

Integrated Inductors And Transformers Characterization Design And Modeling For Rf And Mm Wave Applications

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Silicon Heterostructure Handbook John Wiley & Sons

The result of decades of research and international project experience, Multimedia Communications and Networking provides authoritative insight into recent developments in multimedia, digital communications, and networking services and technologies. Supplying you with the required foundation in these areas, it illustrates the means that will allow

Design Methodology for RF CMOS Phase Locked Loops CRC Press

The modern wireless communication industry has put great demands on circuit designers for smaller, cheaper transceivers in the gigahertz frequency range. One tool which has assisted designers in satisfying these requirements is the use of on-chip inductive elements (inductors and transformers) in silicon (Si) radio-frequency (RF) integrated circuits (ICs). These elements allow greatly improved levels of performance in Si monolithic low-noise amplifiers, power amplifiers, up-conversion and down-conversion mixers and local oscillators. Inductors can be used to improve the intermodulation distortion performance and noise figure of small-signal amplifiers and mixers. In addition, the gain of amplifier stages can be enhanced and the realization of low-cost on-chip local oscillators with good phase noise characteristics is made feasible. In order to reap these benefits, it is essential that the IC designer be able to predict and optimize the characteristics of on-chip inductive elements. Accurate knowledge of inductance values, quality factor (Q) and the influence of adjacent elements (on-chip proximity effects) and substrate losses is essential. In this book the analysis, modeling and application of on-chip inductive elements is considered. Using analyses based on Maxwell's equations, an accurate and efficient technique is developed to model these elements over a wide frequency range. Energy loss to the conductive substrate is modeled through several mechanisms, including electrically induced displacement and conductive currents and by magnetically induced eddy currents. These techniques have been compiled in a user-friendly software tool ASITIC (Analysis and Simulation of Inductors and Transformers for Integrated Circuits).

Media Networks Springer Science & Business Media

Improving the performance of existing technologies has always been a focal practice in the development of computational systems. However, as circuitry is becoming more complex, conventional techniques are becoming outdated and new research methodologies are being implemented by designers. Performance Optimization Techniques in Analog, Mix-Signal, and Radio-Frequency Circuit Design features recent advances in the engineering of integrated systems with prominence placed on methods for maximizing the functionality of these systems. This book emphasizes prospective trends in the field and is an essential reference source for researchers, practitioners, engineers, and technology designers interested in emerging research and techniques in the performance optimization of different circuit designs.

Design of CMOS RF Integrated Circuits and Systems John Wiley & Sons

As one of the three fundamental components for electronic circuits, inductors have been extensively used in a variety of applications such as power delivery, voltage regulation, microwave and RF (radio-frequency) integrated circuits. A lot of research was implemented to achieve high inductance density, low resistance and high quality factor. Compact inductors with high quality factor in radio frequency (RF) applications are of great interest nowadays. Most of the integrated inductors in RF integrated circuits (RFICs) consist of a spiral geometry without magnetic material and show inductances ranging between 1 and 10nH with low quality factors of 10. These spiral inductors typically have a low inductance areal density, which leads to large inductor area and strong

electromagnetic interference that limit the RFIC performance. Increased inductance density and/or quality factor can be achieved using a magnetic material as the inductor core. However, the large loss tangent of these thick metallic magnetic thin films at MHz or GHz frequencies severely limited any quality factor enhancement to 100 MHz or less. It has been challenging to achieve simultaneous enhanced inductance and quality factor at RFs, particularly for GHz frequencies. On the other hand, the still growing demand to integrate more applications in mobile communication terminals comes along with the need to cover an increasingly larger frequency band, as these services are subjected to different standards. Electronic tunability becomes a main research issue since this will allow reducing the number of components in the terminal. Voltage tunable capacitors have been widely used in many different circuit applications. However, voltage tunable inductors have not been readily available, which severely limits their applications and the achievable tunable RF frequency range of LC tank circuits. The goals of this dissertation are designing and fabricating magnetic inductors with characteristic high quality factor and high tunability potential by E-field on Si substrate. The research work includes three parts which are summarized below. Firstly, integrated RF inductors with high quality factor have been designed, fabricated, measured and analyzed. In this part, the details of magnetic material selection will be discussed and multilayer FeGaB/Al₂O₃ films have been finally employed because of the demonstrated eddy-current loss reduction, lower out of plane anisotropy and higher permeability in comparison with a single FeGaB layer with the same thickness. Two model analysis about solenoid inductors that are useful for parameter determination have been presented followed by design matrix with over 20 different sets of dimensions. The fabricated inductors exhibit excellent high-frequency performance with a wide operation frequency range of DC-2.5GHz, in which the inductance of the integrated magnetic inductors show 100% enhancement compared with that of the same size air core inductor, as well as a high quality factor of over 20, showing great promise for RFIC applications. Secondly, based on the fabricated high Q inductors, a new type of tunable RF multiferroic inductors have been made on 0.5mm thick ferroelectric (011) cut lead magnesium niobate - lead titanate (PMN-PT) slab. Under an applied voltage on the PMN-PT heterostructure, the inductance and quality factor can be both tuned through a strain mediated magnetoelectric coupling due to the change of E-field. By using this phenomena and removing back side Si of our devices to enhance magnetoelectric coupling between PMNPT and magnetic layer we have been able to show more than 100% tunability in frequency of GHz. DRIE inducing giant E-field tunability of magnetism and narrow linewidth in multiferroic laminates will also be discussed in detail. Last but not least, with the same magnetic material and fabrication process, we present a micromachined implementation of embedded magnetic solenoid transformers with high quality factor (Q) and low insertion loss. Transformers with excellent performance have been demonstrated, including a high quality factor of 14, flat inductance across a wide frequency range of 0.5-5 GHz, as well as high mutual coupling and low insertion loss, which make them great potential candidates for RFIC applications.

ARFTG Conference Digest Wiley-IEEE Press

This second edition of the highly acclaimed RF Power Amplifiers has been thoroughly revised and expanded to reflect the latest challenges associated with power transmitters used in communications systems. With more rigorous treatment of many concepts, the new edition includes a unique combination of class-tested analysis and industry-proven design techniques. Radio frequency (RF) power amplifiers are the fundamental building blocks used in a vast variety of wireless communication circuits, radio and TV broadcasting transmitters, radars, wireless energy transfer, and industrial processes. Through a combination of theory and practice, RF Power Amplifiers, Second Edition provides a solid understanding of the key concepts, the principle of

operation, synthesis, analysis, and design of RF power amplifiers. This extensive update boasts: up to date end of chapter summaries; review questions and problems; an expansion on key concepts; new examples related to real-world applications illustrating key concepts and brand new chapters covering 'hot topics' such as RF LC oscillators and dynamic power supplies. Carefully edited for superior readability, this work remains an essential reference for research & development staff and design engineers. Senior level undergraduate and graduate electrical engineering students will also find it an invaluable resource with its practical examples & summaries, review questions and end of chapter problems. Key features: • A fully revised solutions manual is now hosted on a companion website alongside new simulations. • Extended treatment of a broad range of topologies of RF power amplifiers. • In-depth treatment of state-of-the art of modern transmitters and a new chapter on oscillators. • Includes problem-solving methodology, step-by-step derivations and closed-form design equations with illustrations.

Distributed CMOS Bidirectional Amplifiers World Scientific Publishing Company

From basic concepts to research grade material, Mobile Web 2.0: Developing and Delivering Services to Mobile Devices provides complete and up-to-date coverage of the range of technical topics related to Mobile Web 2.0. It brings together the work of 51 pioneering experts from around the world who identify the major challenges in Mobile Web 2.0 applications and provide authoritative insight into many of their own innovations and advances in the field. To help you address contemporary challenges, the text details a conceptual framework that provides modeling facilities for context-aware, multi-channel Web applications. It compares various platforms for developing mobile services—from the developer and user perspectives—and explains how to use high-level modeling constructs to drive the application development process through automatic code generation. Proposes an expanded model of mobile application context Explores mobile social software as an Information and Communications Technology (ICT) Discusses the effect of context on mobile usability Through empirical study, the book tests a number of hypotheses on the use of software implementation technology and location context in mobile applications. It introduces Reusable End-User Customization (REUC)—a technique that allows users to adapt the layout of Web pages and automatically reapplies those preferences on subsequent visits. It also investigates the need for non-visual feedback with long system response times, particularly when downloading Web pages to mobile devices.

Planar Spiral Inductors, Planar Antennas and Embedded Planar Transformers CRC Press

Build high-performance, energy-efficient circuits with this cutting-edge guide to designing, modeling, analysing, implementing and testing new mm-wave systems.

Radio Frequency Integrated Circuit Design Springer

Varactors are passive semiconductor devices used in electronic circuits, as a voltage-controlled way of storing energy in order to boost the amount of electric charge produced. In the past, the use of low-cost fabrication processes such as complementary metal oxide semiconductor (CMOS) and silicon germanium (SiGe) were kept for integrated circuits working in frequency ranges below the GHz. Now, the increased working frequency of radio frequency integrated circuits (RF ICs) for communication devices, and the trend of system-on-chip technology, has pushed the requirements of varactors to the limit. As the frequency of RF applications continues to rise, it is essential that passive devices such as varactors are of optimum quality, making this a critical design issue. Initially describing the physical phenomena that occur in passive devices within standard IC fabrication processes, *Design and Characterization of Integrated Varactors for RF Applications* goes on to: present information on the design of wide band electrical varactor models (up to 5 GHz) which enable the accurate prediction of device performance; propose a specific methodology for the measurement of integrated varactors, covering on-wafer measurement structures, the calibration process, and detailed descriptions of the required equipment; explain de-embedding techniques and also analyse confidence level and uncertainty linked to the test set-up; examine the design of a voltage controlled oscillator (VCO) circuit as a practical example of the employment of methods discussed in the book. Providing the reader with the necessary technical knowledge for dealing with challenging VCO designs, this book is an essential guide for practising RF and microwave engineers working on the design of electronic devices for integrated circuits. It is also a useful reference for postgraduate students and researchers interested in electronic design for RF applications.

Springer Science & Business Media

Guiding readers through the basics of these rapidly emerging networks to more advanced concepts and future expectations, this book examines the most pressing research issues in Mobile Ad hoc Networks (MANETs). Leading researchers, industry professionals, and academics provide an authoritative perspective of the state of the art in MANETs. The book includes surveys of recent publications that investigate key areas of interest such as limited resources and the mobility of mobile nodes. It considers routing, multicast, energy, security, channel assignment, and ensuring quality of service.

Lumped Elements for RF and Microwave Circuits Integrated Inductors and Transformers

Microelectromechanical systems (MEMS) refer to a collection of micro-sensors and actuators, which can react to environmental change under micro-circuit control. The integration of MEMS into traditional Radio Frequency (RF) circuits has resulted in systems with superior performance levels and lower manufacturing costs. The incorporation of MEMS based fabrication technologies into micro and millimeter wave systems offers viable routes to ICs with MEMS actuators, antennas, switches and transmission lines. The resultant systems operate with an increased bandwidth and increased radiation efficiency and have considerable scope for implementation within the expanding area of wireless personal communication devices. This text provides leading edge coverage of this increasingly important area and highlights the overlapping information requirements of the RF and MEMS research and development communities. * Provides an introduction to micromachining techniques and their use in the fabrication of micro switches, capacitors and inductors * Includes coverage of MEMS devices for wireless and Bluetooth enabled systems Essential reading for RF Circuit design practitioners and researchers requiring an introduction to MEMS technologies, as well as practitioners and researchers in MEMS and silicon technology requiring an introduction to RF circuit design.

Wireless Radio-Frequency Standards and System Design: Advanced Techniques Springer Science & Business Media

Due to the unprecedented growth in wireless applications over the past decade, development of low-cost solutions for RF and microwave communication systems has become of great importance. This practical new book is the first comprehensive treatment of lumped elements, which are playing a critical role in the development of the circuits that make these cost-effective systems possible. The books offers you an in-depth understanding of the different types of RF and microwave circuit elements, including inductors, capacitors, resistors, transformers, via holes, airbridges, and crossovers.

Physical Principles of Wireless Communications, Second Edition CRC Press

This work covers the design of CMOS fully integrated low power low phase noise voltage controlled oscillators for telecommunication or datacommunication systems. The need for low power is obvious, as mobile wireless telecommunications are battery operated. As wireless telecommunication systems use oscillators in frequency synthesizers for frequency translation, the selectivity and signal

to noise ratio of receivers and transmitters depend heavily on the low phase noise performance of the implemented oscillators. Datacommunication systems need low jitter, the time-domain equivalent of low phase noise, clocks for data detection and recovery. The power consumption is less critical. The need for multi-band and multi-mode systems pushes the high-integration of telecommunication systems. This is offered by sub-micron CMOS featuring digital flexibility. The recent crisis in telecommunication clearly shows that mobile hand-sets became mass-market high-volume consumer products, where low-cost is of prime importance. This need for low-cost products - livens tremendously research towards CMOS alternatives for the bipolar or BiCMOS solutions in use today.

A System Study for RFID John Wiley & Sons

Learn the fundamentals of integrated communication microsystems Advanced communication microsystems—the latest technology to emerge in the semiconductor sector after microprocessors—require integration of diverse signal processing blocks in a power-efficient and cost-effective manner. Typically, these systems include data acquisition, data processing, telemetry, and power management. The overall development is a synergy among system, circuit, and component-level designs with a strong emphasis on integration. This book is targeted at students, researchers, and industry practitioners in the semiconductor area who require a thorough understanding of integrated communication microsystems from a developer's perspective. The book thoroughly and carefully explores: Fundamental requirements of communication microsystems System design and considerations for wired and wireless communication microsystems Advanced block-level design techniques for communication microsystems Integration of communication systems in a hybrid environment Packaging considerations Power and form factor trade-offs in building integrated microsystems Advanced Integrated Communication Microsystems is an ideal textbook for advanced undergraduate and graduate courses. It also serves as a valuable reference for researchers and practitioners in circuit design for telecommunications and related fields.

Design and Characterization of Integrated Varactors for RF Applications John Wiley & Sons

This book describes methods to design distributed amplifiers useful for performing circuit functions such as duplexing, paraphrase amplification, phase shifting power splitting and power combiner applications. A CMOS bidirectional distributed amplifier is presented that combines for the first time device-level with circuit-level linearization, suppressing the third-order intermodulation distortion. It is implemented in 0.13um RF CMOS technology for use in highly-linear, low-cost UWB Radio-over-Fiber communication systems.

RF MEMS and Their Applications CRC Press

In *Physical Unclonable Functions in Theory and Practice*, the authors present an in-depth overview of various topics concerning PUFs, providing theoretical background and application details. This book concentrates on the practical issues of PUF hardware design, focusing on dedicated microelectronic PUF circuits. Additionally, the authors discuss the whole process of circuit design, layout and chip verification. The book also offers coverage of: Different published approaches focusing on dedicated microelectronic PUF circuits Specification of PUF circuits General design issues Minimizing error rate from the circuit's perspective Transistor modeling issues of Montecarlo mismatch simulation and solutions Examples of PUF circuits including an accurate description of the circuits and testing/measurement results Different error rate reducing pre-selection techniques This monograph gives insight into PUFs in general and provides knowledge in the field of PUF circuit design and implementation. It could be of interest for all circuit designers confronted with PUF design, and also for professionals and students being introduced to the topic.

High-Frequency Magnetic Components CRC Press

This book provides a comprehensive, single-source on resonant switched-capacitor converters. It is written in the style of a handbook, with systematic guidelines, and includes implementation examples. The authors explore integrated hybrid resonant DCDC converters in order to achieve highly compact, energy efficient and cost-effective power management solutions in the growing fields of wearables and internet-of-things applications. They provide an introduction into hybrid converters as a new and promising converter class, which merges capacitive and inductive conversion concepts into one. Coverage ranges from fundamentals to implementation details, including topics such as power stage design, gate drive schemes, different control mechanisms for resonant operation and integrated passives. Introduces a new, multi-ratio resonant converter architecture, which enables lower switching frequencies and better passive component utilization; Discusses circuit block design for high efficiency of the power stage; Explores implementation details and concepts for integrated passives; Derives models, implements and compares to each other different control mechanisms.

Integrated Hybrid Resonant DCDC Converters Springer

Describes a new method of generating a lumped-parameter equivalent-circuit (EC) for on-chip inductors based on fundamental electromagnetic principles and parameter optimization, resulting in accurate analytical expressions for inductor equivalent circuits. Applies nonlinear least squares fitting to numerical data obtained from a very large number of single-time ASITIC (analysis and simulation of inductors and transformers for integrated circuits) runs for a given process. Develops a Matlab interface to process the ASITIC simulation results.

Mobile Web 2.0 Springer Science & Business Media

Design and Modeling of Millimeter-wave CMOS Circuits for Wireless Transceivers describes in detail some of the interesting developments in CMOS millimetre-wave circuit design. This includes the re-emergence of the slow-wave technique used on passive devices, the license-free 60GHz band circuit blocks and a 76GHz voltage-controlled oscillator suitable for vehicular radar applications. All circuit solutions described are suitable for digital CMOS technology. Digital CMOS technology developments driven by Moore's law make it an inevitable solution for low cost and high volume products in the marketplace. Explosion of the consumer wireless applications further makes this subject a hot topic of the day. The book begins with a brief history of millimetre-wave research and how the silicon transistor is born. Originally meant for different purposes, the two technologies converged and found its way into advanced chip designs. The second part of the book describes the most important passive devices used in millimetre-wave CMOS circuits. Part three uses these passive devices and builds circuit blocks for the wireless transceiver. The book completes with a comprehensive list of references for further readings. *Design and Modeling of Millimeter-wave CMOS Circuits for Wireless Transceivers* is useful to show the analogue IC designer the issues involved in making the leap to millimetre-wave circuit designs. The graduate student and researcher can also use it as a starting point to understand the subject or proceed to innovative from the works described herein.

Integrated Passive Component Technology Artech House

An extraordinary combination of material science, manufacturing processes, and innovative thinking spurred the development of SiGe heterojunction devices that offer a wide array of functions, unprecedented levels of performance, and low manufacturing costs. While there are many books on specific aspects of Si heterostructures, the *Silicon Heterostructure Handbook: Materials, Fabrication, Devices, Circuits, and Applications of SiGe and Si Strained-Layer Epitaxy* is the first book to bring all aspects together in a single source. Featuring broad, comprehensive, and in-depth discussion, this handbook distills the current state of the field in areas ranging from materials to fabrication, devices, CAD, circuits, and applications. The editor includes "snapshots" of the industrial state-of-

the-art for devices and circuits, presenting a novel perspective for comparing the present status with future directions in the field. With each chapter contributed by expert authors from leading industrial and research institutions worldwide, the book is unequalled not only in breadth of scope, but also in depth of coverage, timeliness of results, and authority of references. It also includes a foreword by Dr. Bernard S. Meyerson, a pioneer in SiGe technology. Containing nearly 1000 figures along with valuable appendices, the Silicon Heterostructure Handbook authoritatively surveys materials, fabrication, device physics, transistor optimization, optoelectronics components, measurement, compact modeling, circuit design, and device simulation.

Performance Optimization Techniques in Analog, Mixed-Signal, and Radio-Frequency Circuit Design Springer Nature

Based on the fundamentals of electromagnetics, this clear and concise text explains basic and applied principles of transformer and inductor design for power electronic applications. It details both the theory and practice of inductors and transformers employed to filter currents, store electromagnetic energy, provide physical isolation between circuits, and perform stepping up and down of DC and AC voltages. The authors present a broad range of applications from modern power

conversion systems. They provide rigorous design guidelines based on a robust methodology for inductor and transformer design. They offer real design examples, informed by proven and working field examples. Key features include: emphasis on high frequency design, including optimisation of the winding layout and treatment of non-sinusoidal waveforms a chapter on planar magnetic with analytical models and descriptions of the processing technologies analysis of the role of variable inductors, and their applications for power factor correction and solar power unique coverage on the measurements of inductance and transformer capacitance, as well as tests for core losses at high frequency worked examples in MATLAB, end-of-chapter problems, and an accompanying website containing solutions, a full set of instructors' presentations, and copies of all the figures. Covering the basics of the magnetic components of power electronic converters, this book is a comprehensive reference for students and professional engineers dealing with specialised inductor and transformer design. It is especially useful for senior undergraduate and graduate students in electrical engineering and electrical energy systems, and engineers working with power supplies and energy conversion systems who want to update their knowledge on a field that has progressed considerably in recent years.

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