired circuit requirements Additionally active devices pose problems of higher power consumption noise figure and potential instability This thesis begins with the study of active inductors the Wu active inductor in particular and considers tuning methods based on the Wu active inductor topology Starting with the small signal model the emulated inductance and quality factor expressions are derived Next the operation of active inductors under large signal is closely examined Comparisons between a passive and an active VCO are made The active inductor based voltage controlled oscillator Active VCO is studied extensively and the methods of improving the performance under large signal behavior are discussed Then a design procedure based on gm ID methodology is proposed A Matlab script that can be applied to gyrator C based active inductors is developed to determine the sizing of the transistors for a desired inductance and resonant frequency Cadence Virtuoso is used for simulations and extraction based on an IBM 8RF technology file Finally a low power active VCO is designed simulated and laid out

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

Design, Simulation and Applications of Inductors and Transformers for Si RF ICs Ali M. Niknejad, Robert G. Meyer, 2000-10-31 Wireless RF and microwave ICs depend critically on passive devices such as inductors capacitors and transformers Passive devices allow the optimization of key RF circuit building blocks by minimizing noise maximizing gain and frequency of operation and minimizing power The integration of passive devices on the Si IC substrate

requires a critical understanding of substrate coupling and loss including electrically induced conductive and displacement current flowing in the substrate as well as magnetically induced eddy currents. Design Simulation and Applications of Inductors and Transformers for Si RF ICs provides a deep understanding of the physics involved in the operation of these devices at microwave frequencies. Additionally, the book tackles two critical blocks that depend critically on the passive devices: the voltage controlled oscillator and a distributed amplifier. Design Simulation and Applications of Inductors and Transformers for Si RF ICs will be of interest to RF and microwave integrated circuit engineers, computer aided designers, device physicists, and electromagnetic researchers as well as power electronics engineers.

Integrated Inductors and Transformers Egidio Ragonese, Angelo Scuderi, Tonio Biondi, Giuseppe Palmisano, 2010-11-15. With the ability to improve performance, reduce fabrication costs, and increase integration levels of both RX and TX sections of the RF mm wave front end, passive inductive components have experienced extraordinary growth in ICs. Therefore, a fundamental understanding of monolithic inductors and transformers has become essential for all process engineers.

Design of CMOS Active Inductors and Their Use in Tuned Narrowband and Wideband-extension Low Noise Amplifier Dhuri Rohan Suresh, 2014. The evolution of CMOS technology has allowed the integration of communication systems on a single chip. A Low Noise Amplifier (LNA) is the first block in an integrated receiver, and its design is critical for the system performance. On-chip spiral inductors are key components in LNA's running at GHz frequency range. They are the performance limiting components of LNA's and have the added problems of rigidity and also do not scale well with CMOS, i.e., consume a large amount of area which increases the chip cost. Their quality factor Q is limited by the resistive losses in the spiral coil and by substrate losses. This project deals with replacing the area-consuming lossy spiral inductors by gyrator-based CMOS active inductors. The project starts with the simulation of some reference spiral inductors to find their main characteristics: inductance value, quality factor at different frequencies, and self-resonant frequency. Next, several CMOS active inductors are designed with the target to achieve similar or improved performance compared to the reference ones. Several topologies are tested, and the designed one is optimized after predictions of simple models. Finally, both active and passive inductors are then used in two test amplifiers: a tuned narrowband amplifier and a wideband extension amplifier. Their performance is compared in terms of input and output matching, gain, isolation, noise figure, and linearity. Frequency tuning capability is tested in the active inductors, which would provide an interesting flexibility in future communication receivers.

CMOS Implementation of Active and Passive LC-VCO Albert Chiu Yiu Chun, 2008.

Whispering the Techniques of Language: An Emotional Quest through **Cmos Active Inductors And Transformers Principle Implementation And Applications**

In a digitally-driven earth wherever displays reign supreme and immediate connection drowns out the subtleties of language, the profound secrets and emotional subtleties hidden within words usually get unheard. However, set within the pages of **Cmos Active Inductors And Transformers Principle Implementation And Applications** a fascinating literary prize pulsing with natural feelings, lies an exceptional journey waiting to be undertaken. Composed by an experienced wordsmith, that enchanting opus encourages viewers on an introspective journey, delicately unraveling the veiled truths and profound impact resonating within the very cloth of each and every word. Within the emotional depths of this moving review, we will embark upon a sincere exploration of the book is key styles, dissect their interesting publishing model, and succumb to the strong resonance it evokes strong within the recesses of readers hearts.

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