

Digital Design Using Vhdl Cambridge University Press

Top-down approach to practical, tool-independent, digital circuit design, reflecting how circuits are designed.

A practical guide to the theory and applications of TFT technologies and circuit designs for those in academia and in industry.

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 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.

Digital Electronics and Design with VHDL offers a friendly presentation of the fundamental principles and practices of modern digital design. Unlike any other book in this field, transistor-level implementations are also included, which allow the readers to gain a solid understanding of a circuit's real potential and limitations, and to develop a realistic perspective on the practical design of actual integrated circuits. Coverage includes the largest selection available of digital circuits in all categories (combinational, sequential, logical, or arithmetic); and detailed digital design techniques, with a thorough discussion on state-machine modeling for the analysis and design of complex sequential systems. Key technologies used in modern circuits are also described, including Bipolar, MOS, ROM/RAM, and CPLD/FPGA chips, as well as codes and techniques used in data storage and transmission. Designs are illustrated by means of complete, realistic applications using VHDL, where the complete code, comments, and simulation results are included. This text is ideal for courses in Digital Design, Digital Logic, Digital Electronics, VLSI, and VHDL; and industry practitioners in digital electronics. Comprehensive coverage of fundamental digital concepts and principles, as well as complete, realistic, industry-standard designs Many circuits shown with internal details at the transistor-level, as in real integrated circuits Actual technologies used in state-of-the-art digital circuits presented in conjunction with fundamental concepts and principles Six chapters dedicated to VHDL-based techniques, with all VHDL-based designs synthesized onto CPLD/FPGA chips

The fundamentals and implementation of digital electronics are essential to understanding the design and working of consumer/industrial electronics, communications, embedded systems, computers, security and military equipment. Devices used in applications such as these are constantly decreasing in size and employing more complex technology. It is therefore essential for engineers and students to understand the fundamentals, implementation and application principles of digital electronics, devices and integrated circuits. This is so that they can use the most appropriate and effective technique to suit their technical need. This book provides practical and comprehensive coverage of digital electronics, bringing together information on fundamental theory, operational aspects and potential applications. With worked problems, examples, and review questions for each chapter, Digital Electronics includes: information on number systems, binary codes, digital arithmetic, logic gates and families, and Boolean algebra; an in-depth look at multiplexers, de-multiplexers, devices for arithmetic operations, flip-flops and related devices, counters and registers, and data conversion circuits; up-to-date coverage of recent application fields, such as programmable logic devices, microprocessors, microcontrollers, digital troubleshooting and digital instrumentation. A comprehensive, must-read book on digital electronics for senior undergraduate and graduate students of electrical, electronics and computer engineering, and a valuable reference book for professionals and researchers.

Rapid Prototyping of Digital Systems, Second Edition provides an exciting and challenging laboratory component for an undergraduate digital logic design class. The more advanced topics and exercises are also appropriate for consideration at schools that have an upper level course in digital logic or programmable logic. Design engineers working in industry will also want to consider this book for a rapid introduction to FPLD technology and logic synthesis using commercial CAD tools, especially if they have not had previous experience with the new and rapidly evolving technology. Two tutorials on the Altera CAD tool environment, an overview of programmable logic, and a design library with several easy-to-use input and output functions were developed for this book to help the reader get started quickly. Early design examples use schematic capture and library components. VHDL is used for more complex designs after a short introduction to VHDL-based synthesis. A coupon is included with the text for purchase of the new UP 1X board. The additional logic and memory in the UP 1X's FLEX 10K70 is useful on larger design projects such as computers and video games. The second edition includes an update chapter on programmable logic, new robot sensors and projects, optional Verilog examples, and a meta assembler which can be used to develop assemble language programs for the computer designs in Chapters 8 and 13.

The book focuses to foster new and original research ideas and results in three broad areas: computing, analytics, and networking with its prospective applications in the various interdisciplinary domains of engineering. This is an exciting and emerging interdisciplinary area in which a wide range of theory and methodologies are being investigated and developed to tackle complex and challenging real world problems. It also provides insights into the International Conference on Computing Analytics and Networking (ICCAN 2017) which is a premier international open forum for scientists, researchers and technocrats in academia as well as in industries from different parts of the world to present, interact, and exchange the state of art of concepts, prototypes, innovative research ideas in several diversified fields. The book includes invited keynote papers and paper presentations from both academia and industry to initiate and ignite our young minds in the meadow of momentous research and thereby enrich their existing knowledge. The

book aims at postgraduate students and researchers working in the discipline of Computer Science & Engineering. It will be also useful for the researchers working in the domain of electronics as it contains some hardware technologies and forthcoming communication technologies.

Written expressly for hardware designers, this book presents a formal model of VHDL clearly specifying both the static and dynamic semantics of VHDL. It provides a mathematical framework for representing VHDL constructs and shows how those constructs can be formally manipulated to reason about VHDL.

A completely updated and expanded comprehensive treatment of VHDL and its applications to the design and simulation of real, industry-standard circuits. This comprehensive treatment of VHDL and its applications to the design and simulation of real, industry-standard circuits has been completely updated and expanded for the third edition. New features include all VHDL-2008 constructs, an extensive review of digital circuits, RTL analysis, and an unequaled collection of VHDL examples and exercises. The book focuses on the use of VHDL rather than solely on the language, with an emphasis on design examples and laboratory exercises. The third edition begins with a detailed review of digital circuits (combinatorial, sequential, state machines, and FPGAs), thus providing a self-contained single reference for the teaching of digital circuit design with VHDL. In its coverage of VHDL-2008, it makes a clear distinction between VHDL for synthesis and VHDL for simulation. The text offers complete VHDL codes in examples as well as simulation results and comments. The significantly expanded examples and exercises include many not previously published, with multiple physical demonstrations meant to inspire and motivate students. The book is suitable for undergraduate and graduate students in VHDL and digital circuit design, and can be used as a professional reference for VHDL practitioners. It can also serve as a text for digital VLSI in-house or academic courses.

Knowledge: A little light expels much darkness _ Bahya ibn Paquda, Duties of the Heart During the early 1970s digital computer techniques concentrated on the computational and interfacing aspects of digital systems and the decade began as the age of both the mainframe computer and the minicomputer. Engineers and system designers needed to know the fundamentals of computer operation and how the practical limitations of the architectures of the day, the memory size, cost and performance could be overcome; it was for this reason that this book was first written. By 1980 the microprocessor revolution had arrived. As a result the microprocessor became a component of a system, rather than a system itself, and the need to understand the behaviour of the device became of even greater importance to the system designer. New developments in mainframe computers were few, with networks of minicomputers taking over their role in many instances. The 1980 revision of this book took into account the major advances in semiconductor technology that had occurred since it was first published in 1972, and included material relevant to the microprocessor.

This book facilitates the VLSI-interested individuals with not only in-depth knowledge, but also the broad aspects of it by explaining its applications in different fields, including image processing and biomedical. The deep understanding of basic concepts gives you the power to develop a new application aspect, which is very well taken care of in this book by using simple language in explaining the concepts. In the VLSI world, the importance of hardware description languages cannot be ignored, as the designing of such dense and complex circuits is not possible without them. Both Verilog and VHDL languages are used here for designing. The current needs of high-performance integrated circuits (ICs) including low power devices and new emerging materials, which can play a very important role in achieving new functionalities, are the most interesting part of the book. The testing of VLSI circuits becomes more crucial than the designing of the circuits in this nanometer technology era. The role of fault simulation algorithms is very well explained, and its implementation using Verilog is the key aspect of this book. This book is well organized into 20 chapters. Chapter 1 emphasizes on uses of FPGA on various image processing and biomedical applications. Then, the descriptions enlighten the basic understanding of digital design from the perspective of HDL in Chapters 2–5. The performance enhancement with alternate material or geometry for silicon-based FET designs is focused in Chapters 6 and 7. Chapters 8 and 9 describe the study of bimolecular interactions with biosensing FETs. Chapters 10–13 deal with advanced FET structures available in various shapes, materials such as nanowire, HFET, and their comparison in terms of device performance metrics calculation. Chapters 14–18 describe different application-specific VLSI design techniques and challenges for analog and digital circuit designs. Chapter 19 explains the VLSI testability issues with the description of simulation and its categorization into logic and fault simulation for test pattern generation using Verilog HDL. Chapter 20 deals with a secured VLSI design with hardware obfuscation by hiding the IC's structure and function, which makes it much more difficult to reverse engineer.

A presentation of circuit synthesis and circuit simulation using VHDL (including VHDL 2008), with an emphasis on design examples and laboratory exercises. This text offers a comprehensive treatment of VHDL and its applications to the design and simulation of real, industry-standard circuits. It focuses on the use of VHDL rather than solely on the language, showing why and how certain types of circuits are inferred from the language constructs and how any of the four simulation categories can be implemented. It makes a rigorous distinction between VHDL for synthesis and VHDL for simulation. The VHDL codes in all design examples are complete, and circuit diagrams, physical synthesis in FPGAs, simulation results, and explanatory comments are included with the designs. The text reviews fundamental concepts of digital electronics and design and includes a series of appendixes that offer tutorials on important design tools including ISE, Quartus II, and ModelSim, as well as descriptions of programmable logic devices in which the designs are implemented, the DE2 development board, standard VHDL packages, and other features. All four VHDL editions (1987, 1993, 2002, and 2008) are covered. This expanded second edition is the first textbook on VHDL to include a detailed analysis of circuit simulation with VHDL testbenches in all four categories (nonautomated, fully automated, functional, and timing simulations), accompanied by complete practical examples. Chapters 1-9 have been updated, with new design examples and new details on such topics as data types and code statements. Chapter 10 is entirely new and deals exclusively with simulation. Chapters 11-17 are also entirely new, presenting extended and advanced designs with theoretical and practical coverage of serial data communications circuits, video circuits, and other topics. There are many more illustrations, and the exercises have been updated and their number more than doubled.

This unique reference book offers a holistic description of the multifaceted field of systematic musicology, which is the study of music, its production and perception, and its cultural, historical and philosophical background. The seven sections reflect the main topics in this interdisciplinary subject. The first two parts discuss musical acoustics and signal processing, comprehensively describing the mathematical and physical fundamentals of musical sound generation and propagation. The complex interplay of physiology and psychology involved in sound and music

perception is covered in the following sections, with a particular focus on psychoacoustics and the recently evolved research on embodied music cognition. In addition, a huge variety of technical applications for professional training, music composition and consumer electronics are presented. A section on music ethnology completes this comprehensive handbook. Music theory and philosophy of music are imbedded throughout. Carefully edited and written by internationally respected experts, it is an invaluable reference resource for professionals and graduate students alike.

The skills and guidance needed to master RTL hardware design This book teaches readers how to systematically design efficient, portable, and scalable Register Transfer Level (RTL) digital circuits using the VHDL hardware description language and synthesis software. Focusing on the module-level design, which is composed of functional units, routing circuit, and storage, the book illustrates the relationship between the VHDL constructs and the underlying hardware components, and shows how to develop codes that faithfully reflect the module-level design and can be synthesized into efficient gate-level implementation. Several unique features distinguish the book: * Coding style that shows a clear relationship between VHDL constructs and hardware components * Conceptual diagrams that illustrate the realization of VHDL codes * Emphasis on the code reuse * Practical examples that demonstrate and reinforce design concepts, procedures, and techniques * Two chapters on realizing sequential algorithms in hardware * Two chapters on scalable and parameterized designs and coding * One chapter covering the synchronization and interface between multiple clock domains Although the focus of the book is RTL synthesis, it also examines the synthesis task from the perspective of the overall development process. Readers learn good design practices and guidelines to ensure that an RTL design can accommodate future simulation, verification, and testing needs, and can be easily incorporated into a larger system or reused. Discussion is independent of technology and can be applied to both ASIC and FPGA devices. With a balanced presentation of fundamentals and practical examples, this is an excellent textbook for upper-level undergraduate or graduate courses in advanced digital logic. Engineers who need to make effective use of today's synthesis software and FPGA devices should also refer to this book.

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

This textbook, based on the author's fifteen years of teaching, is a complete teaching tool for turning students into logic designers in one semester. Each chapter describes new concepts, giving extensive applications and examples. Assuming no prior knowledge of discrete mathematics, the authors introduce all background in propositional logic, asymptotics, graphs, hardware and electronics. Important features of the presentation are: • All material is presented in full detail. Every designed circuit is formally specified and implemented, the correctness of the implementation is proved, and the cost and delay are analyzed • Algorithmic solutions are offered for logical simulation, computation of propagation delay and minimum clock period • Connections are drawn from the physical analog world to the digital abstraction • The language of graphs is used to describe formulas and circuits • Hundreds of figures, examples and exercises enhance understanding. The extensive website (<http://www.eng.tau.ac.il/~guy/Even-Medina/>) includes teaching slides, links to Logisim and a DLX assembly simulator.

This book guides readers through the design of hardware architectures using VHDL for digital communication and image processing applications that require performance computing. Further it includes the description of all the VHDL-related notions, such as language, levels of abstraction, combinational vs. sequential logic, structural and behavioral description, digital circuit design, and finite state machines. It also includes numerous examples to make the concepts presented in text more easily understandable.

This book presents three aspects of digital circuits: digital principles, digital electronics, and digital design. The modern design methods of using electronic design automation (EDA) are also introduced, including the hardware description language (HDL), designs with programmable logic devices and large scale integrated circuit (LSI). The applications of digital devices and integrated circuits are discussed in detail as well.

The book focuses on both theory and applications in the broad areas of communication technology, computer science and information security. This two volume book contains the Proceedings of International Conference on Advanced Computing and Intelligent Engineering. These volumes bring together academic scientists, professors, research scholars and students to share and disseminate information on knowledge and scientific research works related to computing, networking, and informatics to discuss the practical challenges encountered and the solutions adopted. The book also promotes translation of basic research into applied investigation and convert applied investigation into practice.

This book presents the hardware implementation of control algorithms represented by graph-schemes of algorithm. It includes new methods of logic synthesis and optimization for logic circuits of Mealy and Moore FSMs oriented on both ASIC and FPLD.

Digital Design and Computer Architecture: ARM Edition covers the fundamentals of digital logic design and reinforces logic concepts through the design of an ARM microprocessor. Combining an engaging and humorous writing style with an updated and hands-on approach to digital design, this book takes the reader from the fundamentals of digital logic to the actual design of an ARM processor. By the end of this book, readers will be able to build their own microprocessor and will have a top-to-bottom understanding of how it works. Beginning with digital logic gates and progressing to the design of combinational and sequential circuits, this book uses these fundamental building blocks as the basis for designing an ARM processor. SystemVerilog and VHDL are integrated throughout the text in examples illustrating the methods and techniques for CAD-based circuit design. The companion website includes a chapter on I/O systems with

practical examples that show how to use the Raspberry Pi computer to communicate with peripheral devices such as LCDs, Bluetooth radios, and motors. This book will be a valuable resource for students taking a course that combines digital logic and computer architecture or students taking a two-quarter sequence in digital logic and computer organization/architecture. Covers the fundamentals of digital logic design and reinforces logic concepts through the design of an ARM microprocessor. Features side-by-side examples of the two most prominent Hardware Description Languages (HDLs)—SystemVerilog and VHDL—which illustrate and compare the ways each can be used in the design of digital systems. Includes examples throughout the text that enhance the reader's understanding and retention of key concepts and techniques. The Companion website includes a chapter on I/O systems with practical examples that show how to use the Raspberry Pi computer to communicate with peripheral devices such as LCDs, Bluetooth radios, and motors. The Companion website also includes appendices covering practical digital design issues and C programming as well as links to CAD tools, lecture slides, laboratory projects, and solutions to exercises.

Top-Down VLSI Design: From Architectures to Gate-Level Circuits and FPGAs represents a unique approach to learning digital design. Developed from more than 20 years teaching circuit design, Doctor Kaeslin's approach follows the natural VLSI design flow and makes circuit design accessible for professionals with a background in systems engineering or digital signal processing. It begins with hardware architecture and promotes a system-level view, first considering the type of intended application and letting that guide your design choices. Doctor Kaeslin presents modern considerations for handling circuit complexity, throughput, and energy efficiency while preserving functionality. The book focuses on application-specific integrated circuits (ASICs), which along with FPGAs are increasingly used to develop products with applications in telecommunications, IT security, biomedical, automotive, and computer vision industries. Topics include field-programmable logic, algorithms, verification, modeling hardware, synchronous clocking, and more. Demonstrates a top-down approach to digital VLSI design. Provides a systematic overview of architecture optimization techniques. Features a chapter on field-programmable logic devices, their technologies and architectures. Includes checklists, hints, and warnings for various design situations. Emphasizes design flows that do not overlook important action items and which include alternative options when planning the development of microelectronic circuits.

Provides students with a system-level perspective and the tools they need to understand, analyze and design complete digital systems using Verilog. It goes beyond the design of simple combinational and sequential modules to show how such modules are used to build complete systems, reflecting digital design in the real world.

This book focuses on control units, which are a vital part of modern digital systems, and responsible for the efficiency of controlled systems. The model of a finite state machine (FSM) is often used to represent the behavior of a control unit. As a rule, control units have irregular structures that make it impossible to design their logic circuits using the standard library cells. Design methods depend strongly on such factors as the FSM used, specific features of the logic elements implemented in the FSM logic circuit, and the characteristics of the control algorithm to be interpreted. This book discusses Moore and Mealy FSMs implemented with FPGA chips, including look-up table elements (LUT) and embedded memory blocks (EMB). It is crucial to minimize the number of LUTs and EMBs in an FSM logic circuit, as well as to make the interconnections between the logic elements more regular, and various methods of structural decompositions can be used to solve this problem. These methods are reduced to the presentation of an FSM circuit as a composition of different logic blocks, the majority of which implement systems of intermediate logic functions different (and much simpler) than input memory functions and FSM output functions. The structural decomposition results in multilevel FSM circuits having fewer logic elements than equivalent single-level circuits. The book describes well-known methods of structural decomposition and proposes new ones, examining their impact on the final amount of hardware in an FSM circuit. It is of interest to students and postgraduates in the area of Computer Science, as well as experts involved in designing digital systems with complex control units. The proposed models and design methods open new possibilities for creating logic circuits of control units with an optimal amount of hardware and regular interconnections.

This title gives students an integrated and rigorous picture of applied computer science, as it comes to play in the construction of a simple yet powerful computer system.

This book comprises the select proceedings of the annual convention of the Computer Society of India. Divided into 10 topical volumes, the proceedings present papers on state-of-the-art research, surveys, and succinct reviews. The volumes cover diverse topics ranging from parallel processing to system buses, and from computer architecture to VLIW (very long instruction word). This book focuses on systems and architecture. It aims at informing the readers about those attributes of a system visible to a programmer. This book also deals with various innovations and improvements in computing technologies to improve the size, capacity and performance of modern-day computing systems. The contents of this book will be useful to professionals and researchers alike.

A presentation of circuit synthesis and circuit simulation using VHDL (including VHDL 2008), with an emphasis on design examples and laboratory exercises. This text offers a comprehensive treatment of VHDL and its applications to the design and simulation of real, industry-standard circuits. It focuses on the use of VHDL rather than solely on the language, showing why and how certain types of circuits are inferred from the language constructs and how any of the four simulation categories can be implemented. It makes a rigorous distinction between VHDL for synthesis and VHDL for simulation. The VHDL codes in all design examples are complete, and circuit diagrams, physical synthesis in FPGAs, simulation results, and explanatory comments are included with the designs. The text reviews fundamental concepts of digital electronics and design and includes a series of appendixes that offer tutorials on important design tools including ISE, Quartus II, and ModelSim, as well as descriptions of programmable logic devices in which the designs are implemented, the DE2 development board, standard VHDL packages, and other features. All four VHDL editions (1987, 1993, 2002, and 2008) are covered. This expanded second edition is the first textbook on VHDL to include a detailed analysis of circuit simulation with VHDL testbenches in all four categories (nonautomated, fully automated, functional, and timing simulations), accompanied by complete practical examples. Chapters 1–9 have been updated, with new design examples and new details on such topics as data types and code statements. Chapter 10 is entirely new and deals exclusively with simulation. Chapters 11–17 are also entirely new, presenting extended and advanced designs with theoretical and practical coverage of serial data communications circuits, video circuits, and other topics. There are many more illustrations, and the exercises have been updated and their number more than doubled.

What makes some computers slow? Why do some digital systems operate reliably for years while others fail mysteriously every few hours? How can some systems dissipate kilowatts while

others operate off batteries? These questions of speed, reliability, and power are all determined by the system-level electrical design of a digital system. Digital Systems Engineering presents a comprehensive treatment of these topics. It combines a rigorous development of the fundamental principles in each area with real-world examples of circuits and methods. The book not only serves as an undergraduate textbook, filling the gap between circuit design and logic design, but can also help practising digital designers keep pace with the speed and power of modern integrated circuits. The techniques described in this book, once used only in supercomputers, are essential to the correct and efficient operation of any type of digital system.

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 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

A guide to applying software design principles and coding practices to VHDL to improve the readability, maintainability, and quality of VHDL code. This book addresses an often-neglected aspect of the creation of VHDL designs. A VHDL description is also source code, and VHDL designers can use the best practices of software development to write high-quality code and to organize it in a design. This book presents this unique set of skills, teaching VHDL designers of all experience levels how to apply the best design principles and coding practices from the software world to the world of hardware. The concepts introduced here will help readers write code that is easier to understand and more likely to be correct, with improved readability, maintainability, and overall quality. After a brief review of VHDL, the book presents fundamental design principles for writing code, discussing such topics as design, quality, architecture, modularity, abstraction, and hierarchy. Building on these concepts, the book then introduces and provides recommendations for each basic element of VHDL code, including statements, design units, types, data objects, and subprograms. The book covers naming data objects and functions, commenting the source code, and visually presenting the code on the screen. All recommendations are supported by detailed rationales. Finally, the book explores two uses of VHDL: synthesis and testbenches. It examines the key characteristics of code intended for synthesis (distinguishing it from code meant for simulation) and then demonstrates the design and implementation of testbenches with a series of examples that verify different kinds of models, including combinational, sequential, and FSM code. Examples from the book are also available on a companion website, enabling the reader to experiment with the complete source code.

Digital Design Using VHDL Circuit Design with VHDL, third edition MIT Press

The methodology described in this book is the result of many years of research experience in the field of synthesizable VHDL design targeting FPGA based platforms. VHDL was first conceived as a documentation language for ASIC designs. Afterwards, the language was used for the behavioral simulation of ASICs, and also as a design input for synthesis tools. VHDL is a rich language, but just a small subset of it can be used to write synthesizable code, from which a physical circuit can be obtained. Usually VHDL books describe both, synthesis and simulation aspects of the language, but in this book the reader is conducted just through the features acceptable by synthesis tools. The book introduces the subjects in a gradual and concise way, providing just enough information for the reader to develop their synthesizable digital systems in VHDL. The examples in the book were planned targeting an FPGA platform widely used around the world.

The success of VHDL since it has been balloted in 1987 as an IEEE standard may look incomprehensible to the large population of hardware designers, who had never heard of Hardware Description Languages before (for at least 90% of them), as well as to the few hundreds of specialists who had been working on these languages for a long time (25 years for some of them). Until 1988, only a very small subset of designers, in a few large companies, were used to describe their designs using a proprietary HDL, or sometimes a HDL inherited from a University when some software environment happened to be developed around it, allowing usability by third parties. A number of benefits were definitely recognized to this practice, such as functional verification of a specification through simulation, first performance evaluation of a tentative design, and sometimes automatic microprogram generation or even automatic high level synthesis. As there was apparently no market for HDL's, the ECAD vendors did not care about them, start-up companies were seldom able to survive in this area, and large users of proprietary tools were spending more and more people and money just to maintain their internal system.

One of the very important parts of any digital system is the control unit, coordinating interplay of other system blocks. As a rule, control units have irregular structure, which makes process of their logic circuits design very sophisticated. In case of complex logic controllers, the problem of system design is reduced practically to the design of control units. Actually, we observe a real technical boom connected with achievements in semiconductor technology. One of these is the development of integrated circuit known as the "systems-on-a-programmable-chip" (SoPC), where the number of elements approaches one billion. Because of the extreme complexity of microchips, it is very important to develop effective design methods oriented on particular properties of logical elements. Solution of this problem permits improving functional capabilities of the target digital system inside single SoPC chip. As majority of researches point out, design methods used in case of industrial packages are, in case of complex digital system design, far from optimal. Similar problems concern the design of control units with standard field-programmable logic devices (FPLD), such as PLA, PAL, GAL, CPLD, and FPGA. Let us point out that modern SoPC are based on CPLD or FPGA technology. Thus, the development of effective design methods oriented on FPLD implementation of logic circuits used in the control units still remains the problem of great importance.

Digital Systems Design with FPGAs and CPLDs explains how to design and develop digital electronic systems using programmable logic devices (PLDs). Totally practical in nature, the book features numerous (quantify when known) case study designs using a variety of Field Programmable Gate Array (FPGA) and Complex Programmable Logic Devices (CPLD), for a range of applications from control and instrumentation to semiconductor automatic test equipment. Key features include:

- * Case studies that provide a walk through of the design process, highlighting

the trade-offs involved. * Discussion of real world issues such as choice of device, pin-out, power supply, power supply decoupling, signal integrity- for embedding FPGAs within a PCB based design. With this book engineers will be able to: * Use PLD technology to develop digital and mixed signal electronic systems * Develop PLD based designs using both schematic capture and VHDL synthesis techniques * Interface a PLD to digital and mixed-signal systems * Undertake complete design exercises from design concept through to the build and test of PLD based electronic hardware This book will be ideal for electronic and computer engineering students taking a practical or Lab based course on digital systems development using PLDs and for engineers in industry looking for concrete advice on developing a digital system using a FPGA or CPLD as its core. Case studies that provide a walk through of the design process, highlighting the trade-offs involved. Discussion of real world issues such as choice of device, pin-out, power supply, power supply decoupling, signal integrity- for embedding FPGAs within a PCB based design.

A comprehensive guide to the theory and design of hardware-implemented finite state machines, with design examples developed in both VHDL and SystemVerilog languages. Modern, complex digital systems invariably include hardware-implemented finite state machines. The correct design of such parts is crucial for attaining proper system performance. This book offers detailed, comprehensive coverage of the theory and design for any category of hardware-implemented finite state machines. It describes crucial design problems that lead to incorrect or far from optimal implementation and provides examples of finite state machines developed in both VHDL and SystemVerilog (the successor of Verilog) hardware description languages. Important features include: extensive review of design practices for sequential digital circuits; a new division of all state machines into three hardware-based categories, encompassing all possible situations, with numerous practical examples provided in all three categories; the presentation of complete designs, with detailed VHDL and SystemVerilog codes, comments, and simulation results, all tested in FPGA devices; and exercise examples, all of which can be synthesized, simulated, and physically implemented in FPGA boards. Additional material is available on the book's Website. Designing a state machine in hardware is more complex than designing it in software. Although interest in hardware for finite state machines has grown dramatically in recent years, there is no comprehensive treatment of the subject. This book offers the most detailed coverage of finite state machines available. It will be essential for industrial designers of digital systems and for students of electrical engineering and computer science.

As the increased demand for high-speed communication creates an interest in the development of optical networks, intelligent all optical networks have emerged as the next generation for reliable and fast connections. Intelligent Systems for Optical Networks Design: Advancing Techniques is a comprehensive collection of research focused on theoretical and practical aspects of intelligent methodologies as applied to real world problems. This reference source is useful for research and development engineers, scholars, and students interested in the latest development in the area of intelligent systems for optical networks design.

This book constitutes the refereed proceedings of the Third International Workshop on Applied Reconfigurable Computing, ARC 2007, held in Mangaratiba, Brazil, in March 2007. The 27 full papers and 10 short papers presented together with a late-comer contribution from ARC 2006 are organized in topical sections on architectures, mapping techniques and tools, arithmetic, and applications.

This book offers readers a clear guide to implementing engineering applications with FPGAs, from the mathematical description to the hardware synthesis, including discussion of VHDL programming and co-simulation issues. Coverage includes FPGA realizations such as: chaos generators that are described from their mathematical models; artificial neural networks (ANNs) to predict chaotic time series, for which a discussion of different ANN topologies is included, with different learning techniques and activation functions; random number generators (RNGs) that are realized using different chaos generators, and discussions of their maximum Lyapunov exponent values and entropies. Finally, optimized chaotic oscillators are synchronized and realized to implement a secure communication system that processes black and white and grey-scale images. In each application, readers will find VHDL programming guidelines and computer arithmetic issues, along with co-simulation examples with Active-HDL and Simulink. The whole book provides a practical guide to implementing a variety of engineering applications from VHDL programming and co-simulation issues, to FPGA realizations of chaos generators, ANNs for chaotic time-series prediction, RNGs and chaotic secure communications for image transmission.

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