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A practical primer for the student and practicing engineer already familiar with the basics of digital design, the reference develops a working grasp of the VHDL hardware description language step-by-step using easy-to-understand examples. Starting with a simple but workable design sample, increasingly more complex fundamentals of the language are introduced until all core features of VHDL are brought to light. Included in the coverage are state machines, modular design, FPGA-based memories, clock management, specialized I/O, and an introduction to techniques of simulation. The goal is to prepare the reader to design real-world FPGA solutions. All the sample code used in the book is available online. What Strunk and White did for the English language with "The Elements of Style," VHDL BY EXAMPLE does for FPGA design.

Get started with FPGA programming using SystemVerilog, and develop real-world skills by building projects, including a calculator and a keyboard Key Features Explore different FPGA usage methods and the FPGA tool flow Learn how to design, test, and implement hardware circuits using SystemVerilog Build real-world FPGA projects such as a calculator and a

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keyboard using FPGA resources Book Description Field Programmable Gate Arrays (FPGAs) have now become a core part of most modern electronic and computer systems. However, to implement your ideas in the real world, you need to get your head around the FPGA architecture, its toolset, and critical design considerations. *FPGA Programming for Beginners* will help you bring your ideas to life by guiding you through the entire process of programming FPGAs and designing hardware circuits using SystemVerilog. The book will introduce you to the FPGA and Xilinx architectures and show you how to work on your first project, which includes toggling an LED. You'll then cover SystemVerilog RTL designs and their implementations. Next, you'll get to grips with using the combinational Boolean logic design and work on several projects, such as creating a calculator and updating it using FPGA resources. Later, the book will take you through the advanced concepts of AXI and show you how to create a keyboard using PS/2. Finally, you'll be able to consolidate all the projects in the book to create a unified output using a Video Graphics Array (VGA) controller that you'll design. By the end of this SystemVerilog FPGA book, you'll have learned how to work with FPGA systems and be able to design hardware circuits and boards using SystemVerilog programming. What you will learn Understand the FPGA architecture and its implementation Get to grips with writing SystemVerilog

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RTLMake FPGA projects using SystemVerilog programmingWork with computer math basics, parallelism, and pipeliningExplore the advanced topics of AXI and keyboard interfacing with PS/2Discover how you can implement a VGA interface in your projectsWho this book is for This FPGA design book is for embedded system developers, engineers, and programmers who want to learn FPGA and SystemVerilog programming from scratch. FPGA designers looking to gain hands-on experience in working on real-world projects will also find this book useful.

This book constitutes the refereed proceedings of the Cryptographer's Track at the RSA Conference 2020, CT-RSA 2020, held in San Francisco, CA, USA, in February 2020. The 28 papers presented in this volume were carefully reviewed and selected from 95 submissions. CT-RSA is the track devoted to scientific papers on cryptography, public-key to symmetric-key cryptography and from crypto-graphic protocols to primitives and their implementation security.

Sensors were developed to detect and quantify structures and functions of human body as well as to gather information from the environment in order to optimize the efficiency, cost-effectiveness and quality of healthcare services as well as to improve health and quality of life. This book offers an up-to-date overview of the concepts, modeling, technical and technological

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details and practical applications of different types of sensors. It also discusses the trends for the next generation of sensors and systems for healthcare settings. It is aimed at researchers and graduate students in the field of healthcare technologies, as well as academics and industry professionals involved in developing sensing systems for human body structures and functions, and for monitoring activities and health.

Soft Errors and Fault-Tolerant Design

Xilinx MicroBlaze MCS SoC Edition

Using Vivado

High-speed Serial Buses in Embedded Systems

Digital Systems Design Using VHDL

Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers

DIGITAL SYSTEMS DESIGN USING VERILOG integrates coverage of logic design principles, Verilog as a hardware design language, and FPGA implementation to help electrical and computer engineering students master the process of designing and testing new hardware configurations. A Verilog equivalent of authors Roth and John's previous successful text using VHDL, this practical book presents Verilog constructs side-by-side with hardware, encouraging students to think in terms of desired hardware while writing synthesizable Verilog. Following a review of the basic concepts of logic design, the authors

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introduce the basics of Verilog using simple combinational circuit examples, followed by models for simple sequential circuits. Subsequent chapters ask readers to tackle more and more complex designs. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

This book suggests and describes a number of fast parallel circuits for data/vector processing using FPGA-based hardware accelerators. Three primary areas are covered: searching, sorting, and counting in combinational and iterative networks. These include the application of traditional structures that rely on comparators/swappers as well as alternative networks with a variety of core elements such as adders, logical gates, and look-up tables. The iterative technique discussed in the book enables the sequential reuse of relatively large combinational blocks that execute many parallel operations with small propagation delays. For each type of network discussed, the main focus is on the step-by-step development of the architectures proposed from initial concepts to synthesizable hardware description language specifications. Each type of network is taken through several stages, including modeling the desired functionality in software, the retrieval and automatic conversion of key functions, leading to specifications for optimized hardware modules. The resulting specifications are then synthesized, implemented, and tested in FPGAs using commercial design environments and prototyping boards. The methods proposed can be used in a range of data processing applications, including traditional sorting, the extraction of maximum and minimum subsets

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from large data sets, communication-time data processing, finding frequently occurring items in a set, and Hamming weight/distance counters/comparators. The book is intended to be a valuable support material for university and industrial engineering courses that involve FPGA-based circuit and system design.

This textbook for courses in Embedded Systems introduces students to necessary concepts, through a hands-on approach. It gives a great introduction to FPGA-based microprocessor system design using state-of-the-art boards, tools, and microprocessors from Altera/Intel® and Xilinx®. HDL-based designs (soft-core), parameterized cores (Nios II and MicroBlaze), and ARM Cortex-A9 design are discussed, compared and explored using many hand-on designs projects. Custom IP for HDMI coder, Floating-point operations, and FFT bit-swap are developed, implemented, tested and speed-up is measured. Downloadable files include all design examples such as basic processor synthesizable code for Xilinx and Altera tools for PicoBlaze, MicroBlaze, Nios II and ARMv7 architectures in VHDL and Verilog code, as well as the custom IP projects. Each Chapter has a substantial number of short quiz questions, exercises, and challenging projects. Explains soft, parameterized, and hard core systems design tradeoffs; Demonstrates design of popular KCPSM6 8 Bit microprocessor step-by-step; Discusses the 32 Bit ARM Cortex-A9 and a basic processor is synthesized; Covers design flows for both FPGA Market leaders Nios II Altera/Intel and MicroBlaze Xilinx system; Describes Compiler-Compiler Tool development; Includes a substantial number of

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Homework's and FPGA exercises and design projects in each chapter.

Dr Donald Bailey starts with introductory material considering the problem of embedded image processing, and how some of the issues may be solved using parallel hardware solutions. Field programmable gate arrays (FPGAs) are introduced as a technology that provides flexible, fine-grained hardware that can readily exploit parallelism within many image processing algorithms. A brief review of FPGA programming languages provides the link between a software mindset normally associated with image processing algorithms, and the hardware mindset required for efficient utilization of a parallel hardware design. The design process for implementing an image processing algorithm on an FPGA is compared with that for a conventional software implementation, with the key differences highlighted. Particular attention is given to the techniques for mapping an algorithm onto an FPGA implementation, considering timing, memory bandwidth and resource constraints, and efficient hardware computational techniques. Extensive coverage is given of a range of low and intermediate level image processing operations, discussing efficient implementations and how these may vary according to the application. The techniques are illustrated with several example applications or case studies from projects or applications he has been involved with. Issues such as interfacing between the FPGA and peripheral devices are covered briefly, as is designing the system in such a way that it can be more readily debugged and tuned. Provides a bridge between algorithms and hardware Demonstrates how to avoid many of the

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potential pitfalls Offers practical recommendations and solutions Illustrates several real-world applications and case studies Allows those with software backgrounds to understand efficient hardware implementation Design for Embedded Image Processing on FPGAs is ideal for researchers and engineers in the vision or image processing industry, who are looking at smart sensors, machine vision, and robotic vision, as well as FPGA developers and application engineers. The book can also be used by graduate students studying imaging systems, computer engineering, digital design, circuit design, or computer science. It can also be used as supplementary text for courses in advanced digital design, algorithm and hardware implementation, and digital signal processing and applications. Companion website for the book: www.wiley.com/go/bailey/fpga

FPGA-BASED Hardware Accelerators

The Zynq Book

Embedded Processing with the Arm Cortex-A9 on the Xilinx Zynq-7000 All Programmable Soc

Designing with Xilinx® FPGAs

Embedded Systems Design with Platform FPGAs

Ultrasonic Distance Measurement Using Basys 3 FPGA Board

This book helps readers to implement their designs on Xilinx® FPGAs. The authors demonstrate how to get the greatest impact from using the Vivado® Design Suite, which

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delivers a SoC-strength, IP-centric and system-centric, next generation development environment that has been built from the ground up to address the productivity bottlenecks in system-level integration and implementation. This book is a hands-on guide for both users who are new to FPGA designs, as well as those currently using the legacy Xilinx tool set (ISE) but are now moving to Vivado. Throughout the presentation, the authors focus on key concepts, major mechanisms for design entry, and methods to realize the most efficient implementation of the target design, with the least number of iterations.

This Special Issue with 35 published articles shows the significance of the topic “ Signal Processing and Analysis of Electrical Circuit ” . This topic has been gaining increasing attention in recent times. The presented articles can be categorized into four different areas: signal processing and analysis methods of electrical circuits; electrical measurement technology; applications of signal processing of electrical equipment; fault diagnosis of electrical circuits. It is a fact that the development of electrical systems, signal processing methods, and circuits has been accelerating. Electronics applications related to electrical circuits and signal processing methods have gained noticeable attention in recent times. The methods of signal processing and electrical circuits are widely used by engineers and scientists all over the world. The constituent papers represent a significant contribution to electronics and present applications that can be used in industry. Further improvements to the presented approaches are required for realizing their full potential.

"This book assumes no previous knowledge of digital design. You start at the beginning learning about basic gates, logic equations, Boolean algebra, and Karnaugh maps. In over 75 examples we show you how to design digital circuits using Verilog, simulate them, and

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synthesize the designs to a Xilinx FPGA on one of the following Digilent FPGA boards available from www.digilentinc.com: the BasysTM2 Spartan-3E FPGA board, the NexysTM2 Spartan-3E FPGA board, the NexysTM3 Spartan-6 FPGA board, the NexysTM4 Artix-7 FPGA board, or the Basys3TM Artix-7 FPGA board. The differences between these boards are summarized in Appendix C. To simulate and synthesize your designs to a Xilinx FPGA, you will need to download the free Vivado HL WebPACK from Xilinx, Inc. (www.xilinx.com). A tutorial on using Vivado is given in Appendix A. Each of the FPGA boards will need its unique user constraints file (.ucf), which identifies specific pin numbers for a particular board (see Appendix C)." -- Amazon.

This book is about the Zynq-7000 All Programmable System on Chip, the family of devices from Xilinx that combines an application-grade ARM Cortex-A9 processor with traditional FPGA logic fabric. Catering for both new and experienced readers, it covers fundamental issues in an accessible way, starting with a clear overview of the device architecture, and an introduction to the design tools and processes for developing a Zynq SoC. Later chapters progress to more advanced topics such as embedded systems development, IP block design and operating systems. Maintaining a 'real-world' perspective, the book also compares Zynq with other device alternatives, and considers end-user applications. The Zynq Book is accompanied by a set of practical tutorials hosted on a companion website. These tutorials will guide the reader through first steps with Zynq, following on to a complete, audio-based embedded systems design.

Secure Smart Embedded Devices, Platforms and Applications
Principles and Structures of FPGAs

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Bring your ideas to life by creating hardware designs and electronic circuits with SystemVerilog
Project Oberon

FPGA Programming for Beginners

Sensors for Everyday Life

A hands-on introduction to FPGA prototyping and SoC design This is the successor edition of the popular FPGA Prototyping by Verilog Examples text. It follows the same "learning-by-doing" approach to teach the fundamentals and practices of HDL synthesis and FPGA prototyping. The new edition uses a coherent series of examples to demonstrate the process to develop sophisticated digital circuits and IP (intellectual property) cores, integrate them into an SoC (system on a chip) framework, realize the system on an FPGA prototyping board, and verify the hardware and software operation. The examples start with simple gate-level circuits, progress gradually through the RT (register transfer) level modules, and lead to a functional embedded system with custom I/O peripherals and hardware accelerators. Although it is an introductory text, the examples are developed in a rigorous manner, and the derivations follow the strict design guidelines and coding practices used for large, complex digital systems. The book is completely updated and uses the SystemVerilog language, which "absorbs" the Verilog language. It presents the hardware design in the SoC context and introduces the hardware-software co-design concept.

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Instead of treating examples as isolated entities, the book integrates them into a single coherent SoC platform that allows readers to explore both hardware and software “programmability” and develop complex and interesting embedded system projects. The new edition: Adds four general-purpose IP cores, which are multi-channel PWM (pulse width modulation) controller, I2C controller, SPI controller, and XADC (Xilinx analog-to-digital converter) controller. Introduces a music synthesizer constructed with a DDFS (direct digital frequency synthesis) module and an ADSR (attack-decay-sustain-release) envelope generator. Expands the original video controller into a complete stream based video subsystem that incorporates a video synchronization circuit, a test-pattern generator, an OSD (on-screen display) controller, a sprite generator, and a frame buffer. Provides a detailed discussion on blocking and nonblocking statements and coding styles. Describes basic concepts of software-hardware co-design with Xilinx MicroBlaze MCS soft-core processor. Provides an overview of bus interconnect and interface circuit. Presents basic embedded system software development. Suggests additional modules and peripherals for interesting and challenging projects. FPGA Prototyping by SystemVerilog Examples makes a natural companion text for introductory and advanced digital design courses and embedded system courses. It also serves as an ideal self-teaching guide for practicing engineers

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who wish to learn more about this emerging area of interest. This book introduces the concepts of soft errors in FPGAs, as well as the motivation for using commercial, off-the-shelf (COTS) FPGAs in mission-critical and remote applications, such as aerospace. The authors describe the effects of radiation in FPGAs, present a large set of soft-error mitigation techniques that can be applied in these circuits, as well as methods for qualifying these circuits under radiation. Coverage includes radiation effects in FPGAs, fault-tolerant techniques for FPGAs, use of COTS FPGAs in aerospace applications, experimental data of FPGAs under radiation, FPGA embedded processors under radiation and fault injection in FPGAs. Since dedicated parallel processing architectures such as GPUs have become more desirable in aerospace applications due to high computational power, GPU analysis under radiation is also discussed. Digital Logic with an Introduction to Verilog and FPGA-Based Design provides basic knowledge of field programmable gate array (FPGA) design and implementation using Verilog, a hardware description language (HDL) commonly used in the design and verification of digital circuits. Emphasizing fundamental principles, this student-friendly textbook is an ideal resource for introductory digital logic courses. Chapters offer clear explanations of key concepts and step-by-step procedures that illustrate the real-world application of FPGA-based

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design. Designed for beginning students familiar with DC circuits and the C programming language, the text begins by describing of basic terminologies and essential concepts of digital integrated circuits using transistors. Subsequent chapters cover device level and logic level design in detail, including combinational and sequential circuits used in the design of microcontrollers and microprocessors. Topics include Boolean algebra and functions, analysis and design of sequential circuits using logic gates, FPGA-based implementation using CAD software tools, and combinational logic design using various HDLs with focus on Verilog.

This book comprises the peer-reviewed proceedings of the International Conference on Communications, Signal Processing and VLSI (IC2SV) 2019. It explores the recent advances in the fields of signal and image processing, wireless and mobile communications, embedded systems, VLSI, microwave, and antennas. The contents provide insights into present technological challenges and discusses the emerging applications of different imaging techniques and communications systems. Given the range of topics covered, this book can be useful for students as well as researchers interested in the area of communications, signal processing, and VLSI technologies.

Resource Aware Floorplanning of Partially Reconfigurable Designs on Heterogeneous FPGA

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Digital System Design with FPGA: Implementation Using Verilog and VHDL
Modern Computer Architecture and Organization

FPGA Prototyping by VHDL Examples

Smart Card Research and Advanced Applications

The Cryptographers' Track at the RSA Conference 2020, San Francisco, CA, USA, February 24-28, 2020, Proceedings

This comprehensive textbook on the field programmable gate array (FPGA) covers its history, fundamental knowledge, architectures, device technologies, computer-aided design technologies, design tools, examples of application, and future trends. Programmable logic devices represented by FPGAs have been rapidly developed in recent years and have become key electronic devices used in most IT products. This book provides both complete introductions suitable for students and beginners, and high-level techniques useful for engineers and researchers in this field. Differently developed from usual integrated circuits, the FPGA has unique structures, design methodologies, and application techniques. Allowing programming by users, the device can

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dramatically reduce the rising cost of development in advanced semiconductor chips. The FPGA is now driving the most advanced semiconductor processes and is an all-in-one platform combining memory, CPUs, and various peripheral interfaces. This book introduces the FPGA from various aspects for readers of different levels. Novice learners can acquire a fundamental knowledge of the FPGA, including its history, from Chapter 1; the first half of Chapter 2; and Chapter 4. Professionals who are already familiar with the device will gain a deeper understanding of the structures and design methodologies from Chapters 3 and 5. Chapters 6–8 also provide advanced techniques and cutting-edge applications and trends useful for professionals. Although the first parts are mainly suitable for students, the advanced sections of the book will be valuable for professionals in acquiring an in-depth understanding of the FPGA to maximize the performance of the device. Embedded Systems Design with Platform FPGAs introduces professional engineers and students alike to system

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development using Platform FPGAs. The focus is on embedded systems but it also serves as a general guide to building custom computing systems. The text describes the fundamental technology in terms of hardware, software, and a set of principles to guide the development of Platform FPGA systems. The goal is to show how to systematically and creatively apply these principles to the construction of application-specific embedded system architectures. There is a strong focus on using free and open source software to increase productivity. Each chapter is organized into two parts. The white pages describe concepts, principles, and general knowledge. The gray pages provide a technical rendition of the main issues of the chapter and show the concepts applied in practice. This includes step-by-step details for a specific development board and tool chain so that the reader can carry out the same steps on their own. Rather than try to demonstrate the concepts on a broad set of tools and boards, the text uses a single set of tools (Xilinx Platform Studio, Linux, and GNU) throughout and

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uses a single developer board (Xilinx ML-510) for the examples. Explains how to use the Platform FPGA to meet complex design requirements and improve product performance Presents both fundamental concepts together with pragmatic, step-by-step instructions for building a system on a Platform FPGA Includes detailed case studies, extended real-world examples, and lab exercises

This book constitutes the proceedings of the 18th International Conference on Cryptographic Hardware and Embedded Systems, CHES 2016, held in Santa Barbara, CA, USA, in August 2016. The 30 full papers presented in this volume were carefully reviewed and selected from 148 submissions. They were organized in topical sections named: side channel analysis; automotive security; invasive attacks; side channel countermeasures; new directions; software implementations; cache attacks; physical unclonable functions; hardware implementations; and fault attacks.

This book constitutes the thoroughly refereed post-

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conference proceedings of the 18th International Conference on Smart Card Research and Advanced Applications, CARDIS 2019, held in Prague, Czech Republic, in November 2019. The 15 revised full papers presented in this book were carefully reviewed and selected from 31 submissions. The papers are organized in the following topical sections: system-on-a-chip security; post-quantum cryptography; side-channel analysis; microarchitectural attacks; cryptographic primitives; advances in side-channel analysis. CARDIS has provided a space for security experts from industry and academia to exchange on security of smart cards and related applications.

12th International Conference, SecITC 2019, Bucharest, Romania, November 14–15, 2019, Revised Selected Papers

Xilinx MicroBlaze MCS SoC

Image Processing Using FPGAs

Applied Digital Logic Exercises Using FPGAs

Architecting High-Performance Embedded Systems

18th International Conference, Santa Barbara, CA, USA,

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August 17-19, 2016, Proceedings

Explore the complete process of developing systems based on field-programmable gate arrays (FPGAs), including the design of electronic circuits and the construction and debugging of prototype embedded devices ***Key Features*** ***Learn the basics of embedded systems and real-time operating systems*** ***Understand how FPGAs implement processing algorithms in hardware*** ***Design, construct, and debug custom digital systems from scratch using KiCad*** ***Book Description*** ***Modern digital devices used in homes, cars, and wearables contain highly sophisticated computing capabilities composed of embedded systems that generate, receive, and process digital data streams at rates up to multiple gigabits per second. This book will show you how to use Field Programmable Gate Arrays (FPGAs) and high-speed digital circuit design to create your own cutting-edge digital systems. Architecting High-Performance Embedded Systems takes you through the fundamental concepts of embedded systems, including real-time operation and the Internet of Things (IoT), and the architecture and capabilities of the latest generation of FPGAs. Using powerful free tools for FPGA design and electronic circuit design, you'll learn how to design, build, test, and debug high-performance FPGA-based IoT devices. The book will also help you get up to speed with embedded system design, circuit design, hardware construction, firmware development, and debugging to produce a high-performance embedded device – a network-based digital oscilloscope. You'll explore techniques such as designing four-layer printed circuit boards with high-speed differential signal pairs and assembling the board using surface-mount components. By the end of the book, you'll have a solid understanding of the concepts underlying***

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embedded systems and FPGAs and will be able to design and construct your own sophisticated digital devices. What you will learn Understand the fundamentals of real-time embedded systems and sensors Discover the capabilities of FPGAs and how to use FPGA development tools Learn the principles of digital circuit design and PCB layout with KiCad Construct high-speed circuit board prototypes at low cost Design and develop high-performance algorithms for FPGAs Develop robust, reliable, and efficient firmware in C Thoroughly test and debug embedded device hardware and firmware Who this book is for This book is for software developers, IoT engineers, and anyone who wants to understand the process of developing high-performance embedded systems. You'll also find this book useful if you want to learn about the fundamentals of FPGA development and all aspects of firmware development in C and C++. Familiarity with the C language, digital circuits, and electronic soldering is necessary to get started. Learn how to design digital circuits with FPGAs (field-programmable gate arrays), the devices that reconfigure themselves to become the very hardware circuits you set out to program. With this practical guide, author Justin Rajewski shows you hands-on how to create FPGA projects, whether you're a programmer, engineer, product designer, or maker. You'll quickly go from the basics to designing your own processor. Designing digital circuits used to be a long and costly endeavor that only big companies could pursue. FPGAs make the process much easier, and now they're affordable enough even for hobbyists. If you're familiar with electricity and basic electrical components, this book starts simply and progresses through increasingly complex projects. Set up your environment by installing Xilinx ISE and the author's Mojo IDE Learn how hardware

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designs are broken into modules, comparable to functions in a software program Create digital hardware designs and learn the basics on how they'll be implemented by the FPGA Build your projects with Lucid, a beginner-friendly hardware description language, based on Verilog, with syntax similar to C/C++ and Java

The floorplanning problem in FPGA has been a topic of research for more than a decade. Although the floorplanning problem has been thoroughly explored for homogeneous FPGAs, very little work has been done for heterogeneous FPGAs. In this thesis, we have designed a floorplanner for Partially Reconfigurable (PR) designs in FPGA that smartly decides one of the three proposed resource allocation schemes to floorplan a particular type of reconfigurable region. We also proposed a White Space Detection algorithm for efficient management of white space inside an FPGA in order to reduce area and wirelength. The floorplanner uses Xilinx Virtex 5 and Artix 7 FPGA architectures and can be easily integrated with existing vendor supplied Place and Route tools. The main objective of the floorplanner is to reduce wirelength, minimize wasted resources and the area. We have compared our proposed floorplanner with other previously published results reported in the literature. We observe substantial improvement in the overall wirelength as well as the execution time.

A no-nonsense, practical guide to current and future processor and computer architectures that enables you to design computer systems and develop better software applications across a variety of domains Key Features • Understand digital circuitry through the study of transistors, logic gates, and sequential logic • Learn the architecture of x86, x64, ARM, and RISC-V processors, iPhones, and high-performance

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gaming PCs • Study the design principles underlying the domains of cybersecurity, bitcoin, and self-driving cars Book Description Are you a software developer, systems designer, or computer architecture student looking for a methodical introduction to digital device architectures, but are overwhelmed by the complexity of modern systems? This step-by-step guide will teach you how modern computer systems work with the help of practical examples and exercises. You'll gain insights into the internal behavior of processors down to the circuit level and will understand how the hardware executes code developed in high-level languages. This book will teach you the fundamentals of computer systems including transistors, logic gates, sequential logic, and instruction pipelines. You will learn details of modern processor architectures and instruction sets including x86, x64, ARM, and RISC-V. You will see how to implement a RISC-V processor in a low-cost FPGA board and write a quantum computing program and run it on an actual quantum computer. This edition has been updated to cover the architecture and design principles underlying the important domains of cybersecurity, blockchain and bitcoin mining, and self-driving vehicles. By the end of this book, you will have a thorough understanding of modern processors and computer architecture and the future directions these technologies are likely to take. What you will learn • Understand the fundamentals of transistor technology and digital circuits • Explore the concepts underlying pipelining and superscalar processing • Implement a complete RISC-V processor in a low-cost FPGA • Understand the technology used to implement virtual machines • Learn about security-critical computing applications like financial transaction processing • Get up to speed with blockchain and the hardware

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architectures used in bitcoin mining • Explore the capabilities of self-navigating vehicle computing architectures • Write a quantum computing program and run it on a real quantum computer Who this book is for This book is for software developers, computer engineering students, system designers, reverse engineers, and anyone looking to understand the architecture and design principles underlying modern computer systems: ranging from tiny, embedded devices to warehouse-size cloud server farms. A general understanding of computer processors is helpful but not required. Design and build high-performance real-time digital systems based on FPGAs and custom circuits

Signal Processing and Analysis of Electrical Circuit

Biomedical Signals Based Computer-Aided Diagnosis for Neurological Disorders

18th International Conference, CARDIS 2019, Prague, Czech Republic, November 11–13, 2019, Revised Selected Papers

Digital Logic

Learning FPGAs

This book presents a selection of papers representing current research on using field programmable gate arrays (FPGAs) for realising image processing algorithms. These papers are reprints of papers selected for a Special Issue of the Journal of Imaging on image processing using FPGAs. A diverse range of topics is covered, including parallel soft processors, memory management, image filters, segmentation, clustering, image analysis, and image compression. Applications include traffic sign recognition for autonomous driving, cell detection for histopathology, and video compression. Collectively, they represent the current state-of-the-art on image processing using FPGAs.

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This book constitutes the thoroughly refereed post-conference proceedings of the 12th International Conference on Security for Information Technology and Communications, SecITC 2019, held in Bucharest, Romania, in November 2019. The 14 revised full papers presented together with 4 invited talks were carefully reviewed and selected from 34 submissions. The papers present a wide range from cryptographic algorithms, to digital forensic and cyber security.

A hands-on introduction to FPGA prototyping and SoC design This Second Edition of the popular book follows the same “learning-by-doing” approach to teach the fundamentals and practices of VHDL synthesis and FPGA prototyping. It uses a coherent series of examples to demonstrate the process to develop sophisticated digital circuits and IP (intellectual property) cores, integrate them into an SoC (system on a chip) framework, realize the system on an FPGA prototyping board, and verify the hardware and software operation. The examples start with simple gate-level circuits, progress gradually through the RT (register transfer) level modules, and lead to a functional embedded system with custom I/O peripherals and hardware accelerators. Although it is an introductory text, the examples are developed in a rigorous manner, and the derivations follow strict design guidelines and coding practices used for large, complex digital systems. The new edition is completely updated. It presents the hardware design in the SoC context and introduces the hardware-software co-design concept. Instead of treating examples as isolated entities, the book integrates them into a single coherent SoC platform that allows readers to explore both hardware and software “programmability” and develop complex and interesting embedded system projects. The revised edition: Adds four general-purpose IP cores, which are multi-channel PWM (pulse width modulation) controller, I2C controller, SPI controller, and XADC (Xilinx analog-to-digital converter) controller. Introduces a music synthesizer constructed with a DDS (direct digital frequency

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synthesis) module and an ADSR (attack-decay-sustain-release) envelop generator. Expands the original video controller into a complete stream-based video subsystem that incorporates a video synchronization circuit, a test pattern generator, an OSD (on-screen display) controller, a sprite generator, and a frame buffer. Introduces basic concepts of software-hardware co-design with Xilinx MicroBlaze MCS soft-core processor. Provides an overview of bus interconnect and interface circuit. Introduces basic embedded system software development. Suggests additional modules and peripherals for interesting and challenging projects. The FPGA Prototyping by VHDL Examples, Second Edition makes a natural companion text for introductory and advanced digital design courses and embedded system course. It also serves as an ideal self-teaching guide for practicing engineers who wish to learn more about this emerging area of interest.

Project Oberon contains a definition of the Oberon Language and describes its relation to Modula-2 and the software tools developed with the system. This definitive, first-hand account of the design, development, and implementation of Oberon completes the Oberon trilogy.

Design for Embedded Image Processing on FPGAs

Energy Efficient Loop Unrolling for Low-cost FPGAs

FPGAs and Parallel Architectures for Aerospace Applications

Turning Software into Hardware with Eight Fun and Easy DIY Projects

Advances in Communications, Signal Processing, and VLSI

FPGA Prototyping by SystemVerilog Examples

Master FPGA digital system design and implementation with Verilog and VHDL This practical guide explores the development and deployment of FPGA-based digital systems using the two most popular hardware

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description languages, Verilog and VHDL. Written by a pair of digital circuit design experts, the book offers a solid grounding in FPGA principles, practices, and applications and provides an overview of more complex topics. Important concepts are demonstrated through real-world examples, ready-to-run code, and inexpensive start-to-finish projects for both the Basys and Arty boards. Digital System Design with FPGA: Implementation Using Verilog and VHDL covers:

- Field programmable gate array fundamentals
- Basys and Arty FPGA boards
- The Vivado design suite
- Verilog and VHDL
- Data types and operators
- Combinational circuits and circuit blocks
- Data storage elements and sequential circuits
- Soft-core microcontroller and digital interfacing
- Advanced FPGA applications
- The future of FPGA

New generations of IT users are increasingly abstracted from the underlying devices and platforms that provide and safeguard their services. As a result they may have little awareness that they are critically dependent on the embedded security devices that are becoming pervasive in daily modern life. Secure Smart Embedded Devices, Platforms and Applications provides a broad overview of the many security and practical issues of embedded devices, tokens, and their operation systems, platforms and main applications. It also addresses a diverse range of industry/government initiatives and considerations, while focusing strongly on technical and practical

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security issues. The benefits and pitfalls of developing and deploying applications that rely on embedded systems and their security functionality are presented. A sufficient level of technical detail to support embedded systems is provided throughout the text, although the book is quite readable for those seeking awareness through an initial overview of the topics. This edited volume benefits from the contributions of industry and academic experts and helps provide a cross-discipline overview of the security and practical issues for embedded systems, tokens, and platforms. It is an ideal complement to the earlier work, Smart Cards Tokens, Security and Applications from the same editors.

System-on-a-Chip (SoC) technology, which has evolved in recent years, is developed from different devices. A processor, several memory and peripheral components are located on a single chip to form today's high-performance SoCs with hundreds of IP blocks. IP cores are validated design blocks used as part of complex digital designs. Those designs are utilizing a hardware description language like VHDL or Verilog. In this way, time and cost of launching the product are reduced. Thanks to SoC, the features of computers were able to be reduced to the miniature level. Microcontrollers have the features of computer systems on a single chip. They are used to collect, process, and manipulate data in complex projects. The complexity of

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microcontrollers has increased to provide better performance and flexibility to meet customer requirements. However, it must be able to adapt to operational changes. The hardware of a microcontroller can not be changed afterward. If subsequent changes are nevertheless necessary, these are associated with high additional costs.

Reconfigurable devices such as FPGAs can reconfigure the hardware to design, develop, and deploy high-performance digital systems. With the power of a SoC combined with the flexibility of an FPGA, the MC8051 IP Core proves to be a great alternative to purely microcontroller-based systems.

What if you could use software to design hardware? Not just any hardware--imagine specifying the behavior of a complex parallel computer, sending it to a chip, and having it run on that chip--all without any manufacturing? With Field-Programmable Gate Arrays (FPGAs), you can design such a machine with your mouse and keyboard. When you deploy it to the FPGA, it immediately takes on the behavior that you defined. Want to create something that behaves like a display driver integrated circuit? How about a CPU with an instruction set you dreamed up? Or your very own Bitcoin miner You can do all this with FPGAs. Because you're not writing programs--rather, you're designing a chip whose sole purpose is to do what you tell it--it's faster than anything you can do in code. With

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Make: FPGAs, you'll learn how to break down problems into something that can be solved on an FPGA, design the logic that will run on your FPGA, and hook up electronic components to create finished projects.

Membrane Computing Models: Implementations

Innovative Security Solutions for Information Technology and Communications

Using Digilent FPGA Boards - VHDL Active-HDL Edition

Topics in Cryptology – CT-RSA 2020

Principles and Practices

Cryptographic Hardware and Embedded Systems – CHES 2016

The theoretical basis of membrane computing was established in the early 2000s with fundamental research into the computational power, complexity aspects and relationships with other (un)conventional computing paradigms. Although this core theoretical research has continued to grow rapidly and vigorously, another area of investigation has since been added, focusing on the applications of this model in many areas, most prominently in systems and synthetic biology, engineering optimization, power system fault diagnosis and mobile robot controller design. The further development of these applications and their broad adoption by other researchers, as well as the expansion of the membrane computing modelling paradigm to other applications, call for a set of robust, efficient, reliable and easy-to-use tools supporting the most significant membrane computing models. This work provides comprehensive descriptions of such tools, making it a valuable resource for

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anyone interested in membrane computing models.

The book is composed of two parts. The first part introduces the concepts of the design of digital systems using contemporary field-programmable gate arrays (FPGAs). Various design techniques are discussed and illustrated by examples. The operation and effectiveness of these techniques is demonstrated through experiments that use relatively cheap prototyping boards that are widely available. The book begins with easily understandable introductory sections, continues with commonly used digital circuits, and then gradually extends to more advanced topics. The advanced topics include novel techniques where parallelism is applied extensively. These techniques involve not only core reconfigurable logical elements, but also use embedded blocks such as memories and digital signal processing slices and interactions with general-purpose and application-specific computing systems. Fully synthesizable specifications are provided in a hardware-description language (VHDL) and are ready to be tested and incorporated in engineering designs. A number of practical applications are discussed from areas such as data processing and vector-based computations (e.g. Hamming weight counters/comparators). The second part of the book covers the more theoretical aspects of finite state machine synthesis with the main objective of reducing basic FPGA resources, minimizing delays and achieving greater optimization of circuits and systems.

Written for advanced study in digital systems design, Roth/John's **DIGITAL SYSTEMS DESIGN USING VHDL**, 3E integrates the use of the industry-standard hardware

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description language, VHDL, into the digital design process. The book begins with a valuable review of basic logic design concepts before introducing the fundamentals of VHDL. The book concludes with detailed coverage of advanced VHDL topics. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Many embedded applications implement block ciphers and sorting and searching algorithms which use multiple loop iterations for computation. These applications often demand low power operation. The power consumption of designs varies with the implementation choices made by designers. The sequential implementation of loop operations consumes minimal area, but latency and clock power are high. Alternatively, loop unrolling causes high glitch power. In this work, we propose a low area overhead approach for unrolling loop iterations that exhibits reduced glitch power. A latch based glitch filter is introduced that reduces the propagation of glitches from one iteration to next. We explore the optimal number of filters to be inserted for different applications that give a good balance between area and power. We also implement partial unrolling with glitch filters. This approach consumes less area while still giving energy savings comparable to the fully unrolled implementation. Our approach is targeted to Xilinx and Altera FPGAs. We simulate different implementation choices and compare energy results to evaluate the savings. We demonstrate our approach on SIMON-128 and AES-256 block ciphers and a sorting algorithm. We prototype our design on Xilinx Artix-7 and Altera

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Cyclone-IV-GX FPGA development boards and measure the actual power savings. Results show up-to 90% dynamic energy reduction in Xilinx designs, and 97% reduction in Altera designs with our glitch filtering approach due to glitch power reduction.

Synthesis and Optimization of FPGA-Based Systems

Embedded Microprocessor System Design using FPGAs

With an Introduction to Verilog and FPGA-Based Design

Digital Design for Beginners with Mojo and Lucid HDL

Vhdl by Example

Healthcare Settings

FPGAs have almost entirely replaced the traditional Application Specific Standard Parts (ASSP) such as the 74xx logic chip families because of their superior size, versatility, and speed. For example, FPGAs provide over a million fold increase in gates compared to ASSP parts. The traditional approach for hands-on exercises has relied on ASSP parts, primarily because of their simplicity and ease of use for the novice. Not only is this approach technically outdated, but it also severely limits the complexity of the designs that can be implemented. By introducing the readers

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to FPGAs, they are being familiarized with current digital technology and the skills to implement complex, sophisticated designs. However, working with FPGAs comes at a cost of increased complexity, notably the mastering of an HDL language, such as Verilog. Therefore, this book accomplishes the following: first, it teaches basic digital design concepts and then applies them through exercises; second, it implements these digital designs by teaching the user the syntax of the Verilog language while implementing the exercises. Finally, it employs contemporary digital hardware, such as the FPGA, to build a simple calculator, a basic music player, a frequency and period counter and it ends with a microprocessor being embedded in the fabric of the FPGA to communicate with the PC. In the process, readers learn about digital mathematics and digital-to-analog converter concepts through pulse width modulation. This book describes the most frequently used high-speed serial buses in embedded systems, especially those used by FPGAs. These buses employ SerDes, JESD204, SRIO, PCIE,

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Aurora and SATA protocols for chip-to-chip and board-to-board communication, and CPCIE, VPX, FC and Infiniband protocols for inter-chassis communication. For each type, the book provides the bus history and version info, while also assessing its advantages and limitations. Furthermore, it offers a detailed guide to implementing these buses in FPGA design, from the physical layer and link synchronization to the frame format and application command. Given its scope, the book offers a valuable resource for researchers, R&D engineers and graduate students in computer science or electronics who wish to learn the protocol principles, structures and applications of high-speed serial buses.

The Design of an Operating System and Compiler

Digital Systems Design Using Verilog

Digital Design

A Concise Introduction for Fpga Design

Make: FPGAs

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