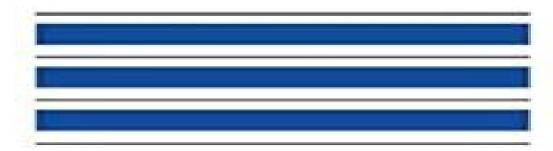# Low-Noise Wide-Band Amplifiers in Bipolar and CMOS Technologies

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Low Noise Wide Band Amplifiers In Bipolar And Cmos Technologies

José Silva-Martínez,Michiel Steyaert,Willy M.C. Sansen

Low Noise Wide Band Amplifiers In Bipolar And Cmos Technologies:

Low-Noise Wide-Band Amplifiers in Bipolar and CMOS Technologies Zhong Yuan Chong,Willy M.C. Sansen,2013-03-09 Analog circuit design has grown in importance because so many circuits cannot be realized with digital techniques Examples are receiver front ends particle detector circuits etc Actually all circuits which require high precision high speed and low power consumption need analog solutions High precision also needs low noise Much has been written already on low noise design and optimization for low noise Very little is available however if the source is not resistive but capacitive or inductive as is the case with antennas or semiconductor detectors This book provides design techniques for these types of optimization This book is thus intended firstly for engineers on senior or graduate level who have already designed their first operational amplifiers and want to go further It is especially for engineers who do not want just a circuit but the best circuit Design techniques are given that lead to the best performance within a certain technology Moreover this is done for all important technologies such as bipolar CMOS and BiCMOS Secondly this book is intended for engineers who want to understand what they are doing The design techniques are intended to provide insight In this way the design techniques can easily be extended to other circuits as well Also the design techniques form a first step towards design automation Thirdly this book is intended for analog design engineers who want to become familiar with both bipolar and CMOS technologies and who want to learn more about which transistor to choose in BiCMOS   Low-Noise Wide-Band Amplifiers in Bipolar and CMOS Technologies Zhong Yuan Chong,Willy Sansen,2013-01-08 Analog circuit design has grown in importance because so many circuits cannot be realized with digital techniques Examples are receiver front ends particle detector circuits etc Actually all circuits which require high precision high speed and low power consumption need analog solutions High precision also needs low noise Much has been written already on low noise design and optimization for low noise Very little is available however if the source is not resistive but capacitive or inductive as is the case with antennas or semiconductor detectors This book provides design techniques for these types of optimization This book is thus intended firstly for engineers on senior or graduate level who have already designed their first operational amplifiers and want to go further It is especially for engineers who do not want just a circuit but the best circuit Design techniques are given that lead to the best performance within a certain technology Moreover this is done for all important technologies such as bipolar CMOS and BiCMOS Secondly this book is intended for engineers who want to understand what they are doing The design techniques are intended to provide insight In this way the design techniques can easily be extended to other circuits as well Also the design techniques form a first step towards design automation Thirdly this book is intended for analog design engineers who want to become familiar with both bipolar and CMOS technologies and who want to learn more about which transistor to choose in BiCMOS

Analog Circuit Design Johan Huijsing,Rudy J. van de Plassche,Willy M.C. Sansen,2013-03-14 Johan H Huijsing This book contains 18 tutorial papers concentrated on 3 topics each topic being covered by 6 papers The topics are Low Noise Low

Power Low Voltage Mixed Mode Design with CAD Tools Voltage Current and Time References The papers of this book were written by top experts in the field currently working at leading European and American universities and companies These papers are the reviewed versions of the papers presented at the Workshop on Advances in Analog Circuit Design which was held in Villach Austria 26 28 April 1995 The chairman of the Workshop was Dr Franz Dielacher from Siemens Austria The program committee existed of Johan H Huijsing from the Delft University of Technology Prof Willy Sansen from the Catholic University of Leuven and Dr Rudy 1 van der Plassche from Philips Eindhoven This book is the fourth of aseries dedicated to the design of analog circuits The topics which were covered earlier were Operational Amplifiers Analog to Digital Converters Analog Computer Aided Design Mixed AlD Circuit Design Sensor Interface Circuits Communication Circuits Low Power Low Voltage Integrated Filters Smart Power As the Workshop will be continued year by year a valuable series of topics will be built up from all the important areas of analog circuit design I hope that this book will help designers of analog circuits to improve their work and to speed it up **Millimeter-Wave Low Noise Amplifiers** Mladen Božanić,Saurabh Sinha,2017-11-30 This book is the first standalone book that combines research into low noise amplifiers LNAs with research into millimeter wave circuits In compiling this book the authors have set two research objectives The first is to bring together the research context behind millimeter wave circuit operation and the theory of low noise amplification The second is to present new research in this multi disciplinary field by dividing the common LNA configurations and typical specifications into subsystems which are then optimized separately to suggest improvements in the current state of the art designs To achieve the second research objective the state of the art LNA configurations are discussed and the weaknesses of state of the art configurations are considered thus identifying research gaps Such research gaps among others point towards optimization at a systems and microelectronics level Optimization topics include the influence of short wavelength layout and crosstalk on LNA performance Advanced fabrication technologies used to decrease the parasitics of passive and active devices are also explored together with packaging technologies such as silicon on chip and silicon on package which are proposed as alternatives to traditional IC implementation This research outcome builds through innovation Innovative ideas for LNA construction are explored and alternative design methodologies are deployed including LNA antenna co design or utilization of the electronic design automation in the research flow The book also offers the authors proposal for streamlined automated LNA design flow which focuses on LNA as a collection of highly optimized subsystems **Wideband Low Noise Amplifiers Exploiting Thermal Noise Cancellation** Federico Bruccoleri,Eric Klumperink,Bram Nauta,2006-03-30 Low Noise Amplifiers LNAs are commonly used to amplify signals that are too weak for direct processing for example in radio or cable receivers Traditionally low noise amplifiers are implemented via tuned amplifiers exploiting inductors and capacitors in resonating LC circuits This can render very low noise but only in a relatively narrow frequency band close to resonance There is a clear trend to use more bandwidth for communication both via cables e g cable TV internet and wireless links e g

satellite links and Ultra Wideband Band Hence wideband low noise amplifier techniques are very much needed Wideband Low Noise Amplifiers Exploiting Thermal Noise Cancellation explores techniques to realize wideband amplifiers capable of impedance matching and still achieving a low noise figure well below 3dB This can be achieved with a new noise cancelling technique as described in this book By using this technique the thermal noise of the input transistor of the LNA can be cancelled while the wanted signal is amplified The book gives a detailed analysis of this technique and presents several new amplifier circuits This book is directly relevant for IC designers and researchers working on integrated transceivers Although the focus is on CMOS circuits the techniques can just as well be applied to other IC technologies e g bipolar and GaAs and even in discrete component technologies *Computer Methods for Analysis of Mixed-Mode Switching Circuits* Fei Yuan,Ajoy Opal,2007-05-08 Computer Methods for Analysis of Mixed Mode Switching Circuits provides an in depth treatment of the principles and implementation details of computer methods and numerical algorithms for analysis of mixed mode switching circuits Major topics include Computer oriented formulation of mixed mode switching circuits Network functions of linear and nonlinear time varying systems Numerical Laplace inversion based integration algorithms and inconsistent initial conditions Time domain analysis of periodically switched linear and nonlinear circuits including response sensitivity noise clock jitter and statistical quantities Time domain analysis of circuits with internally controlled switches and over sampled sigma delta modulators Tellegen s theorem frequency reversal theorem and transfer function theorem of periodically switched linear circuits and their applications Frequency domain analysis of periodically switched linear and nonlinear circuits including response sensitivity group delay noise and statistical quantities *High-Performance CMOS Continuous-Time Filters* José Silva-Martínez,Michiel Steyaert,Willy M.C. Sansen,2013-03-09 High Performance CMOS Continuous Time Filters is devoted to the design of CMOS continuous time filters CMOS is employed because the most complex integrated circuits have been realized with this technology for two decades The most important advantages and drawbacks of continuous time filters are clearly shown The transfer function is one of the most important filter parameters but several others like intermodulation distortion power supply rejection ratio noise level and dynamic range are fundamental in the design of high performance systems Special attention is paid to the practical aspects of the design which shows the difference between an academic design and an industrial design A clear understanding of the behavior of the circuits and techniques is preferred over complex equations or interpretation of simulated results Step by step design procedures are very often used to clarify the use of the techniques and topologies The organization of this text is hierarchical starting with the design consideration of the basic building blocks and ending with the design of several high performance continuous time filters Most of the circuits have been fabricated theoretically analyzed and simulated and silicon measurement results are compared with each other High Performance CMOS Continuous Time Filters can be used as a text book for senior or graduate courses on this topic and can also be useful for industrial engineers as a reference book

Evolutionary Electronics Ricardo Salem Zebulum,Marco Aurelio Pacheco,Marley Maria Be Vellasco,2018-10-08 From the explosion of interest research and applications of evolutionary computation a new field emerges evolutionary electronics Focused on applying evolutionary computation concepts and techniques to the domain of electronics many researchers now see it as holding the greatest potential for overcoming the drawbacks of conventional design techniques Evolutionary Electronics Automatic Design of Electronic Circuits and Systems by Genetic Algorithms formally introduces and defines this area of research presents its main challenges in electronic design and explores emerging technologies It describes the evolutionary computation paradigm and its primary algorithms and explores topics of current interest such as multi objective optimization The authors examine numerous evolutionary electronics applications draw conclusions about those applications and sketch the future of evolutionary computation and its applications in electronics In coming years the appearance of more and more advanced technologies will increase the complexity of optimization and synthesis problems and evolutionary electronics will almost certainly become a key to solving those problems Evolutionary Electronics is your key to discovering and unlocking the potential of this promising new field **Noise In Physical Systems And 1/f Fluctuations - Proceedings Of The 14th International Conference** C Claeys,E Simoen,1997-06-01 The recent conferences in this series were organised in Montreal 1987 Budapest 1989 Kyoto 1991 St Louis 1993 and Palanga 1995 The aim of the conference was to bring together specialists in fluctuation phenomena from different fields and to make a bridge between theoretical scientists and more applied or engineering oriented researchers Therefore a broad variety of topics covering the fundamental aspects of noise and fluctuations as well as applications in various fields are addressed Noise in materials components circuits and electronic biological and other physical systems are discussed Analysis and Solutions for Switching Noise Coupling in Mixed-Signal ICs X. Aragones,J.L. Gonzalez,Antonio Rubio,2013-03-09 Modern microelectronic design is characterized by the integration of full systems on a single die These systems often include large high performance digital circuitry high resolution analog parts high driving I O and maybe RF sections Designers of such systems are constantly faced with the challenge to achieve compatibility in electrical characteristics of every section some circuitry presents fast transients and large consumption spikes whereas others require quiet environments to achieve resolutions well beyond millivolts Coupling between those sections is usually unavoidable since the entire system shares the same silicon substrate bulk and the same package Understanding the way coupling is produced and knowing methods to isolate coupled circuitry and how to apply every method is then mandatory knowledge for every IC designer Analysis and Solutions for Switching Noise Coupling in Mixed Signal ICs is an in depth look at coupling through the common silicon substrate and noise at the power supply lines It explains the elementary knowledge needed to understand these phenomena and presents a review of previous works and new research results The aim is to provide an understanding of the reasons for these particular ways of coupling review and suggest solutions to noise coupling and provide criteria to apply noise reduction Analysis and Solutions

for Switching Noise Coupling in Mixed Signal ICs is an ideal book both as introductory material to noise coupling problems in mixed signal ICs and for more advanced designers facing this problem *Analog Signal Generation for Built-In-Self-Test of Mixed-Signal Integrated Circuits* Gordon W. Roberts,Albert K. Lu,2012-12-06 Analog Signal Generation for Built In Self Test BIST of Mixed Signal Integrated Circuits is a concise introduction to a powerful new signal generation technique The book begins with a brief introduction to the testing problem and a review of conventional signal generation techniques The book then describes an oversampling based oscillator capable of generating high precision analog tones using a combination of digital logic and D A conversion These concepts are then extended to multi tone testing schemes without introducing a severe hardware penalty The concepts are extended further to encompass piece wise linear waveforms such as square triangular and sawtooth waves Experimental results are presented to verify the ideas in each chapter and finally conclusions are drawn For those readers unfamiliar with delta sigma modulation techniques a brief introduction to this subject is also provided in an appendix The book is ideal for test engineers researchers and circuits designers with an interest in IC testing methods Integrated Fiber-Optic Receivers Aaron Buchwald,Kenneth W. Martin,2012-12-06 Integrated Fiber Optic Receivers covers many aspects of the design of integrated circuits for fiber optic receivers and other high speed serial data links Fundamental concepts are explained at the system level circuit level and semiconductor device level Techniques for extracting timing information from the random data stream are described in considerable detail as are all other aspects of receiver design Integrated Fiber Optic Receivers is organized in two parts Part I covers the theory of communications systems as it applies to high speed PAM Pulse Amplitude Modulation systems The primary emphasis is on clock recovery circuits Because theoretical concepts are generally grasped more easily by example Part II is devoted to circuit design issues that illustrate example realizations of architectures described in Part I Part II presents the transistor level design and measured results of fundamental building blocks and test circuits For practicing engineers more than just reporting on the results of specific circuits this book serves as a tutorial on the design of integrated high speed broadband PAM data systems such as repeaters in long haul fiber optic trunk lines transceivers for use in LANs and WANs read channels for high density data storage devices and wireless communication handsets Integrated Fiber Optic Receivers may be used as a text for advanced courses in both analog circuit design and communication systems *LNA-ESD Co-Design for Fully Integrated CMOS Wireless Receivers* Paul Leroux,Michiel Steyaert,2006-03-30 LNA ESD Co Design for Fully Integrated CMOS Wireless Receivers fits in the quest for complete CMOS integration of wireless receiver front ends With a combined discussion of both RF and ESD performance it tackles one of the final obstacles on the road to CMOS integration The book is conceived as a design guide for those actively involved in the design of CMOS wireless receivers The book starts with a comprehensive introduction to the performance requirements of low noise amplifiers in wireless receivers Several popular topologies are explained and compared with respect to future technology and frequency scaling The ESD requirements are introduced and

related to the state of the art protection devices and circuits LNA ESD Co Design for Fully Integrated CMOS Wireless Receivers provides an extensive theoretical treatment of the performance of CMOS low noise amplifiers in the presence of ESD protection circuitry The influence of the ESD protection parasitics on noise figure gain linearity and matching are investigated Several RF ESD co design solutions are discussed allowing both high RF performance and good ESD immunity for frequencies up to and beyond 5 GHz Special attention is also paid to the layout of both active and passive components LNA ESD Co Design for Fully Integrated CMOS Wireless Receivers offers the reader intuitive insight in the LNA s behavior as well as the necessary mathematical background to optimize its performance All material is experimentally verified with several CMOS implementations among which a fully integrated GPS receiver front end The book is essential reading for RF design engineers and researchers in the field and is also suitable as a text book for an advanced course on the subject

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   *Integrated Analog-To-Digital and*

Digital-To-Analog Converters Rudy J. van de Plassche,2012-12-06 Analog to digital A D and digital to analog D A converters provide the link between the analog world of transducers and the digital world of signal processing computing and other digital data collection or data processing systems Several types of converters have been designed each using the best available technology at a given time for a given application For example high performance bipolar and MOS technologies have resulted in the design of high resolution or high speed converters with applications in digital audio and video systems In addition high speed bipolar technologies enable conversion speeds to reach the gigaHertz range and thus have applications in HDTV and digital oscilloscopes Integrated Analog to Digital and Digital to Analog Converters describes in depth the theory behind and the practical design of these circuits It describes the different techniques to improve the accuracy in high resolution A D and D A converters and also special techniques to reduce the number of elements in high speed A D converters by repetitive use of comparators Integrated Analog to Digital and Digital to Analog Converters is the most comprehensive book available on the subject Starting from the basic elements of theory necessary for a complete understanding of the design of A D and D A converters this book describes the design of high speed A D converters high accuracy D A and A D converters sample and hold amplifiers voltage and current reference sources noise shaping coding and sigma delta converters Integrated Analog to Digital and Digital to Analog Converters contains a comprehensive bibliography and index and also includes a complete set of problems This book is ideal for use in an advanced course on the subject and is an essential reference for researchers and practicing engineers   *Analog Circuit Design* Willy M.C. Sansen,Johan Huijsing,Rudy J. van de Plassche,2013-06-29 This volume concentrates on three topics mixed analog digital circuit design sensor interface circuits and communication circuits The book comprises six papers on each topic of a tutorial nature aimed at improving the design of analog circuits The book is divided into three parts Part I Mixed Analog Digital Circuit Design considers the largest growth area in microelectronics Both standard designs and ASICs have begun integrating analog cells and digital sections on the same chip The papers cover topics such as groundbounce and supply line spikes design methodologies for high level design and actual mixed analog digital designs Part II Sensor Interface Circuits describes various types of signal conditioning circuits and interfaces for sensors These include interface solutions for capacitive sensors sigma delta modulation used to combine a microprocessor compatible interface with on chip CMOS sensors injectable sensors and responders signal conditioning circuits and sensors combined with indirect converters Part III Communication Circuits concentrates on systems and implemented circuits for use in personal communication systems These have applications in cordless telephones and mobile telephone systems for use in cellular networks A major requirement for these systems is low power consumption especially when operating in standby mode so as to maximise the time between battery recharges   **Analysis and Synthesis of MOS Translinear Circuits** Remco J. Wiegerink,2012-12-06 This book has its roots in an idea first formulated by Barrie Gilbert in 1975 He showed how bipolar analog circuits can realize nonlinear and

computational functions This extended the analog art from linear to nonlinear applications hence the name trans linear circuits Not only did this new principle enable marvellous signal processing functions to be accurately implemented but also the circuits were simple and practical The perennial problems of analog Ie design namely temperature sensitivity processing spread device nonlinearity and paracitic capacitance were solved to a large extent Using the trans linear principle in circuit design requires changing your point of view in two ways First the grossly nonlinear characteristic of transistors is viewed as an asset rather than as a harmful property Second no longer are the signals represented by voltages but by currents In fact the attendant voltage changes are distorted but as they are very small they are only of secondary interest Understanding and analyzing a given trans linear circuit is fairly straightforward But what about the converse situation suppose you re given some nonlinear or computational function to implement How to find a suitable translinear circuit realization The general problem of analog circuit synthesis is a difficult one and is receiving much attention nowadays Some years ago I had the opportunity to investigate methods for designing bipolar trans linear circuits It turned out that translinear networks have some unique topological properties Using these properties it was possible to establish heuristic synthesis procedures

Semiconductor Radiation Detection Systems Krzysztof Iniewski,2018-10-03 Semiconductor Radiation Detection Systems addresses the state of the art in the design of semiconductor detectors and integrated circuit design in the context of medical imaging using ionizing radiation It addresses exciting new opportunities in X ray detection Computer Tomography CT bone dosimetry and nuclear medicine PET SPECT In addition to medical imaging the book explores other applications of semiconductor radiation detection systems in security applications such as luggage scanning dirty bomb detection and border control Features a chapter written by well known Gamma Ray Imaging authority Tadayuki Takahashi Assembled by a combination of top industrial experts and academic professors this book is more than just a product manual It is practical enough to provide a solid explanation of presented technologies incorporating material that offers an optimal balance of scientific and academic theory With less of a focus on math and physical details the author concentrates more on exploring exactly how technologies are being used With its combined coverage of new materials and innovative new system approaches as well as a succinct overview of recent developments this book is an invaluable tool for any engineer professional or student working in electronics or an associated field **Analog Interfaces for Digital Signal Processing Systems** Frank op 't Eynde,Willy M.C. Sansen,2012-12-06 It is a great honor to provide an introduction for Dr Frank Op t Eynde s and Dr Willy Sansen s book Analog Interfaces for Digital Signal Processing Systems The field of analog integrated circuit design is undergoing rapid evolution The pervasiveness of digital processing has considerably modified the micro system architectures the analog part of complex mixed systems is more and more pushed at the boundary limits of the processing chain Moreover the increased performance of digital circuits in terms of accuracy and speed are making the specification requirements of analog circuits very strict In addition to this the technology supply voltage and power consumption of analog circuits must be

compatible with those typical for digital circuits Therefore in a few words analog circuits are becoming complex and specialised interfaces between the real world and digital signal processing domains This technological evolution should be accompanied by an equivalently fast evolution in designer competencies Knowledge of complicated signal handling should be quickly replaced by know how of simple but very accurate and very fast signal processing and a solid background in data conversion techniques All of this through the use of the CMOS and possibly BiCMOS technology **Computer-Aided Design of Analog Circuits and Systems** L. Richard Carley,Ronald Gyurcsik,2012-12-06 Computer Aided Design of Analog Circuits and Systems brings together in one place important contributions and state of the art research results in the rapidly advancing area of computer aided design of analog circuits and systems This book serves as an excellent reference providing insights into some of the most important issues in the field

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Low Noise Wide Band Amplifiers In Bipolar And Cmos Technologies Introduction

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