Chapter 4 Sequential Logic Design Principles

Digital Electronics and Design with VHDLCRC Handbook of Digital System Design, Second EditionDigital Electronics 2Foundation of Digital Electronics and Logic DesignSequential LogicDigital System DesignDIGITAL ELECTRONICS AND LOGIC DESIGNFundamentals of Computer Organization and DesignDigital Logic and Design and ApplicationComputer Organization, Design, and Architecture, Fourth EditionIntroduction to Digital SystemsDigital Logic DesignLearning FPGAsDigital System DesignLogic DesignApplied Digital Logic Exercises Using FPGAsDigital Principles & System DesignDigital Logic DesignDigital Logic Design MCQsIntroduction to Digital ElectronicsDigital Logic Design & applicationsAnalog and Digital IC - Design and ApplicationsDigital Systems And MicroprocessorSequential Logic Testing and VerificationElectronic Logic CircuitsDigital Design and Computer ArchitectureDigital Electronics (Digital Logic Design)Modern Digital ElectronicsDigital DesignDigital Circuits and Logic DesignEngineering Digital DesignDigital ElectronicsIntroductory Digital ElectronicsPragmatic LogicDigital And Linear Integrated CircuitsLogic DesignDigital Design With Standard MSI and LSIIntroduction to Logic Circuits & Logic Design with VerilogVerification of Systems and Circuits Using LOTOS, Petri Nets, and CCSDigital Logic Circuits

Digital Electronics and Design with VHDL

Until now, there was no single resource for actual digital system design. Using both basic and advanced concepts, Sequential Logic: Analysis and Synthesis offers a thorough exposition of the analysis and synthesis of both synchronous and asynchronous sequential machines. With 25 years of experience in designing computing equipment, the author stresses the practical design of state machines. He clearly delineates each step of the structured and rigorous design principles that can be applied to practical applications. The book begins by reviewing the analysis of combinatorial logic and Boolean algebra, and goes on to define sequential machines and discuss traditional and alternative methods for synthesizing synchronous sequential machines. The final chapters deal with asynchronous sequential machines and pulse-mode asynchronous sequential machines. Because this volume is technology-independent, these techniques can be used in a variety of fields, such as electrical and computer engineering as well as nanotechnology. By presenting each method in detail, expounding on several corresponding examples, and providing over 500 useful figures, Sequential Logic is an excellent tutorial on analysis and synthesis procedures.

CRC Handbook of Digital System Design, Second Edition

In order to design and build computers that achieve and sustain high performance, it is essential that reliability issues be considered care fully. The problem has several aspects. Certainly, considering reliability implies that an engineer must be able to analyze how design decisions affect the incidence of failure. For instance, in order design reliable inte gritted circuits, it is necessary to analyze how decisions regarding design rules affect the yield, i.e., the percentage of functional chips obtained by the manufacturing process. Of equal importance in producing reliable computers is the detection of failures in its Very Large Scale Integrated (VLSI) circuit components, caused by errors in the design specification, implementation, or manufacturing processes. Design verification involves the checking of the specification of a design for correctness prior to carrying out an implementation. Implementation verification ensures that the manual design or automatic synthesis process is correct, i.e., the mask-level description correctly implements the specification. Manufacture test involves the checking of the complex fabrication process for correctness, i.e., ensuring that there are no manufacturing defects in the integrated circuit. It should be noted that all the above verification mechanisms deal not only with verifying the functionality of the integrated circuit but also its performance.

Digital Electronics 2

Engineering Digital Design, Second Edition provides the most extensive coverage

of any available textbook in digital logic and design. The new REVISED Second Edition published in September of 2002 provides 5 productivity tools free on the accompanying CD ROM. This software is also included on the Instructor's Manual CD ROM and complete instructions accompany each software program. In the REVISED Second Edition modern notation combines with state-of-the-art treatment of the most important subjects in digital design to provide the student with the background needed to enter industry or graduate study at a competitive level. Combinatorial logic design and synchronous and asynchronous sequential machine design methods are given equal weight, and new ideas and design approaches are explored. The productivity tools provided on the accompanying CD are outlined below: [1] EXL-Sim2002 logic simulator: EXL-Sim2002 is a full-featured, interactive, schematic-capture and simulation program that is ideally suited for use with the text at either the entry or advanced-level of logic design. Its many features include drag-and-drop capability, rubber banding, mixed logic and positive logic simulations, macro generation, individual and global (or randomized) delay assignments, connection features that eliminate the need for wire connections, schematic page sizing and zooming, waveform zooming and scrolling, a variety of printout capabilities, and a host of other useful features. [2] BOOZER logic minimizer: BOOZER is a software minimization tool that is recommended for use with the text. It accepts entered variable (EV) or canonical (1's and 0's) data from K-maps or truth tables, with or without don't cares, and returns an optimal or near optimal single or multi-output solution. It can handle up to 12 functions Boolean

functions and as many inputs when used on modern computers. [3] ESPRESSO II logic minimizer: ESPRESSO II is another software minimization tool widely used in schools and industry. It supports advanced heuristic algorithms for minimization of two-level, multi-output Boolean functions but does not accept entered variables. It is also readily available from the University of California, Berkeley, 1986 VLSI Tools Distribution. [4] ADAM design software: ADAM (for Automated Design of Asynchronous Machines) is a very powerful productivity tool that permits the automated design of very complex asynchronous state machines, all free of timing defects. The input files are state tables for the desired state machines. The output files are given in the Berkeley format appropriate for directly programming PLAs. ADAM also allows the designer to design synchronous state machines, timing-defect-free. The options include the lumped path delay (LPD) model or NESTED CELL model for asynchronous FSM designs, and the use of D FLIP-FLOPs for synchronous FSM designs. The background for the use of ADAM is covered in Chapters 11, 14 and 16 of the REVISED 2nd Edition. [5] A-OPS design software: A-OPS (for Asynchronous One-hot Programmable Sequencers) is another very powerful productivity tool that permits the design of asynchronous and synchronous state machines by using a programmable sequencer kernel. This software generates a PLA or PAL output file (in Berkeley format) or the VHDL code for the automated timing-defect-free designs of the following: (a) Any 1-Hot programmable sequencer up to 10 states. (b) The 1-Hot design of multiple asynchronous or synchronous state machines driven by either PLDs or RAM. The

input file is that of a state table for the desired state machine. This software can be used to design systems with the capability of instantly switching between several radically different controllers on a time-shared basis. The background for the use of A-OPS is covered in Chapters 13, 14 and 16 of the REVISED 2nd Edition.

Foundation of Digital Electronics and Logic Design

This book focuses on the basic principles of digital electronics and logic design. It is designed as a textbook for undergraduate students of electronics, electrical engineering, computer science, physics, and information technology. The text covers the syllabi of several Indian and foreign universities. It depicts the comprehensive resources on the recent ideas in the area of digital electronics explored by leading experts from both industry and academia. A good number of diagrams are provided to illustrate the concepts related to digital electronics so that students can easily comprehend the subject. Solved examples within the text explain the concepts discussed and exercises are provided at the end of each chapter.

Sequential Logic

Digital Logic Design Multiple Choice Questions and Answers pdf: MCQs, Quizzes &

Practice Tests. Digital logic design quiz questions and answers pdf with practice tests for online exam prep and job interview prep. Digital logic design study guide with questions and answers about algorithmic state machine, asynchronous sequential logic, binary systems, Boolean algebra and logic gates, combinational logic, digital integrated circuits, DLD lab equipment and experiments, MSI and PID components, registers counters and memory units, simplification of Boolean functions, standard graphic symbols, synchronous sequential logic. Digital logic design questions and answers to get prepare for career placement tests and job interview prep with answers key. Practice exam questions and answers about computer science, composed from digital logic design textbooks on chapters: Algorithmic State Machine Multiple Choice Questions: 50 MCQs Asynchronous Sequential Logic Multiple Choice Questions: 50 MCQs Binary Systems Multiple Choice Questions: 50 MCQs Boolean Algebra and Logic Gates Multiple Choice Questions: 50 MCQs Combinational Logic Multiple Choice Questions: 50 MCQs Digital Integrated Circuits Multiple Choice Questions: 50 MCQs DLD Lab Equipment and Experiments Multiple Choice Questions: 150 MCQs MSI and PLD Components Multiple Choice Questions: 50 MCQs Registers Counters and Memory Units Multiple Choice Questions: 50 MCQs Simplification of Boolean Functions Multiple Choice Questions: 50 MCQs Standard Graphic Symbols Multiple Choice Questions: 50 MCQs Synchronous Sequential Logic Multiple Choice Questions: 50 MCQs Digital logic design interview questions and answers on adder and subtractors, adders in DLD, algebraic manipulation, algorithmic state machine chart, alphanumeric codes,

analysis of asynchronous sequential logic, arithmetic addition, ASM chart, axiomatic definition of Boolean algebra, basic definition of Boolean algebra, basic theorems and properties of Boolean algebra, binary adder and subtractor, binary code converters, binary codes in digital logic design, binary numbers, binary storage and registers, binary systems problems, bipolar transistor characteristics. Digital logic design test questions and answers on Boolean functions implementations, Boolean functions, carry propagation, character code, circuits with latches, clocked sequential circuits analysis, clocked sequential circuits, code conversion, code converters, combinational circuits, combinational logic analysis procedure, complement of a function, complements in binary systems, cononical and standard forms, control implementation in ASM, conversion between canonical forms, decimal adder, decimal codes, decoders and encoders, definition of binary logic. Digital logic design exam questions and answers on DeMorgan theorem, dependency notation symbols, design of counters, design procedure in combinational logic, design procedure in sequential logic, design procedure of asynchronous sequential logic, design with multiplexers, digital computer and digital system, digital logic design experiments, digital logic gates, DLD lab experiments, DLD sequential circuits, DLD standard forms, dont care conditions, error detection code, exclusive or functions, five variable map. Digital logic design objective questions and answers on flip-flops excitation tables, flip-flops in digital logic design, flip-flops, flip-flops in synchronous sequential logic, four variable map, full adders in combinational logic, full subtractors, gray code, half adders, half

subtractors, integrated circuits, introduction to algorithmic state machine, introduction to asynchronous sequential logic, introduction to combinational logic, introduction to digital circuits, introduction to digital integrated circuit, introduction to experiments, introduction to integrated circuit, introduction to lab experiments, introduction to MSI and PLD components, introduction to registers counters. Digital logic design certification prep questions on introduction to state machine, introduction to synchronous sequential logic, lab learning, laboratory experiments, lamp handball, logic gates in digital logic design, logical operations, magnitude comparator, map method, memory units, multi-level NAND circuits, multi-level nor circuits, multiplexers, NAND and nor implementation, NAND implementation, nor implementation, number base conversion, octal and HEXA decimal numbers, operator precedence, or and invert implementations, product of maxterms, product of sums simplification, qualifying symbols, radix complement, read only memory, rectangular shape symbols, register transfer, registers, ripple counters, ripple counters in digital logic design, selection of prime implicants, serial addition, shapes and symbols, shift registers, shift registers in digital logic design, signed binary number, simplification of Boolean function, special characteristics of circuits, special characteristics of integrated circuit, state machine diagrams, state reduction and assignment, subtraction with complement, subtractors in combinational logic, sum of minterms, switching circuits and binary signals, synchronous counters, synchronous counters in digital logic design, tabulation method, timing in state machines, timing sequences, transformation to and-or

diagram, transition table in logic design, triggering of flip-flops, two and three variable maps, two level implementations, universal gates in combinational logic, Venn diagrams for competitive exams preparation.

Digital System Design

Number Systems Decimal, Binary, Octal and hexadecimal number system and conversion, Binary weighted codes and inter-conversion, Binary arithmetic including 1's complement and 2's complement, Error detection and correction codes. Boolean Algebra and Combinational Logic Boolean algebra theorems, Realization of switching functions using logic gates, Canonical logic forms, Sum of product and product of sums, Karnaugh maps, Simplification of expressions, Variable entered maps, Quine-McCluskey minimization techniques, Mixed logic combinational circuits and multiple output functions. Analysis and Design of Combinational Logic Combinational circuit, Decoder, Encoder, Priority encoder, Multiplexers as function generators, Binary adder, Subtractor. BCD adder, Binary comparator, Arithmetic and logic units. Sequential Logic : Sequential Circuits, Analysis and Design Triggered flip-flops, Timing specifications, Asynchronous and synchronous counters, Counter design with state equations, Registers, Bidirectional shift registers. Programmable Logic Devices PLAs, PALs, CPLD, FPGA Architectures, Finite state machines - Mealy and Moore design, Introduction to VHDL, Implementation of above combinational and sequential circuits using VHDL ,

Examples of system design applications like Washing machine, Candy vending machine, Traffic lights. CAD Tools Computer aided synthesis and optimization, Circuit models, Synthesis, Optimization, Computer aided simulation, Verification, Testing and design for testability.

DIGITAL ELECTRONICS AND LOGIC DESIGN

Fundamentals of Computer Organization and Design

New, updated and expanded topics in the fourth edition include: EBCDIC, Grey code, practical applications of flip-flops, linear and shaft encoders, memory elements and FPGAs. The section on fault-finding has been expanded. A new chapter is dedicated to the interface between digital components and analog voltages. *A highly accessible, comprehensive and fully up to date digital systems text *A well known and respected text now revamped for current courses *Part of the Newnes suite of texts for HND/1st year modules

Digital Logic and Design and Application

"Digital Design provides a modern approach to learning the increasingly important

topic of digital systems design. The text's focus on register-transfer-level design and present-day applications not only leads to a better appreciation of computers and of today's ubiquitous digital devices, but also provides for a better understanding of careers involving digital design and embedded system design. The book's key features include: An emphasis on register-transfer-level (RTL) design, the level at which most digital design is practiced today, giving readers a modern perspective of the field's applicability. Yet, coverage stays bottom-up and concrete, starting from basic transistors and gates, and moving step-by-step up to more complex components. Extensive use of basic examples to teach and illustrate new concepts, and of application examples, such as pacemakers, ultrasound machines, automobiles, and cell phones, to demonstrate the immediate relevance of the concepts. Separation of basic design from optimization, allowing development of a solid understanding of basic design, before considering the more advanced topic of optimization. Flexible organization, enabling early or late coverage of optimization methods or of HDLs, and enabling choice of VHDL, Verilog, or SystemC HDLs. Career insights and advice from designers with varying levels of experience. A clear bottom-up description of field-programmable gate arrays (FPGAs). About the Author: Frank Vahid is a Professor of Computer Science & Engineering at the University of California, Riverside. He holds Electrical Engineering and Computer Science degrees; has worked/consulted for Hewlett Packard, AMCC, NEC, Motorola, and medical equipment makers; holds 3 U.S. patents; has received several teaching awards; helped setup UCR's Computer

Engineering program; has authored two previous textbooks; and has published over 120 papers on digital design topics (automation, architecture, and low-power).

Computer Organization, Design, and Architecture, Fourth Edition

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 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.

Introduction to Digital Systems

A new advanced textbook/reference providing a comprehensive survey of hardware and software architectural principles and methods of computer systems organization and design. The book is suitable for a first course in computer organization. The style is similar to that of the author's book on assembly language in that it strongly supports self-study by students. This organization facilitates compressed presentation of material. Emphasis is also placed on related concepts to practical designs/chips. Topics: material presentation suitable for self- study; concepts related to practical designs and implementations; extensive examples

and figures; details provided on several digital logic simulation packages; free MASM download instructions provided; and end-of-chapter exercises.

Digital Logic Design

Most branches of organizing utilize digital electronic systems. This book introduces the design of such systems using basic logic elements as the components. The material is presented in a straightforward manner suitable for students of electronic engineering and computer science. The book is also of use to engineers in related disciplines who require a clear introduction to logic circuits. This third edition has been revised to encompass the most recent advances in technology as well as the latest trends in components and notation. It includes a wide coverage of application specific integrated circuits (ASCIs), many worked examples and a step-by-step logical and practical approach.

Learning FPGAs

Digital System Design

Designed as a textbook for undergraduate students in Electrical Engineering,

Electronics, Computer Science, and Information Technology, this up-to-date, well-organized study gives an exhaustive treatment of the basic principles of Digital Electronics and Logic Design. It aims at bridging the gap between these two subjects. The many years of teaching undergraduate and postgraduate students of engineering that Professor Somanathan Nair has done is reflected in the in-depth analysis and student-friendly approach of this book. Concepts are illustrated with the help of a large number of diagrams so that students can comprehend the subject with ease. Worked-out examples within the text illustrate the concepts discussed, and questions at the end of each chapter drill the students in self-study.

Logic Design

Logic Design: A Review of Theory and Practice describes computer design focusing on the theoretical and practical relationships of sequential machines. This book reviews the major technologies that make the computer, particularly the switching circuit design involving vacuum tubes, discrete transistors, and integrated circuits. The switching theory associated in the logic design of sequential machine models and synthesis techniques lead to understanding of constraints due to stray delays, input change restrictions, and memory element operation. This text also describes the logic design processes including the use of flow charts, design languages, simulations, and system timing. Three aspects needed prior to the design phase that should be considered by the programmer are data flow, the micro-operations

(and their sequencing), and the timing (machine cycle or logic). The significance between theoretical and mathematical models can then be determined through fault detection, masking, digital simulation, and test generation. This book can be beneficial for computer engineering instructors and advanced students in computer science.

Applied Digital Logic Exercises Using FPGAs

A Step-by-Step Guide to Verification of Digital Systems This practical book provides a step-by-step, interactive introduction to formal verification of systems and circuits. The book offers theoretical background and introduces the application of three powerful verification toolsets: LOTOS-based CADP, Petri nets–based PETRIFY, and CCS-based CWB. The book covers verification of modular asynchronous circuits, alternating-bit protocols, arbiters, pipeline controllers, up-down counters, and phase converters, as well as many other verification examples. Using the given detailed examples, exercises, and easy-to-follow tutorials, complete with the downloadable toolsets available via referenced Web sites, this book serves as an ideal text in advanced undergraduate and graduate courses in computer science and electrical engineering. It is also valuable as a desktop reference for practicing verification engineers who are interested in verifying that designed digital systems meet specifications and requirements.

Digital Principles & System Design

Digital Logic Design

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 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.

Digital Logic Design MCQs

This text takes the student from the very basics of digital electronics to an introduction of state-of-the-art techniques used in the field. It is ideal for any engineering or science student who wishes to study the subject from its basic principles as well as serving as a guide to more advanced topics for readers already familiar with the subject. The coverage is sufficiently in-depth to allow the reader to progress smoothly onto higher level texts.

Introduction to Digital Electronics

Philosophy: adapting the job to the bargain components. The goals of digital system design. Combinational logic I: traditional logic design. Combinational logic II: MSI and LSI logic design. Sequential logic design. Nasty realities I: race conditions and hangup states. Programmed logic I: microcomputers. Programmed logic II: computer-aided programming. Programmed logic III: development systems. Programmed logic IV: microcomputer hardware design. The time dimension. Nasty realities II: noise and reflections. Input/Output devices. Use of statistics in digital design. The social consequences of engineering.

Digital Logic Design & applications

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 to FPGAs, they are being familiarized with current digital technology and the skills to implement complex, sophisticated designs. However, working with FGPAs 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 FGPA to communicate with the PC. In the process, readers learn about digital mathematics and digital-to-analog converter concepts through pulse width modulation.

Analog and Digital IC - Design and Applications

This book is an edited version of part of the teaching text used for the Open

University's undergraduate course 'T283 Introductory Electronics', first presented in 1980. The original text was pro duced by a course team of nine authors and nine support staff. The team was also responsible for student experimental kits, television and radio programmes. The approach adopted by the course team was to try and teach, where possible, through specification of the problem rather than through discussion of the operation of a selection of available devices and components; since this leads more naturally to modem design strategies such as 'top-down'. The emphasis in the book on the solution of combinational and sequential logic problems by the truth tables and ROMs, rather than logic gates and mapping techniques, illustrates this approach. The book covers topics ranging from logic to microprocessor memory systems and is intended for students with a background in analogue electronics who wish to update their knowledge to include digital electronic systems. Chapter 2 introduces the basic ideas of combinational logic design; truth tables, ROMs, logic gates and Boolean algebra. Chapter 3 deals with sequential logic, and shows how one can design binary and decimal counters and use these to produce a system controller. Chapter 4 examines the system elements needed to interconnect analogue and digital systems.

Digital Systems And Microprocessor

Sequential Logic Testing and Verification

Suitable for a one- or two-semester undergraduate or beginning graduate course in computer science and computer engineering, Computer Organization, Design, and Architecture, Fourth Edition presents the operating principles, capabilities, and limitations of digital computers to enable development of complex yet efficient systems. With 40% updated material and four new chapters, this edition takes students through a solid, up-to-date exploration of single- and multiple-processor systems, embedded architectures, and performance evaluation. New to the Fourth Edition Additional material that covers the ACM/IEEE computer science and engineering curricula More coverage on computer organization, embedded systems, networks, and performance evaluation Expanded discussions of RISC, CISC, VLIW, and parallel/pipelined architectures The latest information on integrated circuit technologies and devices, memory hierarchy, and storage Updated examples, references, and problems Supplying appendices with relevant details of integrated circuits reprinted from vendors' manuals, this book provides all of the necessary information to program and design a computer system.

Electronic Logic Circuits

Digital Design and Computer Architecture

Combinational Logic DesignUsing MSI circuits, BCD adder, BCD subtractor, BCD to 7 segment decoder. Adder/Subtractor using IC 7483.Design of Code Converter CircuitsBCD to binary, Binary to BCD, BCD to gray, Gray to BCD, BCD to Ex-3, etc.Design of counter and shift register using IC 7493 and IC 7495.Design of ROM, PLA, PALBasic structure of ROM, Size of ROM, Design of ROM, Structure of PLA, PAL, And their designs. Introductions to Complex Programmable Logic Devices (CPLDs) and Field-Programmble Gate Array, (FPGA).Sequential Logic DesignReview of excitation table of S-R, J-K, D and T flip-flops. Analysis of clocked sequential circuit, State table, State diagram, Next state equations, State reduction, State assignment. Design of register, Shift resister ripple counter, Synchronous counters, Sequence generator and detector.Asynchronous Sequential CircuitAsynchronous versus synchronous sequential circuit, Application of asynchronous sequential circuit.Asynchronous sequential machine modes, Analysis of asynchronous sequential machine, Design of asynchronous sequential circuit.Algorithmic State MachinesASM chart, Definition, Standard symbols for ASM chart, Method of implementation ASM chart by 'D' flip-flop, Mux-controller, ROM controller, One hot controller.Generation of ASM chart for different waveforms, Miscellaneous problem of ASM chart, e.g. Traffic light, Washing machine , Wending machine etc.Introduction to VHDLEntity, Architecture, Configuration declaration generic, Data objects example of VHDL codes.

Digital Electronics (Digital Logic Design)

Number Systems Decimal, Binary, Octal and hexadecimal number system and conversion, Number system's application e.g. shaft encoding, Binary weighted codes, Signed number binary order, 1's and 2's complement codes, All number system's arithmetic.Boolean Algebra : Binary logic functions, Boolean laws, Truth tables, Associative and distributive properties, DeMorgan's theorem, Realization of switching functions using logic gates. Combinational Logic Switching equations, Canonical logic forms, Sum of product & product of sum, Karnaugh maps, Two, three and four variable Karnaugh graph, Simplification of expression, Quine McCluskey minimization techniques, Mixed logic combinational circuits, Multiple output functions. Analysis and Design of Combinational Logic Combinational circuits, Multiplexer and demultiplexer, Multiplexers as function generator, Binary adder, Substractor, BCD adder, Binary comparator with physical applications, Arithmetic and logic units, Design of combinational circuits using statements. Sequential Logic Sequential circuits, Flip-flop conversions, Clocked and edge triggered flip-flops timing specifications, Timing analysis, State diagrams and tables, Transition tables, Excitation table and equations, Examples using flip-flops. Sequential Circuits Simple synchronous and asynchronous sequential circuit analysis, Different types of counters asynchronous and synchronous, Counter design with state equations, Registers, Different types of shift registers, Construction of state diagram and counter design. Digital Integrated Circuits

Digital circuit logic levels, Propagation delay times, Power dissipation, Fan out and Fan in, Noise margin for popular logic families, TTL, TTL sub families, CMOS and their performance comparison

Modern Digital Electronics

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

Digital Design

Digital Circuits and Logic Design

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.

Engineering Digital Design

Digital Electronics

Introductory Digital Electronics

As electronic devices become increasingly prevalent in everyday life, digital circuits are becoming even more complex and smaller in size. This book presents the basic principles of digital electronics in an accessible manner, allowing the reader to grasp the principles of combinational and sequential logic and the underlying techniques for the analysis and design of digital circuits. Providing a hands-on approach, this work introduces techniques and methods for establishing logic equations and designing and analyzing digital circuits. Each chapter is supplemented with practical examples and well-designed exercises with worked solutions. This second of three volumes focuses on sequential and arithmetic logic circuits. It covers various aspects related to the following topics: latch and flip-flop; binary counters; shift registers; arithmetic and logic circuits; digital integrated circuit technology; semiconductor memory; programmable logic circuits. Along with the two accompanying volumes, this book is an indispensable tool for students at a bachelors or masters level seeking to improve their understanding of digital electronics, and is detailed enough to serve as a reference for electronic, automation and computer engineers.

Pragmatic Logic

Digital And Linear Integrated Circuits

Digital Logic Overview of basic gates and universal logic gates and AND-OR-Invert gates, Positive and negative logic, Introduction to HDL.Combinational Logic Circuits Boolean laws and theorems, Sum-of-products method, Truth table to Karnaugh Map, Pairs, Quads, and Octets, Karnaugh simplifications, Don't care conditions, Product-of-sums method, Product-of-sums simplification, Simplification by Quine-McClusky method, Hazards and Hazard covers, HDL implementation models.Data Processing Circuits Multiplexers, Demultiplexers, 1-to-16 decoders BCD-to-Decimal decoders, Seven-segment decoders, Encoders, EX-OR gates, Parity generators and checkers, Magnitude comparator, Read-only memory, Programmable array logic, Programmable logic array, Troubleshooting with a logic probe, HDL implementation of data processing circuits.Arithmetic Circuits Binary addition, Binary subtraction, Unsigned binary numbers, Sign-magnitude numbers, 2's complement representation, 2's complement arithmetic, arithmetic building blocks, The adder-subtractor, Fast adder, Arithmetic logic unit, Binary multiplication and division, Arithmetic circuits using HDL.Clocks and Timing CircuitsClock waveforms, TTL clock, Schmitt trigger, Monostables with input logic, Pulse-forming circuits.Flip-

flopsRS flip-flops, gated flip-flops, Edged-triggered RS, D, JK flip-flops, Flip-flop timing, JK master-slave flip-flops, Switch contact bounce circuits, Various representations of flip-flops, Analysis of sequential circuits, Conversion of flip-flops - a synthesis example, HDL implementation of flip-flop.RegistersTypes of registers, Serial in-serial out, Serial in-parallel out, Parallel in-serial out, Parallel in-parallel out, Applications of shift registers, register implementation in HDL.CountersAsynchronous counters, Decoding gates, Synchronous counters, Changing the counter modulus, Decade counters, Presettable counters, Counter design as a synthesis problem, A digital clock, Counter design using HDL.Design of Sequential CircuitModel selection, State transition diagram, State synthesis table, Design equations and circuit diagram, Implementation using read only memory, Algorithmic state machine, State reduction technique, Analysis of asynchronous sequential circuit, Problems with asynchronous sequential circuits, Design of asynchronous sequential circuit.D/A Conversion and A/D ConversionVariable, Resistor networks, Binary ladders, D/A converters, D/A accuracy and resolution, A/D converter-simultaneous conversion, A/D converter-counter method, Continuous A/D conversion, A/D techniques, Dual-slope A/D conversion, A/D accuracy and resolution.Digital Integrated CircuitsSwitching circuits, 7400 TTL, TTL parameters, TTL overview, Open-collector gates, Three-state TTL devices, External drive for TTL loads, TTL driving external loads, 74C00 CMOS, CMOS characteristics, TTL-to-CMOS interface, CMOS-to-TTL interface, TTL and CMOS family and their characteristics.

Logic Design

Number Systems :Binary, Octal, Decimal, Hexadecimal-Number base conversions-complements-signed binary numbers. Binary arithmetic-Binary codes : Weighted - BCD-2421- Gray code - Excess 3 code - ASCII - Error detecting code - Conversion from one code to another - Boolean postulates and laws - De-Morgan's theorem, Principle of Duality - Boolean expression - Boolean function - Minimization of Boolean expressions - Sum of Products (SOP) - Product of Sums(POS) - Minterm - Maxterm - Canonical forms - Conversion between canonical form - Karnaugh map minimization - Don't care conditions.Logic Gates :AND, OR , NOT, NAND, NOR, Exclusive - OR and Exclusive - NOR - Implementations of logic functions using gates, NAND-NOR implementations - Multi level gate implementations - Multi output gate implementations. TTL and CMOS logic and their characteristics - Tristate gates. Combinational Circuits :Design procedure - Adder - Subtractors - Serial adder/Subtractor - Parallel adder/Subtractor - Carry look ahead adder - BCD adder - Magnitude comparator - Multiplexer/Demultiplexer - Encoder/Decoder - Parity checker - Code converters. Implementation of combinational logic using MUX, ROM, PAL and PLA.Sequential Circuit :Flip flops SR, JK, T, D and Master slave - Characteristic table and equation - Application table - Edge triggering - Level triggering - Realization of one flip flop using other flip flops - Asynchronous / Ripple counters - Synchronous counters - Modulo - n counter - Classification of sequential circuits - Moore and Mealy - Design of synchronous counters; State diagram - State

table - State minimization - State assignment - ASM - Excitation table and maps - Circuit implementation register - Shift registers - Universal shift register - Shift counters - Ring counters.Asynchronous Sequential Circuits :Design of fundamental mode and pulse mode circuits - Primitive state / flow table - Minimization of primitive state table - State assignment - Excitation table - Excitation map - cycles - Races - Hazards : Static - Dynamic - Essential - Hazards elimination.Memory DevicesClassification of memories - RAM organization - Write operation - Read operation - Memory cycle - Timing wave forms - Memory decoding - Memory expansion - Static RAM Cell - Bipolar RAM cell MOSFET RAM cell - Dynamic RAM cell - ROM organization - PROM - EPROM - EEPROM - EAPROM - Programmable logic devices - Programmable logic Array (PLA) - Programmable Array Logic (PAL). Field Programmable Gate Arrays (FPGA).

Digital Design With Standard MSI and LSI

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 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

Introduction to Logic Circuits & Logic Design with Verilog

As technology advances, digital system designers must acquire and maintain skills to design systems with analog, pulse/time, and digital circuits along with LSI and VLSI devices. The CRC Handbook of Digital System Design, Second Edition reviews the fundamentals of these topics for the convenience of designers who need to refresh their memories from time to time. In a somewhat unique presentation, this book integrates theory with practical design and covers three broad topics: The basics- formulas, design equation, terminology, symbols, and notation Characterstics, properties, and principles of operation of devices, modules, and building blocks frequently used as components in digital system design Design procedures-guidelines for system design presented through examples The author includes numerous examples, both simple and complex, throughout the book that

help clarify points often confusing or overlooked. He also addresses memory and arithmetic unit design, techniques of grounding and shielding for analog and digital noise, and graphical techniques for nonlinear circuits and transmission line analysis. The style is straightforward, the treatment self-contained and practical. The CRC Handbook of Digital System Design, Second Edition remains a popular and valuable resource for anyone involved in digital system design.

Verification of Systems and Circuits Using LOTOS, Petri Nets, and CCS

Pragmatic Logic presents the analysis and design of digital logic systems. The author begins with a brief study of binary and hexadecimal number systems and then looks at the basics of Boolean algebra. The study of logic circuits is divided into two parts, combinational logic, which has no memory, and sequential logic, which does. Numerous examples highlight the principles being presented. The text ends with an introduction to digital logic design using Verilog, a hardware description language. The chapter on Verilog can be studied along with the other chapters in the text. After the reader has completed combinational logic in Chapters 4 and 5, sections 9.1 and 9.2 would be appropriate. Similarly, the rest of Chapter 9 could be studied after completing sequential logic in Chapters 6 and 7. This short lecture book will be of use to students at any level of electrical or

computer engineering and for practicing engineers or scientists in any field looking for a practical and applied introduction to digital logic. The author's "pragmatic" and applied style gives a unique and helpful "non-idealist, practical, opinionated" introduction to digital systems.

Digital Logic Circuits