

Digital System Design Using Vhdl Roth Solutions

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.

ANALYSIS AND DESIGN OF DIGITAL SYSTEMS WITH VHDL integrates industry-standard hardware description language (VHDL) technology into the undergraduate digital logic course. Author Allen Dewey observes that the widespread use of VHDL in specifying digital system designs is driving change and innovation in industry, and defining a new skill set that engineering students must master to design, model, communicate, and implement digital systems. VHDL provides a formal mechanism for describing digital systems in a format easily processed by computers, succinctly capturing the basic concepts of digital systems engineering and harnessing the power of design automation technology. This book first presents combinational and sequential systems and their design, along with logic families and integrated circuits. It then interlocks these subjects with discussions of structural and data flow modeling, synchronous behavior, and

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algorithmic modeling of digital systems in VHDL. This dual-track organization of conceptual and VHDL-related material makes the book easily adaptable to one- or two-semester courses and a variety of teaching approaches.

This book presents an integrated approach to digital design principles, processes, and implementations to help the reader design increasingly complex systems within shorter design cycles. It also introduces digital design concepts, VHDL coding, VHDL simulation, synthesis commands, and strategies together.

- VHDL and Digital Circuit Primitives
- VHDL Simulation and Synthesis Environment and Design Process
- Basic Combinational Circuits
- Basic Binary Arithmetic Circuits
- Basic Sequential Circuits
- Registers
- Clock and Reset Circuits
- Dual-Port RAM, FIFO, and DRAM Modeling
- A Design Case Study: Finite Impulse Response Filter ASIC Design
- A Design Case Study: A Microprogram Controller Design
- Error Detection and Correction
- Fixed-Point Multiplication
- Fixed-Point Division
- Floating-Point Arithmetic

This book introduces a modern approach to embedded system design, presenting software design and hardware design in a unified manner. It covers trends and challenges, introduces the design and use of single-purpose processors ("hardware") and general-purpose processors ("software"), describes memories and buses, illustrates hardware/software tradeoffs using a digital

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camera example, and discusses advanced computation models, controls systems, chip technologies, and modern design tools. For courses found in EE, CS and other engineering departments.

Fundamentals of Digital Logic With VHDL Design teaches the basic design techniques for logic circuits. It emphasizes the synthesis of circuits and explains how circuits are implemented in real chips. Fundamental concepts are illustrated by using small examples, which are easy to understand. Then, a modular approach is used to show how larger circuits are designed. VHDL is used to demonstrate how the basic building blocks and larger systems are defined in a hardware description language, producing designs that can be implemented with modern CAD tools. The book emphasizes the concepts that should be covered in an introductory course on logic design, focusing on: Logic functions, gates, and rules of Boolean algebra Circuit synthesis and optimization techniques Number representation and arithmetic circuits Combinational-circuit building blocks, such as multiplexers, decoders, encoders, and code converters Sequential-circuit building blocks, such as flip-flops, registers, and counters Design of synchronous sequential circuits Use of the basic building blocks in designing larger systems It also includes chapters that deal with important, but more advanced topics: Design of asynchronous sequential circuits Testing of logic circuits For students

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who have had no exposure to basic electronics, but are interested in learning a few key concepts, there is a chapter that presents the most basic aspects of electronic implementation of digital circuits. Major changes in the second edition of the book include new examples to clarify the presentation of fundamental concepts over 50 new examples of solved problems provided at the end of chapters NAND and NOR gates now introduced in Chapter 2 more complete discussion of techniques for minimization of logic functions in Chapter 4 (including the tabular method) a new chapter explaining the CAD flow for synthesis of logic circuits Altera's Quartus II CAD software provided on a CD-ROM three appendices that give tutorials on the use of Quartus II software This textbook for courses in Digital Systems Design introduces students to the fundamental hardware used in modern computers. Coverage includes both the classical approach to digital system design (i.e., pen and paper) in addition to the modern hardware description language (HDL) design approach (computer-based). Using this textbook enables readers to design digital systems using the modern HDL approach, but they have a broad foundation of knowledge of the underlying hardware and theory of their designs. This book is designed to match the way the material is actually taught in the classroom. Topics are presented in a manner which builds foundational knowledge before moving onto advanced

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topics. The author has designed the presentation with learning Goals and assessment at its core. Each section addresses a specific learning outcome that the student should be able to “do” after its completion. The concept checks and exercise problems provide a rich set of assessment tools to measure student performance on each outcome.

This book provides step-by-step guidance on how to design VLSI systems using Verilog. It shows the way to design systems that are device, vendor and technology independent. Coverage presents new material and theory as well as synthesis of recent work with complete Project Designs using industry standard CAD tools and FPGA boards. The reader is taken step by step through different designs, from implementing a single digital gate to a massive design consuming well over 100,000 gates. All the design codes developed in this book are Register Transfer Level (RTL) compliant and can be readily used or amended to suit new projects.

This textbook is intended for a senior-level course in digital systems design. The book covers both basic principles of digital systems design and the use of a hardware description language, VHDL, in the design process.

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)

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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.

Digital Design: An Embedded Systems Approach Using Verilog provides a foundation in digital design for students in computer engineering, electrical engineering and computer science courses. It takes an up-to-date and modern approach of presenting digital logic design as an

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activity in a larger systems design context. Rather than focus on aspects of digital design that have little relevance in a realistic design context, this book concentrates on modern and evolving knowledge and design skills. Hardware description language (HDL)-based design and verification is emphasized--Verilog examples are used extensively throughout. By treating digital logic as part of embedded systems design, this book provides an understanding of the hardware needed in the analysis and design of systems comprising both hardware and software components. Includes a Web site with links to vendor tools, labs and tutorials. Presents digital logic design as an activity in a larger systems design context Features extensive use of Verilog examples to demonstrate HDL (hardware description language) usage at the abstract behavioural level and register transfer level, as well as for low-level verification and verification environments Includes worked examples throughout to enhance the reader's understanding and retention of the material Companion Web site includes links to tools for FPGA design from Synplicity, Mentor Graphics, and Xilinx, Verilog source code for all the examples in the book, lecture slides, laboratory projects, and solutions to exercises 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

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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

This textbook is intended to serve as a practical guide for the design of complex digital logic circuits such as digital control circuits, network interface circuits, pipelined arithmetic units, and RISC microprocessors. It is an advanced digital logic design textbook that emphasizes the use of synthesizable Verilog code and provides numerous fully worked-out practical design examples including a Universal Serial Bus interface, a pipelined multiply-accumulate unit, and a pipelined microprocessor for the ARM THUMB architecture.

VHDL, the IEEE standard hardware description language for describing digital electronic systems, has recently been revised. The Designer's Guide to VHDL has become a standard in the industry for learning the features of VHDL and using it to verify hardware designs. This third edition is the first comprehensive book on the market to address the new features of VHDL-2008. First comprehensive book on VHDL to incorporate all new features of VHDL-2008, the latest release of the VHDL standard Helps readers get up to speed quickly with new features of the new standard Presents a structured guide to the modeling facilities offered by VHDL Shows how VHDL functions to help design digital systems Includes extensive case studies and source code used to develop testbenches and case study examples Helps readers gain maximum facility with VHDL for design of digital systems

DIGITAL SYSTEMS DESIGN USING VERILOG integrates coverage of logic design principles, Verilog as a hardware design language, and FPGA implementation to help electrical and

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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 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.

The future of circuit and device design lies with Hardware Description Languages. This is an easy, hand-holding introduction to using HDLs for rapid design and prototyping. Learn all you need to know to start using HDLs in the digital design of circuits and devices. This book walks through all the basics, and presents extensive examples. All circuit/device designers who use, or are considering using, a Hardware Description Language (HDL).

Using the fundamentals fuel gathered from the first book, volume 2 of Digital Design from Scratch, launches the inquisitive reader into practical realms of FPGA design, mastering iconic FPGA implementation features such as simulation, memory structures, memory-mapped buses, FIFOs, serial interfaces such as UARTs, I2C, and SPI, and pipelined methods to meet timing. Like the first volume, colorful diagrams guide the learning process with visual clarity. Detailed exercises allow the student of digital design to flex their burgeoning logical muscles. Comprehensive and approachable, the book teaches the VHDL programming language in parallel with FPGA-based logic design.

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The definitive guide to VHDL—now updated with the new VHDL93 standard! Here's the new second edition of the authoritative reference engineers need to guide them through the use of VHDL hardware description language in the analysis, simulation, and modeling of complicated microelectronic circuits. The number and depth of its relevant and practical examples and problems is what sets this edition apart from other VHDL texts. It includes extensive new material to bring the guide fully up to date with the new VHDL93 standard, including new chapters on design flow, interfacing, modeling, and timing, as well as appendixes on logic synthesis and description styles.

The book covers the complete syllabus of subject as suggested by most of the universities in India. Generic VHDL code is taught and used through out the book so that different companies. VHDL tools can be used if desired. Moving from the unknown in a logical manner. Subject matter in each chapter develops systematically from inceptions. Large number of carefully selected worked examples in sufficient details. No other reference is required. Ideally suited for self-study.

Written for an advanced-level course in digital systems design, DIGITAL SYSTEMS DESIGN USING VHDL integrates the use of the industry-standard hardware description language VHDL into the digital design process. Following a review of basic concepts of logic design in Chapter 1, the author introduces the basics of VHDL in Chapter 2, and then incorporates more coverage of VHDL topics as needed, with advanced topics covered in Chapter 8. Rather than simply teach VHDL as a programming language, this book emphasizes the practical use of VHDL in the digital design process. For example, in Chapter 9, the author develops VHDL models for a RAM memory and a microprocessor bus interface; he then uses a VHDL

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simulation to verify that timing specifications for the interface between the memory and microprocessor bus are satisfied. The book also covers the use of CAD tools to synthesize digital logic from a VHDL description (in Chapter 8), and stresses the use of programmable logic devices, including programmable gate arrays. Chapter 10 introduces methods for testing digital systems including boundary scan and a built-in self-test.

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 unequalled 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. The Definitive, Up-to-Date Guide to Digital Design with SystemVerilog: Concepts, Techniques,

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and Code To design state-of-the-art digital hardware, engineers first specify functionality in a high-level Hardware Description Language (HDL)—and today's most powerful, useful HDL is SystemVerilog, now an IEEE standard. Digital System Design with SystemVerilog is the first comprehensive introduction to both SystemVerilog and the contemporary digital hardware design techniques used with it. Building on the proven approach of his bestselling Digital System Design with VHDL, Mark Zwolinski covers everything engineers need to know to automate the entire design process with SystemVerilog—from modeling through functional simulation, synthesis, timing simulation, and verification. Zwolinski teaches through about a hundred and fifty practical examples, each with carefully detailed syntax and enough in-depth information to enable rapid hardware design and verification. All examples are available for download from the book's companion Web site, zwolinski.org. Coverage includes Using electronic design automation tools with programmable logic and ASIC technologies Essential principles of Boolean algebra and combinational logic design, with discussions of timing and hazards Core modeling techniques: combinational building blocks, buffers, decoders, encoders, multiplexers, adders, and parity checkers Sequential building blocks: latches, flip-flops, registers, counters, memory, and sequential multipliers Designing finite state machines: from ASM chart to D flip-flops, next state, and output logic Modeling interfaces and packages with SystemVerilog Designing testbenches: architecture, constrained random test generation, and assertion-based verification Describing RTL and FPGA synthesis models Understanding and implementing Design-for-Test Exploring anomalous behavior in asynchronous sequential circuits Performing Verilog-AMS and mixed-signal modeling Whatever your experience with digital design, older versions of Verilog, or VHDL, this book will help you discover

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SystemVerilog's full power and use it to the fullest.

This book uses a "learn by doing" approach to introduce the concepts and techniques of VHDL and FPGA to designers through a series of hands-on experiments. FPGA Prototyping by VHDL Examples provides a collection of clear, easy-to-follow templates for quick code development; a large number of practical examples to illustrate and reinforce the concepts and design techniques; realistic projects that can be implemented and tested on a Xilinx prototyping board; and a thorough exploration of the Xilinx PicoBlaze soft-core microcontroller.

Master the process of designing and testing new hardware configurations with DIGITAL SYSTEMS DESIGN USING VERILOG. This practical book integrates coverage of logic design principles, Verilog as a hardware design language, and FPGA implementation. The authors present Verilog constructs side-by-side with hardware, encouraging you to think in terms of desired hardware while writing synthesizable Verilog. Following a review of the basic concepts of logic design, the authors introduce the basics of Verilog using simple combinational circuit examples, followed by models for simple sequential circuits. Subsequent chapters ask you to tackle more and more complex designs.

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. This book will teach students how to design digital logic circuits, specifically combinational and

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sequential circuits. Students will learn how to put these two types of circuits together to form dedicated and general-purpose microprocessors. This book is unique in that it combines the use of logic principles and the building of individual components to create data paths and control units, and finally the building of real dedicated custom microprocessors and general-purpose microprocessors. After understanding the material in the book, students will be able to design simple microprocessors and implement them in real hardware.

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.

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Adapted from Floyd's best-selling Digital Fundamentals—widely recognized as the authority in digital electronics—this book also applies basic VHDL concepts to the description of logic circuits. It introduces digital logic concepts and functions in the same way as the original book, but with an emphasis on PLDs rather than fixed-function logic devices. Reflects the trend away from fixed-function logic devices with an emphasis on CPLDs and FPGAs, while offering coverage of fixed-function logic for reference. Presents VHDL as a tool for implementing the digital logic in programmable logic devices. Offers complete, up-to-date coverage, from the basic digital logic concepts to the latest in digital signal processing. Emphasizes applications and troubleshooting. Provides Digital System Applications in most chapters, illustrating how basic logic functions can be applied in real-world situations; many use VHDL to implement a system. Provides many examples with related problems. Includes ample illustrations throughout. A solid introduction to digital systems and programming in VHDL for design engineers or software engineers.

Advanced Digital Systems Design with Rapid Prototyping on FPGAs using VHDL aims to provide students, researcher, and hardware designers in electrical & computer engineering with a reference manual that covers the main aspects of hardware implementation of complex algorithms in the field of digital technology using FPGAs.

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

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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 Electronic systems based on digital principles are becoming ubiquitous. A good design approach to these systems is essential and a top-down methodology is favoured. Such an approach is vastly simplified by the use of computer modeling to describe the systems. VHDL is a formal language which allows a designer to model the behaviours and structure of a digital circuit on a computer before implementation. "Digital System Design with VHDL" is intended both for students on Digital Design courses and practitioners who would like to integrate digital design and VHDL synthesis in the workplace. Its unique approach combines the principles of digital design with a guide to the use of VHDL. Synthesis issues are discussed and practical guidelines are provided for improving simulation accuracy and performance. Features: a

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practical perspective is obtained by the inclusion of real-life examples an emphasis on software engineering practices encourages clear coding and adequate documentation of the process demonstrates the effects of particular coding styles on synthesis and simulation efficiency covers the major VHDL standards includes an appendix with examples in Verilog This rigorous text shows electronics designers and students how to deploy Verilog in sophisticated digital systems design. The Second Edition is completely updated -- along with the many worked examples -- for Verilog 2001, new synthesis standards and coverage of the new OVI verification library.

A unique guide to using both modeling and simulation in digital systems design Digital systems design requires rigorous modeling and simulation analysis that eliminates design risks and potential harm to users. Introduction to Digital Systems: Modeling, Synthesis, and Simulation Using VHDL introduces the application of modeling and synthesis in the effective design of digital systems and explains applicable analytical and computational methods. Through step-by-step explanations and numerous examples, the author equips readers with the tools needed to model, synthesize, and simulate digital principles using Very High Speed Integrated Circuit Hardware Description Language (VHDL) programming. Extensively classroom-tested to ensure a fluid presentation, this book provides a comprehensive overview of the topic by integrating theoretical principles, discrete mathematical models, computer simulations, and basic methods of analysis. Topical coverage includes: Digital systems modeling and simulation Integrated logic Boolean algebra and logic Logic function optimization Number systems Combinational logic VHDL design concepts Sequential and synchronous sequential logic Each chapter begins with learning objectives that outline key concepts that follow, and all

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discussions conclude with problem sets that allow readers to test their comprehension of the presented material. Throughout the book, VHDL sample codes are used to illustrate circuit design, providing guidance not only on how to learn and master VHDL programming, but also how to model and simulate digital circuits. Introduction to Digital Systems is an excellent book for courses in modeling and simulation, operations research, engineering, and computer science at the upper-undergraduate and graduate levels. The book also serves as a valuable resource for researchers and practitioners in the fields of operations research, mathematical modeling, simulation, electrical engineering, and computer science.

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

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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.

VHDL is a comprehensive language that allows a user to deal with design complexity. Design, and the data representing a design, are complex by the very nature of a modern digital system constructed from VLSI chips. VHDL is the first language to allow one to capture all the nuances of that complexity, and to effectively manage the data and the design process. As this book shows, VHDL is not by its nature a complex language. In 1980, the U. S. Government launched a very aggressive effort to advance the state-of-the-art in silicon technology. The objective was to significantly enhance operating performance and circuit density for Very Large Scale Integration (VLSI) silicon chips. The U. S. Government realized that in order for contractors to be able to work together to develop VLSI products, to document the resulting designs, to be able to reuse the designs in future products, and to efficiently upgrade existing designs, they needed a common communication medium for the design data. They wanted the design descriptions to be computer readable and executable. They also recognized that with the high densities envisioned for the U. S. Government's Very High Speed Integrated Circuit (VHSIC) chips and the large systems required in future procurements, a means of streamlining the design process and managing the large volumes of design data was required. Thus was born the concept of a standard hardware design and description language to solve all of these problems.

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