

ACSP - Analog Circuits And Signal Processing

Mahdi Kashmiri
Kofi A. A. Makinwa

Electrothermal Frequency References in Standard CMOS

 Springer

Electrothermal Frequency References In Standard Cmos Analog Circuits And Signal Processing

**Seng-Pan U, Rui Paulo Martins, José
Epifânio da Franca**



Electrothermal Frequency References In Standard Cmos Analog Circuits And Signal Processing:

Electrothermal Frequency References in Standard CMOS S. Mahdi Kashmiri, Kofi A. A. Makinwa, 2013-04-02 This book describes an alternative method of realizing accurate on chip frequency references in standard CMOS processes This method exploits the thermal diffusivity of silicon i e the rate at which heat diffuses through a silicon substrate This is the first book describing the design of such electrothermal frequency references It includes the necessary theory supported by practical realizations that achieve inaccuracies as low as 0.1% and thus demonstrate the feasibility of this approach The book also includes several circuit and system level solutions to the precision circuit design challenges encountered during the design of such frequency references

Temperature- and Supply Voltage-Independent Time References for Wireless Sensor Networks Valentijn De Smedt, Georges Gielen, Wim Dehaene, 2014-11-07 This book investigates the possible circuit solutions to overcome the temperature and supply voltage sensitivity of fully integrated time references for ultra low power communication in wireless sensor networks The authors provide an elaborate theoretical introduction and literature study to enable full understanding of the design challenges and shortcomings of current oscillator implementations Furthermore a closer look to the short term as well as the long term frequency stability of integrated oscillators is taken Next a design strategy is developed and applied to 5 different oscillator topologies and 1 sensor interface All 6 implementations are subject to an elaborate study of frequency stability phase noise and power consumption In the final chapter all blocks are compared to the state of the art

Symbolic Analysis for Automated Design of Analog Integrated Circuits Georges Gielen, Willy Sansen, 1991-05-31 It is a great honor to provide a few words of introduction for Dr Georges Gielen s and Prof Willy Sansen s book Symbolic analysis for automated design of analog integrated circuits The symbolic analysis method presented in this book represents a significant step forward in the area of analog circuit design As demonstrated in this book symbolic analysis opens up new possibilities for the development of computer aided design CAD tools that can analyze an analog circuit topology and automatically size the components for a given set of specifications Symbolic analysis even has the potential to improve the training of young analog circuit designers and to guide more experienced designers through second order phenomena such as distortion This book can also serve as an excellent reference for researchers in the analog circuit design area and creators of CAD tools as it provides a comprehensive overview and comparison of various approaches for analog circuit design automation and an extensive bibliography The world is essentially analog in nature hence most electronic systems involve both analog and digital circuitry As the number of transistors that can be integrated on a single integrated circuit IC substrate steadily increases over time an ever increasing number of systems will be implemented with one or a few very complex ICs because of their lower production costs

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Voltage-to-Frequency Converters Cristina Azcona Murillo,Belén Calvo Lopez,Santiago Celma Pueyo,2013-03-12 This book develops voltage to frequency converter VFC solutions integrated in standard CMOS technology to be used as a part of a microcontroller based multisensor interface in the environment of portable applications particularly within a WSN node Coverage includes the total design flow of monolithic VFCs according to the target application as well as the analysis design and implementation of the main VFC blocks revealing the main challenges and solutions encountered during the design of such high performance cells Four complete VFCs each temperature compensated are fully designed and evaluated a programmable VFC that includes an offset frequency and a sleep mode enable terminal a low power rail to rail VFC and two rail to rail differential VFCs

Low-Voltage CMOS Log Companding Analog Design Francisco Serra-Graells,Adoración Rueda,José L. Huertas,2006-04-18 Low Voltage CMOS Log Companding Analog Design presents in detail state of the art analog circuit techniques for the very low voltage and low power design of systems on chip in CMOS technologies The proposed strategy is mainly based on two bases the Instantaneous Log Companding Theory and the MOSFET operating in the subthreshold region The former allows inner compression of the voltage dynamic range for very low voltage operation while the latter is compatible with CMOS technologies and suitable for low power circuits The required background on the specific modeling of the MOS transistor for Companding is supplied at the beginning Following this general approach a complete set of CMOS basic building blocks is proposed and analyzed for a wide variety of analog signal processing In particular the covered areas include amplification and AGC arbitrary filtering PTAT generation and pulse duration modulation PDM For each topic several case studies are considered to illustrate the design methodology Also integrated examples in 1.2um and 0.35um CMOS technologies are reported to verify the good agreement between design equations and experimental data The resulting analog circuit topologies exhibit very low voltage i e 1V and low power few tenths of uA capabilities Apart from these specific design examples a real industrial application in the field of hearing aids is also presented as the main demonstrator of all the proposed basic building blocks This system on chip exhibits true 1V operation high flexibility through digital programmability and very low power consumption about 300uA including the Class D amplifier As a result the reported ASIC can meet the specifications of a complete family of common hearing aid models In conclusion this book is addressed to both industry ASIC designers who can apply its contents to the synthesis of very low power systems on chip in standard CMOS technologies as well as to the teachers of modern circuit design in electronic engineering

Radiation Hardened CMOS Integrated Circuits for Time-Based Signal Processing Jeffrey Prinzie,Michiel Steyaert,Paul Leroux,2018-04-26 This book presents

state of the art techniques for radiation hardened high resolution Time to Digital converters and low noise frequency synthesizers Throughout the book advanced degradation mechanisms and error sources are discussed and several ways to prevent such errors are presented An overview of the prerequisite physics of nuclear interactions is given that has been compiled in an easy to understand chapter The book is structured in a way that different hardening techniques and solutions are supported by theory and experimental data with their various tradeoffs Based on leading edge research conducted in collaboration between KU Leuven and CERN the European Center for Nuclear Research Describes in detail advanced techniques to harden circuits against ionizing radiation Provides a practical way to learn and understand radiation effects in time based circuits Includes an introduction to the underlying physics circuit design and advanced techniques accompanied with experimental data

Design of Very High-Frequency Multirate Switched-Capacitor Circuits Seng-Pan U, Rui Paulo Martins, José Epifânio da Franca, 2006 Design of Very High Frequency Multirate Switched Capacitor Circuits presents the theory and the corresponding CMOS implementation of the novel multirate sampled data analog interpolation technique which has its great potential on very high frequency analog front end filtering due to its inherent dual advantage of reducing the speed of data converters and DSP core together with the specification relaxation of the post continuous time filtering This technique completely eliminates the traditional phenomenon of sampled and hold frequency shaping at the lower input sampling rate Also in order to tackle physical IC imperfections at very high frequency the state of the art circuit design and layout techniques for high speed Switched Capacitor SC circuits are comprehensively discussed Optimum circuit architecture tradeoff analysis Simple speed and power trade off analysis of active elements High order filtering response accuracy with respect to capacitor ratio mismatches Time interleaved effect with respect to gain and offset mismatch Time interleaved effect with respect to timing skew and random jitter with non uniformly holding Stage noise analysis and allocation scheme Substrate and supply noise reduction Gain and offset compensation techniques High bandwidth low power amplifier design and layout Very low timing skew multiphase generation Two tailor made optimum design examples in CMOS are presented The first one achieves a 3 stage 8 fold SC interpolating filter with 5.5MHz bandwidth and 108MHz output sampling rate for a NTSC PAL CCIR 601 digital video at 3 V Another is a 15 tap 57MHz SC FIR bandpass interpolating filter with 4 fold sampling rate increase to 320MHz and the first time embedded frequency band up translation for DDFS system at 2.5V The corresponding chip prototype achieves so far the highest operating frequency highest filter order and highest center frequency with highest dynamic range under the lowest supply voltage when compared to the previously reported high frequency SC filters in CMOS

EMC of Analog Integrated Circuits Jean-Michel Redouté, Michiel Steyaert, 2009-10-10 Environmental electromagnetic pollution has drastically increased over the last decades The omnipresence of communication systems various electronic appliances and the use of ever increasing frequencies all contribute to a noisy electromagnetic environment which acts detrimentally on sensitive electronic equipment Integrated circuits must be able to operate

satisfactorily while cohabiting harmoniously in the same appliance and not generate intolerable levels of electromagnetic emission while maintaining a sound immunity to potential electromagnetic disturbances analog integrated circuits are in particular more easily disturbed than their digital counterparts since they don't have the benefit of dealing with predefined levels ensuring an innate immunity to disturbances The objective of the research domain presented in EMC of Analog Integrated Circuits is to improve the electromagnetic immunity of considered analog integrated circuits so that they start to fail at relevantly higher conduction levels than before *CMOS Analog Circuit Design* Phillip E. Allen, Douglas R. Holberg, 2011 A textbook for 4th year undergraduate first year graduate electrical engineering students

Integrated Video-Frequency Continuous-Time Filters Scott D. Willingham, Kenneth W. Martin, 2012-12-06 Advances in the state of the art mean the signal processing ICs of ever increasing complexity are being introduced While the typical portion of a large IC devoted to analog circuits has diminished the performance of those surviving analog signal processing circuits remains vital and their design challenging Moreover the emerging high definition TV technology has created a new area for IC development one with formidable signal processing requirements The antialiasing filters needed for one proposed HDTV decoder motivated the research documented in this book Sharply selective filters place tight constraints on the permitted excess phase shifts of their constituent circuits Combined with stringent requirements for low distortion at video frequencies these constraints challenge the IC filter designer *Integrated Video Frequency Continuous Time Filters High Performance Realizations in BiCMOS* deals with what is arguably the mainstay of analog signal processing circuits Prominent applications in computer disk drive read channels video receivers rf circuits and antialiasing and reconstruction in data converters testifies to their importance Moreover they are excellent benchmarks for more general analog signal processors Bipolar and MOSFET transistors freely combined at the lowest circuit levels provide the designer with an opportunity to develop potent variations on the standard idioms The book considers the general principles of BiCMOS circuit design through to a demanding design problem This case study approach allows a concrete discussion of the justification for and practical trade offs of each design decision Audience A reference work for experienced IC designers and a text for advanced IC design students *Fundamentals of High Frequency CMOS Analog Integrated Circuits* Duran Leblebici, Yusuf Leblebici, 2021-03-10 This textbook is ideal for senior undergraduate and graduate courses in RF CMOS circuits RF circuit design and high frequency analog circuit design It is aimed at electronics engineering students and IC design engineers in the field wishing to gain a deeper understanding of circuit fundamentals and to go beyond the widely used automated design procedures The authors employ a design centric approach in order to bridge the gap between fundamental analog electronic circuits textbooks and more advanced RF IC design texts The structure and operation of the building blocks of high frequency ICs are introduced in a systematic manner with an emphasis on transistor level operation the influence of device characteristics and parasitic effects and input output behavior in the time and frequency domains This second edition has been revised

extensively to expand some of the key topics to clarify the explanations and to provide extensive design examples and problems New material has been added for basic coverage of core topics such as wide band LNAs noise feedback concept and noise cancellation inductive compensated band widening techniques for flat gain or flat delay characteristics and basic communication system concepts that exploit the convergence and co existence of Analog and Digital building blocks in RF systems A new chapter Chapter 5 has been added on Noise and Linearity addressing key topics in a comprehensive manner All of the other chapters have also been revised and largely re written with the addition of numerous solved design examples and exercise problems

CMOS Analog Integrated Circuits Tertulien Ndjountche, 2019-12-17 High speed power efficient analog integrated circuits can be used as standalone devices or to interface modern digital signal processors and micro controllers in various applications including multimedia communication instrumentation and control systems New architectures and low device geometry of complementary metaloxidesemiconductor CMOS technologies have accelerated the movement toward system on a chip design which merges analog circuits with digital and radio frequency components

High-Linearity CMOS RF Front-End Circuits Yongwang Ding, Ramesh Harjani, 2004-11-12 This book focuses on high performance radio frequency integrated circuits RF IC design in CMOS 1 Development of radio frequency ICs Wireless communications has been advancing rapidly in the past two decades Many high performance systems have been developed such as cellular systems AMPS GSM TDMA CDMA W CDMA etc GPS system global positioning system and WLAN wireless local area network systems The rapid growth of VLSI technology in both digital circuits and analog circuits provides benefits for wireless communication systems Twenty years ago not many people could imagine millions of transistors in a single chip or a complete radio for size of a penny Now not only complete radios have been put in a single chip but also more and more functions have been realized by a single chip and at a much lower price A radio transmits and receives electro magnetic signals through the air The signals are usually transmitted on high frequency carriers For example a typical voice signal requires only 30 Kilo hertz bandwidth When it is transmitted by a FM radio station it is often carried by a frequency in the range of tens of megahertz to hundreds of megahertz Usually a radio is categorized by its carrier frequency such as 900 MHz radio or 5 GHz radio In general the higher the carrier frequency the better the directivity but the more difficult the radio design

Multi-Gigahertz Nyquist Analog-to-Digital Converters Athanasios T. Ramkaj, Marcel J.M. Pelgrom, Michiel S. J. Steyaert, Filip Tavernier, 2023-01-12 This book proposes innovative circuit architecture and system solutions in deep scaled CMOS and FinFET technologies which address the challenges in maximizing the accuracy speed power of multi GHz sample rate and bandwidth Analog to Digital Converters ADC s A new holistic approach is introduced that first identifies the major error sources of a converter building blocks and quantitatively analyzes their impact on the overall performance establishing the fundamental circuit imposed accuracy speed power limits The analysis extends to the architecture level by introducing a mathematical framework to estimate and compare the accuracy speed power limits of several ADC architectures and variants

To gain system level insight time interleaving is covered in detail and a framework is also introduced to compare key metrics of interleaver architectures quantitatively The impact of technology is also considered by adding process effects from several deep scaled CMOS technologies The validity of the introduced analytical approach and the feasibility of the proposed concepts are demonstrated by four silicon prototype Integrated Circuits IC s realized in ultra deep scaled CMOS and FinFET technologies Introduces a new holistic approach for the analysis and design of high performance ADCs in deep scaled CMOS technologies from theoretical concepts to silicon bring up and verification Describes novel methods and techniques to push the accuracy speed power boundaries of multi GHz ADCs analyzing core and peripheral circuits trade offs across the entire ADC chain Supports the introduced analysis and design concepts by four state of the art silicon prototype ICs implemented in 28nm bulk CMOS and 16nm FinFET technologies Provides a useful reference and a valuable tool for beginners as well as experienced ADC design engineers

CMOS Analog and Radio-frequency Integrated-circuit Design Employing Low-power Switched-capacitor Techniques Yu Song,2011 We propose and verify the design of low power high performance CMOS Switched Capacitor SC circuits for analog and radio frequency RF applications In low cost CMOS semiconductor processes SC circuits play a crucial role in implementing accurate analog signal processing functions However conventional SC circuits are usually power demanding due to the accurate signal settling requirement On the other hand the shrinking of amplifier gain and voltage swing driven by technology scaling makes SC circuit design in deep sub micron CMOS processes more and more challenging To counteract these problems low power SC circuit techniques suitable for deep sub micron CMOS processes are investigated in this work In the first illustrative circuit example a 2.5 GHz Phase Locked Loop PLL employing a new low power SC loop filter is proposed designed and verified in a 180nm CMOS technology By employing the proposed SC loop filter the advantages of low reference spur and small on chip capacitor size are achieved While the loop filter consumes a very low power 1 f noise introduced by the inverter amplifier is also suppressed The second circuit example is an audio band highly linear low power multi bit Delta Sigma modulator with a SC nonlinearity suppressed feedback DAC verified in a 130nm CMOS technology By employing this proposed scheme problems with conventional methods to realize multi bit feedback DACs are circumvented The power consumption of the proposed method can be maintained low A promising approach to implement practical multi bit Delta Sigma analog to digital converters ADCs is demonstrated Page iv

Analog circuits and signal processing. Heidelberg , CMOS Analog Design Using All-Region MOSFET Modeling Márcio Cherem Schneider,Carlos Galup-Montoro,2010-01-28 The essentials of analog circuit design with a unique all region MOSFET modeling approach

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