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### KEY=DESIGN - AUTUMN SINGLETON

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### EMBEDDED SYSTEM DESIGN

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### EMBEDDED SYSTEMS FOUNDATIONS OF CYBER-PHYSICAL SYSTEMS

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*Springer Science & Business Media* 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>.

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### EMBEDDED SYSTEM DESIGN

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### A UNIFIED HARDWARE / SOFTWARE INTRODUCTION

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*John Wiley & Sons* 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.

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### EMBEDDED SYSTEM DESIGN ON A SHOESTRING

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### ACHIEVING HIGH PERFORMANCE WITH A LIMITED BUDGET

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*Newnes* Shares many advanced, "in-the-trenches" design secrets to help engineers achieve better performance on the job!

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## EMBEDDED SYSTEM DESIGN

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### MODELING, SYNTHESIS AND VERIFICATION

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Springer Science & Business Media *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.

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### FAST AND EFFECTIVE EMBEDDED SYSTEMS DESIGN

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#### APPLYING THE ARM MBED

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Elsevier *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

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### MAKING EMBEDDED SYSTEMS

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#### DESIGN PATTERNS FOR GREAT SOFTWARE

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"O'Reilly Media, Inc." *Interested in developing embedded systems? Since they don't tolerate inefficiency, these systems require a disciplined approach to programming. This easy-to-read guide helps you cultivate a host of good development practices, based on classic software design patterns and new patterns unique to embedded programming. Learn how to build system architecture for processors, not operating systems, and discover specific techniques for dealing with hardware difficulties and manufacturing requirements. Written by an expert who's created embedded systems ranging from urban surveillance and DNA scanners to children's toys, this book is ideal for intermediate and experienced programmers, no matter what platform you use. Optimize your system to reduce cost and increase performance Develop an architecture that makes your software robust in resource-constrained environments Explore sensors, motors, and other I/O devices Do more with less: reduce RAM consumption, code space, processor cycles, and power consumption Learn how to update embedded code directly in the processor Discover how to implement complex mathematics on small processors Understand what interviewers look for when you apply for an embedded systems job "Making Embedded Systems is the book for a C programmer who wants to enter the fun (and lucrative) world of embedded systems. It's very well written—entertaining, even—and filled with clear illustrations." —Jack Ganssle, author and embedded system expert.*

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### EMBEDDED SYSTEM DESIGN: TOPICS, TECHNIQUES AND TRENDS

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#### IFIP TC10 WORKING CONFERENCE: INTERNATIONAL EMBEDDED SYSTEMS SYMPOSIUM (IESS), MAY 30 - JUNE 1, 2007, IRVINE (CA), USA

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Springer 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.

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## **EMBEDDED SYSTEM DESIGN**

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### **EMBEDDED SYSTEMS FOUNDATIONS OF CYBER-PHYSICAL SYSTEMS, AND THE INTERNET OF THINGS**

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*Springer Nature* A unique feature of this open access textbook is to provide a comprehensive introduction to the fundamental knowledge in embedded systems, with applications in cyber-physical systems and the Internet of things. It starts with an introduction to the field 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, including real-time operating systems. The author also discusses evaluation and validation techniques for embedded systems and provides an overview of techniques for mapping applications to execution platforms, including multi-core platforms. Embedded systems have to operate under tight constraints and, hence, the book also contains a selected set of optimization techniques, including software optimization techniques. The book closes with a brief survey on testing. This fourth edition has been updated and revised to reflect new trends and technologies, such as the importance of cyber-physical systems (CPS) and the Internet of things (IoT), the evolution of single-core processors to multi-core processors, and the increased importance of energy efficiency and thermal issues.

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## **EMBEDDED SYSTEM DESIGN**

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*PHI Learning Pvt. Ltd.* Embedded system, as a subject, is an amalgamation of different domains, such as digital design, architecture, operating systems, interfaces, and algorithmic optimization techniques. This book acquaints the students with the alternatives and intricacies of embedded system design. It is designed as a textbook for the undergraduate students of Electronics and Communication Engineering, Electronics and Instrumentation Engineering, Computer Science and Engineering, Information Communication Technology (ICT), as well as for the postgraduate students of Computer Applications (MCA). While in the hardware platform the book explains the role of microcontrollers and introduces one of the most widely used embedded processor, ARM, it also deliberates on other alternatives, such as digital signal processors, field programmable devices, and integrated circuits. It provides a very good overview of the interfacing standards covering RS232C, RS422, RS485, USB, IrDA, Bluetooth, and CAN. In the software domain, the book introduces the features of real-time operating systems for use in embedded applications. Various scheduling algorithms have been discussed with their merits and demerits. The existing real-time operating systems have been surveyed. Guided by cost and performance requirements, embedded applications are often implemented partly in hardware and partly in software. The book covers the different optimization techniques proposed in the literature to take a judicious decision about this partitioning of application tasks. Power-aware design of embedded systems has also been dealt with. In its second edition, the text has been extensively revised and updated. Almost all the chapters have been modified and elaborated including detailed discussion on hardware platforms—ARM, DSP, and FPGA. The chapter on “interfacing standards” has been updated to incorporate the latest information. The new edition will be thereby immensely useful to the students, practitioners and advanced readers. **Key Features** • Presents a considerably wide coverage of the field of embedded systems • Discusses the ARM microcontroller in detail • Provides numerous exercises to assess the learning process • Offers a good discussion on hardware–software codesign

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## **DESIGNING EMBEDDED HARDWARE**

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*"O'Reilly Media, Inc."* 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.

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## **EMBEDDED SYSTEM DESIGN WITH ARM CORTEX-M MICROCONTROLLERS**

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## APPLICATIONS WITH C, C++ AND MICROPYTHON

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*Springer Nature* This textbook introduces basic and advanced embedded system topics through Arm Cortex M microcontrollers, covering programmable microcontroller usage starting from basic to advanced concepts using the STMicroelectronics Discovery development board. Designed for use in upper-level undergraduate and graduate courses on microcontrollers, microprocessor systems, and embedded systems, the book explores fundamental and advanced topics, real-time operating systems via FreeRTOS and Mbed OS, and then offers a solid grounding in digital signal processing, digital control, and digital image processing concepts — with emphasis placed on the usage of a microcontroller for these advanced topics. The book uses C language, “the” programming language for microcontrollers, C++ language, and MicroPython, which allows Python language usage on a microcontroller. Sample codes and course slides are available for readers and instructors, and a solutions manual is available to instructors. The book will also be an ideal reference for practicing engineers and electronics hobbyists who wish to become familiar with basic and advanced microcontroller concepts.

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## EMBEDDED SYSTEMS DESIGN USING THE MSP430FR2355 LAUNCHPAD™

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*Springer Nature* This textbook for courses in Embedded Systems introduces students to necessary concepts, through a hands-on approach. **LEARN BY EXAMPLE** – This book is designed to teach the material the way it is learned, through example. Every concept is supported by numerous programming examples that provide the reader with a step-by-step explanation for how and why the computer is doing what it is doing. **LEARN BY DOING** – This book targets the Texas Instruments MSP430 microcontroller. This platform is a widely popular, low-cost embedded system that is used to illustrate each concept in the book. The book is designed for a reader that is at their computer with an MSP430FR2355 LaunchPad™ Development Kit plugged in so that each example can be coded and run as they learn. **LEARN BOTH ASSEMBLY AND C** – The book teaches the basic operation of an embedded computer using assembly language so that the computer operation can be explored at a low-level. Once more complicated systems are introduced (i.e., timers, analog-to-digital converters, and serial interfaces), the book moves into the C programming language. Moving to C allows the learner to abstract the operation of the lower-level hardware and focus on understanding how to “make things work”. **BASED ON SOUND PEDAGOGY** – This book is designed with learning outcomes and assessment at its core. Each section addresses a specific learning outcome that the student should be able to “do” after its completion. The concept checks and exercise problems provide a rich set of assessment tools to measure student performance on each outcome.

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## EMBEDDED SYSTEM DESIGN

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*Springer Science & Business Media* Embedded systems can be defined as information processing systems embedded into enclosing products such as cars, telecommunication or fabrication equipment. Such systems come with a large number of common characteristics, including real-time constraints, and dependability as well as efficiency requirements. Following the success of information technology (IT) for office and workflow applications, embedded systems are considered to be the most important application area of IT during the coming years. This importance of embedded systems is so far not well reflected in many of the current curricula. Embedded System Design is intended as an aid for changing this situation. It provides the material for a first course on embedded systems, but can also be used by PhD students and professors. A key goal of this book is to provide an overview of embedded system design and to relate the most important topics in embedded system design to each other. It should help to motivate students as well as professors to put more emphasis on education in embedded systems. In order to facilitate teaching from this book, slides, exercises and other related material can be downloaded via the author's web page.

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## FAST AND EFFECTIVE EMBEDDED SYSTEMS DESIGN

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### APPLYING THE ARM Mbed

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*Newnes* Fast and Effective Embedded Systems Design is a fast-moving introduction to embedded systems 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 to start. C/C++ programming is applied, with a step-by-step approach which allows you to get coding quickly. Once the basics are covered, the book progresses to some “hot” embedded issues – intelligent instrumentation, wireless and networked systems, digital audio and digital signal processing. In this new edition all examples and peripheral devices are updated to use the most recent libraries and peripheral devices, with increased technical depth, and introduction of the “mbed enabled” concept. 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 and techniques introduced, and considers applications in a wider context. **New Chapters on:** Bluetooth and ZigBee communication Internet communication and control, setting the scene for the ‘Internet of Things’ Digital Audio, with high-fidelity applications and use of the I2S bus Power supply, and very low power applications The development process of moving from prototyping to small-scale or mass manufacture, with a commercial case study. Updates all examples and peripheral devices to use the most recent

libraries and peripheral products Includes examples with touch screen displays and includes high definition audio input/output with the I2S interface Covers the development process of moving from prototyping to small-scale or mass manufacture with commercial case studies Covers hot embedded issues such as intelligent instrumentation, networked systems, closed loop control, and digital signal processing

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## **EMBEDDED SYSTEMS DESIGN WITH PLATFORM FPGAS**

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### **PRINCIPLES AND PRACTICES**

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*Morgan Kaufmann 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*

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## **EMBEDDED SYSTEMS DESIGN WITH FPGAS**

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*Springer Science & Business Media 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.*

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## **EMBEDDED SYSTEMS DESIGN**

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*Elsevier 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*

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## **EMBEDDED LINUX SYSTEM DESIGN AND DEVELOPMENT**

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*CRC Press Based upon the authors' experience in designing and deploying an embedded Linux system with a variety of applications, Embedded Linux System Design and Development contains a full embedded Linux system development roadmap for systems architects and software programmers. Explaining the issues that arise out of the use of Linux in embedded systems, the book facilitates movement to embedded Linux from traditional real-time operating systems, and describes the system design model containing embedded Linux. This book delivers practical solutions for writing, debugging, and profiling applications and drivers in embedded Linux, and for understanding Linux BSP architecture. It enables you to understand: various drivers such as serial, I2C and USB gadgets; uClinux architecture and its programming model; and the embedded Linux graphics subsystem. The text also promotes learning of methods to reduce system boot time, optimize memory and storage, and find memory leaks and corruption in applications. This volume benefits IT managers in planning to choose an embedded Linux distribution and in creating a roadmap for OS transition. It also describes the application of the Linux licensing model in commercial products.*

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## **EMBEDDED SYSTEMS - A HARDWARE-SOFTWARE CO-DESIGN APPROACH**

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## UNLEASH THE POWER OF ARDUINO!

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*Springer Nature 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.*

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## EMBEDDED SYSTEMS DESIGN

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### THE ARTIST ROADMAP FOR RESEARCH AND DEVELOPMENT

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*Springer Science & Business Media This extensive and increasing use of embedded systems and their integration in everyday products mark a significant evolution in information science and technology. Nowadays embedded systems design is subject to seamless integration with the physical and electronic environment while meeting requirements like reliability, availability, robustness, power consumption, cost, and deadlines. Thus, embedded systems design raises challenging problems for research, such as security, reliable and mobile services, large-scale heterogeneous distributed systems, adaptation, component-based development, and validation and tool-based certification. This book results from the ARTIST FP5 project funded by the European Commission. By integration 28 leading European research institutions with many top researchers in the area, this book assesses and strategically advances the state of the art in embedded systems. The coherently written monograph-like book is a valuable source of reference for researchers active in the field and serves well as an introduction to scientists and professionals interested in learning about embedded systems design.*

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## EMBEDDED SYSTEMS

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### HARDWARE, DESIGN AND IMPLEMENTATION

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*John Wiley & Sons Covers the significant embedded computing technologies—highlighting their applications in wireless communication and computing power An embedded system is a computer system designed for specific control functions within a larger system—often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Presented in three parts, Embedded Systems: Hardware, Design, and Implementation provides readers with an immersive introduction to this rapidly growing segment of the computer industry. Acknowledging the fact that embedded systems control many of today's most common devices such as smart phones, PC tablets, as well as hardware embedded in cars, TVs, and even refrigerators and heating systems, the book starts with a basic introduction to embedded 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 hardware accelerators, 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 embedded computing systems, going over the basics of field-programmable gate array (FPGA), digital signal processing (DSP) and application-specific integrated circuit (ASIC) technology, architectural support for on-chip integration of custom accelerators with processors, and OS support for these systems. Finally, it offers full details on architecture, testability, and computer-aided design (CAD) support for embedded systems, soft processors, heterogeneous resources, and on-chip storage before concluding with coverage of software support—in particular, OS Linux. Embedded Systems: Hardware, Design, and Implementation is an ideal book for design engineers looking to optimize and reduce the size and cost of embedded system products and increase their reliability and performance.*

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## EMBEDDED SYSTEMS

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### DESIGN, PROGRAMMING AND APPLICATIONS

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*Alpha Science International Limited*

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## DESIGNING EMBEDDED HARDWARE

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### CREATE NEW COMPUTERS AND DEVICES

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"O'Reilly Media, Inc." Embedded computer systems literally surround us: they're in our cell phones, PDAs, cars, TVs, refrigerators, heating systems, and more. In fact, embedded systems are one of the most rapidly growing segments of the computer industry today. Along with the growing list of devices for which embedded computer systems are appropriate, interest is growing among programmers, hobbyists, and engineers of all types in how to design and build devices of their own. Furthermore, the knowledge offered by this book into the fundamentals of these computer systems can benefit anyone who has to evaluate and apply the systems. The second edition of *Designing Embedded Hardware* has been updated to include information on the latest generation of processors and microcontrollers, including the new MAXQ processor. If you're new to this and don't know what a MAXQ is, don't worry--the book spells out the basics of embedded design for beginners while providing material useful for advanced systems designers. *Designing Embedded Hardware* steers a course between those books dedicated to writing code for particular microprocessors, and those that stress the philosophy of embedded system design without providing any practical information. Having designed 40 embedded computer systems of his own, author John Catsoulis brings a wealth of real-world experience to show readers how to design and create entirely new embedded devices and computerized gadgets, as well as how to customize and extend off-the-shelf systems. Loaded with real examples, this book also provides a roadmap to the pitfalls and traps to avoid. *Designing Embedded Hardware* includes: The theory and practice of embedded systems Understanding schematics and data sheets Powering an embedded system Producing and debugging an embedded system Processors such as the PIC, Atmel AVR, and Motorola 68000-series Digital Signal Processing (DSP) architectures Protocols (SPI and I2C) used to add peripherals RS-232C, RS-422, infrared communication, and USB CAN and Ethernet networking Pulse Width Monitoring and motor control If you want to build your own embedded system, or tweak an existing one, this invaluable book gives you the understanding and practical skills you need.

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### EMBEDDED SYSTEMS DESIGN WITH 8051 MICROCONTROLLERS

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#### HARDWARE AND SOFTWARE

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CRC Press 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.

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### INTRODUCTION TO EMBEDDED SYSTEM DESIGN USING FIELD PROGRAMMABLE GATE ARRAYS

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Springer Science & Business Media "Introduction to Embedded System Design Using Field Programmable Gate Arrays" provides a starting point for the use of field programmable gate arrays in the design of embedded systems. The text considers a hypothetical robot controller as an embedded application and weaves around it related concepts of FPGA-based digital design. The book details: use of FPGA vis-à-vis general purpose processor and microcontroller; design using Verilog hardware description language; digital design synthesis using Verilog and Xilinx® Spartan™ 3 FPGA; FPGA-based embedded processors and peripherals; overview of serial data communications and signal conditioning using FPGA; FPGA-based motor drive controllers; and prototyping digital systems using FPGA. The book is a good introductory text for FPGA-based design for both students and digital systems designers. Its end-of-chapter exercises and frequent use of example can be used for teaching or for self-study.

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### DESIGN PATTERNS FOR EMBEDDED SYSTEMS IN C

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#### AN EMBEDDED SOFTWARE ENGINEERING TOOLKIT

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Elsevier 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 constraints 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

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## **INTRODUCTION TO EMBEDDED SYSTEMS, SECOND EDITION**

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### **A CYBER-PHYSICAL SYSTEMS APPROACH**

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*MIT Press* An introduction to the engineering principles of embedded systems, with a focus on modeling, design, and analysis of cyber-physical systems. The most visible use of computers and software is processing information for human consumption. The vast majority of computers in use, however, are much less visible. They run the engine, brakes, seatbelts, airbag, and audio system in your car. They digitally encode your voice and construct a radio signal to send it from your cell phone to a base station. They command robots on a factory floor, power generation in a power plant, processes in a chemical plant, and traffic lights in a city. These less visible computers are called embedded systems, and the software they run is called embedded software. The principal challenges in designing and analyzing embedded systems stem from their interaction with physical processes. This book takes a cyber-physical approach to embedded systems, introducing the engineering concepts underlying embedded systems as a technology and as a subject of study. The focus is on modeling, design, and analysis of cyber-physical systems, which integrate computation, networking, and physical processes. The second edition offers two new chapters, several new exercises, and other improvements. The book can be used as a textbook at the advanced undergraduate or introductory graduate level and as a professional reference for practicing engineers and computer scientists. Readers should have some familiarity with machine structures, computer programming, basic discrete mathematics and algorithms, and signals and systems.

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### **MIXED-SIGNAL EMBEDDED SYSTEMS DESIGN**

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#### **A HANDS-ON GUIDE TO THE CYPRESS PSoC**

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*Springer Nature* This textbook introduces readers to mixed-signal, embedded design and provides, in one place, much of the basic information to engage in serious mixed-signal design using Cypress' PSoC. Designing with PSoC technology can be a challenging undertaking, especially for the novice. This book brings together a wealth of information gathered from a large number of sources and combines it with the fundamentals of mixed-signal, embedded design, making the PSoC learning curve ascent much less difficult. The book covers, sensors, digital logic, analog components, PSoC peripherals and building blocks in considerable detail, and each chapter includes illustrative examples, exercises, and an extensive bibliography.

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### **MAKING EMBEDDED SYSTEMS**

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#### **DESIGN PATTERNS FOR GREAT SOFTWARE**

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*"O'Reilly Media, Inc."* Eager to develop embedded systems? These systems don't tolerate inefficiency, so you may need a more disciplined approach to programming. This easy-to-read book helps you cultivate a host of good development practices, based on classic software design patterns as well as new patterns unique to embedded programming. You not only learn system architecture, but also specific techniques for dealing with system constraints and manufacturing requirements. Written by an expert who's created embedded systems ranging from urban surveillance and DNA scanners to children's toys, *Making Embedded Systems* is ideal for intermediate and experienced programmers, no matter what platform you use. Develop an architecture that makes your software robust and maintainable Understand how to make your code smaller, your processor seem faster, and your system use less power Learn how to explore sensors, motors, communications, and other I/O devices Explore tasks that are complicated on embedded systems, such as updating the software and using fixed point math to implement complex algorithms

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### **EMBEDDED CONTROL SYSTEM DESIGN**

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#### **A MODEL BASED APPROACH**

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*Springer Science & Business Media* Control system design is a challenging task for practicing engineers. It requires knowledge of different engineering fields, a good understanding of technical specifications and good communication skills. The current book introduces the reader into practical control system design, bridging the gap between theory and practice. The control design techniques presented in the book are all model based., considering the needs and possibilities of practicing engineers. Classical control design techniques are reviewed and methods are presented how to verify the robustness of the design. It is how the designed control algorithm can be implemented in real-time and tested, fulfilling different safety requirements. Good design practices and the systematic software development process are emphasized in the book according to the generic standard IEC61508. The book is mainly addressed to practicing control and embedded software engineers - working in research and development - as well as graduate students who are faced with the challenge to design control systems and implement them in real-time.

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## DESIGN PRINCIPLES FOR EMBEDDED SYSTEMS

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*Springer Nature* The book is designed to serve as a textbook for courses offered to graduate and undergraduate students enrolled in electronics and electrical engineering and computer science. This book attempts to bridge the gap between electronics and computer science students, providing complementary knowledge that is essential for designing an embedded system. The book covers key concepts tailored for embedded system design in one place. The topics covered in this book are models and architectures, Executable Specific Languages – SystemC, Unified Modeling Language, real-time systems, real-time operating systems, networked embedded systems, Embedded Processor architectures, and platforms that are secured and energy-efficient. A major segment of embedded systems needs hard real-time requirements. This textbook includes real-time concepts including algorithms and real-time operating system standards like POSIX threads. Embedded systems are mostly distributed and networked for deterministic responses. The book covers how to design networked embedded systems with appropriate protocols for real-time requirements. Each chapter contains 2-3 solved case studies and 10 real-world problems as exercises to provide detailed coverage and essential pedagogical tools that make this an ideal textbook for students enrolled in electrical and electronics engineering and computer science programs.

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## ARCHITECTING HIGH-PERFORMANCE EMBEDDED SYSTEMS

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### DESIGN AND BUILD HIGH-PERFORMANCE REAL-TIME DIGITAL SYSTEMS BASED ON FPGAS AND CUSTOM CIRCUITS

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*Packt Publishing Ltd* Explore the complete process of developing systems based on field-programmable gate arrays (FPGAs), including the design of electronic circuits and the construction and debugging of prototype embedded devices **Key Features** Learn the basics of embedded systems and real-time operating systems Understand how FPGAs implement processing algorithms in hardware Design, construct, and debug custom digital systems from scratch using KiCad **Book Description** Modern digital devices used in homes, cars, and wearables contain highly sophisticated computing capabilities composed of embedded systems that generate, receive, and process digital data streams at rates up to multiple gigabits per second. This book will show you how to use Field Programmable Gate Arrays (FPGAs) and high-speed digital circuit design to create your own cutting-edge digital systems. Architecting High-Performance Embedded Systems takes you through the fundamental concepts of embedded systems, including real-time operation and the Internet of Things (IoT), and the architecture and capabilities of the latest generation of FPGAs. Using powerful free tools for FPGA design and electronic circuit design, you'll learn how to design, build, test, and debug high-performance FPGA-based IoT devices. The book will also help you get up to speed with embedded system design, circuit design, hardware construction, firmware development, and debugging to produce a high-performance embedded device – a network-based digital oscilloscope. You'll explore techniques such as designing four-layer printed circuit boards with high-speed differential signal pairs and assembling the board using surface-mount components. By the end of the book, you'll have a solid understanding of the concepts underlying embedded systems and FPGAs and will be able to design and construct your own sophisticated digital devices. **What you will learn** Understand the fundamentals of real-time embedded systems and sensors Discover the capabilities of FPGAs and how to use FPGA development tools Learn the principles of digital circuit design and PCB layout with KiCad Construct high-speed circuit board prototypes at low cost Design and develop high-performance algorithms for FPGAs Develop robust, reliable, and efficient firmware in C Thoroughly test and debug embedded device hardware and firmware **Who this book is for** This book is for software developers, IoT engineers, and anyone who wants to understand the process of developing high-performance embedded systems. You'll also find this book useful if you want to learn about the fundamentals of FPGA development and all aspects of firmware development in C and C++. Familiarity with the C language, digital circuits, and electronic soldering is necessary to get started.

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## DESIGNING EMBEDDED SYSTEMS WITH PIC MICROCONTROLLERS

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### PRINCIPLES AND APPLICATIONS

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*Elsevier* *Embedded Systems with PIC Microcontrollers: Principles and Applications* is a hands-on introduction to the principles and practice of embedded system design using the PIC microcontroller. Packed with helpful examples and illustrations, the book provides an in-depth treatment of microcontroller design as well as programming in both assembly language and C, along with advanced topics such as techniques of connectivity and networking and real-time operating systems. In this one book students get all they need to know to be highly proficient at embedded systems design. This text combines embedded systems principles with applications, using the 16F84A, 16F873A and the 18F242 PIC microcontrollers. Students learn how to apply the principles using a multitude of sample designs and design ideas, including a robot in the form of an autonomous guide vehicle. Coverage between software and hardware is fully balanced, with full presentation given to microcontroller design and software programming, using both assembler and C. The book is accompanied by a companion website containing copies of all programs and software tools used in the text and a 'student' version of the C compiler. This textbook will be ideal for introductory courses and lab-based courses on embedded systems, microprocessors using the PIC microcontroller, as well as more advanced courses which use the 18F series and teach C programming in an embedded environment. Engineers in industry and informed hobbyists will also find this book a valuable resource when designing and implementing both simple

and sophisticated embedded systems using the PIC microcontroller. \*Gain the knowledge and skills required for developing today's embedded systems, through use of the PIC microcontroller. \*Explore in detail the 16F84A, 16F873A and 18F242 microcontrollers as examples of the wider PIC family. \*Learn how to program in Assembler and C. \*Work through sample designs and design ideas, including a robot in the form of an autonomous guided vehicle. \*Accompanied by a CD-ROM containing copies of all programs and software tools used in the text and a 'student' version of the C compiler.

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## **DESIGN PATTERNS FOR EMBEDDED SYSTEMS IN C**

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### **AN EMBEDDED SOFTWARE ENGINEERING TOOLKIT**

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Newnes 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 constraints 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 are contain ANSI C for ease of use with C programming code

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## **EMBEDDED SYSTEMS DESIGN FOR HIGH-SPEED DATA ACQUISITION AND CONTROL**

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Springer 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.

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## **DESIGNING EMBEDDED SYSTEMS WITH THE SIGNAL PROGRAMMING LANGUAGE**

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### **SYNCHRONOUS, REACTIVE SPECIFICATION**

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Springer Science & Business Media I am very pleased to play even a small part in the publication of this book on the SIGNAL language and its environment POLYCHRONY. I am sure it will be a significant milestone in the development of the SIGNAL language, of synchronous computing in general, and of the dataflow approach to computation. In dataflow, the computation takes place in a producer-consumer network of independent processing stations. Data travels in streams and is transformed as these streams pass through the processing stations (often called filters). Dataflow is an attractive model for many reasons, not least because it corresponds to the way production, transportation, and communication are typically organized in the real world (outside cyberspace). I myself stumbled into dataflow almost against my will. In the mid-1970s, Ed Ashcroft and I set out to design a "super" structured programming language that, we hoped, would radically simplify proving assertions about programs. In the end, we decided that it had to be declarative. However, we also were determined that iterative algorithms could be expressed directly, without circumlocutions such as the use of a tail-recursive function. The language that resulted, which we named LUCID, was much less traditional than we would have liked. LUCID statements are equations in a kind of executable temporal logic that specify the (time) sequences of variables involved in an iteration.

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## **EMBEDDED AND NETWORKING SYSTEMS**

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### **DESIGN, SOFTWARE, AND IMPLEMENTATION**

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CRC Press 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.

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## **EMBEDDED SYSTEM DESIGN**

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### **INTRODUCTION TO SOC SYSTEM ARCHITECTURE**

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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 primarily 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.

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### **EMBEDDED SYSTEM DEVELOPMENT PROCESS**

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#### **PLAN, DESIGN, INTEGRATED DEVELOPMENT, AND DESIGN VERIFICATION**

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Almost each and every electronic gadget around us is an embedded system, for example: Smart phone, palmtop, digital watch, digital camera, printer, scanner, washer machine control panel, home security system, and many more. Embedded systems have revolutionized our society into a digital world due to the fact that they are microcontroller-based, compact in sizes, reliable in performance, and cheaper in cost. **Book Contents** This book will assist you to learn about embedded systems, its design and development process. Four serial phases: plan, design, integrated development (ID), design verification and validation (DV&V) are presented and discussed in this book. This book begins by introducing what the embedded system basics are. Chapter 1 present classification and aspect of embedded systems, describes embedded systems' hardware and software characteristics. Then it is continued by chapter 2 to depict a time-task span of the embedded system product development process. Chapter 3, 4, 5, and 6, each describes the four phases of the design and development process respectively, which are Plan (Chapter 3), Design (chapter 4), Integrated Development (Chapter 5), Design Verification and Validation (Chapter 6). Plan phase (Chapter 3) describes product requirement, cost analysis, development strategy, management plan, development methodology, design tools and equipment. Design phase (Chapter 4) go over each design process flows, and present descriptions on: hardware board design process, hardware PCB design process, signal integrity analysis and simulation, software design process, and FPGA design process. Integrated Development phase (Chapter 5) discuss on: mechanical and PCB preparations, parts acquisition, FPGA preparation, PCB assembly, hardware testing and debug, hardware/software integrated development, and virtual prototype. Design Verification and Validation phase (Chapter 6) present appearance inspection, functional testing, characteristics and measurements, performance testing, and ESD, EMC, safety testing. Appendixes in this book provide tables and descriptions on hardware and software design checklists, guidelines, and development tools for reference. **Bold texts in the paragraphs shall represent a development process name, phase name, step name, or a term of the glossary, or an emphasis.** Audience: This book is intentionally written for following audience: -Managers and team leaders who need to manage and guide embedded system design and development process effectively. -Engineers and technicians who want to speed up and optimize embedded system design and development process. -New graduates and students who want to study and learn embedded system design and development process. -Interested readers who want explore embedded system design and development process.

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### **REAL-TIME EMBEDDED SYSTEMS**

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#### **DESIGN PRINCIPLES AND ENGINEERING PRACTICES**

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Newnes This book integrates new ideas and topics from real time systems, embedded systems, and software engineering to give a complete picture of the whole process of developing software for real-time embedded applications. You will not only gain a thorough understanding of concepts related to microprocessors, interrupts, and system boot process, appreciating the importance of real-time modeling and scheduling, but you will also learn software engineering practices such as model documentation, model analysis, design patterns, and standard conformance. This book is split into four parts to help you learn the key concept of embedded systems; Part one introduces the development process, and includes two chapters on microprocessors and interrupts---fundamental topics for software engineers; Part two is dedicated to modeling techniques for real-time systems; Part three looks at the design of software architectures and Part four covers software implementations, with a focus on

*POSIX-compliant operating systems. With this book you will learn: The pros and cons of different architectures for embedded systems POSIX real-time extensions, and how to develop POSIX-compliant real time applications How to use real-time UML to document system designs with timing constraints The challenges and concepts related to cross-development Multitasking design and inter-task communication techniques (shared memory objects, message queues, pipes, signals) How to use kernel objects (e.g. Semaphores, Mutex, Condition variables) to address resource sharing issues in RTOS applications The philosophy underpinning the notion of "resource manager" and how to implement a virtual file system using a resource manager The key principles of real-time scheduling and several key algorithms Coverage of the latest UML standard (UML 2.4) Over 20 design patterns which represent the best practices for reuse in a wide range of real-time embedded systems Example codes which have been tested in QNX---a real-time operating system widely adopted in industry*