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Hardware
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STEWART TYLER

**System-Level Design
Techniques for Energy-
Efficient Embedded**

Systems Newnes

A guide to using Linux on embedded platforms for interfacing to the real world. "Embedded Linux"

is one of the first books available that teaches readers development and implementation of interfacing applications on an Embedded Linux platform.

Parallel Computer Architecture Readings in Hardware/software Co-design

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
Hardware/Software Co-
 Design and Optimization

for Cyberphysical
 Integration in Digital
 Microfluidic Biochips
 Elsevier
 Rapid energy estimation
 for energy efficient
 applications using field-
 programmable gate
 arrays (FPGAs) remains a
 challenging research
 topic. Energy dissipation
 and efficiency have
 prevented the widespread
 use of FPGA devices in
 embedded systems,
 where energy efficiency is
 a key performance metric.
 Helping overcome these
 challenges, Energy
 Efficient Hardware-

Software Co-Synthesis
 Using Reconfigurable
 Hardware offers solutions
 for the development of
 energy efficient
 applications using FPGAs.
 The book integrates
 various high-level
 abstractions for
 describing hardware and
 software platforms into a
 single, consistent
 application development
 framework, enabling users
 to construct, simulate,
 and debug systems.
 Based on these high-level
 concepts, it proposes an
 energy performance
 modeling technique to

capture the energy dissipation behavior of both the reconfigurable hardware platform and the target applications running on it. The authors also present a dynamic programming-based algorithm to optimize the energy performance of an application running on a reconfigurable hardware platform. They then discuss an instruction-level energy estimation technique and a domain-specific modeling technique to provide rapid and fairly accurate energy estimation for hardware-

software co-designs using reconfigurable hardware. The text concludes with example designs and illustrative examples that show how the proposed co-synthesis techniques lead to a significant amount of energy reduction. This book explores the advantages of using reconfigurable hardware for application development and looks ahead to future research directions in the field. It outlines the range of aspects and steps that lead to an energy efficient hardware-software

application synthesis using FPGAs.

Hardware/Software Co-Design Elsevier

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

Co-verification of
Hardware and Software
for ARM SoC Design

Springer Nature

To the hard-pressed systems designer this book will come as a godsend. It is a hands-on guide to the many ways in which processor-based systems are designed to allow low power devices. Covering a huge range of topics, and co-authored by some of the field's top practitioners, the book provides a good starting point for engineers in the area, and to research students embarking upon

work on embedded systems and architectures.

Embedded Linux

Springer Science & Business Media

I am honored and delighted to write the foreword to this very first book about SystemC. It is now an excellent time to summarize what SystemC really is and what it can be used for. The main message in the area of design in the 2001 International Technology Roadmap for Semiconductors (ITRS) is that "cost of design is the

greatest threat to the continuation of the semiconductor roadmap." This recent revision of the ITRS describes the major productivity improvements of the last few years as "small block reuse," "large block reuse," and "IC implementation tools." In order to continue to reduce design cost, the required future solutions will be "intelligent test benches" and "embedded system-level methodology." As the new system-level specification and design language, SystemC -

rectly contributes to these two solutions. These will have the biggest impact on future design technology and will reduce system implementation cost. It took SystemC less than two years to emerge as the leader among the many new and well-discussed system-level design languages. In my opinion, this is due to the fact that SystemC adopted object-oriented system-level design—the most promising method already applied by the majority of firms during the last couple of years.

Even before the introduction of SystemC, many system designers have attempted to develop executable specifications in C++. These executable functional specifications are then refined to the well-known transaction level, to model the communication of system-level processes. Particle Swarm Optimization John Wiley & Sons This handbook presents fundamental knowledge on the hardware/software (HW/SW) codesign

methodology. Contributing expert authors look at key techniques in the design flow as well as selected codesign tools and design environments, building on basic knowledge to consider the latest techniques. The book enables readers to gain real benefits from the HW/SW codesign methodology through explanations and case studies which demonstrate its usefulness. Readers are invited to follow the progress of design

techniques through this work, which assists readers in following current research directions and learning about state-of-the-art techniques. Students and researchers will appreciate the wide spectrum of subjects that belong to the design methodology from this handbook.

Software Engineering for Embedded Systems

Springer Science & Business Media

This textbook is written for junior/senior undergraduate and first-

year graduate students in the electrical and computer engineering departments. Using PSoC mixed-signal array design, the authors define the characteristics of embedded design, embedded mixed-signal architectures, and top-down design.

Optimized implementations of these designs are included to illustrate the theory. Exercises are provided at the end of each chapter for practice. Topics covered include the hardware and software used to implement analog

and digital interfaces, various filter structures, amplifiers and other signal-conditioning circuits, pulse-width modulators, timers, and data structures for handling multiple similar peripheral devices. The practical exercises contained in the companion laboratory manual, which was co-authored by Cypress Staff Applications Engineer Dave Van Ess, are also based on PSoC. PSoC's integrated microcontroller, highly configurable

analog/digital peripherals, and a full set of development tools make it an ideal learning tool for developing mixed-signal embedded design skills.

Handbook of Hardware/Software Codesign Springer

Science & Business Media
This is a practical book for computer engineers who want to understand or implement hardware/software systems. It focuses on problems that require one to combine hardware design with software design - such problems

can be solved with hardware/software codesign. When used properly, hardware/software codesign works better than hardware design or software design alone: it can improve the overall performance of digital systems, and it can shorten their design time. Hardware/software codesign can help a designer to make trade-offs between the flexibility and the performance of a digital system. To achieve this, a designer needs to combine two radically

different ways of design: the sequential way of decomposition in time, using software, with the parallel way of decomposition in space, using hardware.
Intended Audience This book assumes that you have a basic understanding of hardware that you are familiar with standard digital hardware components such as registers, logic gates, and components such as multiplexers and arithmetic operators. The book also assumes that you know how to write a program in C. These

topics are usually covered in an introductory course on computer engineering or in a combination of courses on digital design and software engineering. Hardware/Software Co-Design John Wiley & Sons Introduction to Hardware-Software Co-Design presents a number of issues of fundamental importance for the design of integrated hardware software products such as embedded, communication, and multimedia systems. This book is a comprehensive introduction to the

fundamentals of hardware/software co-design. Co-design is still a new field but one which has substantially matured over the past few years. This book, written by leading international experts, covers all the major topics including: fundamental issues in co-design; hardware/software co-synthesis algorithms; prototyping and emulation; target architectures; compiler techniques; specification and verification; system-level specification. Special

chapters describe in detail several leading-edge co-design systems including Cosyma, LYCOS, and Cosmos. Introduction to Hardware-Software Co-Design contains sufficient material for use by teachers and students in an advanced course of hardware/software co-design. It also contains extensive explanation of the fundamental concepts of the subject and the necessary background to bring practitioners up-to-date on this increasingly important topic. System Level

Hardware/Software Co-Design CRC Press High-Performance Embedded Computing, Second Edition, combines leading-edge research with practical guidance in a variety of embedded computing topics, including real-time systems, computer architecture, and low-power design. Author Marilyn Wolf presents a comprehensive survey of the state of the art, and guides you to achieve high levels of performance from the embedded systems that

bring these technologies together. The book covers CPU design, operating systems, multiprocessor programs and architectures, and much more. Embedded computing is a key component of cyber-physical systems, which combine physical devices with computational resources for control and communication. This revised edition adds new content and examples of cyber-physical systems throughout the book, including design methodologies,

scheduling, and wide-area CPS to illustrate the possibilities of these new systems. Revised and updated with coverage of recently developed consumer electronics architectures and models of computing Includes new VLIW processors such as the TI Da Vinci, and CPU simulation Learn model-based verification and middleware for embedded systems Supplemental material includes lecture slides, labs, and additional resources
Principles and Practice

Springer
Particle swarm optimization (PSO) is a population based stochastic optimization technique influenced by the social behavior of bird flocking or fish schooling. PSO shares many similarities with evolutionary computation techniques such as Genetic Algorithms (GA). The system is initialized with a population of random solutions and searches for optima by updating generations. However, unlike GA, PSO has no evolution

operators such as crossover and mutation. In PSO, the potential solutions, called particles, fly through the problem space by following the current optimum particles. This book represents the contributions of the top researchers in this field and will serve as a valuable tool for professionals in this interdisciplinary field.
The POLIS Approach
John Wiley & Sons
Over the past several years, embedded systems have emerged as an

integral though unseen part of many consumer, industrial, and military devices. The explosive growth of these systems has resulted in embedded computing becoming an increasingly important discipline. The need for designers of high-performance, application-specific computing systems has never been greater, and many universities and colleges in the US and worldwide are now developing advanced courses to help prepare their students for careers in embedded

computing. High-Performance Embedded Computing: Architectures, Applications, and Methodologies is the first book designed to address the needs of advanced students and industry professionals. Focusing on the unique complexities of embedded system design, the book provides a detailed look at advanced topics in the field, including multiprocessors, VLIW and superscalar architectures, and power consumption. Fundamental challenges in embedded computing

are described, together with design methodologies and models of computation. HPEC provides an in-depth and advanced treatment of all the components of embedded systems, with discussions of the current developments in the field and numerous examples of real-world applications. Covers advanced topics in embedded computing, including multiprocessors, VLIW and superscalar architectures, and power consumption Provides in-depth coverage of networks, reconfigurable

systems, hardware-software co-design, security, and program analysis Includes examples of many real-world embedded computing applications (cell phones, printers, digital video) and architectures (the Freescale Starcore, TI OMAP multiprocessor, the TI C5000 and C6000 series, and others) Hardware/Software Co-Design and Co-Verification Springer Science & Business Media 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.
*High-Performance
Embedded Computing*
Springer Science &
Business Media
Hardware/software co-
verification is how to
make sure that embedded
system software works
correctly with the
hardware, and that the
hardware has been
properly designed to run
the software successfully -
before large sums are
spent on prototypes or
manufacturing. This is the
first book to apply this
verification technique to
the rapidly growing field

of embedded systems-on-
a-chip(SoC). As traditional
embedded system design
evolves into single-chip
design, embedded
engineers must be armed
with the necessary
information to make
educated decisions about
which tools and
methodology to deploy.
SoC verification requires a
mix of expertise from the
disciplines of
microprocessor and
computer architecture,
logic design and
simulation, and C and
Assembly language
embedded software. Until

now, the relevant
information on how it all
fits together has not been
available. Andrews, a
recognized expert,
provides in-depth
information about how co-
verification really works,
how to be successful
using it, and pitfalls to
avoid. He illustrates these
concepts using concrete
examples with the ARM
core - a technology that
has the dominant market
share in embedded
system product design.
The companion CD-ROM
contains all source code
used in the design

examples, a searchable e-book version, and useful design tools. * The only book on verification for systems-on-a-chip (SoC) on the market * Will save engineers and their companies time and money by showing them how to speed up the testing process, while still avoiding costly mistakes * Design examples use the ARM core, the dominant technology in SoC, and all the source code is included on the accompanying CD-Rom, so engineers can easily use it in their own designs

Hardware-Software Co-Synthesis of Distributed Embedded Systems
Springer
Hierarchical design methods were originally introduced for the design of digital ICs, and they appeared to provide for significant advances in design productivity, Time-to-Market, and first-time right design. These concepts have gained increasing importance in the semiconductor industry in recent years. In the course of time, the supportive quality of hierarchical methods and

their advantages were confirmed. System Level Hardware/Software Co-design: An Industrial Approach demonstrates the applicability of hierarchical methods to hardware / software codesign, and mixed analogue / digital design following a similar approach. Hierarchical design methods provide for high levels of design support, both in a qualitative and a quantitative sense. In the qualitative sense, the presented methods support all phases in the

product life cycle of electronic products, ranging from requirements analysis to application support. Hierarchical methods furthermore allow for efficient digital hardware design, hardware / software codesign, and mixed analogue / digital design, on the basis of commercially available formalisms and design tools. In the quantitative sense, hierarchical methods have prompted a substantial increase in design productivity. System Level

Hardware/Software Co-design: An Industrial Approach reports on a six year study during which time the number of square millimeters of normalized complexity an individual designer contributed every week rose by more than a factor of five. Hierarchical methods therefore enabled designers to keep track of the ever increasing design complexity, while effectively reducing the number of design iterations in the form of redesigns. System Level

Hardware/Software Co-design: An Industrial Approach is the first book to provide a comprehensive, coherent system design methodology that has been proven to increase productivity in industrial practice. The book will be of interest to all managers, designers and researchers working in the semiconductor industry. *Unleash the Power of Arduino!* Springer Science & Business Media This title serves as an introduction and reference

for the field, with the papers that have shaped the hardware/software co-design since its inception in the early 90s.

Dedicated Digital Processors "O'Reilly Media, Inc."

Concurrent design, or co-design of hardware and software is extremely important for meeting design goals, such as high performance, that are the key to commercial competitiveness.

Hardware/Software Co-Design covers many aspects of the subject, including methods and

examples for designing: (1) general purpose and embedded computing systems based on instruction set processors; (2) telecommunication systems using general purpose digital signal processors as well as application specific instruction set processors; (3) embedded control systems and applications to automotive electronics. The book also surveys the areas of emulation and prototyping systems with field programmable gate array technologies, hardware/software

synthesis and verification, and industrial design trends. Most contributions emphasize the design methodology, the requirements and state of the art of computer aided co-design tools, together with current design examples.

Hardware, Software, and Interfacing McGraw Hill Professional Proceedings of the NATO Advanced Study Institute, Tremezzo, Italy, June 19-30, 1995

Embedded Systems Foundations of Cyber-Physical Systems

Addison-Wesley Professional Embedded Systems: A Contemporary Design Tool, Second Edition Embedded systems are one of the foundational elements of today's evolving and growing computer technology. From operating our cars, managing our smart phones, cleaning our homes, or cooking our meals, the special computers we call embedded systems are quietly and unobtrusively making our lives easier, safer, and more

connected. While working in increasingly challenging environments, embedded systems give us the ability to put increasing amounts of capability into ever-smaller and more powerful devices. Embedded Systems: A Contemporary Design Tool, Second Edition introduces you to the theoretical hardware and software foundations of these systems and expands into the areas of signal integrity, system security, low power, and hardware-software co-

design. The text builds upon earlier material to show you how to apply reliable, robust solutions to a wide range of applications operating in today's often challenging environments. Taking the user's problem and needs as your starting point, you will explore each of the key theoretical and practical issues to consider when designing an application in today's world. Author James Peckol walks you through the formal hardware and software development process covering:

Breaking the problem down into major functional blocks; Planning the digital and software architecture of the system; Utilizing the hardware and software co-design process; Designing the physical world interface to external analog and digital signals; Addressing security issues as an integral part of the

design process; Managing signal integrity problems and reducing power demands in contemporary systems; Debugging and testing throughout the design and development cycle; Improving performance. Stressing the importance of security, safety, and reliability in the design

and development of embedded systems and providing a balanced treatment of both the hardware and the software aspects, Embedded Systems: A Contemporary Design Tool, Second Edition gives you the tools for creating embedded designs that solve contemporary real-world challenges.