

Digital Systems Design Frank Vahid Solutions Manual

High-Performance Embedded Computing, Second Edition, combines leading-edge research with practical guidance in a variety of embedded computing topics, including real-time systems, computer architecture, and low-power design. Author Marilyn Wolf presents a comprehensive survey of the state of the art, and guides you to achieve high levels of performance from the embedded systems that bring these technologies together. The book covers CPU design, operating systems, multiprocessor programs and architectures, and much more. Embedded computing is a key component of cyber-physical systems, which combine physical devices with computational resources for control and communication. This revised edition adds new content and examples of cyber-physical systems throughout the book, including design methodologies, scheduling, and wide-area CPS to illustrate the possibilities of these new systems. Revised and updated with coverage of recently developed consumer electronics architectures and models of computing Includes new VLIW processors such as the TI Da Vinci, and CPU simulation Learn model-based verification and middleware for embedded systems Supplemental material includes lecture slides, labs, and additional resources

This is the first book on embedded systems to offer a unified approach to hardware and software specification and design issues -- and the first to outline a new specify-explore-refine paradigm that is presently being used in industry in an ad-hoc manner, but until now has not been formally described. The book addresses the system design methodology from conceptualization to manufacturing using this new paradigm, and shows how this methodology can result in 10x improvement in productivity. Addresses two of the most significant topics in the design of digital systems -- executable system specification and a methodology for system partitioning and refinement into system-level components. Covers models and architectures; specification languages; a specification example; translation to VHDL; system partitioning; design quality estimation; specification refinement into synthesizable models; and system-design methodology and environment. Contains a complete specification of a model product (telephone answering machine), and demonstrates how to write the specification from an English description. For RISC design methodologists and VHDL methodologists; and CAD software developers.

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

VLSI 91

ESL Models and their Application

System-Level Synthesis

Embedded System Design

Embedded Systems

... IEEE Asia-Pacific Conference on Circuits and Systems

System-Level Synthesis deals with the concurrent design of electronic applications, including both hardware and software. The issue has become the bottleneck in the design of electronic systems, including both hardware and software, in several major industrial fields, including telecommunications, automotive and aerospace engineering. The major difficulty with the subject is that it demands contributions from several research fields, including system specification, system architecture, hardware design, and software design. Most existing book cover well only a few aspects of system-level synthesis. The present volume presents a comprehensive discussion of all the aspects of system-level synthesis. Each topic is covered by a contribution written by an international authority on the subject.

This volume presents the proceedings of the 7th International Workshop on Higher Order Logic Theorem Proving and Its Applications held in Valetta, Malta in September 1994. Besides 3 invited papers, the proceedings contains 27 refereed papers selected from 42 submissions. In total the book presents many new results by leading researchers working on the design and applications of theorem provers for higher order logic. In particular, this book gives a thorough state-of-the-art report on applications of the HOL system, one of the most widely used theorem provers for higher order logic.

Chip Design and Implementation from a Practical Viewpoint Focusing on chip implementation, Low-Power NoC for High-Performance SoC Design provides practical knowledge and real examples of how to use network on chip (NoC) in the design of system on chip (SoC). It discusses many architectural and theoretical studies on NoCs, including design methodology, topology exploration, quality-of-service guarantee, low-power design, and implementation trials. The Steps to Implement NoC The book covers the full spectrum of the subject, from theory to actual chip design using NoC. Employing the Unified Modeling Language (UML) throughout, it presents complicated concepts, such as models of computation and communication-computation partitioning, in a manner accessible to laypeople. The authors provide guidelines on how to simplify complex networking theory to design a working chip. In addition, they explore the novel NoC techniques and implementations of the Basic On-Chip Network (BONE) project. Examples of real-time decisions, circuit-level design, systems, and chips give the material a real-world context. Low-Power NoC and Its Application to SoC Design Emphasizing the application of NoC to SoC design, this book shows how to build the complicated interconnections on SoC while keeping a low power consumption.

Leicester, England, 19-20th September 1998

High-Performance Embedded Computing

Low-Power NoC for High-Performance SoC Design

Design and VLSI Implementation of Perceptive Controller for Robotic Systems

The Anatomy of a High-Performance Microprocessor
Specification and Design of Embedded Systems

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. 1. Introduction 2. Combinational Logic Design 3. Sequential Logic Design-Controllers 4. Datapath Components 5. Register-Transfer Level (RTL) Design 6. Optimizations and Tradeoffs 7. Physical Implementation 8. Programmable Processors 9. Hardware Description Languages

This book offers readers a set of new approaches and tools a set of tools and techniques for facing challenges in parallelization with design of embedded systems. It provides an advanced parallel simulation infrastructure for efficient and effective system-level model validation and development so as to build better products in less time. Since parallel discrete event simulation (PDES) has the potential to exploit the underlying parallel computational capability in today's multi-core simulation hosts, the author begins by reviewing the parallelization of discrete event simulation, identifying problems and solutions. She then describes out-of-order parallel discrete event simulation (OoO PDES), a novel approach for efficient validation of system-level designs by aggressively exploiting the parallel capabilities of today's multi-core PCs. This approach enables readers to design simulators that can fully exploit the parallel processing capability of the multi-core system to achieve fast speed simulation, without loss of simulation and timing accuracy. Based on this parallel simulation infrastructure, the author further describes automatic approaches that help the designer quickly to narrow down the debugging targets in faulty ESL models with parallelism.

Embedded System Design: Modeling, Synthesis and Verification introduces a model-based approach to system level design. It presents modeling techniques for both computation and communication at different levels of abstraction, such as specification, transaction level and cycle-accurate level. It discusses synthesis methods for system level architectures, embedded software and hardware components. Using these methods, designers can develop applications with high level models, which are automatically translatable to low level implementations. This book, furthermore, describes simulation-based and formal verification methods that are essential for achieving design confidence. The book concludes with an overview of existing tools along with a design case study outlining the practice of embedded system design. Specifically, this book addresses the following topics in detail: . System modeling at different abstraction levels . Model-based system design . Hardware/Software codesign . Software and Hardware component synthesis . System verification This book is for groups within the embedded system community: students in courses on embedded systems, embedded application developers, system designers and managers, CAD tool developers, design automation, and system engineering.

Architecture, Programming and Design

Higher Order Logic Theorem Proving and Its Applications

CONCEPTS AND PRACTICE

Digital VLSI Systems Design

Readings in Hardware/software Co-design

Out-of-order Parallel Discrete Event Simulation for Electronic System-level Design

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 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.

The purpose of this book is to introduce VHSIC Hardware Description Language (VHDL) and its use for synthesis. VHDL is a hardware description language which provides a means of specifying a digital system over different levels of abstraction. It supports behavior specification during the early stages of a design process and structural specification during the later implementation stages. VHDL was originally introduced as a hardware description language that permitted the simulation of digital designs. It is now increasingly used for design specifications that are given as the input to synthesis tools which translate the specifications into netlists from which the physical systems can be built. One problem with this use of VHDL is that not all of its constructs are useful in synthesis. The specification of delay in signal assignments does not have a clear meaning in synthesis, where delays have already been determined by the implementation technology. VHDL has data-structures such as files and pointers, useful for simulation purposes but not for actual synthesis. As a result synthesis tools accept only subsets of VHDL. This book tries to cover the synthesis aspect of VHDL, while keeping the simulation-specifics to a minimum. This book is suitable for working professionals as well as for graduate or under graduate study. Readers can view this book as a way to get acquainted with VHDL and how it can be used in modeling of digital designs.

This volume presents the technical program of the 2007 International Embedded Systems Symposium held in Irvine, California. It covers timely topics, techniques and trends in embedded system design, including design methodology, networks-on-chip, distributed and networked systems, and system verification. It places emphasis on automotive and medical applications and includes case studies and special aspects in embedded system design.

A Systems Perspective

A Design Manual for Implementation of Projects on FPGAs and ASICs Using Verilog

Proceedings of the 1998 Chinese Automation Conference in the UK

Architectures, Applications, and Methodologies

APCCAS ...

With Vhdl Digital Design

An eagerly anticipated, up-to-date guide to essential digital design fundamentals Offering a modern, updated approach to digital design, this much-needed book reviews basic design

fundamentals before diving into specific details of design optimization. You begin with an examination of the low-levels of design, noting a clear distinction between design and gate-level minimization. The author then progresses to the key uses of digital design today, and how it is used to build high-performance alternatives to software. Offers a fresh, up-to-date approach to digital design, whereas most literature available is solely outdated Progresses through low levels of design, making a clear distinction between design and gate-level minimization Addresses the various uses of digital design today Enables you to gain a clearer understanding of applying digital design to your life With this book by your side, you'll gain a better understanding of how to apply the material in the book to real-world scenarios.

Over the past several years, embedded systems have emerged as an integral though unseen part of many consumer, industrial, and military devices. The explosive growth of these systems has resulted in embedded computing becoming an increasingly important discipline. The need for designers of high-performance, application-specific computing systems has never been greater, and many universities and colleges in the US and worldwide are now developing advanced courses to help prepare their students for careers in embedded computing. High-Performance Embedded Computing: Architectures, Applications, and Methodologies is the first book designed to address the needs of advanced students and industry professionals. Focusing on the unique complexities of embedded system design, the book provides a detailed look at advanced topics in the field, including multiprocessors, VLIW and superscalar architectures, and power consumption. Fundamental challenges in embedded computing are described, together with design methodologies and models of computation. HPEC provides an in-depth and advanced treatment of all the components of embedded systems, with discussions of the current developments in the field and numerous examples of real-world applications. Covers advanced topics in embedded computing, including multiprocessors, VLIW and superscalar architectures, and power consumption Provides in-depth coverage of networks, reconfigurable systems, hardware-software co-design, security, and program analysis Includes examples of many real-world embedded computing applications (cell phones, printers, digital video) and architectures (the Freescale Starcore, TI OMAP multiprocessor, the TI C5000 and C6000 series, and others)

"A rare look into high-performance main-stream processors exposed with clarity and elegance." — Harold Stone, NEC Research Institute "A unique combination of a very well developed, scholarly, thorough, long-term, perspective with detailed hands-on insight into actual current industrial practices." — Tore Larsen, Princeton University and University of Tromso "There are few books on the market which can compete with this text either in the technical depth of the presentation, or the completeness of the coverage." — Ron Hoelzeman, University of Pittsburgh "The best and easiest way to learn how the latest superscalar microprocessors really work. Not only are the microarchitectural features well presented, but they are presented along with a historical context which shows that the new microprocessors have inherited much from the supercomputers of the 60's and 70's." — Edmund Gallizzi, Eckerd College This work describes in detail the microarchitecture of a high-performance microprocessor, giving an integrated treatment of platform and systems issues relating to the design and implementation of microprocessor-based systems. Unique in content and approach, the accompanying interactive CD-ROM provides multiple books and a wide variety of materials: Complete data books Articles from journals and conference proceedings Manuscripts of important historical interest IEEE and Industry standards VHDL and Verilog simulators Numerous video and audio clips Complete text of the book, including figures and tables Shriver and Smith use AMD's K6 3D microprocessor as a "case study" basis for discussions on microarchitecture issues and increasingly important industry specifications and platforms on systems issues. This book is an important reference for individuals building systems using microprocessors and readers looking for significant insights into fundamental design guidelines that transcend the design, implementation, and use of a specific microprocessor. Practitioners, academics, and technical and product managers alike will benefit from this detailed overview of microprocessors, platforms, and systems for years in the future. The main sections: Microprocessors, Platforms, and Systems A Microarchitecture Case Study The K6 3D Microarchitecture Technology Components of Platform Architecture Platform Memory Technology Platform Optimization Techniques and Directions System Requirements: All of the material on the companion CD-ROM, except for the three simulators, can be used on any system with the following: A CD-ROM reader, a video board, and a sound card Acrobat Reader with Search Version 3.01 or higher All of the standard plug-ins installed including the Search, Movie, and Weblink plug-ins Adobe Acrobat Readers with Search Version 3.01 for Windows systems and some versions of Unix are included on the companion CD-ROM. The Acrobat Reader with Search for Mac systems, as well as for the operating systems with which the Reader or the Reader with Search (strongly recommended) can be used, is available on Adobe's Web-site UNIX users may have to install a .MOV and .WAV viewer for their specific system The simulators can only be installed on Windows 95 or Windows NT systems Web-site: There is a Web-site associated with this book and its companion CD-ROM, <http://computer.org/books/anatomy> (see inside frontflap)

Proceedings of the IFIP TC10/WG 10.5 International Conference on Very Large Scale Integration, Edinburgh, Scotland, 20-22 August 1991
 Hardware/Software Co-Design
 Verilog for Digital Design

Digital System Design - Use of Microcontroller

7th International Workshop, Valletta, Malta, September 19-22, 1994. Proceedings

Digital Design

Memory Architecture Exploration for Programmable Embedded Systems addresses efficient exploration of alternative memory architectures, assisted by a "compiler-in-the-loop" that allows effective matching of the target application to the processor-memory architecture. This new approach for memory architecture exploration replaces the traditional black-box view of the memory system and allows for aggressive co-optimization of the programmable processor together with a customized memory system. The book concludes with a set of experiments demonstrating the utility of this exploration approach. The authors perform architecture and compiler exploration for a set of large, real-life benchmarks, uncovering promising memory configurations from different perspectives, such as cost, performance and power.

To help designers and developers of hardware/software systems knock together a working model more quickly, the 33 papers discuss models for system simulation and emulation in a hierarchical sense, software-to-hardware mapping, software prototyping and validation, prototyping environments of hardware

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.

EURO-DAC ...

Digital Design with Embedded System Design Set

Proceedings

Applications in Cyber-Physical Systems and Mobile Computing

Digital Design, Preview Ed.

SOFTWARE DESIGN, ARCHITECTURE AND ENGINEERING

This book arises from experience the authors have gained from years of work as industry practitioners in the field of Electronic System Level design (ESL). At the heart of all things related to Electronic Design Automation (EDA), the core issue is one of models: what are the models used for, what should the models contain, and how should they be written and distributed. Issues such as interoperability and tool transportability become central factors that may decide which ones are successful and those that cannot get sufficient traction in the industry to survive. Through a set of real examples taken from recent industry experience, this book will distill the state of the art in terms of System-Level Design models and provide practical guidance to readers that can be put into use. This book is an invaluable tool that will aid readers in their own designs, reduce risk in development projects, expand the scope of design projects, and improve developmental processes and project planning.

This title serves as an introduction and reference for the field, with the papers that have shaped the hardware/software co-design since its inception in the early 90s.

"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).

Electronic System Level Design and Verification in Practice

Digital Integrated Circuit Design

A Unified Hardware/Software Introduction

Modeling, Synthesis and Verification

VHDL for Digital Design

Hardware and Software

This textbook aims to prepare students, as well as, practitioners for software design and production. Keeping in mind theory and practice, the book keeps a balance between theoretical foundations and practical considerations. The book by and large meets the requirements of students at all levels of computer science and engineering/information technology for their Software design and Software engineering courses. The book begins with concepts of data and object. This helps in exploring the rationale that guide high level programming language (HLL) design and object oriented frameworks. Once past this post, the book moves on to expand on software design concerns. The book emphasizes the centrality of Parnas's separation of concerns in evolving software designs and architecture. The book extensively explores modelling frameworks such as Unified Modelling Language (UML) and Petri net based methods. Next, the book

covers architectural principles and software engineering practices such as Agile - emphasizing software testing during development. It winds up with case studies demonstrating how systems evolve from basic concepts to final products for quality software designs. TARGET AUDIENCE • Undergraduate/postgraduate students of Computer Science and Engineering, and Information Technology • Postgraduate students of Software Engineering/Software Systems

A presentation of developments in microcontroller technology, providing lucid instructions on its many and varied applications. It focuses on the popular eight-bit microcontroller, the 8051, and the 83C552. The text outlines a systematic methodology for small-scale, control-dominated embedded systems, and is accompanied by a disk of all the example problems included in the book.

* Ideal as either a standalone introductory guide or in tandem with Vahid's Digital Design to allow for greater language coverage, this is an accessible introductory guide to hardware description language * VHDL is a hardware description language used to model electronic systems and this book is helpful for anyone who is starting out and learning the language * Features numerous examples and tips in the margins * Focuses on application and use of the language, rather than just teaching the basics of the language

Digital Design with RTL Design, Verilog and VHDL
Embedded Systems Design with 8051 Microcontrollers
Memory Architecture Exploration for Programmable Embedded Systems
Effective Coding with VHDL
6th IEEE International Workshop on Rapid System Prototyping
Design Automation, 29th

The major problem in VLSI is really the control of complexity. The hardest part is the control of autonomous yet interacting processes. We do not yet have satisfactory techniques for handling that sort of thing, but I think the techniques we need to develop are independent of whether you are programming or designing the chip. Sidney Michaelson, Initiator of the IFIP Working Group on VLSI. This proceedings, dedicated to the late Prof. Sidney Michaelson, who ten years ago established this IFIP Working Group, reflects the continuing interest in improving design tools and the wide range of engineering concerns surrounding the effective exploitation of VLSI.

The proceedings of the conference held in Anaheim, California, June 1992, comprise 125 papers organized into 44 sessions. There is increased emphasis on presentations (short tutorials, panels, and selected papers) of interest to the design automation user community, with a better balance between the Concurrent design, or co-design of hardware and software is extremely important for meeting design goals, such as high performance, that are the key to commercial competitiveness. Hardware/Software Co-Design covers many aspects of the subject, including methods and examples for designing: (1) general purpose and embedded computing systems based on instruction set processors; (2) telecommunication systems using general purpose digital signal processors as well as application specific instruction set processors; (3) embedded control systems and applications to automotive electronics. The book also surveys the areas of emulation and prototyping systems with field programmable gate array technologies, hardware/software synthesis and verification, and industrial design trends. Most contributions emphasize the design methodology, the requirements and state of the art of computer aided co-design tools, together with current design examples. IFIP TC10 Working Conference: International Embedded Systems Symposium (IESS), May 30 - June 1, 2007, Irvine (CA), USA

VHDL Modeling for Digital Design Synthesis

Principles and Best Practice

Embedded System Design: Topics, Techniques and Trends

From VLSI Architectures to CMOS Fabrication

European Design Automation Conference : EURO-VHDL ...: [proceedings].

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.

* Ideal as either a standalone introductory guide or in tandem with Vahid's Digital Design to allow for greater language coverage, this is an accessible introductory guide to hardware description language * Verilog is a hardware description language used to model electronic systems (sometimes called Verilog HDL) and this book is helpful for anyone who is starting out and learning the language * Focuses on application and use of the language, rather than just teaching the basics of the language

Embedded systems are today, widely deployed in just about every piece of machinery from toasters to spacecraft. Embedded system designers face many challenges. They are asked to produce increasingly complex systems using the latest technologies, but these

technologies are changing faster than ever. They are asked to produce better quality designs with a shorter time-to-market. They are asked to implement increasingly complex functionality but more importantly to satisfy numerous other constraints. To achieve the current goals of design, the designer must be aware with such design constraints and more importantly, the factors that have a direct effect on them. One of the challenges facing embedded system designers is the selection of the optimum processor for the application in hand; single-purpose, general-purpose or application specific. Microcontrollers are one member of the family of the application specific processors. The book concentrates on the use of microcontroller as the embedded system's processor, and how to use it in many embedded system applications. The book covers both the hardware and software aspects needed to design using microcontroller. The book is ideal for undergraduate students and also the engineers that are working in the field of digital system design.