SWITCHED-CURRENT DESIGN AND IMPLEMENTATION OF OVERSAMPLING A/D CONVERTERS

Nianxiong Tan

Switched Current Design And Implementation Of Oversampling Ad Converters

Piet Wambacq,Willy M.C. Sansen

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    <u>Switched-Current Design and Implementation of Oversampling A/D Converters</u> Nianxiong Tan,2012-10-12 Switched Current Design and Implementation of Oversampling A D Converters discusses the switched current SI technique and its application in oversampling A D converters design The SI technique is an analog sampled data technique that fully exploits the digital CMOS process Compared with the traditional switched capacitor SC technique the SI technique has both pros and cons that are highlighted in the book With the consideration of similarity and difference of SI and SC techniques oversampling A D converter architectures are tailored and optimized for SI design and implementation in the book Switched Current Design and Implementation of Oversampling A D Converters emphasizes the practical aspects of SI circuits without tedious mathematical derivations and is full of circuit design and implementation examples There are more than 10 different chips included in the book demonstrating the high speed over 100 MHz and ultra low voltage 1 2 V operation of SI circuits and systems in standard digital CMOS processes Therefore the book is of special value as a practical guide for designing SI circuits and SI oversampling A D converters Switched Current Design and Implementation of Oversampling A D Converters serves as an excellent reference for analog designers especially A D converter designers and is of interest to digital designers for real time signal processing who need A D interfaces The book may also be used as a text for advanced courses on the subject   *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

    CMOS Data Converters for Communications Mikael Gustavsson,J. Jacob Wikner,Nianxiong Tan,2005-12-15 CMOS Data Converters for Communications distinguishes itself from other data converter books by emphasizing system related aspects of the design and frequency domain measures It explains in detail how to derive data converter requirements for a given communication system baseband passband and multi carrier systems The authors also review CMOS data converter architectures and discuss their suitability for communications The rest of the book is dedicated to high performance CMOS

data converter architecture and circuit design Pipelined ADCs parallel ADCs with an improved passive sampling technique and oversampling ADCs are the focus for ADC architectures while current steering DAC modeling and implementation are the focus for DAC architectures The principles of the switched current and the switched capacitor techniques are reviewed and their applications to crucial functional blocks such as multiplying DACs and integrators are detailed The book outlines the design of the basic building blocks such as operational amplifiers comparators and reference generators with emphasis on the practical aspects To operate analog circuits at a reduced supply voltage special circuit techniques are needed Low voltage techniques are also discussed in this book CMOS Data Converters for Communications can be used as a reference book by analog circuit designers to understand the data converter requirements for communication applications It can also be used by telecommunication system designers to understand the difficulties of certain performance requirements on data converters It is also an excellent resource to prepare analog students for the new challenges ahead *Design of Modulators for Oversampled Converters* Feng Wang,Ramesh Harjani,2012-12-06 Oversampled A D converters have become very popular in recent years Some of their advantages include relaxed requirements for anti alias filters relaxed requirements for component matching high resolution and compatibility with digital VLSI technology There is a significant amount of literature discussing the principle theory and implementation of various oversampled converters Such converters are likely to continue to proliferate in the foreseeable future Additionally more recently there has been great interest in low voltage and low power circuit design New design techniques have been proposed for both the digital domain and the analog domain Both trends point to the importance of the low power design of oversampled A D converters Unfortunately there has been no systematic study of the optimal design of modulators for oversampled converters Design has generally focused on new architectures with little attention being paid to optimization The goal of Design of Modulators for Oversampled Converters is to develop a methodology for the optimal design of modulators in oversampled converters The primary focus of the presentation is on minimizing power consumption and understanding and limiting the nonlinearities that result in such converters Design of Modulators for Oversampled Converters offers a quantitative justification for the various design tradeoffs and serves as a guide for designing low power highly linear oversampled converters Design of Modulators for Oversampled Converters will serve as a valuable guide for circuit design practitioners university researchers and graduate students who are interested in this fast moving area Systematic Design of Sigma-Delta Analog-to-Digital Converters Ovidiu Bajdechi,Johan Huijsing,2004-04-30 Systematic Design of Sigma Delta Analog to Digital Converters describes the issues related to the sigma delta analog to digital converters ADCs design in a systematic manner from the top level of abstraction represented by the filters defining signal and noise transfer functions STF NTF passing through the architecture level where topology related performance is calculated and simulated and finally down to parameters of circuit elements like resistors capacitors and amplifier transconductances used in individual integrators The systematic approach allows the

evaluation of different loop filters order aggressiveness discrete time or continuous time implementation with quantizers varying in resolution Topologies explored range from simple single loops to multiple cascaded loops with complex structures including more feedbacks and feedforwards For differential circuits with switched capacitor integrators for discrete time DT loop filters and active RC for continuous time CT ones the passive integrator components are calculated and the power consumption is estimated based on top level requirements like harmonic distortion and noise budget This unified systematic approach to choosing the best sigma delta ADC implementation for a given design target yields an interesting solution for a high resolution broadband DSL like ADC operated at low oversampling ratio which is detailed down to transistor level schematics The target audience of Systematic Design of Sigma Delta Analog to Digital Converters are engineers designing sigma delta ADCs and or switched capacitor and continuous time filters both beginners and experienced It is also intended for students academics involved in sigma delta and analog CAD research   *CMOS Current Amplifiers* Giuseppe Palmisano,Gaetano Palumbo,Salvatore Pennisi,2012-12-06 CMOS Current Amplifiers presents design strategies for high performance current amplifiers based on CMOS technology After an introduction to various architectures of operational amplifiers the operating principles of the current amplifier are outlined This book provides the reader with simple and compact design equations for use in a pencil and paper design and the following simulation step Chapter 1 introduces the general aspects of current amplifiers After a preliminary classification of operational amplifiers ideal blocks and models are discussed for different architectures and a first high level comparison is made between traditional amplifiers and current amplifiers Analysis and examples of basic circuits as well as signal processing applications involving current amplifiers are also given Non idealities and second order effects causing limitations in performance are then discussed and evaluated Chapter 2 focuses on low drive current amplifiers Several design examples for current conveyors and class A current amplifiers are discussed in detail and design equations are presented for the main performance parameters which allows a good trade off between requirements High performance solutions for high bandwidth and low voltage capability are also considered and finally current comparators with progressively enhanced performance are reported and analyzed critically Chapter 3 deals with current amplifiers for off chip loads Several class AB current mode output stages are discussed and design strategies which improve performance are presented A detailed analysis of non ideal effect is carried out with particular emphasis on linearity Design examples are given and circuit arrangements for further developments are included CMOS Current Amplifiers serves as an excellent reference for researchers and professionals of analog IC design and may also be used as an advanced text on current amplifiers   **Switched-currents** Chris Toumazou,John B. Hughes,Nicholas C. Battersby,1993 Analogue designers from industry and academia worldwide have contributed to this first volume devoted entirely to switched current analogue signal processing The volume introduces the basic switched current technique reviews the state of the art and presents practical chip examples Numerous application areas are described ranging from filters and

data converters to image processing applications It also gives a comprehensive treatment of the fundamental principles of switched current circuits and systems For undergraduate and graduate students and practicing engineers in industry Distributed by INSPEC Annotation copyright by Book News Inc Portland OR *Modeling, Analysis, and Applications in Metaheuristic Computing: Advancements and Trends* Yin, Peng-Yeng,2012-03-31 This book is a collection of the latest developments models and applications within the transdisciplinary fields related to metaheuristic computing providing readers with insight into a wide range of topics such as genetic algorithms differential evolution and ant colony optimization Provided by publisher *Continuous-Time Delta-Sigma Modulators for High-Speed A/D Conversion* James A. Cherry,W. Martin Snelgrove,2006-04-18 Among analog to digital converters the delta sigma modulator has cornered the market on high to very high resolution converters at moderate speeds with typical applications such as digital audio and instrumentation Interest has recently increased in delta sigma circuits built with a continuous time loop filter rather than the more common switched capacitor approach Continuous time delta sigma modulators offer less noisy virtual ground nodes at the input inherent protection against signal aliasing and the potential to use a physical rather than an electrical integrator in the first stage for novel applications like accelerometers and magnetic flux sensors More significantly they relax settling time restrictions so that modulator clock rates can be raised This opens the possibility of wideband 1 MHz or more converters possibly for use in radio applications at an intermediate frequency so that one or more stages of mixing might be done in the digital domain Continuous Time Delta Sigma Modulators for High Speed A D Conversion Theory Practice and Fundamental Performance Limits covers all aspects of continuous time delta sigma modulator design with particular emphasis on design for high clock speeds The authors explain the ideal design of such modulators in terms of the well understood discrete time modulator design problem and provide design examples in Matlab They also cover commonly encountered non idealities in continuous time modulators and how they degrade performance plus a wealth of material on the main problems feedback path delays clock jitter and quantizer metastability in very high speed designs and how to avoid them They also give a concrete design procedure for a real high speed circuit which illustrates the tradeoffs in the selection of key parameters Detailed circuit diagrams simulation results and test results for an integrated continuous time 4 GHz band pass modulator for A D conversion of 1 GHz analog signals are also presented Continuous Time Delta Sigma Modulators for High Speed A D Conversion Theory Practice and Fundamental Performance Limits concludes with some promising modulator architectures and a list of the challenges that remain in this exciting field **Design of Low-Voltage Low-Power CMOS Delta-Sigma A/D Converters** Vincenzo Peluso,Michiel Steyaert,Willy M.C. Sansen,2013-03-09 Design of Low Voltage Low Power CMOS Delta Sigma A D Converters investigates the feasibility of designing Delta Sigma Analog to Digital Converters for very low supply voltage lower than 1 5V and low power operation in standard CMOS processes The chosen technique of implementation is the Switched Opamp Technique which provides Switched Capacitor operation at low supply voltage

without the need to apply voltage multipliers or low VtMOST devices A method of implementing the classic single loop and cascaded Delta Sigma modulator topologies with half delay integrators is presented Those topologies are studied in order to find the parameters that maximise the performance in terms of peak SNR Based on a linear model the performance degradations of higher order single loop and cascaded modulators compared to a hypothetical ideal modulator are quantified An overview of low voltage Switched Capacitor design techniques such as the use of voltage multipliers low VtMOST devices and the Switched Opamp Technique is given An in depth discussion of the present status of the Switched Opamp Technique covers the single ended Original Switched Opamp Technique the Modified Switched Opamp Technique which allows lower supply voltage operation and differential implementation including common mode control techniques The restrictions imposed on the analog circuits by low supply voltage operation are investigated Several low voltage circuit building blocks some of which are new are discussed A new low voltage class AB OTA especially suited for differential Switched Opamp applications together with a common mode feedback amplifier and a comparator are presented and analyzed As part of a systematic top down design approach the non ideal charge transfer of the Switched Opamp integrator cell is modeled based upon several models of the main opamp non ideal characteristics Behavioral simulations carried out with these models yield the required opamp specifications that ensure that the intended performance is met in an implementation A power consumption analysis is performed The influence of all design parameters especially the low power supply voltage is highlighted Design guidelines towards low power operation are distilled Two implementations are presented together with measurement results The first one is a single ended implementation of a Delta Sigma ADC operating with 1 5V supply voltage and consuming 100 W for a 74 dB dynamic range in a 3 4 kHz bandwidth The second implementation is differential and operates with 900 mV It achieves 77 dB dynamic range in 16 kHz bandwidth and consumes 40 W Design of Low Voltage Low Power CMOS Delta Sigma A D Converters is essential reading for analog design engineers and researchers

Neuromorphic Systems Engineering Tor Sverre Lande,2007-08-26 Neuromorphic Systems Engineering Neural Networks in Silicon emphasizes three important aspects of this exciting new research field The term neuromorphic expresses relations to computational models found in biological neural systems which are used as inspiration for building large electronic systems in silicon By adequate engineering these silicon systems are made useful to mankind Neuromorphic Systems Engineering Neural Networks in Silicon provides the reader with a snapshot of neuromorphic engineering today It is organized into five parts viewing state of the art developments within neuromorphic engineering from different perspectives Neuromorphic Systems Engineering Neural Networks in Silicon provides the first collection of neuromorphic systems descriptions with firm foundations in silicon Topics presented include large scale analog systems in silicon neuromorphic silicon auditory ear and vision eye systems in silicon learning and adaptation in silicon merging biology and technology micropower analog circuit design analog memory analog interchipcommunication on digital buses LIST Neuromorphic

Systems Engineering Neural Networks in Silicon serves as an excellent resource for scientists researchers and engineers in this emerging field and may also be used as a text for advanced courses on the subject   *Highly Linear Integrated Wideband Amplifiers* Henrik Sjöland,2012-12-06 Highly Linear Integrated Wideband Amplifiers Design and Analysis Techniques for Frequencies from Audio to RF deals with the complicated issues involved in the design of high linearity integrated wideband amplifiers for different operating frequencies The book demonstrates these principles using a number of high performance designs New topologies for high linearity are presented as well as a novel method for estimating the intermodulation distortion of a wideband signal One of the most exciting results presented is an enhanced feedback configuration called feedback boosting that is capable of very low distortion Also important is a statistical method for relating the intermodulation distortion of a wideband signal to the total harmonic distortion THD of a single tone The THD as opposed to the intermodulation distortion of the wideband signal is easy to measure and use as a design parameter Three different applications where high linearity is needed are identified namely audio power amplifiers wideband IF amplifiers and RF power amplifiers For these applications high performance integrated amplifier designs using novel topologies are presented together with measurement results The audio amplifiers are built in CMOS and are capable of driving 8Omega loudspeaker loads directly without using any external components One of the designs can operate on a supply voltage down to 1 5V Both bipolar and CMOS wideband IF amplifiers are built they are fully differential and have linearity from DC to 20 MHz Finally an RF power amplifier is built in CMOS without using inductors in order to investigate what performance can be achieved without them Highly Linear Integrated Wideband Amplifiers Design and Analysis Techniques for Frequencies from Audio to RF is an excellent reference for researchers and designers of integrated amplifiers and may be used as a text for advanced courses on the topic   **Top-Down Design of High-Performance Sigma-Delta Modulators** Fernando Medeiro,Belén Pérez Verdú,Angel Rodríguez-Vázquez,2013-04-18 The interest for I modulation based NO converters has significantly increased in the last years The reason for that is twofold On the one hand unlike other converters that need accurate building blocks to obtain high res olution I converters show low sensitivity to the imperfections of their building blocks This is achieved through extensive use of digital signal pro cessing a desirable feature regarding the implementation of NO interfaces in mainstream CMOS technologies which are better suited for implementing fast dense digital circuits than accurate analog circuits On the other hand the number of applications with industrial interest has also grown In fact starting from the earliest in the audio band today we can find I converters in a large variety of NO interfaces ranging from instrumentation to commu nications These advances have been supported by a number of research works that have lead to a considerably large amount of published papers and books cov ering different sub topics from purely theoretical aspects to architecture and circuit optimization However so much material is often difficultly digested by those unexperienced designers who have been committed to developing a I converter mainly because there is a lack of methodology In our view a

clear methodology is necessary in I modulator design because all related tasks are rather hard **Analog Layout Generation for Performance and Manufacturability** Koen Lampaert,Georges Gielen,Willy M.C. Sansen,2013-04-18 Analog integrated circuits are very important as interfaces between the digital parts of integrated electronic systems and the outside world A large portion of the effort involved in designing these circuits is spent in the layout phase Whereas the physical design of digital circuits is automated to a large extent the layout of analog circuits is still a manual time consuming and error prone task This is mainly due to the continuous nature of analog signals which causes analog circuit performance to be very sensitive to layout parasitics The parasitic elements associated with interconnect wires cause loading and coupling effects that degrade the frequency behaviour and the noise performance of analog circuits Device mismatch and thermal effects put a fundamental limit on the achievable accuracy of circuits For successful automation of analog layout advanced place and route tools that can handle these critical parasitics are required In the past automatic analog layout tools tried to optimize the layout without quantifying the performance degradation introduced by layout parasitics Therefore it was not guaranteed that the resulting layout met the specifications and one or more layout iterations could be needed In Analog Layout Generation for Performance and Manufacturability the authors propose a performance driven layout strategy to overcome this problem In this methodology the layout tools are driven by performance constraints such that the final layout with parasitic effects still satisfies the specifications of the circuit The performance degradation associated with an intermediate layout solution is evaluated at runtime using predetermined sensitivities In contrast with other performance driven layout methodologies the tools proposed in this book operate directly on the performance constraints without an intermediate parasitic constraint generation step This approach makes a completeand sensible trade off between the different layout alternatives possible at runtime and therefore eliminates the possible feedback route between constraint derivation placement and layout extraction Besides its influence on the performance layout also has a profound impact on the yield and testability of an analog circuit In Analog Layout Generation for Performance and Manufacturability the authors outline a new criterion to quantify the detectability of a fault and combine this with a yield model to evaluate the testability of an integrated circuit layout They then integrate this technique with their performance driven routing algorithm to produce layouts that have optimal manufacturability while still meeting their performance specifications Analog Layout Generation for Performance and Manufacturability will be of interest to analog engineers researchers and students *CMOS Telecom Data Converters* Angel Rodríguez-Vázquez,Fernando Medeiro,Edmond Janssens,2013-03-09 CMOS Telecom Data Converters compiles the latest achievements regarding the design of high speed and high resolution data converters in deep submicron CMOS technologies The four types of analog to digital converter architectures commonly found in this arena are covered namely sigma delta pipeline folding interpolating and flash For all these types latest achievements regarding the solution of critical architectural and circuital issues are presented and illustrated through IC prototypes with measured state of the art

performances Some of these prototypes are conceived to be employed at the chipset of newest generation wireline modems ADSL and ADSL Others are intended for wireless transceivers Besides analog to digital converters the book also covers other functions needed for communication systems such as digital to analog converters analog filters programmable gain amplifiers digital filters and line drivers **Distortion Analysis of Analog Integrated Circuits** Piet Wambacq,Willy M.C. Sansen,2013-04-17 The analysis and prediction of nonlinear behavior in electronic circuits has long been a topic of concern for analog circuit designers The recent explosion of interest in portable electronics such as cellular telephones cordless telephones and other applications has served to reinforce the importance of these issues The need now often arises to predict and optimize the distortion performance of diverse electronic circuit configurations operating in the gigahertz frequency range where nonlinear reactive effects often dominate However there have historically been few sources available from which design engineers could obtain information on analysis tech niques suitable for tackling these important problems I am sure that the analog circuit design community will thus welcome this work by Dr Wambacq and Professor Sansen as a major contribution to the analog circuit design literature in the area of distortion analysis of electronic circuits I am personally looking forward to having a copy readily available for reference when designing integrated circuits for communication systems Dynamic Translinear and Log-Domain Circuits Jan Mulder,Wouter A. Serdijn,Albert C. van der Woerd,Arthur H.M. van Roermund,2012-12-06 Log domain and translinear filters provide a competitive alternative to the challenges of ever increasing low voltage low power and high frequency demands in the area of continuous time filters Since translinear filters are fundamentally large signal linear they are capable of realizing a large dynamic range in combination with excellent tunability characteristics Large signal linearity is achieved by exploiting the accurate exponential behavior of the bipolar transistor or the subthreshold MOS transistor A generalization of the dynamic translinear principle exploiting the square law behavior of the MOS transistor is theoretically possible but not practically relevant Translinear and log domain filters are based on the dynamic translinear principle a generalization of the conventional static translinear principle Besides their application for linear filters dynamic translinear circuits can also be used for the realization of non linear dynamic functions such as oscillators RMS DC converters and phase locked loops Dynamic Translinear and Log Domain Circuits Analysis and Synthesis covers both the analysis and synthesis of translinear circuits The theory is presented using one unifying framework for both static and dynamic translinear networks which is based on a current mode approach General analysis methods are presented including the large signal and non stationary analysis of noise A well structured synthesis method is described greatly enhancing the designability of log domain and translinear circuits Comparisons are made with respect to alternative analysis and synthesis methods presented in the literature The theory is illustrated and verified by various examples and realizations Dynamic Translinear and Log Domain Circuits Analysis and Synthesis is an excellent reference for researchers and circuit designers and may be used as a text for advanced courses on the topic **Oversampling Delta-Sigma Data**

Converters James C. Candy,Gabor C. Temes,1991-09-02 This now famous anthology brings together various aspects of oversampling methods and compares and evaluates design approaches It describes the theoretical analysis of converter performances the actual design of converters and their simulation circuit implementations and applications **The Design of Low-Voltage, Low-Power Sigma-Delta Modulators** Shahriar Rabii,Bruce A. Wooley,2012-12-06 Oversampling techniques based on sigma delta modulation are widely used to implement the analog digital interfaces in CMOS VLSI technologies This approach is relatively insensitive to imperfections in the manufacturing process and offers numerous advantages for the realization of high resolution analog to digital A D converters in the low voltage environment that is increasingly demanded by advanced VLSI technologies and by portable electronic systems In The Design of Low Voltage Low Power Sigma Delta Modulators an analysis of power dissipation in sigma delta modulators is presented and a low voltage implementation of a digital audio performance A D converter based on the results of this analysis is described Although significant power savings can typically be achieved in digital circuits by reducing the power supply voltage the power dissipation in analog circuits actually tends to increase with decreasing supply voltages Oversampling architectures are a potentially power efficient means of implementing high resolution A D converters because they reduce the number and complexity of the analog circuits in comparison with Nyquist rate converters In fact it is shown that the power dissipation of a sigma delta modulator can approach that of a single integrator with the resolution and bandwidth required for a given application In this research the influence of various parameters on the power dissipation of the modulator has been evaluated and strategies for the design of a power efficient implementation have been identified The Design of Low Voltage Low Power Sigma Delta Modulators begins with an overview of A D conversion emphasizing sigma delta modulators It includes a detailed analysis of noise in sigma delta modulators analyzes power dissipation in integrator circuits and addresses practical issues in the circuit design and testing of a high resolution modulator The Design of Low Voltage Low Power Sigma Delta Modulators will be of interest to practicing engineers and researchers in the areas of mixed signal and analog integrated circuit design **Compact Low-Voltage and High-Speed CMOS, BiCMOS and Bipolar Operational Amplifiers** Klaas-Jan de Langen,Johan Huijsing,2013-03-14 Compact Low Voltage and High Speed CMOS BiCMOS and Bipolar Operational Amplifiers discusses the design of integrated operational amplifiers that approach the limits of low supply voltage or very high bandwidth The resulting realizations span the whole field of applications from micro power CMOS VLSI amplifiers to 1 GHz bipolar amplifiers The book presents efficient circuit topologies in order to combine high performance with simple solutions In total twelve amplifier realizations are discussed Two bipolar amplifiers are discussed a 1 GHz operational amplifier and an amplifier with a high ratio between the maximum output current and the quiescent current Five amplifiers have been designed in CMOS technology extremely compact circuits that can operate on supply voltages down to one gate source voltage and two saturation voltages which equals about 1 4 V and ultimate low voltage amplifiers that can

operate on supply voltages down to one gate source voltage and one saturation voltage which amounts to about 1 2 V In BiCMOS technology five amplifiers have been designed The first two amplifiers are based on a compact topology Two other amplifiers are designed to operate on low supply voltages down to 1 3 V The final amplifier has a unity gain frequency of 200 MHz and can operate down to 2 5 V Compact Low Voltage and High Speed CMOS BiCMOS and Bipolar Operational Amplifiers is intended for the professional analog designer Also it is suitable as a text book for advanced courses in amplifier design

Uncover the mysteries within Explore with is enigmatic creation, **Switched Current Design And Implementation Of Oversampling Ad Converters** . This downloadable ebook, shrouded in suspense, is available in a PDF format (Download in PDF: *). Dive into a world of uncertainty and anticipation. Download now to unravel the secrets hidden within the pages.

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