

# **Pipelined Adaptive Digital Filters**

**Naresh R. Shanbhag**

**Keshab K. Parhi**



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# Pipelined Adaptive Digital Filters

**B. Courtois, N. Guillemot, G.  
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## **Pipelined Adaptive Digital Filters:**

**Pipelined Adaptive Digital Filters** Naresh R. Shanbhag, Keshab K. Parhi, 2012-12-06 Adaptive filtering is commonly used in many communication applications including speech and video predictive coding mobile radio ISDN subscriber loops and multimedia systems Existing adaptive filtering topologies are non concurrent and cannot be pipelined Pipelined Adaptive Digital Filters presents new pipelined topologies which are useful in reducing area and power and in increasing speed If the adaptive filter portion of a system suffers from a power speed area bottleneck a solution is provided Pipelined Adaptive Digital Filters is required reading for all users of adaptive digital filtering algorithms Algorithm application and integrated circuit chip designers can learn how their algorithms can be tailored and implemented with lower area and power consumption and with higher speed The relaxed look ahead techniques are used to design families of new topologies for many adaptive filtering applications including least mean square and lattice adaptive filters adaptive differential pulse code modulation coders adaptive differential vector quantizers adaptive decision feedback equalizers and adaptive Kalman filters Those who use adaptive filtering in communications signal and image processing algorithms can learn the basis of relaxed look ahead pipelining and can use their own relaxations to design pipelined topologies suitable for their applications Pipelined Adaptive Digital Filters is especially useful to designers of communications speech and video applications who deal with adaptive filtering those involved with design of modems wireless systems subscriber loops beam formers and system identification applications This book can also be used as a text for advanced courses on the topic

**Pipelined Adaptive Digital Filters** Naresh R. Shanbhag, Keshab Parhi, 2012-10-08 Adaptive filtering is commonly used in many communication applications including speech and video predictive coding mobile radio ISDN subscriber loops and multimedia systems Existing adaptive filtering topologies are non concurrent and cannot be pipelined Pipelined Adaptive Digital Filters presents new pipelined topologies which are useful in reducing area and power and in increasing speed If the adaptive filter portion of a system suffers from a power speed area bottleneck a solution is provided Pipelined Adaptive Digital Filters is required reading for all users of adaptive digital filtering algorithms Algorithm application and integrated circuit chip designers can learn how their algorithms can be tailored and implemented with lower area and power consumption and with higher speed The relaxed look ahead techniques are used to design families of new topologies for many adaptive filtering applications including least mean square and lattice adaptive filters adaptive differential pulse code modulation coders adaptive differential vector quantizers adaptive decision feedback equalizers and adaptive Kalman filters Those who use adaptive filtering in communications signal and image processing algorithms can learn the basis of relaxed look ahead pipelining and can use their own relaxations to design pipelined topologies suitable for their applications Pipelined Adaptive Digital Filters is especially useful to designers of communications speech and video applications who deal with adaptive filtering those involved with design of modems wireless systems subscriber loops beam formers and system identification applications This

book can also be used as a text for advanced courses on the topic      *Design of Pipelined VLSI Adaptive Digital Filters with Relaxed Look-ahead* Naresh R. Shanbhag,1993      **High-Performance Digital VLSI Circuit Design** Richard X. Gu,Khaled M. Sharaf,Mohamed I. Elmasry,2012-12-06 High Performance Digital VLSI Circuit Design is the first book devoted entirely to the design of digital high performance VLSI circuits CMOS BiCMOS and bipolar circuits are covered in depth including state of the art circuit structures Recent advances in both the computer and telecommunications industries demand high performance VLSI digital circuits Digital processing of signals demands high speed circuit techniques for the GHz range The design of such circuits represents a great challenge one that is amplified when the power supply is scaled down to 3.3 V Moreover the requirements of low power high performance circuits adds an extra dimension to the design of such circuits High Performance Digital VLSI Circuit Design is a self contained text introducing the subject of high performance VLSI circuit design and explaining the speed power tradeoffs The first few chapters of the book discuss the necessary background material in the area of device design and device modeling respectively High performance CMOS circuits are then covered especially the new all N logic dynamic circuits Propagation delay times of high speed bipolar CML and ECL are developed analytically to give a thorough understanding of various interacting process device and circuit parameters High current phenomena of bipolar devices are also addressed as these devices typically operate at maximum currents for limited device area Different new high performance BiCMOS circuits are presented and compared to their conventional counterparts These new circuits find direct applications in the areas of high speed adders frequency dividers sense amplifiers level shifters input output clock buffers and PLLs The book concludes with a few system application examples of digital high performance VLSI circuits Audience A vital reference for practicing IC designers Can be used as a text for graduate and senior undergraduate students in the area      **Advances in VLSI, Communication, and Signal Processing** Debashis Dutta,Haranath Kar,Chiranjeev Kumar,Vijaya Bhaduria,2019-12-03 This book comprises select proceedings of the International Conference on VLSI Communication and Signal processing VCAS 2018 It looks at latest research findings in VLSI design and applications The book covers a wide range of topics in electronics and communication engineering especially in the area of microelectronics and VLSI design communication systems and networks and image and signal processing The contents of this book will be useful to researchers and professionals alike      **Co-Synthesis of Hardware and Software for Digital Embedded Systems** Rajesh Kumar Gupta,2012-12-06 Co Synthesis of Hardware and Software for Digital Embedded Systems with a Foreword written by Giovanni De Micheli presents techniques that are useful in building complex embedded systems These techniques provide a competitive advantage over purely hardware or software implementations of time constrained embedded systems Recent advances in chip level synthesis have made it possible to synthesize application specific circuits under strict timing constraints This work advances the state of the art by formulating the problem of system synthesis using both application specific as well as reprogrammable components such as off the shelf processors Timing

constraints are used to determine what part of the system functionality must be delegated to dedicated application specific hardware while the rest is delegated to software that runs on the processor This co synthesis of hardware and software from behavioral specifications makes it possible to realize real time embedded systems using off the shelf parts and a relatively small amount of application specific circuitry that can be mapped to semi custom VLSI such as gate arrays The ability to perform detailed analysis of timing performance provides the opportunity of improving the system definition by creating better prototypes Co Synthesis of Hardware and Software for Digital Embedded Systems is of interest to CAD researchers and developers who want to branch off into the expanding field of hardware software co design as well as to digital system designers who are interested in the present power and limitations of CAD techniques and their likely evolution

Digital Timing Macromodeling for VLSI Design Verification Jeong-Taek Kong, David V. Overhauser, 2012-12-06 Digital Timing Macromodeling for VLSI Design Verification first of all provides an extensive history of the development of simulation techniques It presents detailed discussion of the various techniques implemented in circuit timing fast timing switch level timing switch level and gate level simulation It also discusses mixed mode simulation and interconnection analysis methods The review in Chapter 2 gives an understanding of the advantages and disadvantages of the many techniques applied in modern digital macromodels The book also presents a wide variety of techniques for performing nonlinear macromodeling of digital MOS subcircuits which address a large number of shortcomings in existing digital MOS macromodels Specifically the techniques address the device model detail transistor coupling capacitance effective channel length modulation series transistor reduction effective transconductance input terminal dependence gate parasitic capacitance the body effect the impact of parasitic RC interconnects and the effect of transmission gates The techniques address major sources of errors in existing macromodeling techniques which must be addressed if macromodeling is to be accepted in commercial CAD tools by chip designers The techniques presented in Chapters 4 6 can be implemented in other macromodels and are demonstrated using the macromodel presented in Chapter 3 The new techniques are validated over an extremely wide range of operating conditions much wider than has been presented for previous macromodels thus demonstrating the wide range of applicability of these techniques

Domain-Specific Processors Shuvra S. Bhattacharyya, Ed F. Deprettere, Jürgen Teich, 2003-11-11 Ranging from low level application and architecture optimizations to high level modeling and exploration concerns this authoritative reference compiles essential research on various levels of abstraction appearing in embedded systems and software design It promotes platform based design for improved system implementation and modeling and enhanced performance and cost analyses Domain Specific Processors relies upon notions of concurrency and parallelism to satisfy performance and cost constraints resulting from increasingly complex applications and architectures and addresses concepts in specification simulation and verification in embedded systems and software design

**Digital Signal Processing with Field Programmable Gate Arrays** Uwe Meyer-Baese, 2007-09-28 A practical and fascinating book on a topic at the forefront

of communications technology Field Programmable Gate Arrays FPGAs are on the verge of revolutionizing digital signal processing Novel FPGA families are replacing ASICs and PDSPs for front end digital signal processing algorithms at an accelerating rate The efficient implementation of these algorithms is the main goal of this book It starts with an overview of today s FPGA technology devices and tools for designing state of the art DSP systems Each of the book s chapter contains exercises The VERILOG source code and a glossary are given in the appendices

**Design of Digital Video Coding Systems** Jie Chen,Ut-Va Koc,KJ Ray Liu,2001-10-31 A discussion of a compressed domain approach for designing and implementing digital video coding systems which is drastically different from the traditional hybrid approach It demonstrates how the combination of discrete cosine transform DCT coders and motion compensated MC units reduces power consumption and hardware complexity

**The Electrical Engineering Handbook,Second Edition** Richard C. Dorf,1997-09-26 In 1993 the first edition of The Electrical Engineering Handbook set a new standard for breadth and depth of coverage in an engineering reference work Now this classic has been substantially revised and updated to include the latest information on all the important topics in electrical engineering today Every electrical engineer should have an opportunity to expand his expertise with this definitive guide In a single volume this handbook provides a complete reference to answer the questions encountered by practicing engineers in industry government or academia This well organized book is divided into 12 major sections that encompass the entire field of electrical engineering including circuits signal processing electronics electromagnetics electrical effects and devices and energy and the emerging trends in the fields of communications digital devices computer engineering systems and biomedical engineering A compendium of physical chemical material and mathematical data completes this comprehensive resource Every major topic is thoroughly covered and every important concept is defined described and illustrated Conceptually challenging but carefully explained articles are equally valuable to the practicing engineer researchers and students A distinguished advisory board and contributors including many of the leading authors professors and researchers in the field today assist noted author and professor Richard Dorf in offering complete coverage of this rapidly expanding field No other single volume available today offers this combination of broad coverage and depth of exploration of the topics The Electrical Engineering Handbook will be an invaluable resource for electrical engineers for years to come

**Microelectronics Education** B. Courtois,N. Guillemot,G. Kamarinos,G. Stéhelin,2013-03-09 This is the third edition of the European Workshop on Microelectronics Education EWME A steady state regime has now been reached An international community of university teachers is constituted they exchange their experience and their pedagogical tools They discuss the best ways to transfer the rapidly changing techniques to their students and to introduce them to the new physical and mathematical concepts and models for the innovative techniques devices circuits and design methods The number of abstracts submitted to EWME 2000 about one hundred enabled the scientific committee to proceed to a clear selection EWME is a European meeting Indeed authors from 20 different European

countries contribute to this volume Nevertheless the participation of authors from Brazil Canada China New Zealand and USA shows that the workshop gradually attains an international dimension th The 20 century can be characterized as the century of electron The electron as an elementary particle was discovered by J J Thomson in 1897 and was rapidly used to transfer energy and information Thanks to electron universe and micro cosmos could be explored Electron became the omnipotent and omnipresent almost immaterial angel of our W orld This was made possible thanks to electronics and for the last 30 years to microelectronics Microelectronics not only modified and even radically transformed the industrial and the every day landscapes but it also led to the so called information revolution with which begins the 21 st century      **Advanced Signal Processing** Stergios Stergiopoulos,2017-09-29 Discover the Applicability Benefits and Potential of New Technologies As advances in algorithms and computer technology have bolstered the digital signal processing capabilities of real time sonar radar and non invasive medical diagnostics systems cutting edge military and defense research has established conceptual similarities in these areas Now civilian enterprises can use government innovations to facilitate optimal functionality of complex real time systems Advanced Signal Processing details a cost efficient generic processing structure that exploits these commonalities to benefit commercial applications Learn from a Renowned Defense Scientist Researcher and Innovator The author preserves the mathematical focus and key information from the first edition that provided invaluable coverage of topics including adaptive systems advanced beamformers and volume visualization methods in medicine Integrating the best features of non linear and conventional algorithms and explaining their application in PC based architectures this text contains new data on Advances in biometrics image segmentation registration and fusion techniques for 3D 4D ultrasound CT and MRI Fully digital 3D 4D 3D time ultrasound system technology computing architecture requirements and relevant implementation issues State of the art non invasive medical procedures non destructive 3D tomography imaging and biometrics and monitoring of vital signs Cardiac motion correction in multi slice X ray CT imaging Space time adaptive processing and detection of targets interference intense backgrounds comprised of clutter and jamming With its detailed explanation of adaptive synthetic aperture and fusion processing schemes with near instantaneous convergence in 2 D and 3 D sensors including planar circular cylindrical and spherical arrays the quality and illustration of this text s concepts and techniques will make it a favored reference      **Advanced Signal Processing Handbook** Stergios Stergiopoulos,2017-09-08 Advances in digital signal processing algorithms and computer technology have combined to produce real time systems with capabilities far beyond those of just few years ago Nonlinear adaptive methods for signal processing have emerged to provide better array gain performance however they lack the robustness of conventional algorithms The challenge remains to develop a concept that exploits the advantages of both a scheme that integrates these methods in practical real time systems The Advanced Signal Processing Handbook helps you meet that challenge Beyond offering an outstanding introduction to the principles and applications of advanced signal processing it develops a generic

processing structure that takes advantage of the similarities that exist among radar sonar and medical imaging systems and integrates conventional and nonlinear processing schemes      Digital Signal Processing Systems: Implementation Techniques ,1995-06-23 This volume on implementation techniques in digital signal processing systems clearly reveals the significance and power of the techniques that are available and with further development the essential role they will play as applied to a wide variety of areas The authors are all to highly commended for their splendid contributors to this volume which will provide a significant and unique international reference source for students research workers practicing engineers and others for years to come      *Automatic Speech and Speaker Recognition* Chin-Hui Lee, Frank K. Soong, Kuldeep K. Paliwal, 2012-12-06 Research in the field of automatic speech and speaker recognition has made a number of significant advances in the last two decades influenced by advances in signal processing algorithms architectures and hardware These advances include the adoption of a statistical pattern recognition paradigm the use of the hidden Markov modeling framework to characterize both the spectral and the temporal variations in the speech signal the use of a large set of speech utterance examples from a large population of speakers to train the hidden Markov models of some fundamental speech units the organization of speech and language knowledge sources into a structural finite state network and the use of dynamic programming based heuristic search methods to find the best word sequence in the lexical network corresponding to the spoken utterance *Automatic Speech and Speaker Recognition Advanced Topics* groups together in a single volume a number of important topics on speech and speaker recognition topics which are of fundamental importance but not yet covered in detail in existing textbooks Although no explicit partition is given the book is divided into five parts Chapters 1 2 are devoted to technology overviews Chapters 3 12 discuss acoustic modeling of fundamental speech units and lexical modeling of words and pronunciations Chapters 13 15 address the issues related to flexibility and robustness Chapter 16 18 concern the theoretical and practical issues of search Chapters 19 20 give two examples of algorithm and implementational aspects for recognition system realization Audience A reference book for speech researchers and graduate students interested in pursuing potential research on the topic May also be used as a text for advanced courses on the subject      **Logic Synthesis for Field-Programmable Gate Arrays** Rajeev Murgai, Robert K. Brayton, Alberto L. Sangiovanni-Vincentelli, 2012-12-06 Short turnaround has become critical in the design of electronic systems Software programmable components such as microprocessors and digital signal processors have been used extensively in such systems since they allow rapid design revisions However the inherent performance limitations of software programmable systems mean that they are inadequate for high performance designs Designers thus turned to gate arrays as a solution User programmable gate arrays field programmable gate arrays FPGAs have recently emerged and are changing the way electronic systems are designed and implemented The growing complexity of the logic circuits that can be packed onto an FPGA chip means that it has become important to have automatic synthesis tools that implement logic functions on these architectures *Logic Synthesis for Field*



Programmable Gate Arrays describes logic synthesis for both look up table LUT and multiplexor based architectures with a balanced presentation of existing techniques together with algorithms and the system developed by the authors Audience A useful reference for VLSI designers developers of computer aided design tools and anyone involved in or with FPGAs

*Mixed-Mode Simulation and Analog Multilevel Simulation* Resve A. Saleh, Shyh-Jye Jou, A. Richard Newton, 2013-03-09 Mixed Mode Simulation and Analog Multilevel Simulation addresses the problems of simulating entire mixed analog digital systems in the time domain A complete hierarchy of modeling and simulation methods for analog and digital circuits is described Mixed Mode Simulation and Analog Multilevel Simulation also provides a chronology of the research in the field of mixed mode simulation and analog multilevel simulation over the last ten to fifteen years In addition it provides enough information to the reader so that a prototype mixed mode simulator could be developed using the algorithms in this book Mixed Mode Simulation and Analog Multilevel Simulation can also be used as documentation for the SPLICE family of mixed mode programs as they are based on the algorithms and techniques described in this book *Binary Decision Diagrams and Applications for VLSI CAD* Shin-ichi Minato, 2012-12-06 Symbolic Boolean manipulation using binary decision diagrams BDDs has been successfully applied to a wide variety of tasks particularly in very large scale integration VLSI computer aided design CAD The concept of decision graphs as an abstract representation of Boolean functions dates back to the early work by Lee and Akers In the last ten years BDDs have found widespread use as a concrete data structure for symbolic Boolean manipulation With BDDs functions can be constructed manipulated and compared by simple and efficient graph algorithms Since Boolean functions can represent not just digital circuit functions but also such mathematical domains as sets and relations a wide variety of CAD problems can be solved using BDDs Binary Decision Diagrams and Applications for VLSI CAD provides valuable information for both those who are new to BDDs as well as to long time aficionados from the Foreword by Randal E Bryant Over the past ten years BDDs have attracted the attention of many researchers because of their suitability for representing Boolean functions They are now widely used in many practical VLSI CAD systems this book can serve as an introduction to BDD techniques and it presents several new ideas on BDDs and their applications many computer scientists and engineers will be interested in this book since Boolean function manipulation is a fundamental technique not only in digital system design but also in exploring various problems in computer science from the Preface by Shin ichi Minato

**Cad Frameworks** Pieter van der Wolf, 2012-12-06 Since the early 1980s CAD frameworks have received a great deal of attention both in the research community and in the commercial arena It is generally agreed that CAD framework technology promises much advanced CAD frameworks can turn collections of individual tools into effective and user friendly design environments But how can this promise be fulfilled CAD Frameworks Principles and Architecture describes the design and construction of CAD frameworks It presents principles for building integrated design environments and shows how a CAD framework can be based on these principles It derives the architecture of a CAD framework in a systematic way using well

defined primitives for representation This architecture defines how the many different framework sub topics ranging from concurrency control to design flow management relate to each other and come together into an overall system The origin of this work is the research and development performed in the context of the Nelsis CAD Framework which has been a working system for well over eight years gaining functionality while evolving from one release to the next The principles and concepts presented in this book have been field tested in the Nelsis CAD Framework CAD Frameworks Principles and Architecture is primarily intended for EDA professionals both in industry and in academia but is also valuable outside the domain of electronic design Many of the principles and concepts presented are also applicable to other design oriented application domains such as mechanical design or computer aided software engineering CASE It is thus a valuable reference for all those involved in computer aided design

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