Embedded Systems Design For High Speed Data Acquisition And Control

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Embedded Systems

This comprehensive textbook provides a broad and in-depth overview of embedded systems architecture for engineering students and embedded systems professionals. The book is well-suited for undergraduate embedded systems courses in electronics/electrical engineering and engineering technology (EET) departments in universities and colleges, and for corporate training of employees. The book is a readable and practical guide covering embedded hardware, firmware, and applications. It clarifies all concepts with references to current embedded technology as it exists in the industry today, including many diagrams and applicable computer code. Among the topics covered in detail are: hardware components, including processors, memory, buses, and I/O system software, including device drivers and operating systems use of assembly language and high-level languages such as C and Java interfacing and networking case studies of real-world embedded designs applicable standards grouped by system application The CD-ROM accompanying the text contains source code for the design examples and numerous design tools useful to both students and professionals. A detailed laboratory manual suitable for a lab course in embedded systems design is also provided. Ancillaries also include a solutions manual and technical slides. * without a doubt the most accessible, comprehensive yet comprehensible book on

embedded systems ever written! * leading companies and universities have been involved in the development of the content * an instant classic!

EMBEDDED SYSTEM DESIGN

This book introduces readers to alternative approaches to designing efficient embedded systems using unconventional number systems. The authors describe various systems that can be used for designing efficient embedded and application-specific processors, such as Residue Number System, Logarithmic Number System, Redundant Binary Number System Double-Base Number System, Decimal Floating Point Number System and Continuous Valued Number System. Readers will learn the strategies and trade-offs of using unconventional number systems in application-specific processors and be able to apply and design appropriate arithmetic operations from these number systems to boost the performance of digital systems.

Embedded Systems Architecture

This volume provides an overview of embedded system design and relates the most important topics in the field to each other.

ARCHITECTING HIGH-PERFORMANCE EMBEDDED SYSTEMS

Embedded System Interfacing: Design for the Internet-of-Things (IoT) and Cyber-Physical Systems (CPS) takes a comprehensive approach to the interface between embedded systems and software. It provides the principles needed to understand how digital and analog interfaces work and how to design new interfaces for specific applications. The presentation is self-contained and practical, with discussions based on real-world components. Design examples are used throughout the book to illustrate important concepts. This book is a complement to the author's Computers as Components, now in its fourth edition, which concentrates on software running on the CPU, while Embedded System Interfacing explains the hardware surrounding the CPU. Provides a comprehensive background in embedded system interfacing techniques Includes design examples to illustrate important concepts and serve as the basis for new designs Discusses well-known, widely available hardware components and computer-aided design tools

Embedded Systems Design with Platform FPGAs

Embedded Systems Design with Platform FPGAs introduces professional engineers and students alike to system

development using Platform FPGAs. The focus is on embedded systems but it also serves as a general guide to building custom computing systems. The text describes the fundamental technology in terms of hardware, software, and a set of principles to guide the development of Platform FPGA systems. The goal is to show how to systematically and creatively apply these principles to the construction of application-specific embedded system architectures. There is a strong focus on using free and open source software to increase productivity. Each chapter is organized into two parts. The white pages describe concepts, principles, and general knowledge. The gray pages provide a technical rendition of the main issues of the chapter and show the concepts applied in practice. This includes step-by-step details for a specific development board and tool chain so that the reader can carry out the same steps on their own. Rather than try to demonstrate the concepts on a broad set of tools and boards, the text uses a single set of tools (Xilinx Platform Studio, Linux, and GNU) throughout and uses a single developer board (Xilinx ML-510) for the examples. Explains how to use the Platform FPGA to meet complex design requirements and improve product performance Presents both fundamental concepts together with pragmatic, step-by-step instructions for building a system on a Platform FPGA Includes detailed case studies, extended real-world examples, and lab exercises

Ambient Intelligence: Impact on Embedded System Design

In this new edition the latest ARM processors and other hardware developments are fully covered along with new sections on Embedded Linux and the new freeware operating system eCOS. The hot topic of embedded systems and the internet is also introduced. In addition a fascinating new case study explores how embedded systems can be developed and experimented with using nothing more than a standard PC. * A practical introduction to the hottest topic in modern electronics design * Covers hardware, interfacing and programming in one book * New material on Embedded Linux for embedded internet systems

Embedded and Networking Systems

Special Features: · Embedded Systems Design: A Unified Hardware/Software Introduction provides readers a unified view of hardware design and software design. This view enables readers to build modern embedded systems having both hardware and software. Chapter 7's example uses the methods described earlier in the book to build a combined hardware/software system that meets performance constraints while minimizing costs.· Not specific to any one microprocessor. The reader maintains an open view towards all microprocessors. Chapter 3 talks of features common to most microprocessors.· Provides a simple, yet powerful, new view of hardware design, showing that hardware can be automatically generated from a high-level programming language. Presents unified view of hardware and software; both are described using a programming language, both get derived from that language, only differing in design metrics. Chapter 2 concisely provides

a method for deriving hardware implementations of sequential programs -- something not found in any other book. About The Book: 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.

Embedded Systems Design

This book provides a thorough introduction to the Texas Instruments MPS432TM microcontroller. The MPS432 is a 32-bit processor with the ARM Cortex M4F architecture and a built-in floating point unit. At the core, the MSP432 features a 32-bit ARM Cortex-M4F CPU, a RISC-architecture processing unit that includes a built-in DSP engine and a floating point unit. As an extension of the ultra-low-power MSP microcontroller family, the MSP432 features ultra-low power consumption and integrated digital and analog hardware peripherals. The MSP432 is a new member to the MSP family. It provides for a seamless transition to applications requiring 32-bit processing at an operating frequency of up to 48 MHz. The processor may be programmed at a variety of levels with different programming languages including the user-friendly Energia rapid prototyping platform, in assembly language, and in C. A number of C programming options are also available to developers, starting with register-level access code where developers can directly configure the device's registers, to Driver Library, which provides a standardized set of application program interfaces (APIs) that enable software developers to quickly manipulate various peripherals available on the device. Even higher abstraction layers are also available, such as the extremely user-friendly Energia platform, that enables even beginners to quickly prototype an application on MSP432. The MSP432 LaunchPad is supported by a host of technical data, application notes, training modules, and software examples. All are encapsulated inside one handy package called MSPWare, available as both a stand-alone download package as well as on the TI Cloud development site: dev.ti.com The features of the MSP432 may be extended with a full line of BoosterPack plug-in modules. The MSP432 is also supported by a variety of third party modular sensors and software compiler companies. In the back, a thorough introduction to the MPS432 line of microcontrollers, programming techniques, and interface concepts are provided along with considerable tutorial information with many illustrated examples. Each chapter provides laboratory exercises to apply what has been presented in the chapter. The book is intended for an upper level undergraduate course in microcontrollers or mechatronics but may also be used as a reference for capstone design projects. Practicing engineers already familiar with another microcontroller, who require a quick tutorial on the microcontroller, will also find this book very useful. Finally, middle school and high school students will find the MSP432 highly approachable via the Energia rapid prototyping system.

Embedded System Design on a Shoestring

As electronic technology reaches the point where complex systems can be integrated on a single chip, and higher degrees of performance can be achieved at lower costs, designers must devise new ways to undertake the laborious task of coping with the numerous, and non-trivial, problems that arise during the conception of such systems. On the other hand, shorter design cycles (so that electronic products can fit into shrinking market windows) put companies, and consequently designers, under pressure in a race to obtain reliable products in the minimum period of time. New methodologies, supported by automation and abstraction, have appeared which have been crucial in making it possible for system designers to take over the traditional electronic design process and embedded systems is one of the fields that these methodologies are mainly targeting. The inherent complexity of these systems, with hardware and software components that usually execute concurrently, and the very tight cost and performance constraints, make them specially suitable to introduce higher levels of abstraction and automation, so as to allow the designer to better tackle the many problems that appear during their design. Advanced Techniques for Embedded Systems Design and Test is a comprehensive book presenting recent developments in methodologies and tools for the specification, synthesis, verification, and test of embedded systems, characterized by the use of high-level languages as a road to productivity. Each specific part of the design process, from specification through to test, is looked at with a constant emphasis on behavioral methodologies. Advanced Techniques for Embedded Systems Design and Test is essential reading for all researchers in the design and test communities as well as system designers and CAD tools developers.

Programming Embedded Systems

Embedded Systems Design with Platform FPGAs introduces professional engineers and students alike to system development using Platform FPGAs. The focus is on embedded systems but it also serves as a general guide to building custom computing systems. The text describes the fundamental technology in terms of hardware, software, and a set of principles to guide the development of Platform FPGA systems. The goal is to show how to systematically and creatively apply these principles to the construction of application-specific embedded system architectures. There is a strong focus on using free and open source software to increase productivity. Each chapter is organized into two parts. The white pages describe concepts, principles, and general knowledge. The gray pages provide a technical rendition of the main issues of the chapter and show the concepts applied in practice. This includes step-by-step details for a specific development board and tool chain so that the reader can carry out the same steps on their own. Rather than try to demonstrate the concepts on a broad set of tools and boards, the text uses a single set of tools (Xilinx Platform Studio, Linux, and GNU) throughout and uses a single developer board (Xilinx ML-510) for the examples. Explains how to use the Platform FPGA to meet complex design requirements and improve product performance Presents both fundamental concepts together with

pragmatic, step-by-step instructions for building a system on a Platform FPGA Includes detailed case studies, extended real-world examples, and lab exercises

Handbook of Research on Embedded Systems Design

Covers the significant embedded computingtechnologies—highlighting their applications in wirelesscommunication and computing power An embedded system is a computer system designed for specificcontrol functions within a larger system—often with real-timecomputing constraints. It is embedded as part of a complete deviceoften including hardware and mechanical parts. Presented in threeparts, Embedded Systems: Hardware, Design, andImplementation provides readers with an immersive introductionto this rapidly growing segment of the computer industry. Acknowledging the fact that embedded systems control many oftoday's most common devices such as smart phones, PC tablets, aswell as hardware embedded in cars, TVs, and even refrigerators andheating systems, the book starts with a basic introduction toembedded computing systems. It hones in on system-on-a-chip (SoC),multiprocessor system-on-chip (MPSoC), and network-on-chip (NoC).It then covers on-chip integration of software and custom hardwareaccelerators, as well as fabric flexibility, custom architectures,and the multiple I/O standards that facilitate PCB integration. Next, it focuses on the technologies associated with embeddedcomputing systems, going over the basics of field-programmable gatearray (FPGA), digital signal processing (DSP) andapplication-specific integrated circuit (ASIC) technology,architectural support for on-chip integration of customaccelerators with processors, and O/S support for thesesystems. Finally, it offers full details on architecture, testability,and computer-aided design (CAD) support for embedded systems, softprocessors, heterogeneous resources, and on-chip storage beforeconcluding with coverage of software support—in particular,O/S Linux. Embedded Systems: Hardware, Design, and Implementation isan ideal book for design engineers looking to optimize and reducethe size and cost of embedded system products and increase theirreliability and performance.

Embedded Computing for High Performance

The book's aim is to highlight all the complex issues, tasks and techniques that must be mastered by a SoC Architect to define and architect SoC for an embedded application. This book is primary focused on real problems with emphasis on architectural techniques across various aspects of chip-design, especially in context to embedded systems. The book covers aspects of embedded systems in a consistent way, starting with basic concepts that provides introduction to embedded systems and gradually increasing the depth to reach advanced concepts, such as power management and design consideration for maximum power efficiency and higher battery life. Theoretical part has been intentionally kept to the minimum that is essentially required to understand the subject. The guidelines explained across various chapters are independent of any CAD tool or silicon process and are applicable to any SoC architecture targeted for embedded systems.

Embedded System Design: Topics, Techniques and Trends

Famed author Jack Ganssle has selected the very best embedded systems design material from the Newnes portfolio and compiled into this volume. The result is a book covering the gamut of embedded design—from hardware to software to integrated embedded systems—with a strong pragmatic emphasis. In addition to specific design techniques and practices, this book also discusses various approaches to solving embedded design problems and how to successfully apply theory to actual design tasks. The material has been selected for its timelessness as well as for its relevance to contemporary embedded design issues. This book will be an essential working reference for anyone involved in embedded system design! Table of Contents: Chapter 1. Motors - Stuart Ball Chapter 2. Testing – Arnold S. Berger Chapter 3. System-Level Design – Keith E. Curtis Chapter 4. Some Example Sensor, Actuator and Control Applications and Circuits (Hard Tasks) – Lewin ARW Edwards Chapter 5. Installing and Using a Version Control System – Chris Keydel and Olaf Meding Chapter 6. Embedded State Machine Implementation - Martin Gomez Chapter 7. Firmware Musings – Jack Ganssle Chapter 8. Hardware Musings – Jack Ganssle Chapter 9. Closed Loop Controls, Rabbits, and Hounds - John M. Holland Chapter 10. Application Examples David J. Katz and Rick Gentile Chapter 11. Analog I/Os – Jean LaBrosse Chapter 12. Optimizing DSP Software – Robert Oshana Chapter 13. Embedded Processors – Peter Wilson *Hand-picked content selected by embedded systems luminary Jack Ganssle *Real-world best design practices including chapters on FPGAs, DSPs, and microcontrollers *Covers both hardware and software aspects of embedded systems

Practical Aspects of Embedded System Design using Microcontrollers

Fast and Effective Embedded Systems Design is a fast-moving introduction to embedded system design, applying the innovative ARM mbed and its web-based development environment. Each chapter introduces a major topic in embedded systems, and proceeds as a series of practical experiments, adopting a "learning through doing" strategy. Minimal background knowledge is needed. C/C++ programming is applied, with a step-by-step approach which allows the novice to get coding quickly. Once the basics are covered, the book progresses to some "hot" embedded issues - intelligent instrumentation, networked systems, closed loop control, and digital signal processing. Written by two experts in the field, this book reflects on the experimental results, develops and matches theory to practice, evaluates the strengths and weaknesses of the technology or technique introduced, and considers applications and the wider context. Numerous exercises and end of chapter questions are included. A hands-on introduction to the field of embedded systems, with a focus on fast prototyping Key embedded system concepts covered through simple and effective experimentation Amazing breadth of coverage, from simple digital i/o, to advanced networking and control Applies the most accessible tools available in the embedded world Supported by mbed and book web sites, containing FAQs and all code examples Deep insights into ARM technology, and aspects of microcontroller architecture Instructor support available, including power point slides, and

solutions to questions and exercises

Embedded Systems Design with FPGAs

As real-time and integrated systems become increasingly sophisticated, issues related to development life cycles, non-recurring engineering costs, and poor synergy between development teams will arise. The Handbook of Research on Embedded Systems Design provides insights from the computer science community on integrated systems research projects taking place in the European region. This premier references work takes a look at the diverse range of design principles covered by these projects, from specification at high abstraction levels using standards such as UML and related profiles to intermediate design phases. This work will be invaluable to designers of embedded software, academicians, students, practitioners, professionals, and researchers working in the computer science industry.

Embedded System Design

Embedded Computing for High Performance: Design Exploration and Customization Using High-level Compilation and Synthesis Tools provides a set of real-life example implementations that migrate traditional desktop systems to embedded systems. Working with popular hardware, including Xilinx and ARM, the book offers a comprehensive description of techniques for mapping computations expressed in programming languages such as C or MATLAB to high-performance embedded architectures consisting of multiple CPUs, GPUs, and reconfigurable hardware (FPGAs). The authors demonstrate a domain-specific language (LARA) that facilitates retargeting to multiple computing systems using the same source code. In this way, users can decouple original application code from transformed code and enhance productivity and program portability. After reading this book, engineers will understand the processes, methodologies, and best practices needed for the development of applications for high-performance embedded computing systems. Focuses on maximizing performance while managing energy consumption in embedded systems Explains how to retarget code for heterogeneous systems with GPUs and FPGAs Demonstrates a domain-specific language that facilitates migrating and retargeting existing applications to modern systems Includes downloadable slides, tools, and tutorials

Fast and Effective Embedded Systems Design

Embedded and Networking Systems: Design, Software, and Implementation explores issues related to the design and synthesis of high-performance embedded computer systems and networks. The emphasis is on the fundamental concepts and analytical techniques that are applicable to a range of embedded and networking applications, rather than on specific embedded architectures, software development, or system-level integration. This system point of view guides designers in

dealing with the trade-offs to optimize performance, power, cost, and other system-level non-functional requirements. The book brings together contributions by researchers and experts from around the world, offering a global view of the latest research and development in embedded and networking systems. Chapters highlight the evolution and trends in the field and supply a fundamental and analytical understanding of some underlying technologies. Topics include the co-design of embedded systems, code optimization for a variety of applications, power and performance trade-offs, benchmarks for evaluating embedded systems and their components, and mobile sensor network systems. The book also looks at novel applications such as mobile sensor systems and video networks. A comprehensive review of groundbreaking technology and applications, this book is a timely resource for system designers, researchers, and students interested in the possibilities of embedded and networking systems. It gives readers a better understanding of an emerging technology evolution that is helping drive telecommunications into the next decade.

Embedded Systems Design with the Texas Instruments MSP432 32-bit Processor

Hugo de Man Professor Katholieke Universiteit Leuven Senior Research Fellow IMEC The steady evolution of hardware, software and communications technology is rapidly transforming the PC- and dot.com world into the world of Ambient Intelligence (AmI). This next wave of information technology is fundam- tally different in that it makes distributed wired and wireless computing and communication disappear to the background and puts users to the foreground. AmI adapts to people instead of the other way around. It will augment our consciousness, monitor our health and security, guide us through traffic etc. In short, its ultimate goal is to improve the quality of our life by a quiet, reliable and secure interaction with our social and material environment. What makes AmI engineering so fascinating is that its design starts from studying person to world interactions that need to be implemented as an int- ligent and autonomous interplay of virtually all necessary networked electronic intelligence on the globe. This is a new and exciting dimension for most elect- cal and software engineers and may attract more creative talent to engineering than pure technology does. Development of the leading technology for AmI will only succeed if the engineering research community is prepared to join forces in order to make Mark Weiser’s dream of 1991 come true. This will not be business as usual by just doubling transistor count or clock speed in a microprocessor or increasing the bandwidth of communication.

Embedded System Interfacing

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.

EMBEDDED SYSTEM DESIGN: A UNIFIED HARDWARE/SOFTWARE INTRODUCTION

In this practical guide, experienced embedded engineer Lewin Edwards demonstrates faster, lower-cost methods for developing high-end embedded systems. With today's tight schedules and lower budgets, embedded designers are under greater pressure to deliver prototypes and system designs faster and cheaper. Edwards demonstrates how the use of the right tools and operating systems can make seemingly impossible deadlines possible. Designer's Guide to Embedded Systems Development shares many advanced, in-the-trenches design secrets to help engineers achieve better performance on the job. In particular, it covers many of the newer design tools supported by the GPL (GNU Public License) system. Code examples are given to provide concrete illustrations of tasks described in the text. The general procedures are applicable to many possible projects based on any 16/32-bit microcontroller. The book covers choosing the right architecture and development hardware to fit the project; choosing an operating system and developing a toolchain; evaluating software licenses and how they affect a project; step-by-step building instructions for gcc, binutils, gdb and newlib for the ARM7 core used in the case study project; prototyping techniques using a custom printed circuit board; debugging tips; and portability considerations. A wealth of practical tips, tricks and techniques Design better, faster and more cost-effectively

Embedded System Design

This book serves as a practical guide for practicing engineers who need to design embedded systems for high-speed data acquisition and control systems. A minimum amount of theory is presented, along with a review of analog and digital electronics, followed by detailed explanations of essential topics in hardware design and software development. The discussion of hardware focuses on microcontroller design (ARM microcontrollers and FPGAs), techniques of embedded design, high speed data acquisition (DAQ) and control systems. Coverage of software development includes main programming techniques, culminating in the study of real-time operating systems. All concepts are introduced in a manner to be highly-accessible to practicing engineers and lead to the practical implementation of an embedded board that can be used in various industrial fields as a control system and high speed data acquisition system.

Embedded Systems Design for High-Speed Data Acquisition and Control

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.

Embedded Systems

Second in the series, Practical Aspects of Embedded System Design using Microcontrollers emphasizes the same philosophy of “Learning by Doing” and “Hands on Approach” with the application oriented case studies developed around the PIC16F877 and AT 89S52, today’s most popular microcontrollers. Readers with an academic and theoretical understanding of embedded microcontroller systems are introduced to the practical and industry oriented Embedded System design. When kick starting a project in the laboratory a reader will be able to benefit experimenting with the ready made designs and ‘C’ programs. One can also go about carving a big dream project by treating the designs and programs presented in this book as building blocks. Practical Aspects of Embedded System Design using Microcontrollers is yet another valuable addition and guides the developers to achieve shorter product development times with the use of microcontrollers in the days of increased software complexity. Going through the text and experimenting with the programs in a laboratory will definitely empower the potential reader, having more or less programming or electronics experience, to build embedded systems using microcontrollers around the home, office, store, etc. Practical Aspects of Embedded System Design using Microcontrollers will serve as a good reference for the academic community as well as industry professionals and overcome the fear of the newbies in this field of immense global importance.

Model-Based Design for Embedded Systems

Embedded Systems Architecture is a practical and technical guide to understanding the components that make up an embedded system’s architecture. This book is perfect for those starting out as technical professionals such as engineers, programmers and designers of embedded systems; and also for students of computer science, computer engineering and electrical engineering. It gives a much-needed ‘big picture’ for recently graduated engineers grappling with understanding the design of real-world systems for the first time, and provides professionals with a systems-level picture of the key elements that can go into an embedded design, providing a firm foundation on which to build their skills. Real-world approach to the fundamentals, as well as the design and architecture process, makes this book a popular reference for the

daunted or the inexperienced: if in doubt, the answer is in here! Fully updated with new coverage of FPGAs, testing, middleware and the latest programming techniques in C, plus complete source code and sample code, reference designs and tools online make this the complete package Visit the companion web site at http://booksite.elsevier.com/9780123821966/ for source code, design examples, data sheets and more A true introductory book, provides a comprehensive get up and running reference for those new to the field, and updating skills: assumes no prior knowledge beyond undergrad level electrical engineering Addresses the needs of practicing engineers, enabling it to get to the point more directly, and cover more ground. Covers hardware, software and middleware in a single volume Includes a library of design examples and design tools, plus a complete set of source code and embedded systems design tutorial materials from companion website

Embedded Systems Design with 8051 Microcontrollers

This book describes the fundamentals of data acquisition systems, how they enable users to sample signals that measure real physical conditions and convert the resulting samples into digital, numeric values that can be analyzed by a computer. The author takes a problem-solving approach to data acquisition, providing the tools engineers need to use the concepts introduced. Coverage includes sensors that convert physical parameters to electrical signals, signal conditioning circuitry to convert sensor signals into a form that can be converted to digital values and analog-to-digital converters, which convert conditioned sensor signals to digital values. Readers will benefit from the hands-on approach, culminating with data acquisition projects, including hardware and software needed to build data acquisition systems.

Embedded Systems Design with Platform FPGAs

Embedded Systems Architecture

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.

Embedded Systems Hardware for Software Engineers

A PRACTICAL GUIDE TO HARDWARE FUNDAMENTALS Embedded Systems Hardware for Software Engineers describes the

electrical and electronic circuits that are used in embedded systems, their functions, and how they can be interfaced to other devices. Basic computer architecture topics, memory, address decoding techniques, ROM, RAM, DRAM, DDR, cache memory, and memory hierarchy are discussed. The book covers key architectural features of widely used microcontrollers and microprocessors, including Microchip's PIC32, ATMEL's AVR32, and Freescale's MC68000. Interfacing to an embedded system is then described. Data acquisition system level design considerations and a design example are presented with real-world parameters and characteristics. Serial interfaces such as RS-232, RS-485, PC, and USB are addressed and printed circuit boards and high-speed signal propagation over transmission lines are covered with a minimum of math. A brief survey of logic families of integrated circuits and programmable logic devices is also contained in this in-depth resource. COVERAGE INCLUDES: Architecture examples Memory Memory address decoding Read-only memory and other related devices Input and output ports Analog-to-digital and digital-to-analog converters Interfacing to external devices Transmission lines Logic families of integrated circuits and their signaling characteristics The printed circuit board Programmable logic devices Test equipment: oscilloscopes and logic analyzers

Embedded System Design

This book presents the methodologies and for embedded systems design, using field programmable gate array (FPGA) devices, for the most modern applications. Coverage includes state-of-the-art research from academia and industry on a wide range of topics, including applications, advanced electronic design automation (EDA), novel system architectures, embedded processors, arithmetic, and dynamic reconfiguration.

Embedded Systems Design with Special Arithmetic and Number Systems

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 Art of Designing Embedded Systems

Jack Ganssle has been forming the careers of embedded engineers for 20+ years. He has done this with four books, over 500 articles, a weekly column, and continuous lecturing. Technology moves fast and since the first edition of this best-selling classic much has changed. The new edition will reflect the author's new and ever evolving philosophy in the face of

new technology and realities. Now more than ever an overarching philosophy of development is needed before just sitting down to build an application. Practicing embedded engineers will find that Jack provides a high-level strategic plan of attack to the often times chaotic and ad hoc design and development process. He helps frame and solve the issues an engineer confronts with real-time code and applications, hardware and software coexistences, and streamlines detail management. CONTENTS: Chapter 1 - Introduction Chapter 2 – The Project Chapter 3 – The Code Chapter 4 – Real Time Chapter 5 – The Real World Chapter 6 – Disciplined Development Appendix A – A Firmware Standard Appendix B - A Simple Drawing System Appendix C – A Boss's Guide to Process *Authored by Jack Ganssle, Tech Editor of Embedded Systems Programming and weekly column on embedded.com *Keep schedules in check as projects and codes grow by taking time to understand the project beforehand *Understand how cost/benefit coexists with design and development

Embedded System Design

The demands of increasingly complex embedded systems and associated performance computations have resulted in the development of heterogeneous computing architectures that often integrate several types of processors, analog and digital electronic components, and mechanical and optical components—all on a single chip. As a result, now the most prominent challenge for the design automation community is to efficiently plan for such heterogeneity and to fully exploit its capabilities. A compilation of work from internationally renowned authors, Model-Based Design for Embedded Systems elaborates on related practices and addresses the main facets of heterogeneous model-based design for embedded systems, including the current state of the art, important challenges, and the latest trends. Focusing on computational models as the core design artifact, this book presents the cutting-edge results that have helped establish model-based design and continue to expand its parameters. The book is organized into three sections: Real-Time and Performance Analysis in Heterogeneous Embedded Systems, Design Tools and Methodology for Multiprocessor System-on-Chip, and Design Tools and Methodology for Multidomain Embedded Systems. The respective contributors share their considerable expertise on the automation of design refinement and how to relate properties throughout this refinement while enabling analytic and synthetic qualities. They focus on multi-core methodological issues, real-time analysis, and modeling and validation, taking into account how optical, electronic, and mechanical components often interface. Model-based design is emerging as a solution to bridge the gap between the availability of computational capabilities and our inability to make full use of them yet. This approach enables teams to start the design process using a high-level model that is gradually refined through abstraction levels to ultimately yield a prototype. When executed well, model-based design encourages enhanced performance and quicker time to market for a product. Illustrating a broad and diverse spectrum of applications such as in the automotive aerospace, health care, consumer electronics, this volume provides designers with practical, readily adaptable modeling solutions for their own practice.

Embedded System Design

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.

Embedded Systems Design for High-Speed Data Acquisition and Control

Intelligent readers who want to build their own embedded computer systems-- installed in everything from cell phones to cars to handheld organizers to refrigerators-- will find this book to be the most in-depth, practical, and up-to-date guide on the market. Designing Embedded Hardware carefully steers between the practical and philosophical aspects, so developers can both create their own devices and gadgets and customize and extend off-the-shelf systems. There are hundreds of books to choose from if you need to learn programming, but only a few are available if you want to learn to create hardware. Designing Embedded Hardware provides software and hardware engineers with no prior experience in embedded systems with the necessary conceptual and design building blocks to understand the architectures of embedded systems. Written to provide the depth of coverage and real-world examples developers need, Designing Embedded Hardware also provides a road-map to the pitfalls and traps to avoid in designing embedded systems. Designing Embedded Hardware covers such essential topics as: The principles of developing computer hardware Core hardware designs Assembly language concepts Parallel I/O Analog-digital conversion Timers (internal and external) UART Serial Peripheral Interface Inter-Integrated Circuit Bus Controller Area Network (CAN) Data Converter Interface (DCI) Low-power operation This invaluable and eminently useful book gives you the practical tools and skills to develop, build, and program your own application-specific computers.

Advanced Techniques for Embedded Systems Design and Test

Until the late 1980s, information processing was associated with large mainframe computers and huge tape drives. During the 1990s, this trend shifted toward information processing with personal computers, or PCs. The trend toward miniaturization continues and in the future the majority of information processing systems will be small mobile computers, many of which will be embedded into larger products and interfaced to the physical environment. Hence, these kinds of systems are called embedded systems. Embedded systems together with their physical environment are called cyber-physical systems. Examples include systems such as transportation and fabrication equipment. It is expected that the total market volume of embedded systems will be significantly larger than that of traditional information processing systems such as PCs and mainframes. Embedded systems share a number of common characteristics. For example, they must be dependable, efficient, meet real-time constraints and require customized user interfaces (instead of generic keyboard and mouse interfaces). Therefore, it makes sense to consider common principles of embedded system design. Embedded System Design starts with an introduction into the area and a survey of specification models and languages for embedded and cyber-physical systems. It provides a brief overview of hardware devices used for such systems and presents the essentials of system software for embedded systems, like real-time operating systems. The book also discusses evaluation and validation techniques for embedded systems. Furthermore, the book presents an overview of techniques for mapping applications to execution platforms. Due to the importance of resource efficiency, the book also contains a selected set of optimization techniques for embedded systems, including special compilation techniques. The book closes with a brief survey on testing. Embedded System Design can be used as a text book for courses on embedded systems and as a source which provides pointers to relevant material in the area for PhD students and teachers. It assumes a basic knowledge of information processing hardware and software. Courseware related to this book is available at http://ls12-www.cs.tu-dortmund.de/~marwedel.

Advanced Techniques for Embedded Systems Design and Test

Design Patterns for Embedded Systems in C

A recent survey stated that 52% of embedded projects are late by 4-5 months. This book can help get those projects in on-time with design patterns. The author carefully takes into account the special concerns found in designing and developing embedded applications specifically concurrency, communication, speed, and memory usage. Patterns are given in UML (Unified Modeling Language) with examples including ANSI C for direct and practical application to C code. A basic C knowledge is a prerequisite for the book while UML notation and terminology is included. General C programming books do not include discussion of the contraints found within embedded system design. The practical examples give the reader an understanding of the use of UML and OO (Object Oriented) designs in a resource-limited environment. Also included are two

chapters on state machines. The beauty of this book is that it can help you today. . Design Patterns within these pages are immediately applicable to your project Addresses embedded system design concerns such as concurrency, communication, and memory usage Examples contain ANSI C for ease of use with C programming code

Data Acquisition Systems

As electronic technology reaches the point where complex systems can be integrated on a single chip, and higher degrees of performance can be achieved at lower costs, designers must devise new ways to undertake the laborious task of coping with the numerous, and non-trivial, problems that arise during the conception of such systems. On the other hand, shorter design cycles (so that electronic products can fit into shrinking market windows) put companies, and consequently designers, under pressure in a race to obtain reliable products in the minimum period of time. New methodologies, supported by automation and abstraction, have appeared which have been crucial in making it possible for system designers to take over the traditional electronic design process and embedded systems is one of the fields that these methodologies are mainly targeting. The inherent complexity of these systems, with hardware and software components that usually execute concurrently, and the very tight cost and performance constraints, make them specially suitable to introduce higher levels of abstraction and automation, so as to allow the designer to better tackle the many problems that appear during their design. Advanced Techniques for Embedded Systems Design and Test is a comprehensive book presenting recent developments in methodologies and tools for the specification, synthesis, verification, and test of embedded systems, characterized by the use of high-level languages as a road to productivity. Each specific part of the design process, from specification through to test, is looked at with a constant emphasis on behavioral methodologies. Advanced Techniques for Embedded Systems Design and Test is essential reading for all researchers in the design and test communities as well as system designers and CAD tools developers.

Designing Embedded Hardware

This book serves as a practical guide for practicing engineers who need to design embedded systems for high-speed data acquisition and control systems. A minimum amount of theory is presented, along with a review of analog and digital electronics, followed by detailed explanations of essential topics in hardware design and software development. The discussion of hardware focuses on microcontroller design (ARM microcontrollers and FPGAs), techniques of embedded design, high speed data acquisition (DAQ) and control systems. Coverage of software development includes main programming techniques, culminating in the study of real-time operating systems. All concepts are introduced in a manner to be highly-accessible to practicing engineers and lead to the practical implementation of an embedded board that can be used in various industrial fields as a control system and high speed data acquisition system.

Embedded Software Design and Programming of Multiprocessor System-on-Chip

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.