RESEARCH PERSPECTIVES ON DYNAMIC TRANSLINEAR AND LOG-DOMAIN CIRCUITS

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Research Perspectives On Dynamic Translinear And Log Domain Circuits

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Research Perspectives On Dynamic Translinear And Log Domain Circuits:

   Research Perspectives on Dynamic Translinear and Log-Domain Circuits Wouter A. Serdijn,Jan Mulder,2013-06-29 The area of analog integrated circuits is facing some serious challenges due to the ongoing trends towards low supply voltages low power consumption and high frequency operation The situation is becoming even more complicated by the fact that many transfer functions have to be tunable or controllable A promising approach to facing these challenges is given by the class of dynamic translinear circuits which are as a consequence receiving increasing interest Several different names are used in literature log domain exponential state space current mode companding instantaneous companding tanh domain sinh domain polynomial state space square root domain and translinear filters In fact all these groups are overlapping subclasses of the overall class of dynamic translinear circuits Research Perspectives on Dynamic Translinear and Log Domain Circuits is a compilation of research findings in this growing field It comprises ten contributions coming from recognized dynamic translinear researchers in Europe and North America Research Perspectives on Dynamic Translinear and Log Domain Circuits is an edited volume of original research   *Trade-Offs in Analog Circuit Design* Chris Toumazou,George S. Moschytz,Barrie Gilbert,2007-05-08 As the frequency of communication systems increases and the dimensions of transistors are reduced more and more stringent performance requirements are placed on analog circuits This is a trend that is bound to continue for the foreseeable future and while it does understanding performance trade offs will constitute a vital part of the analog design process It is the insight and intuition obtained from a fundamental understanding of performance conflicts and trade offs that ultimately provides the designer with the basic tools necessary for effective and creative analog design Trade offs in Analog Circuit Design which is devoted to the understanding of trade offs in analog design is quite unique in that it draws together fundamental material from and identifies interrelationships within a number of key analog circuits The book covers ten subject areas Design methodology Technology General Performance Filters Switched Circuits Oscillators Data Converters Transceivers Neural Processing and Analog CAD Within these subject areas it deals with a wide diversity of trade offs ranging from frequency dynamic range and power gain bandwidth speed dynamic range and phase noise to tradeoffs in design for manufacture and IC layout The book has by far transcended its original scope and has become both a designer s companion as well as a graduate textbook An important feature of this book is that it promotes an intuitive approach to understanding analog circuits by explaining fundamental relationships and in many cases providing practical illustrative examples to demonstrate the inherent basic interrelationships and trade offs Trade offs in Analog Circuit Design draws together 34 contributions from some of the world s most eminent analog circuits and systems designers to provide for the first time a comprehensive text devoted to a very important and timely approach to analog circuit design   *Switched-Current Signal Processing and A/D Conversion Circuits* Bengt E. Jonsson,2013-04-18 Switched Current Signal Processing and A D Conversion Circuits Design and Implementation describes the design and implementation of

switched current SI circuits with emphasis on signal processing and data conversion applications The work includes theoretical analysis high level and circuit level simulation results as well as measurement results from a few of the author s circuit implementations An extensive overview of the SI field of research is also given The book contains an extensive overview of the switched current field of research and can therefore be used as a quick reference to the field The description of each design example has been organized to describe the entire design flow from system level design and simulation to circuit simulation layout and measurement as accurately as possible Thus it is possible to follow each step in the design process Switched Current Signal Processing and A D Conversion Circuits Design and Implementation is an invaluable reference for researchers and circuit designers working with one chip mixed signal system solutions and low voltage analog CMOS design It will also be appreciated by anyone requiring a quick overview of what has been done in the SI field

Analog IC Design Techniques for Nanopower Biomedical Signal Processing Chutham Sawigun,Wouter A. Serdijn,2022-09-01 As the requirements for low power consumption and very small physical dimensions in portable wearable and implantable medical devices are calling for integrated circuit design techniques using MOSFETs operating in the subthreshold regime this book first revisits some well known circuit techniques that use CMOS devices biased in subthreshold in order to establish nanopower integrated circuit designs Based on the these findings this book shows the development of a class AB current mode sample and hold circuit with an order of magnitude improvement in its figure of merit compared to other state of the art designs Also the concepts and design procedures of 1 single branch filters 2 follower integrator based lowpass filters and 3 modular transconductance reduction techniques for very low frequency filters are presented Finally to serve the requirement of a very large signal swing in an energy based action potential detector a nanopower class AB current mode analog multiplier is designed to handle input current amplitudes of more than 10 times the bias current of the multiplier circuit The invented filter circuits have been fabricated in a standard 0 18 CMOS process in order to verify our circuit concepts and design procedures Their experimental results are reported **The Piezojunction Effect in Silicon Integrated Circuits and Sensors** Fabiano Fruett,Gerard C.M. Meijer,2006-04-18 Mechanical stress affects the magnitude of base emitter voltages of forward biased bipolar transistors This phenomenon is called the piezojunction effect The piezojunction effect is the main cause of inaccuracy and drift in integrated temperature sensors and bandgap voltage references The aim of The Piezojunction Effect in Silicon Integrated Circuits and Sensors is twofold Firstly to describe techniques that can reduce the mechanical stress induced inaccuracy and long term instability Secondly to show that the piezojunction effect can be applied for new types of mechanical sensor structures During IC fabrication and packaging thermo mechanical stress is induced when the packaged chips cool down to the temperature of application The piezojunction effect is caused by a stress induced change in the conductivity of the minority charge carriers while the piezoresistive effect is caused by a similar effect for the majority charge carriers To characterise the anisotropic

piezojunction effect the authors performed systematic investigations over wide ranges of mechanical stress and temperature The experiments have been performed for various crystal and stress orientations The experimental results have been used to extract the first and second order piezojunction FOPJ and SOPJ coefficients for bipolar transistors It is shown how the knowledge of the piezojunction and piezoresistive coefficients can used to minimize the undesirable mechanical stress effects on the electrical characteristics of transistors and resistors respectively Devices with lower mechanical stress sensitivity can be found by comparing their piezo coefficients The layout of the device can also be optimized to reduce the mechanical stress sensitivity As a next step it is shown how the knowledge of the piezo effects on device level can be used to predict and to reduce their negative influence on circuit level This is demonstrated for a number of important basic circuits including translinear circuits temperature transducers and bandgap references Finally it is shown how the piezojunction effect can be used to fabricate stress sensing elements It appears that in comparison with resistive stress sensing elements the piezojunction sensors have the advantage of a smaller size and very low power dissipation   Model Engineering in Mixed-Signal Circuit Design Sorin Alexander Huss,2006-04-18 For the first time this up to date text combines the main issues of the hardware description language VHDL AMS aimed at model representation of mixed signal circuits and systems characterization methods and tools for the extraction of model parameters and modelling methodologies for accurate high level behavioural models   **Architectures for RF Frequency Synthesizers** Cicero S. Vaucher,2006-04-18 This text describes a conceptual framework for analyzing the performance of PLL frequency synthesizers and presents optimization procedures for the different performance aspects It contains basic information and in depth knowledge widely illustrated with practical design examples used in industrial products   **CMOS Current Amplifiers** Kimmo Koli,Kari A.I. Halonen,2006-04-18 CMOS Current Amplifiers Speed versus Nonlinearity is intended as a current amplifier cookbook containing an extensive review of different current amplifier topologies realisable with modern CMOS integration technologies The seldom discussed issue of high frequency distortion performance is derived for all reviewed amplifier topologies using as simple and intuitive mathematical methods as possible The topologies discussed are also useful as building blocks for high performance voltage mode amplifiers So the reader can apply the discussed techniques to both voltage and current mode analogue integrated circuit design This book contains application examples with experimental results in three different fields instrumentation amplifiers continuous time analogue filters and logarithmic amplifiers

   Direct Conversion Receivers in Wide-Band Systems Aarno Pärssinen,2006-04-18 This book is based on my doctoral thesis at the Helsinki University of Technology Several different projects during five years guided me from the basics of the RF IC design to the implementations of highly integrated radio receiver chips Sharing time and effort between IC and system issues is not always straightforward I have been lucky to follow both topics and share experiences with diligent and enthusiastic people having different specialities As a result this book will cover a wide range of different topics needed in the design of

highly integrated radio receivers Experiences from the first receiver prototypes for the third generation cellular systems form the basis of this book Most of the issues are directly related to the early proposals of European and Japanese standardization organizations For example the chip rate was originally set to 4 096 Mcps in a wide band CDMA channel I have kept that number in the book in most of the examples although it has been later changed to 3 84 Mcps I hope that the readers will accept that and the possible other incompabilities to the latest specifications At least in the research phase the changes even in the most essential requirements are definitely not a rare incident and IC designers should be able to react and modify their designs as soon as they can **Data Converters for Wireless Standards** Chunlei Shi,Ismail Mohamed Mostafa,2006-04-18 This text presents the design of data converters for emerging standards and introduces the underlying circuit design principles It is an excellent reference for IC and mixed signal designers design managers and project leaders in industry particularly those in the wireless semiconductor industry **Multi-Standard CMOS Wireless Receivers: Analysis and Design** Xiaopeng Li,Mohammed Ismail,2005-12-19 This is the first book on the subject of multi standard wireless receivers It covers both the analysis and design aspects of CMOS radio receivers with primary focus on receivers for mobile terminals The subject of multi standard data converter design for base stations is also covered **Automated Calibration of Modulated Frequency Synthesizers** Dan McMahill,2006-04-18 In recent years there has been considerable interest in highly integrated low power portable wireless devices This monograph focuses on the problem of low power GFSK GMSK modulation and presents an architectural approach for improved performance Including several valuable tools for the practicing engineer **Continuous-Time Sigma-Delta Modulation for A/D Conversion in Radio Receivers** Lucien Breems,Johan Huijsing,2006-04-18 This text describes the design and theory of continuous time sigma delta modulators for analogue to digital conversion in radio receivers The book s main focus is on dynamic range linearity and power efficiency aspects of sigma delta modulators which are very important requirements for use in battery operated receivers Direct Digital Synthesizers Jouko Vankka,Kari A.I. Halonen,2013-04-17 A major advantage of a direct digital synthesizer DDS is that its output frequency phase and amplitude can be precisely and rapidly manipulated under digital processor control Other inherent DDS attributes include the ability to tune with extremely fine frequency and phase resolution and to rapidly hop between frequencies These combined characteristics have made the technology popular in military radar and communications systems In fact DDS technology was previously applied almost exclusively to high end and military applications it was costly power hungry difficult to implement and required a discrete high speed D A converter Due to improved integrated circuit IC technologies they now present a viable alternative to analog based phase locked loop PLL technology for generating agile analog output frequency in consumer synthesizer applications It is easy to include different modulation capabilities in the DDS by using digital signal processing DSP methods because the signal is in digital form By programming the DDS adaptive channel bandwidths modulation formats frequency hopping and data rates are easily

achieved The flexibility of the DDS makes it ideal for signal generator for software radio The digital circuits used to implement signal processing functions do not suffer the effects of thermal drift aging and component variations associated with their analog counterparts The implementation of digital functional blocks makes it possible to achieve a high degree of system integration Recent advances in IC fabrication technology particularly CMOS coupled with advanced DSP algorithms and architectures are providing possible single chip DDS solutions to complex communication and signal processing subsystems as modulators demodulators local oscillators programmable clock generators and chirp generators The DDS addresses a variety of applications including cable modems measurement equipments arbitrary waveform generators cellular base stations and wireless local loop base stations Direct Digital Synthesizers was written to find possible applications for radio communication systems It will have appeal for wireless and wireline communication engineers teachers and students

Systematic Design for Optimisation of Pipelined ADCs João Goes,João C. Vital,José E. Franca,2006-04-18 Systematic Design for Optimisation of Pipelined ADCs proposes and develops new strategies methodologies and tools for designing low power and low area CMOS pipelined A D converters The task is tackled by following a scientifically consistent approach First of all the state of the art in pipeline A D converters is analysed with a double purpose a to identify the best suited among different strategies reported in literature and taking into account the objectives pursued b to identify the drawbacks of these strategies as a basic first step to improve them Then the book proposes a top down design approach for implementing high performance low power and low area CMOS pipelined A D converters through The conception development and implementation of self calibrated techniques to extend the linearity of some critical stages in the architecture of pipelined ADCs The detailed analysis and modelling of some major non idealities that limit the physical realisation of pipelined ADCs and the proposal development and implementation of design methodologies to support systematic design of optimised instances of these converters which combine maximum performance with minimum power dissipation and minimum area occupation LIST Several implementations together with consistent measured results are presented In particular a practical realisation of a low power 14 bit 5MS s CMOS pipelined ADC with background analogue self calibration is fully described The proposed approach is fully in line with the best practice regarding the design of mixed signal integrated circuits On the one hand drawbacks of currently existing solutions are overcame through innovative strategies and on the other hand the expert knowledge is packaged and made available for re usability by the community of circuit designers Finally feasibility of the strategies and the associated encapsulated knowledge isgranted through experimental validation of working silicon Systematic Design for Optimisation of Pipelined ADCs serves as an excellent reference for analogue design engineers especially designers of low power CMOS A D converters The book may also be used as a text for advanced reading on the subject *High Speed A/D Converters* Alfi Moscovici,2006-04-18 The Analog to Digital Converters represent one half of the link between the world we live in analog and the digital world of computers which can handle the computations required in

digital signal processing These devices are mathematically very complex due to their nonlinear behavior and thus fairly difficult to analyze without the use of simulation tools High Speed A D Converters Understanding Data Converters Through SPICE presents the subject from the practising engineer s point of view rather than from the academic s point of view A practical approach is emphasized High Speed A D Converters Understanding Data Converters Through SPICE is intended as a learning tool by providing building blocks that can be stacked on top of each other to build higher order systems The book provides a guide to understanding the various topologies used in A D converters by suggesting simple methods for the blocks used in an A D converter The converters discussed throughout the book constitute a class of devices called undersampled or Nyquist converters The tools used in deriving the results presented are TopSpice by Penzar a mixed mode SPICE simulator version 5 90 The files included in Appendix A were written for this tool However most circuit files need only minor adjustments to be used on other SPICE simulators such as PSpice Hspice IS_Spice and Micro Cap IV Mathcad 2000 Professional by Mathsoft This tool is very useful in performing FFT analysis as well as drawing some of the graphs Again the mathcad files are included to help the user analyze the data High Speed A D Converters Understanding Data Converters Through SPICE not only supplies the models for the A D converters for SPICE program but also describes the physical reasons for the converter s performance   Structured Electronic Design Arie van Staveren,Chris J.M. Verhoeven,Arthur H.M. van Roermund,2006-04-18 Analog design still has unfortunately a flavor of art Art can be beautiful However art in itself is difficult to teach to students and difficult to transfer from experienced analog designers to new trainee designers in companies Structured Electronic Design High Performance Harmonic Oscillators and Bandgap References aims to systemize analog design The use of orthogonalization of the design of the fundamental quality aspects noise distortion and bandwidth and hierarchy in the subsequent design steps enables designers to achieve high performance designs in a relatively short time As a result of the systematic design procedure the effect of design decisions on the circuit performance is made clear Additionally the use of resources for reaching a specified performance is tracked This book therefore describes the structured electronic design of high performance harmonic oscillators and bandgap references The structured design of harmonic oscillators includes the maximization of the carrier to noise ratio by means of tapping i e an impedance adaption method for noise matching The bandgap reference a popular implementation of a voltage reference is studied via the unusual concept of the linear combination of base emitter voltages The presented method leads to the design of high performance references in CMOS and Bipolar technology Using this concept on a high level of abstraction the quality with respect to for instance noise and power supply rejection can be identified In this book it is shown with several design examples that this method provides an excellent starting point for the design of high performance bandgap references Auxiliary to the harmonic oscillator and bandgap reference design are the negative feedback amplifiers In this book the systematic design of the dynamic behavior is emphasized By means of the identification of the dominant poles it is possible to give an upper limit of

the attainable bandwidth even before the real frequency compensation is accomplished Structured Electronic Design High Performance Harmonic Oscillators and Bandgap References is a valuable book for researchers and designers as well as students in the field of analog design It helps both the experienced and trainee designer to come to grips with the design of analog circuits The presented method is illustrated by several well described design examples **Operational Amplifiers** Johan Huijsing,2013-03-14 Operational Amplifiers Theory and Design is the first book to present a systematic circuit design of operational amplifiers Containing state of the art material as well as the essentials the book is written to appeal to both the experienced practitioner and the less initiated circuit designer It is shown that the topology of all operational amplifiers can be divided into nine main overall configurations These configurations range from one gain stage up to four or more gain stages Many famous designs are evaluated in depth High frequency compensation techniques are presented for all nine configurations Special emphasis is placed on low power low voltage architectures with rail to rail input and output ranges Operational Amplifiers Theory and Design also develops on the theme of the design of fully differential operational amplifiers and operational floating amplifiers In addition the characterization of operational amplifiers by macromodels and error matrices is presented together with measurement techniques for their parameters Carefully structured and enriched by numerous figures problems and simulation exercises the book is ideal for the purposes of self study and self evaluation

Analog Test Signal Generation Using Periodic ΣΔ-Encoded Data Streams Benoit Dufort,G.W. Roberts,2012-12-06 Analog Test Signal Generation Using Periodic SigmaDelta Encoded Data Streams presents a new method to generate high quality analog signals with low hardware complexity The theory of periodic SigmaDelta encoded bitstreams is presented along with a set of empirical tables to help select the appropriate parameters of a bitstream An optimization procedure is also outlined to help select a bit sequence with the desired attributes A large variety of signals can be generated using this approach Silicon implementation issues are discussed with a specific emphasis on area overhead and ease of design One FPGA circuit and three different silicon implementations are presented along with experimental results It is shown that simple designs are capable of generating very high precision signals on chip The technique is further extended to multi bit signal generation where it is shown how to increase the performance of arbitrary waveform generators commonly found in past and present day mixed signal testers No hardware modifications are required only the numbers in memory are changed Three different calibration techniques to reduce the effects of the AWG s non linearities are also introduced together with supporting experimental evidence The main focus of this text is to describe an area efficient technique for analog signal generation using SigmaDelta encoded data stream The main characteristics of the technique are High quality signals SFDR of 110 dB observed Large variety of signals generated Bitstreams easily obtained with a fast optimization program Good frequency resolution compatible with coherent sampling Simple and fast hardware implementation Mostly digital except an easily testable 1 bit DAC and possibly a reconstruction filter Memory already available on chip can be reused reducing area

overhead Designs can be incorporated into existing CAD tools High frequency generation <u>IEEE Transactions on Circuits and Systems</u> ,2005

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