

## Readings In Hardware Software Co Design Hurriyetore

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.

This best selling text on computer organization has been thoroughly updated to reflect the newest technologies. Examples highlight the latest processor designs, benchmarking standards, languages and tools. As with previous editions, a MIPS processor is the core used to present the fundamentals of hardware technologies at work in a computer system. The book presents an entire MIPS instruction set—instruction by instruction—the fundamentals of assembly language, computer arithmetic, pipelining, memory hierarchies and I/O. A new aspect of the third edition is the explicit connection between program performance and CPU performance. The authors show how hardware and software components--such as the specific algorithm, programming language, compiler, ISA and processor implementation--impact program performance. Throughout the book a new feature focusing on program performance describes how to search for bottlenecks and improve performance in various parts of the system. The book digs deeper into the hardware/software interface, presenting a complete view of the function of the programming language and compiler--crucial for understanding computer organization. A CD provides a toolkit of simulators and compilers along with tutorials for using them. For instructor resources click on the grey "companion site" button found on the right side of this page. This new edition represents a major revision. New to this edition: \* Entire Text has been updated to reflect new technology \* 70% new exercises. \* Includes a CD loaded with software, projects and exercises to support courses using a number of tools \* A new interior design presents defined terms in the margin for quick reference \* A new feature, "Understanding Program Performance" focuses on performance from the programmer's perspective \* Two sets of exercises and solutions, "For More Practice" and "In More Depth," are included on the CD \* "Check Yourself" questions help students check their understanding of major concepts \* "Computers In the Real World" feature illustrates the diversity of uses for information technology \*More detail below...

The Architecture of Computer Hardware, Systems Software and Networking is designed help students majoring in information technology (IT) and information systems (IS) understand the structure and operation of computers and computer-based devices. Requiring only basic computer skills, this accessible textbook introduces the basic principles of system architecture and explores current technological practices and trends using clear, easy-to-understand language. Throughout the text, numerous relatable examples, subject-specific illustrations, and in-depth case studies reinforce key learning points and show students how important concepts are applied in the real world. This fully-updated sixth edition features a wealth of new and revised content that reflects today's technological landscape. Organized into five parts, the book first explains the role of the computer in information systems and provides an overview of its components. Subsequent sections discuss the representation of data in the computer, hardware architecture and operational concepts, the basics of computer networking, system software and operating systems, and various interconnected systems and components. Students are introduced to the material using ideas already familiar to them, allowing them to gradually build upon what they have learned without being overwhelmed and develop a deeper knowledge of computer architecture.

Considered a standard industry resource, the Embedded Systems Handbook provided researchers and technicians with the authoritative information needed to launch a wealth of diverse applications, including those in automotive electronics, industrial automated systems, and building automation and control. Now a new resource is required to report on current developments and provide a technical reference for those looking to move the field forward yet again. Divided into two volumes to accommodate this growth, the Embedded Systems Handbook, Second Edition presents a comprehensive view on this area of computer engineering with a currently appropriate emphasis on developments in networking and applications. Those experts directly involved in the creation and evolution of the ideas and technologies presented offer tutorials, research surveys, and technology overviews that explore cutting-edge developments and deployments and identify potential trends. This first self-contained volume of the handbook, Embedded Systems Design and Verification, is divided into three sections. It begins with a brief introduction to embedded systems design and verification. It then provides a comprehensive overview of embedded processors and various aspects of system-on-chip and FPGA, as well as solutions to design challenges. The final section explores power-aware embedded computing, design issues specific to secure embedded systems, and web services for embedded devices. Those interested in taking their work with embedded systems to the network level should complete their study with the second volume: Network Embedded Systems.

Readings in Hardware/software Co-design Morgan Kaufmann

Hardware/software co-verification is how to make sure that embedded system software works correctly with the hardware, and that the hardware has been properly designed to run the software successfully -before large sums are spent on prototypes or manufacturing. This is the first book to apply this verification technique to the rapidly growing field of embedded systems-on-a-chip(SoC). As traditional embedded system design evolves into single-chip design, embedded engineers must be armed with the necessary information to make educated decisions about which tools and methodology to deploy. SoC verification requires a mix of expertise from the disciplines of microprocessor and computer architecture, logic design and simulation, and C and Assembly language embedded software. Until now, the relevant information on how it all fits together has not been available. Andrews, a recognized expert, provides in-depth information about how co-verification really works, how to be successful using it, and pitfalls to avoid. He illustrates these concepts using concrete examples with the ARM core - a technology that has the dominant market share in embedded system product design. The companion CD-ROM contains all source code used in the design examples, a searchable e-book version, and useful design tools. \* The only book on verification for systems-on-a-chip (SoC) on the market \* Will save engineers and their companies time and money by showing them how to speed up the testing process, while still avoiding costly mistakes \* Design examples use the ARM core, the dominant technology in SoC, and all the source code is included on the accompanying CD-Rom, so engineers can easily use it in their own designs

Authored by two of the leading authorities in the field, this guide offers readers the knowledge and skills needed to achieve proficiency with embedded software.

System-Level Design Techniques for Energy-Efficient Embedded Systems addresses the development and validation of co-synthesis techniques that allow an effective design of embedded systems with low energy dissipation. The book provides an overview of a system-level co-design flow, illustrating through examples how system performance is influenced at various steps of the flow including allocation, mapping, and scheduling. The book places special emphasis upon system-level co-synthesis techniques for architectures that contain voltage scalable processors, which can dynamically trade off between computational performance and power consumption. Throughout the book, the introduced co-synthesis techniques, which target both single-mode systems and emerging multi-mode applications, are applied to numerous benchmarks and real-life examples including a realistic smart phone.

Real-time and embedded systems are essential to our lives, from controlling car engines and regulating traffic lights to monitoring

plane takeoffs and landings to providing up-to-the-minute stock quotes. Bringing together researchers from both academia and industry, the Handbook of Real-Time and Embedded Systems provides comprehensive coverage

I am honored and delighted to write the foreword to this very first book about SystemC. It is now an excellent time to summarize what SystemC really is and what it can be used for. The main message in the area of design in the 2001 International Technology Roadmap for Semiconductors (ITRS) is that "cost of design is the greatest threat to the continuation of the semiconductor roadmap." This recent revision of the ITRS describes the major productivity improvements of the last few years as "small block reuse," "large block reuse," and "IC implementation tools." In order to continue to reduce design cost, the required future solutions will be "intelligent test benches" and "embedded system-level methodology." As the new system-level specification and design language, SystemC directly contributes to these two solutions. These will have the biggest impact on future design technology and will reduce system implementation cost. It took SystemC less than two years to emerge as the leader among the many new and well-discussed system-level design languages. In my opinion, this is due to the fact that SystemC adopted object-oriented system-level design—the most promising method already applied by the majority of firms during the last couple of years. Even before the introduction of SystemC, many system designers have attempted to develop executable specifications in C++. These executable functional specifications are then refined to the well-known transaction level, to model the communication of system-level processes.

Current multimedia and telecom applications require complex, heterogeneous multiprocessor system on chip (MPSoC) architectures with specific communication infrastructure in order to achieve the required performance. Heterogeneous MPSoC includes different types of processing units (DSP, microcontroller, ASIP) and different communication schemes (fast links, non standard memory organization and access). Programming an MPSoC requires the generation of efficient software running on MPSoC from a high level environment, by using the characteristics of the architecture. This task is known to be tedious and error prone, because it requires a combination of high level programming environments with low level software design. This book gives an overview of concepts related to embedded software design for MPSoC. It details a full software design approach, allowing systematic, high-level mapping of software applications on heterogeneous MPSoC. This approach is based on gradual refinement of hardware/software interfaces and simulation models allowing to validate the software at different abstraction levels. This book combines Simulink for high level programming and SystemC for the low level software development. This approach is illustrated with multiple examples of application software and MPSoC architectures that can be used for deep understanding of software design for MPSoC.

From basic architecture, interconnection, and parallelization to power optimization, this book provides a comprehensive description of emerging multicore systems-on-chip (MCSoCs) hardware and software design. Highlighting both fundamentals and advanced software and hardware design, it can serve as a primary textbook for advanced courses in MCSoCs design and embedded systems. The first three chapters introduce MCSoCs architectures, present design challenges and conventional design methods, and describe in detail the main building blocks of MCSoCs. Chapters 4, 5, and 6 discuss fundamental and advanced on-chip interconnection network technologies for multi and many core SoCs, enabling readers to understand the microarchitectures for on-chip routers and network interfaces that are essential in the context of latency, area, and power constraints. With the rise of multicore and many-core systems, concurrency is becoming a major issue in the daily life of a programmer. Thus, compiler and software development tools are critical in helping programmers create high-performance software. Programmers should make sure that their parallelized program codes will not cause race condition, memory-access deadlocks, or other faults that may crash their entire systems. As such, Chapter 7 describes a novel parallelizing compiler design for high-performance computing. Chapter 8 provides a detailed investigation of power reduction techniques for MCSoCs at component and network levels. It discusses energy conservation in general hardware design, and also in embedded multicore system components, such as CPUs, disks, displays and memories. Lastly, Chapter 9 presents a real embedded MCSoCs system design targeted for health monitoring in the elderly.

The new RISC-V Edition of Computer Organization and Design features the RISC-V open source instruction set architecture, the first open source architecture designed to be used in modern computing environments such as cloud computing, mobile devices, and other embedded systems. With the post-PC era now upon us, Computer Organization and Design moves forward to explore this generational change with examples, exercises, and material highlighting the emergence of mobile computing and the Cloud. Updated content featuring tablet computers, Cloud infrastructure, and the x86 (cloud computing) and ARM (mobile computing devices) architectures is included. An online companion Web site provides advanced content for further study, appendices, glossary, references, and recommended reading. Features RISC-V, the first such architecture designed to be used in modern computing environments, such as cloud computing, mobile devices, and other embedded systems. Includes relevant examples, exercises, and material highlighting the emergence of mobile computing and the cloud

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)

Conventional on-chip communication design mostly use ad-hoc approaches that fail to meet the challenges posed by the next-generation MultiCore Systems on-chip (MCSoC) designs. These major challenges include wiring delay, predictability, diverse

interconnection architectures, and power dissipation. A Network-on-Chip (NoC) paradigm is emerging as the solution for the problems of interconnecting dozens of cores into a single system on-chip. However, there are many problems associated with the design of such systems. These problems arise from non-scalable global wire delays, failure to achieve global synchronization, and difficulties associated with non-scalable bus-based functional interconnects. The book consists of three parts, with each part being subdivided into four chapters. The first part deals with design and methodology issues. The architectures used in conventional methods of MCSoCs design and custom multiprocessor architectures are not flexible enough to meet the requirements of different application domains and not scalable enough to meet different computation needs and different complexities of various applications. Several chapters of the first part will emphasize on the design techniques and methodologies. The second part covers the most critical part of MCSoCs design — the interconnections. One approach to addressing the design methodologies is to adopt the so-called reusability feature to boost design productivity. In the past years, the primitive design units evolved from transistors to gates, finite state machines, and processor cores. The network-on-chip paradigm offers this attractive property for the future and will be able to close the productivity gap. The last part of this book delves into MCSoCs validations and optimizations. A more qualitative approach of system validation is based on the use of formal techniques for hardware design. The main advantage of formal methods is the possibility to prove the validity of essential design requirements. As formal languages have a mathematical foundation, it is possible to formally extract and verify these desired properties of the complete abstract state space. Online testing techniques for identifying faults that can lead to system failure are also surveyed. Emphasis is given to analytical redundancy-based techniques that have been developed for fault detection and isolation in the automatic control area. Novel Algorithms and Techniques in Telecommunications, Automation and Industrial Electronics includes a set of rigorously reviewed world-class manuscripts addressing and detailing state-of-the-art research projects in the areas of Industrial Electronics, Technology and Automation, Telecommunications and Networking. Novel Algorithms and Techniques in Telecommunications, Automation and Industrial Electronics includes selected papers from the conference proceedings of the International Conference on Industrial Electronics, Technology and Automation (IETA 2007) and International Conference on Telecommunications and Networking (TeNe 07) which were part of the International Joint Conferences on Computer, Information and Systems Sciences and Engineering (CISSE 2007).

Co-Design is the set of emerging techniques which allows for the simultaneous design of Hardware and Software. In many cases where the application is very demanding in terms of various performances (time, surface, power consumption), trade-offs between dedicated hardware and dedicated software are becoming increasingly difficult to decide upon in the early stages of a design. Verification techniques - such as simulation or proof techniques - that have proven necessary in the hardware design must be dramatically adapted to the simultaneous verification of Software and Hardware. Describing the latest tools available for both Co-Design and Co-Verification of systems, Hardware/Software Co-Design and Co-Verification offers a complete look at this evolving set of procedures for CAD environments. The book considers all trade-offs that have to be made when co-designing a system. Several models are presented for determining the optimum solution to any co-design problem, including partitioning, architecture synthesis and code generation. When deciding on trade-offs, one of the main factors to be considered is the flow of communication, especially to and from the outside world. This involves the modeling of communication protocols. An approach to the synthesis of interface circuits in the context of co-design is presented. Other chapters present a co-design oriented flexible component data-base and retrieval methods; a case study of an ethernet bridge, designed using LOTOS and co-design methodologies and finally a programmable user interface based on monitors. Hardware/Software Co-Design and Co-Verification will help designers and researchers to understand these latest techniques in system design and as such will be of interest to all involved in embedded system design.

Embedded Systems: A Contemporary Design Tool, Second Edition Embedded systems are one of the foundational elements of today's evolving and growing computer technology. From operating our cars, managing our smart phones, cleaning our homes, or cooking our meals, the special computers we call embedded systems are quietly and unobtrusively making our lives easier, safer, and more connected. While working in increasingly challenging environments, embedded systems give us the ability to put increasing amounts of capability into ever-smaller and more powerful devices. Embedded Systems: A Contemporary Design Tool, Second Edition introduces you to the theoretical hardware and software foundations of these systems and expands into the areas of signal integrity, system security, low power, and hardware-software co-design. The text builds upon earlier material to show you how to apply reliable, robust solutions to a wide range of applications operating in today's often challenging environments. Taking the user's problem and needs as your starting point, you will explore each of the key theoretical and practical issues to consider when designing an application in today's world. Author James Peckol walks you through the formal hardware and software development process covering: Breaking the problem down into major functional blocks; Planning the digital and software architecture of the system; Utilizing the hardware and software co-design process; Designing the physical world interface to external analog and digital signals; Addressing security issues as an integral part of the design process; Managing signal integrity problems and reducing power demands in contemporary systems; Debugging and testing throughout the design and development cycle; Improving performance. Stressing the importance of security, safety, and reliability in the design and development of embedded systems and providing a balanced treatment of both the hardware and the software aspects, Embedded Systems: A Contemporary Design Tool, Second Edition gives you the tools for creating embedded designs that solve contemporary real-world challenges.

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.

This book outlines a set of issues that are critical to all of parallel architecture--communication latency, communication bandwidth, and coordination of cooperative work (across modern designs). It describes the set of techniques available in hardware and in software to address each issues and explore how the various techniques interact.

This is a practical book for computer engineers who want to understand or implement hardware/software systems. It focuses on problems that require one to combine hardware design with software design — such problems can be solved with hardware/software codesign. When used properly, hardware/software co- sign works better than hardware design or software design alone: it can improve the overall performance of digital systems, and it can shorten their design time. Hardware/software codesign can help a designer to make trade-offs between the ?exibility and the performanceof a digital system. To achieve this, a designer needs to combine two radically different ways of design: the sequential way of dec- position in time, using software, with

the parallel way of decomposition in space, using hardware. Intended Audience This book assumes that you have a basic understanding of hardware that you are familiar with standard digital hardware components such as registers, logic gates, and components such as multiplexers and arithmetic operators. The book also assumes that you know how to write a program in C. These topics are usually covered in an introductory course on computer engineering or in a combination of courses on digital design and software engineering.

This textbook is written for junior/senior undergraduate and first-year graduate students in the electrical and computer engineering departments. Using PSoC mixed-signal array design, the authors define the characteristics of embedded design, embedded mixed-signal architectures, and top-down design. Optimized implementations of these designs are included to illustrate the theory. Exercises are provided at the end of each chapter for practice. Topics covered include the hardware and software used to implement analog and digital interfaces, various filter structures, amplifiers and other signal-conditioning circuits, pulse-width modulators, timers, and data structures for handling multiple similar peripheral devices. The practical exercises contained in the companion laboratory manual, which was co-authored by Cypress Staff Applications Engineer Dave Van Ess, are also based on PSoC. PSoC's integrated microcontroller, highly configurable analog/digital peripherals, and a full set of development tools make it an ideal learning tool for developing mixed-signal embedded design skills.

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.

Rapid energy estimation for energy efficient applications using field-programmable gate arrays (FPGAs) remains a challenging research topic. Energy dissipation and efficiency have prevented the widespread use of FPGA devices in embedded systems, where energy efficiency is a key performance metric. Helping overcome these challenges, Energy Efficient Hardware-Software Co-Synthesis Using Reconfigurable Hardware offers solutions for the development of energy efficient applications using FPGAs. The book integrates various high-level abstractions for describing hardware and software platforms into a single, consistent application development framework, enabling users to construct, simulate, and debug systems. Based on these high-level concepts, it proposes an energy performance modeling technique to capture the energy dissipation behavior of both the reconfigurable hardware platform and the target applications running on it. The authors also present a dynamic programming-based algorithm to optimize the energy performance of an application running on a reconfigurable hardware platform. They then discuss an instruction-level energy estimation technique and a domain-specific modeling technique to provide rapid and fairly accurate energy estimation for hardware-software co-designs using reconfigurable hardware. The text concludes with example designs and illustrative examples that show how the proposed co-synthesis techniques lead to a significant amount of energy reduction. This book explores the advantages of using reconfigurable hardware for application development and looks ahead to future research directions in the field. It outlines the range of aspects and steps that lead to an energy efficient hardware-software application synthesis using FPGAs.

This textbook introduces the concept of embedded systems with exercises using Arduino Uno. It is intended for advanced undergraduate and graduate students in computer science, computer engineering, and electrical engineering programs. It contains a balanced discussion on both hardware and software related to embedded systems, with a focus on co-design aspects.

Embedded systems have applications in Internet-of-Things (IoT), wearables, self-driving cars, smart devices, cyberphysical systems, drones, and robotics. The hardware chapter discusses various microcontrollers (including popular microcontroller hardware examples), sensors, amplifiers, filters, actuators, wired and wireless communication topologies, schematic and PCB designs, and much more. The software chapter describes OS-less programming, bitmath, polling, interrupt, timer, sleep modes, direct memory access, shared memory, mutex, and smart algorithms, with lots of C-code examples for Arduino Uno. Other topics discussed are prototyping, testing, verification, reliability, optimization, and regulations. Appropriate for courses on embedded systems, microcontrollers, and instrumentation, this textbook teaches budding embedded system programmers practical skills with fun projects to prepare them for industry products. Introduces embedded systems for wearables, Internet-of-Things (IoT), robotics, and other smart devices; Offers a balanced focus on both hardware and software co-design of embedded systems; Includes exercises, tutorials, and assignments.

System on chips designs have evolved from fairly simple uncore, single memory designs to complex heterogeneous multicore SoC architectures consisting of a large number of IP blocks on the same silicon. To meet high computational demands posed by latest consumer electronic devices, most current systems are based on such paradigm, which represents a real revolution in many aspects in computing. The attraction of multicore processing for power reduction is compelling. By splitting a set of tasks among multiple processor cores, the operating frequency necessary for each core can be reduced, allowing to reduce the voltage on each core. Because dynamic power is proportional to the frequency and to the square of the voltage, we get a big gain, even though we may have more cores running. As more and more cores are integrated into these designs to share the ever increasing processing load, the main challenges lie in efficient memory hierarchy, scalable system interconnect, new programming paradigms, and efficient integration methodology for connecting such heterogeneous cores into a single system capable of leveraging their individual flexibility. Current design methods tend toward mixed HW/SW co-designs targeting multicore systems on-chip for specific applications. To decide on the lowest cost mix of cores, designers must iteratively map the device's functionality to a particular HW/SW partition and target architectures. In addition, to connect the heterogeneous cores, the architecture requires high performance complex communication architectures and efficient communication protocols, such as hierarchical bus, point-to-point connection, or Network-on-Chip. Software development also becomes far more complex due to the difficulties in breaking a single processing task into multiple parts that can be processed separately and then reassembled later. This reflects the fact that certain processor jobs cannot be easily parallelized to run concurrently on multiple processing cores and that load balancing between processing cores – especially heterogeneous cores – is very difficult.

The recent evolution of digital technology has resulted in the design of digital processors with increasingly complex capabilities. The implementation of hardware/software co-design methodologies provides new opportunities for the development of low power, high speed DSPs and processor networks. Dedicated digital processors are digital processors with an application specific computational task. Dedicated Digital Processors presents an integrated and accessible approach to digital processor design

principles, processes, and implementations based upon the author's considerable experience in teaching digital systems design and digital signal processing. Emphasis is placed on presentation of hardware/software co-design methods, with examples and illustrations provided throughout the text. System-on-a-chip and embedded systems are described and examples of high speed real-time processing are given. Coverage of standard and emerging DSP architectures enable the reader to make an informed selection when undertaking their own designs. Presents readers with the elementary building blocks for the design of digital hardware systems and processor networks Provides a unique evaluation of standard DSP architectures whilst providing up-to-date information on the latest architectures, including the TI 55x and TigerSharc chip families and the Virtex FPGA (field-programmable gate array) Introduces the concepts and methodologies for describing and designing hardware VHDL is presented and used to illustrate the design of a simple processor A practical overview of hardware/software codesign with design techniques and considerations illustrated with examples of real-world designs Fundamental reading for graduate and senior undergraduate students of computer and electronic engineering, and Practicing engineers developing DSP applications.

The design process of embedded systems has changed substantially in recent years. One of the main reasons for this change is the pressure to shorten time-to-market when designing digital systems. To shorten the product cycles, programmable processes are used to implement more and more functionality of the embedded system. Therefore, nowadays, embedded systems are very often implemented by heterogeneous systems consisting of ASICs, processors, memories and peripherals. As a consequence, the research topic of hardware/software co-design, dealing with the problems of designing these heterogeneous systems, has gained great importance. Hardware/Software Co-design for Data Flow Dominated Embedded Systems introduces the different tasks of hardware/software co-design including system specification, hardware/software partitioning, co-synthesis and co-simulation. The book summarizes and classifies state-of-the-art co-design tools and methods for these tasks. In addition, the co-design tool COOL is presented which solves the co-design tasks for the class of data-flow dominated embedded systems. In Hardware/Software Co-design for Data Flow Dominated Embedded Systems the primary emphasis has been put on the hardware/software partitioning and the co-synthesis phase and their coupling. In contrast to many other publications in this area, a mathematical formulation of the hardware/software partitioning problem is given. This problem formulation supports target architectures consisting of multiple processors and multiple ASICs. Several novel approaches are presented and compared for solving the partitioning problem, including an MILP approach, a heuristic solution and an approach based on genetic algorithms. The co-synthesis phase is based on the idea of controlling the system by means of a static run-time scheduler implemented in hardware. New algorithms are introduced which generate a complete set of hardware and software specifications required to implement heterogeneous systems. All of these techniques are described in detail and exemplified. Hardware/Software Co-design for Data Flow Dominated Embedded Systems is intended to serve students and researchers working on hardware/software co-design. At the same time the variety of presented techniques automating the design tasks of hardware/software systems will be of interest to industrial engineers and designers of digital systems. From the foreword by Peter Marwedel: Niemann's method should be known by all persons working in the field. Hence, I recommend this book for everyone who is interested in hardware/software co-design. Presenting a comprehensive overview of the design automation algorithms, tools, and methodologies used to design integrated circuits, the Electronic Design Automation for Integrated Circuits Handbook is available in two volumes. The first volume, EDA for IC System Design, Verification, and Testing, thoroughly examines system-level design, microarchitectural design, logical verification, and testing. Chapters contributed by leading experts authoritatively discuss processor modeling and design tools, using performance metrics to select microprocessor cores for IC designs, design and verification languages, digital simulation, hardware acceleration and emulation, and much more. Save on the complete set.

There are many books on computers, networks, and software engineering but none that integrate the three with applications. Integration is important because, increasingly, software dominates the performance, reliability, maintainability, and availability of complex computer and systems. Books on software engineering typically portray software as if it exists in a vacuum with no relationship to the wider system. This is wrong because a system is more than software. It is comprised of people, organizations, processes, hardware, and software. All of these components must be considered in an integrative fashion when designing systems. On the other hand, books on computers and networks do not demonstrate a deep understanding of the intricacies of developing software. In this book you will learn, for example, how to quantitatively analyze the performance, reliability, maintainability, and availability of computers, networks, and software in relation to the total system. Furthermore, you will learn how to evaluate and mitigate the risk of deploying integrated systems. You will learn how to apply many models dealing with the optimization of systems. Numerous quantitative examples are provided to help you understand and interpret model results. This book can be used as a first year graduate course in computer, network, and software engineering; as an on-the-job reference for computer, network, and software engineers; and as a reference for these disciplines.

Embedded systems are informally defined as a collection of programmable parts surrounded by ASICs and other standard components, that interact continuously with an environment through sensors and actuators. The programmable parts include micro-controllers and Digital Signal Processors (DSPs). Embedded systems are often used in life-critical situations, where reliability and safety are more important criteria than performance. Today, embedded systems are designed with an ad hoc approach that is heavily based on earlier experience with similar products and on manual design. Use of higher-level languages such as C helps structure the design somewhat, but with increasing complexity it is not sufficient. Formal verification and automatic synthesis of implementations are the surest ways to guarantee safety. Thus, the POLIS system which is a co-design environment for embedded systems is based on a formal model of computation. POLIS was initiated in 1988 as a research project at the University of California at Berkeley and, over the years, grew into a full design methodology with a software system supporting it. Hardware-Software Co-Design of Embedded Systems: The POLIS Approach is intended to give a complete overview of the POLIS system including its formal and algorithmic aspects. Hardware-Software Co-Design of Embedded Systems: The POLIS Approach will be of interest to embedded system designers (automotive electronics, consumer electronics and telecommunications), micro-controller designers, CAD developers and students.

This book offers up a deep understanding of concepts and practices behind the composition of heterogeneous components. After the analysis of existing computation and execution models used for the specification and validation of different sub-systems, the book introduces a systematic approach to build an execution model for systems composed of heterogeneous components. Mixed continuous/discrete and hardware/software systems are used to illustrate these concepts. The benefit of reading this book is to arrive at a clear vision of the theory and practice of specification and validation of complex modern systems. Numerous examples

give designers highly applicable solutions.

Advances in signal and image processing together with increasing computing power are bringing mobile technology closer to applications in a variety of domains like automotive, health, telecommunication, multimedia, entertainment and many others. The development of these leading applications, involving a large diversity of algorithms (e.g. signal, image, video, 3D, communication, cryptography) is classically divided into three consecutive steps: a theoretical study of the algorithms, a study of the target architecture, and finally the implementation. Such a linear design flow is reaching its limits due to intense pressure on design cycle and strict performance constraints. The approach, called Algorithm-Architecture Matching, aims to leverage design flows with a simultaneous study of both algorithmic and architectural issues, taking into account multiple design constraints, as well as algorithm and architecture optimizations, that couldn't be achieved otherwise if considered separately. Introducing new design methodologies is mandatory when facing the new emerging applications as for example advanced mobile communication or graphics using sub-micron manufacturing technologies or 3D-Integrated Circuits. This diversity forms a driving force for the future evolutions of embedded system designs methodologies. The main expectations from system designers' point of view are related to methods, tools and architectures supporting application complexity and design cycle reduction. Advanced optimizations are essential to meet design constraints and to enable a wide acceptance of these new technologies. Algorithm-Architecture Matching for Signal and Image Processing presents a collection of selected contributions from both industry and academia, addressing different aspects of Algorithm-Architecture Matching approach ranging from sensors to architectures design. The scope of this book reflects the diversity of potential algorithms, including signal, communication, image, video, 3D-Graphics implemented onto various architectures from FPGA to multiprocessor systems. Several synthesis and resource management techniques leveraging design optimizations are also described and applied to numerous algorithms. Algorithm-Architecture Matching for Signal and Image Processing should be on each designer's and EDA tool developer's shelf, as well as on those with an interest in digital system design optimizations dealing with advanced algorithms.

Introduction to Hardware-Software Co-Design presents a number of issues of fundamental importance for the design of integrated hardware software products such as embedded, communication, and multimedia systems. This book is a comprehensive introduction to the fundamentals of hardware/software co-design. Co-design is still a new field but one which has substantially matured over the past few years. This book, written by leading international experts, covers all the major topics including: fundamental issues in co-design; hardware/software co-synthesis algorithms; prototyping and emulation; target architectures; compiler techniques; specification and verification; system-level specification. Special chapters describe in detail several leading-edge co-design systems including Cosyma, LYCOS, and Cosmos. Introduction to Hardware-Software Co-Design contains sufficient material for use by teachers and students in an advanced course of hardware/software co-design. It also contains extensive explanation of the fundamental concepts of the subject and the necessary background to bring practitioners up-to-date on this increasingly important topic.

Particle swarm optimization (PSO) is a population based stochastic optimization technique influenced by the social behavior of bird flocking or fish schooling. PSO shares many similarities with evolutionary computation techniques such as Genetic Algorithms (GA). The system is initialized with a population of random solutions and searches for optima by updating generations. However, unlike GA, PSO has no evolution operators such as crossover and mutation. In PSO, the potential solutions, called particles, fly through the problem space by following the current optimum particles. This book represents the contributions of the top researchers in this field and will serve as a valuable tool for professionals in this interdisciplinary field.

Proceedings of the NATO Advanced Study Institute, Tremezzo, Italy, June 19-30, 1995

This book describes a comprehensive framework for hardware/software co-design, optimization, and use of robust, low-cost, and cyberphysical digital microfluidic systems. Readers with a background in electronic design automation will find this book to be a valuable reference for leveraging conventional VLSI CAD techniques for emerging technologies, e.g., biochips or bioMEMS. Readers from the circuit/system design community will benefit from methods presented to extend design and testing techniques from microelectronics to mixed-technology microsystems. For readers from the microfluidics domain, this book presents a new design and development strategy for cyberphysical microfluidics-based biochips suitable for large-scale bioassay applications. • Takes a transformative, "cyberphysical" approach towards achieving closed-loop and sensor feedback-driven biochip operation under program control; • Presents a "physically-aware" system reconfiguration technique that uses sensor data at intermediate checkpoints to dynamically reconfigure biochips; • Enables readers to simplify the structure of biochips, while facilitating the "general-purpose" use of digital microfluidic biochips for a wider range of applications.

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