

VLSI Digital Signal Processing Systems

Devadas K. Parthasarathy

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- R. K. Parthasarathy, VLSI Digital Signal Processing Systems: Design and Implementation, John Wiley, (1996)

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VLSI Design Methodologies for Digital Signal Processing Architectures Magdy A. Bayoumi, 2012-12-06 Designing VLSI systems represents a challenging task. It is a transformation among different specifications corresponding to different levels of design abstraction: behavioral, structural, and physical. The behavioral level describes the functionality of the design. It consists of two components: static and dynamic. The static component describes operations, whereas the dynamic component describes sequencing and timing. The structural level contains information about components, control, and connectivity. The physical level describes the constraints that should be imposed on the floor plan: the placement of components and the geometry of the design. Constraints of area, speed, and power are also applied at this level. To implement such multilevel transformation, a design methodology should be devised, taking into consideration the constraints, limitations, and properties of each level. The mapping process between any of these domains is non-isomorphic. A single behavioral component may be transformed into more than one structural component. Design methodologies are the most recent evolution in the design automation era, which started off with the introduction and subsequent usage of module generation, especially for regular structures such as PLAs and memories. A design methodology should offer an integrated design system rather than a set of separate, unrelated routines and tools. A general outline of a desired integrated design system is as follows: Decide on a certain unified framework for all design levels. Derive a design method based on this framework. Create a design environment to implement this design method. *Digital Signal Processing for Multimedia Systems* Keshab K. Parhi, Takao

Nishitami, 2018-10-03 Addresses a wide selection of multimedia applications, programmable and custom architectures for the implementations of multimedia systems and arithmetic architectures, and design methodologies. The book covers recent applications of digital signal processing algorithms in multimedia, presents high-speed and low-priority binary and finite-field arithmetic architectures, details VHDL-based implementation approaches, and more. **FPGA-based Implementation of**

Signal Processing Systems Roger Woods, John McAllister, Gaye Lightbody, Ying Yi, 2008-10-13 Field-programmable gate arrays (FPGAs) are an increasingly popular technology for implementing digital signal processing (DSP) systems. By allowing designers to create circuit architectures developed for the specific applications, high levels of performance can be achieved for many DSP applications, providing considerable improvements over conventional microprocessor and dedicated DSP processor solutions. The book addresses the key issue in this process: specifically, the methods and tools needed for the design, optimization, and implementation of DSP systems in programmable FPGA hardware. It presents a review of the leading-edge techniques in this field, analyzing advanced DSP-based design flows for both signal-flow-graph (SFG)-based and dataflow-based implementation systems on-chip (SoC) aspects and future trends and challenges for FPGAs. The automation of the techniques for component architectural synthesis, computational models, and the reduction of energy consumption to help improve FPGA performance are given in detail. Written from a system-level design perspective and with a DSP focus, the authors present

many practical application examples of complex DSP implementation involving high performance computing e g matrix operations such as matrix multiplication high speed filtering including finite impulse response FIR filters and wave digital filters WDFs adaptive filtering e g recursive least squares RLS filtering transforms such as the fast Fourier transform FFT FPGA based Implementation of Signal Processing Systems is an important reference for practising engineers and researchers working on the design and development of DSP systems for radio telecommunication information audio visual and security applications Senior level electrical and computer engineering graduates taking courses in signal processing or digital signal processing shall also find this volume of interest

Simulation Techniques and Solutions for Mixed-Signal Coupling in Integrated Circuits Nishath K. Verghese, Timothy J. Schmerbeck, David J. Allstot, 2012-12-06 The goal of putting systems on a chip has been a difficult challenge that is only recently being met Since the world is analog putting systems on a chip requires putting analog interfaces on the same chip as digital processing functions Since some processing functions are accomplished more efficiently in analog circuitry chips with a large amount of analog and digital circuitry are being designed Whether a small amount of analog circuitry is combined with varying amounts of digital circuitry or the other way around the problem encountered in marrying analog and digital circuitry are the same but with different scope Some of the most prevalent problems are chip package capacitive and inductive coupling ringing on the RLC tuned circuits that form the chip package power supply rails and off chip drivers and receivers coupling between circuits through the chip substrate bulk and radiated emissions from the chip package interconnects To aggravate the problems of designers who have to deal with the complexity of mixed signal coupling there is a lack of verification techniques to simulate the problem In addition to considering RLC models for the various chip package board level parasitics mixed signal circuit designers must also model coupling through the common substrate when simulating ICs to obtain an accurate estimate of coupled noise in their designs Unfortunately accurate simulation of substrate coupling has only recently begun to receive attention and techniques for the same are not widely known Simulation Techniques and Solutions for Mixed Signal Coupling in Integrated Circuits addresses two major issues of the mixed signal coupling problem how to simulate it and how to overcome it It identifies some of the problems that will be encountered gives examples of actual hardware experiences offers simulation techniques and suggests possible solutions Readers of this book should come away with a clear directive to simulate their design for interactions prior to building the design versus a build it and see mentality

High-Performance Computing and Networking Peter Sloot, Marian Bubak, Alfons Hoekstra, Bob Hertzberger, 1999-03-30 This book constitutes the refereed proceedings of the 7th International Conference on High Performance Computing and Networking HPCN Europe 1999 held in Amsterdam The Netherlands in April 1999 The 115 revised full papers presented were carefully selected from a total of close to 200 conference submissions as well as from submissions for various topical workshops Also included are 40 selected poster presentations The conference papers are organized in three tracks end user applications of HPCN computational science and

computer science additionally there are six sections corresponding to topical workshops

Light Propagation in Periodic Media Michel Nevriere, Evgeny Popov, 2018-10-03 Based on more than 30 years of research on differential theories of gratings this book describes developments in differential theory for applications in spectroscopy acoustics X ray instrumentation optical communication information processing photolithography high power lasers high precision engineering and astronomy Introducing the Fast Fourier Factorization approach to improve the convergence of a truncated series the book examines multilayers stacked gratings crossed gratings photonic crystals and isotropic and anisotropic materials techniques and examples in grating design and Maxwell equations in a truncated Fourier space

IEEE Circuits & Devices, 2000

The Electrical Engineering Handbook - Six Volume Set Richard C. Dorf, 2018-12-14 In two editions spanning more than a decade The Electrical Engineering Handbook stands as the definitive reference to the multidisciplinary field of electrical engineering Our knowledge continues to grow and so does the Handbook For the third edition it has grown into a set of six books carefully focused on specialized areas or fields of study Each one represents a concise yet definitive collection of key concepts models and equations in its respective domain thoughtfully gathered for convenient access Combined they constitute the most comprehensive authoritative resource available Circuits Signals and Speech and Image Processing presents all of the basic information related to electric circuits and components analysis of circuits the use of the Laplace transform as well as signal speech and image processing using filters and algorithms It also examines emerging areas such as text to speech synthesis real time processing and embedded signal processing Electronics Power Electronics Optoelectronics Microwaves Electromagnetics and Radar delves into the fields of electronics integrated circuits power electronics optoelectronics electromagnetics light waves and radar supplying all of the basic information required for a deep understanding of each area It also devotes a section to electrical effects and devices and explores the emerging fields of microlithography and power electronics Sensors Nanoscience Biomedical Engineering and Instruments provides thorough coverage of sensors materials and nanoscience instruments and measurements and biomedical systems and devices including all of the basic information required to thoroughly understand each area It explores the emerging fields of sensors nanotechnologies and biological effects Broadcasting and Optical Communication Technology explores communications information theory and devices covering all of the basic information needed for a thorough understanding of these areas It also examines the emerging areas of adaptive estimation and optical communication Computers Software Engineering and Digital Devices examines digital and logical devices displays testing software and computers presenting the fundamental concepts needed to ensure a thorough understanding of each field It treats the emerging fields of programmable logic hardware description languages and parallel computing in detail Systems Controls Embedded Systems Energy and Machines explores in detail the fields of energy devices machines and systems as well as control systems It provides all of the fundamental concepts needed for thorough in depth understanding of each area and devotes special attention to the

emerging area of embedded systems Encompassing the work of the world's foremost experts in their respective specialties The Electrical Engineering Handbook Third Edition remains the most convenient reliable source of information available This edition features the latest developments the broadest scope of coverage and new material on nanotechnologies fuel cells embedded systems and biometrics The engineering community has relied on the Handbook for more than twelve years and it will continue to be a platform to launch the next wave of advancements The Handbook's latest incarnation features a protective slipcase which helps you stay organized without overwhelming your bookshelf It is an attractive addition to any collection and will help keep each volume of the Handbook as fresh as your latest research *Applying Parallel Processing Techniques to Digital Signal Processing Algorithms and Architectures for High Level VLSI Synthesis* Lori Ellen Lucke, 1992

OFDM Baseband Receiver Design for Wireless Communications Tzi-Dar Chiueh, Pei-Yun Tsai, 2008-04-15 Orthogonal frequency division multiplexing OFDM access schemes are becoming more prevalent among cellular and wireless broadband systems accelerating the need for smaller more energy efficient receiver solutions Up to now the majority of OFDM texts have dealt with signal processing aspects To address the current gap in OFDM integrated circuit IC instruction Chiueh and Tsai have produced this timely text on baseband design OFDM Baseband Receiver Design for Wireless Communications covers the gamut of OFDM technology from theories and algorithms to architectures and circuits Chiueh and Tsai give a concise yet comprehensive look at digital communications fundamentals before explaining modulation and signal processing algorithms in OFDM receivers Moreover the authors give detailed treatment of hardware issues from design methodology to physical IC implementation Closes the gap between OFDM theory and implementation Enables the reader to transfer communication receiver concepts into hardware design wireless receivers with acceptable implementation loss achieve low power designs Contains numerous figures to illustrate techniques Features concrete design examples of MC CDMA systems and cognitive radio applications Presents theoretical discussions that focus on concepts rather than mathematical derivation Provides a much needed single source of material from numerous papers Based on course materials for a class in digital communication IC design this book is ideal for advanced undergraduate or post graduate students from either VLSI design or signal processing backgrounds New and experienced engineers in industry working on algorithms or hardware for wireless communications devices will also find this book to be a key reference Journal of VLSI Signal Processing Systems for Signal, Image, and Video Technology, 1997

Systems Design for Remote Healthcare Koushik Maharatna, Silvio Bonfiglio, 2013-11-13 This book provides a multidisciplinary overview of the design and implementation of systems for remote patient monitoring and healthcare Readers are guided step by step through the components of such a system and shown how they could be integrated in a coherent framework for deployment in practice The authors explain planning from subsystem design to complete integration and deployment given particular application constraints Readers will benefit from descriptions of the clinical requirements underpinning the entire application scenario physiological parameter sensing

techniques information processing approaches and overall application dependent system integration Each chapter ends with a discussion of practical design challenges and two case studies are included to provide practical examples and design methods for two remote healthcare systems with different needs *Advanced Concepts in Adaptive Signal Processing* W. Kenneth Jenkins, Andrew W. Hull, Jeffrey C. Strait, Bernard A. Schnaufer, Xiaohui Li, 2012-12-06 Although adaptive filtering and adaptive array processing began with research and development efforts in the late 1950 s and early 1960 s it was not until the publication of the pioneering books by Honig and Messerschmitt in 1984 and Widrow and Stearns in 1985 that the field of adaptive signal processing began to emerge as a distinct discipline in its own right Since 1984 many new books have been published on adaptive signal processing which serve to define what we will refer to throughout this book as conventional adaptive signal processing These books deal primarily with basic architectures and algorithms for adaptive filtering and adaptive array processing with many of them emphasizing practical applications Most of the existing textbooks on adaptive signal processing focus on finite impulse response FIR filter structures that are trained with strategies based on steepest descent optimization or more precisely the least mean square LMS approximation to steepest descent While literally hundreds of archival research papers have been published that deal with more advanced adaptive filtering concepts none of the current books attempt to treat these advanced concepts in a unified framework The goal of this new book is to present a number of important but not so well known topics that currently exist scattered in the research literature The book also documents some new results that have been conceived and developed through research conducted at the University of Illinois during the past five years Retiming, Folding and Register Minimization for DSP Synthesis Tracy Carroll Denk, 1996 This thesis introduces some formal techniques which can be used for synthesis of VLSI very large scale integration architectures for DSP digital signal processing algorithms These techniques can be used to design architectures for single rate and single dimensional DSP multirate and single dimensional DSP and single rate and multi dimensional DSP For single rate and single dimensional DSP we have developed a novel technique for exhaustively generating all retiming and scheduling solutions for the DSP algorithm The significance of this contribution is twofold First it allows a circuit designer to explore a large space of possible high level implementations for the algorithm which allows the designer to make a good decision about the high level architectural details of the design Second this work explicitly shows the important interaction between retiming and scheduling in high level synthesis While retiming and scheduling have been treated as separate problems in the past our work uses a mathematical framework to show that retiming is a special case of scheduling Also for single rate and single dimensional DSP we have developed techniques for computing the minimum number of registers required to implement a statically scheduled DSP program Closed form expressions are derived for computing the minimum number of registers assuming various memory models with or without retiming the scheduled DFG This is an important problem because memory typically occupies a large portion of the area of a DSP implementation often over half of the area

and minimizing this area leads to more efficient designs For multirate and single dimensional DSP we have developed a multirate folding technique which can be used to synthesize single rate architectures from multirate DSP algorithms Prior to the development of this formal technique the design of single rate

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

Circuits, Signals, and Speech and Image Processing Richard C. Dorf, 2018-10-03 In two editions spanning more than a decade *The Electrical Engineering Handbook* stands as the definitive reference to the multidisciplinary field of electrical engineering Our knowledge continues to grow and so does the Handbook For the third edition it has expanded into a set of six books carefully focused on a specialized area or field of study Each book represents a concise yet definitive collection of key concepts models and equations in its respective domain thoughtfully gathered for convenient access *Circuits Signals and Speech and Image Processing* presents all of the basic information related to electric circuits and components analysis of circuits the use of the Laplace transform as well as signal speech and image processing using filters and algorithms It also examines emerging areas such as text to speech synthesis real time processing and embedded signal processing Each article includes defining terms references and sources of further information Encompassing the work of the world's foremost experts in their respective specialties *Circuits Signals and Speech and Image Processing* features the latest developments the broadest scope of coverage and new material on biometrics

Digital Signal Processing Paulo S. R. Diniz, Eduardo A. B. da Silva, Sergio L. Netto, 2002-04-18 Digital signal processing lies at the heart of the communications revolution and is an essential element of key technologies such as mobile phones and the Internet This book covers all the major topics in digital signal processing DSP design and analysis supported by MatLab examples and other modelling techniques The authors explain clearly and

concisely why and how to use digital signal processing systems how to approximate a desired transfer function characteristic using polynomials and ratio of polynomials why an appropriate mapping of a transfer function on to a suitable structure is important for practical applications and how to analyse represent and explore the trade off between time and frequency representation of signals An ideal textbook for students it will also be a useful reference for engineers working on the development of signal processing systems *Custom Memory Management Methodology* Francky Catthoor, Sven Wuytack, G.E. de Greef, Florin Banica, Lode Nachtergaele, Arnout Vandecappelle, 2013-03-09 The main intention of this book is to give an impression of the state of the art in system level memory management data transfer and storage related issues for complex data dominated real time signal and data processing applications The material is based on research at IMEC in this area in the period 1989 1997 In order to deal with the stringent timing requirements and the data dominated characteristics of this domain we have adopted a target architecture style and a systematic methodology to make the exploration and optimization of such systems feasible Our approach is also very heavily application driven which is illustrated by several realistic demonstrators partly used as red thread examples in the book Moreover the book addresses only the steps above the traditional high level synthesis scheduling and allocation or compilation traditional or ILP oriented tasks The latter are mainly focussed on scalar or scalar stream operations and data where the internal structure of the complex data types is not exploited in contrast to the approaches discussed here The proposed methodologies are largely independent of the level of programmability in the data path and controller so they are valuable for the realisation of both hardware and software systems Our target domain consists of signal and data processing systems which deal with large amounts of data

Handbook of Signal Processing Systems Shuvra S. Bhattacharyya, Ed F. Deprettere, Rainer Leupers, Jarmo Takala, 2010-09-10 It gives me immense pleasure to introduce this timely handbook to the research development communities in the field of signal processing systems SPS This is the first of its kind and represents state of the arts coverage of research in this field The driving force behind information technologies IT hinges critically upon the major advances in both component integration and system integration The major breakthrough for the former is undoubtedly the invention of IC in the 50 s by Jack S Kilby the Nobel Prize Laureate in Physics 2000 In an integrated circuit all components were made of the same semiconductor material Beginning with the pocket calculator in 1964 there have been many increasingly complex applications followed In fact processing gates and memory storage on a chip have since then grown at an exponential rate following Moore s Law Moore himself admitted that Moore s Law had turned out to be more accurate longer lasting and deeper in impact than he ever imagined With greater device integration various signal processing systems have been realized for many killer IT applications Further breakthroughs in computer sciences and Internet technologies have also catalyzed large scale system integration All these have led to today s IT revolution which has profound impacts on our lifestyle and overall prospect of humanity It is hard to imagine life today without mobiles or Internets The success of SPS requires a well

concerted integrated approach from multiple disciplines such as device design and application

Computer Systems: Architectures, Modeling, and Simulation Andy Pimentel, Stamatis Vassiliadis, 2004-07-05 This book constitutes the refereed proceedings of the 4th International Workshop on Systems Architectures Modeling and Simulation SAMOS 2004 held in Samos Greece on July 2004 Besides the SAMOS 2004 proceedings the book also presents 19 revised papers from the predecessor workshop SAMOS 2003 The 55 revised full papers presented were carefully reviewed and selected for inclusion in the book The papers are organized in topical sections on reconfigurable computing architectures and implementation and systems modeling and simulation

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