

Kenichi Okada · Shouhei Kousai  
*Editors*

# Digitally-Assisted Analog and RF CMOS Circuit Design for Software-Defined Radio

 Springer

# Digitally Assisted Analog And Rf Cmos Circuit Design For Software Defined Radio

**JS Bruner**



## **Digitally Assisted Analog And Rf Cmos Circuit Design For Software Defined Radio:**

**Digitally-Assisted Analog and RF CMOS Circuit Design for Software-Defined Radio** Kenichi Okada, Shouhei Kousai, 2011-08-26 This book describes the state of the art in RF analog and mixed signal circuit design for Software Defined Radio SDR. It synthesizes for analog RF circuit designers the most important general design approaches to take advantage of the most recent CMOS technology which can integrate millions of transistors as well as several real examples from the most recent research results.

**VLSI Design and Test for Systems Dependability** Shojiro Asai, 2018-07-20 This book discusses the new roles that the VLSI very large scale integration of semiconductor circuits is taking for the safe, secure, and dependable design and operation of electronic systems. The book consists of three parts. Part I as a general introduction to this vital topic describes how electronic systems are designed and tested with particular emphasis on dependability engineering where the simultaneous assessment of the detrimental outcome of failures and cost of their containment is made. This section also describes the related research project Dependable VLSI Systems in which the editor and authors of the book were involved for 8 years. Part II addresses various threats to the dependability of VLSIs as key systems components including time dependent degradations, variations in device characteristics, ionizing radiation, electromagnetic interference, design errors, and tampering, with discussion of technologies to counter those threats. Part III elaborates on the design and test technologies for dependability in such applications as control of robots and vehicles, data processing and storage in a cloud environment, and heterogeneous wireless telecommunications. This book is intended to be used as a reference for engineers who work on the design and testing of VLSI systems with particular attention to dependability. It can be used as a textbook in graduate courses as well. Readers interested in dependable systems from social and industrial economic perspectives will also benefit from the discussions in this book.

**Silicon Photonics III** Lorenzo Pavesi, David J. Lockwood, 2016-01-08 This book is volume III of a series of books on silicon photonics. It reports on the development of fully integrated systems where many different photonics components are integrated together to build complex circuits. This is the demonstration of the full potentiality of silicon photonics. It contains a number of chapters written by engineers and scientists of the main companies, research centers, and universities active in the field. It can be of use for all those persons interested to know the potentialities and the recent applications of silicon photonics both in microelectronics, telecommunication, and consumer electronics market.

**Stochastic Process Variation in Deep-Submicron CMOS** Amir Zjajo, 2013-11-19 One of the most notable features of nanometer scale CMOS technology is the increasing magnitude of variability of the key device parameters affecting performance of integrated circuits. The growth of variability can be attributed to multiple factors including the difficulty of manufacturing control, the emergence of new systematic variation generating mechanisms, and most importantly the increase in atomic scale randomness where device operation must be described as a stochastic process. In addition to wide-sense stationary stochastic device variability and temperature variation

existence of non stationary stochastic electrical noise associated with fundamental processes in integrated circuit devices represents an elementary limit on the performance of electronic circuits In an attempt to address these issues Stochastic Process Variation in Deep Submicron CMOS Circuits and Algorithms offers unique combination of mathematical treatment of random process variation electrical noise and temperature and necessary circuit realizations for on chip monitoring and performance calibration The associated problems are addressed at various abstraction levels i e circuit level architecture level and system level It therefore provides a broad view on the various solutions that have to be used and their possible combination in very effective complementary techniques for both analog mixed signal and digital circuits The feasibility of the described algorithms and built in circuitry has been verified by measurements from the silicon prototypes fabricated in standard 90 nm and 65 nm CMOS technology

**Energy-Efficient Communication Processors** Robert Fasthuber, Franky Catthoor, Praveen Raghavan, Frederik Naessens, 2013-05-29 This book describes a new design approach for energy efficient Domain Specific Instruction set Processor DSIP architectures for the wireless baseband domain The innovative techniques presented enable co design of algorithms architectures and technology for efficient implementation of the most advanced technologies To demonstrate the feasibility of the author s design approach case studies are included for crucial functionality of advanced wireless systems with increased computational performance flexibility and reusability Designers using this approach will benefit from reduced development product costs and greater scalability to future process technology nodes

**Brain-Machine Interface** Amir Zjajo, 2016-03-30 This book provides a complete overview of significant design challenges in respect to circuit miniaturization and power reduction of the neural recording system along with circuit topologies architecture trends and post silicon circuit optimization algorithms The introduced novel circuits for signal conditioning quantization and classification as well as system configurations focus on optimized power per area performance from the spatial resolution i e number of channels feasible wireless data bandwidth and information quality to the delivered power of implantable system

CMOSET 2014 Vol. 2: Circuits and Systems Track CMOS Emerging Technologies Research, 2014-06-19 Presentation slides from the Plenary track at the 2014 CMOS Emerging Technologies Research conference in Grenoble France

Charge-based CMOS Digital RF Transmitters Pedro Emiliano Paro Filho, Jan Craninckx, Piet Wambacq, Mark Ingels, 2016-09-27 This book introduces a completely novel architecture that can relax the trade off existing today between noise power and area consumption in a very suitable solution for advanced wireless communication systems Through the combination of charge domain operation with incremental signaling this architecture gives the best of both worlds providing the reduced area and high portability of digital intensive architectures with an improved out of band noise performance given by intrinsic noise filtering capabilities Readers will be enabled to design higher performance radio front ends that consume less power and area especially with respect to the transmitter and power amplifier designs considered by many the battery killers on most mobile devices

**Multi-Mode / Multi-Band RF**

**Transceivers for Wireless Communications** Gernot Hueber, Robert Bogdan Staszewski, 2011-02-22 Summarizes cutting edge physical layer technologies for multi mode wireless RF transceivers Includes original contributions from distinguished researchers and professionals Covers cutting edge physical layer technologies for multi mode wireless RF transceivers Contributors are all leading researchers and professionals in this field *Digital Front-End in Wireless Communications and Broadcasting* Fa-Long Luo, 2011-09-29 Covering everything from signal processing algorithms to integrated circuit design this complete guide to digital front end is invaluable for professional engineers and researchers in the fields of signal processing wireless communication and circuit design Showing how theory is translated into practical technology it covers all the relevant standards and gives readers the ideal design methodology to manage a rapidly increasing range of applications Step by step information for designing practical systems is provided with a systematic presentation of theory principles algorithms standards and implementation Design trade offs are also included as are practical implementation examples from real world systems A broad range of topics is covered including digital pre distortion DPD digital up conversion DUC digital down conversion DDC and DC offset calibration Other important areas discussed are peak to average power ratio PAPR reduction crest factor reduction CFR pulse shaping image rejection digital mixing delay gain imbalance compensation error correction noise shaping numerical controlled oscillator NCO and various diversity methods **Continuous-Time**

**Low-Pass Filters for Integrated Wideband Radio Receivers** Ville Saari, Jussi Rynänen, Saska Lindfors, 2012-03-15 This book presents a new filter design approach and concentrates on the circuit techniques that can be utilized when designing continuous time low pass filters in modern ultra deep submicron CMOS technologies for integrated wideband radio receivers Coverage includes system level issues related to the design and implementation of a complete single chip radio receiver and related to the design and implementation of a filter circuit as a part of a complete single chip radio receiver Presents a new filter design approach emphasizing low voltage circuit solutions that can be implemented in modern ultra deep submicron CMOS technologies Includes filter circuit implementations designed as a part of a single chip radio receiver in modern 1.2V 0.13μm and 65nm CMOS Describes design and implementation of a continuous time low pass filter for a multicarrier WCDMA base station Emphasizes system level considerations throughout **Cognitive Radio Oriented Wireless Networks** Ingrid Moerman, Johann Marquez-Barja, Adnan Shahid, Wei Liu, Spilios Giannoulis, Xianjun Jiao, 2019-01-08 This book constitutes the refereed proceedings of the 13th EAI International Conference on Cognitive Radio Oriented Wireless Networks CROWNCOM 2018 held in Ghent Belgium in September 2018 The 20 revised full papers were selected from 26 submissions The papers are organized thematically in tracks Experimental Licensed Shared Access and Dynamic Spectrum Access and PHX and Sensing

Parametric Analog Signal Amplification Applied to Nanoscale CMOS Technologies João P. Oliveira, João Goes, 2012-01-07 This book is dedicated to the analysis of parametric amplification with special emphasis on the MOS discrete time implementation This implementation is demonstrated by the presentation of several circuits where the MOS parametric

amplifier cell is used small gain amplifier comparator with embedded pre amplification discrete time mixer IIR Filter and analog to digital converter ADC Experimental results are shown to validate the overall design technique **Baseband Analog Circuits for Software Defined Radio** Vito Giannini, Jan Craninckx, Andrea Baschiroto, 2008-01-08 By the end of this decade a 4G wireless terminal will be available that provides high quality multimedia personalized services and ubiquitous multi standard broadband connectivity with a reasonable power consumption In this context a multi band transceiver is needed that provides a high level of programmability while keeping low design complexity and costs Software Defined Radio SDR is the most promising technology to implement such a terminal as it enables multi mode reception by tuning to any frequency band by selecting any channel bandwidth and by detecting any modulation Baseband Analog Circuits for Software Defined Radio aims to describe the transition towards a Software Radio from the analog design perspective As the original idea of a full digital Software Radio is far from the state of art an analog front end is still needed to achieve a feasible implementation Most of the existent front end architectures are explored from the flexibility point of view A complete overview of the actual state of art for reconfigurable transceivers is given in detail focusing on the challenges imposed by flexibility in analog design As far as the design of adaptive analog circuits is concerned specifications like bandwidth gain noise resolution and linearity should be programmable The development of circuit topologies and architectures that can be easily reconfigured while providing a near optimal power performance trade offs is a key challenge In this book we tackle this challenge mainly for baseband analog circuits i e amplifiers and filters proposing efficient solutions that provide a high level of programmability Measurements results validate the design strategies *Electrical & Electronics Abstracts* ,1997

**Digitally-Assisted Analog and Analog-Assisted Digital IC Design** Xicheng Jiang, 2015-07-23 Achieve enhanced performance with this guide to cutting edge techniques for digitally assisted analog and analog assisted digital integrated circuit design Discover how architecture and circuit innovations can deliver improved performance in terms of speed density power and cost Learn about practical design considerations for high performance scaled CMOS processes FinFet devices and architectures and the implications of FD SOI technology Get up to speed with established circuit techniques that take advantage of scaled CMOS process technology in analog digital RF and SoC designs including digitally assisted techniques for data converters DSP enabled frequency synthesizers and digital controllers for switching power converters With detailed descriptions explanations and practical advice from leading industry experts this is an ideal resource for practicing engineers researchers and graduate students working in circuit design Nanometer CMOS Sigma-Delta Modulators for Software Defined Radio Alonso Morgado, Rocío del Río, José M. de la Rosa, 2011-09-15 This book presents innovative solutions for the implementation of Sigma Delta Modulation SDM based Analog to Digital Conversion ADC required for the next generation of wireless hand held terminals These devices will be based on the so called multi standard transceiver chipsets integrated in nanometer CMOS technologies One of the most challenging and critical parts in such transceivers is the analog digital

interface because of the assorted signal bandwidths and dynamic ranges that can be required to handle the A/D conversion for several operation modes. This book describes new adaptive and reconfigurable SDM ADC topologies, circuit strategies and synthesis methods specially suited for multi-standard wireless telecom systems and future Software defined radios (SDRs) integrated in nanoscale CMOS. It is a practical book going from basic concepts to the frontiers of SDM architectures and circuit implementations which are explained in a didactical and systematic way. It gives a comprehensive overview of the state of the art, performance challenges and practical solutions providing the necessary insight to implement successful design through an efficient design and synthesis methodology. Readers will learn a number of practical skills from system level design to experimental measurements and testing.

#### **Device Modeling for Analog and RF CMOS Circuit Design**

Trond Ytterdal, Yuhua Cheng, Tor A. Fjeldly, 2003-08-01. Bridges the gap between device modelling and analog circuit design. Includes dedicated software enabling actual circuit design. Covers the three significant models: BSIM3, Model 9 and EKV. Presents practical guidance on device development and circuit implementation. The authors offer a combination of extensive academic and industrial experience.

#### **Toward 5G Software Defined Radio Receiver Front-Ends**

Silvian Spiridon, 2016-06-21. This book introduces a new intuitive design methodology for the optimal design path for next generation software defined radio front ends (SDRXs). The methodology described empowers designers to attack the multi-standard environment in a parallel way rather than serially, providing a critical tool for any design methodology targeting 5G circuits and systems. Throughout the book, the SDRX design follows the key wireless standards of the moment, i.e. GSM, WCDMA, LTE, Bluetooth, WLAN, since a receiver compatible with these standards is the most likely candidate for the first design iteration in a 5G deployment. The author explains the fundamental choice the designer has to make regarding the optimal channel selection: how much of the blockers/interferers will be filtered in the analog domain and how much will remain to be filtered in the digital domain. The system level analysis the author describes entails the direct sampling architecture; this is treated as a particular case of mixer based direct conversion architecture. This allows readers to give a power consumption budget to determine how much filtering is required on the receive path by considering the ADC performance characteristics and the corresponding blocker diagram.

#### **Cognitive Radio Receiver Front-Ends**

Bodhisatwa Sadhu, Ramesh Harjani, 2013-10-11. This book focuses on the architecture and circuit design for cognitive radio receiver front ends. The authors first provide a holistic explanation of RF circuits for cognitive radio systems. This is followed by an in-depth exploration of existing techniques that can be utilized by circuit designers. Coverage also includes novel circuit techniques and architectures that can be invaluable for designers for cognitive radio systems.

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