# Hardware/Software Co-Design and Co-Verification

Edited by Jean-Michel Bergé, Oz Levia and Jacques Rouillard



Current Issues in Electronic Modeling

# **Hardware Software Co Design And Co Verification**

Giovanni DeMicheli, M.G. Sami

### **Hardware Software Co Design And Co Verification:**

Hardware/Software Co-Design and Co-Verification Jean-Michel Bergé, Oz Levia, Jacques Rouillard, 2013-03-09 Co Design is the set of emerging techniques which allows for the simultaneous design of Hardware and Software In many cases where the application is very demanding in terms of various performances time surface power consumption trade offs between dedicated hardware and dedicated software are becoming increasingly difficult to decide upon in the early stages of a design Verification techniques such as simulation or proof techniques that have proven necessary in the hardware design must be dramatically adapted to the simultaneous verification of Software and Hardware Describing the latest tools available for both Co Design and Co Verification of systems Hardware Software Co Design and Co Verification offers a complete look at this evolving set of procedures for CAD environments The book considers all trade offs that have to be made when co designing a system Several models are presented for determining the optimum solution to any co design problem including partitioning architecture synthesis and code generation When deciding on trade offs one of the main factors to be considered is the flow of communication especially to and from the outside world This involves the modeling of communication protocols An approach to the synthesis of interface circuits in the context of co design is presented Other chapters present a co design oriented flexible component data base and retrieval methods a case study of an ethernet bridge designed using LOTOS and co design methodologies and finally a programmable user interface based on monitors Hardware Software Co Design and Co Verification will help designers and researchers to understand these latest techniques in system design and as such will be of interest to all involved in embedded system design Hardware/Software Co-Design Giovanni DeMicheli, M.G. Sami, 2013-11-11 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 Co-Design Jørgen Staunstrup, Wayne Wolf, 2013-04-17 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 **Co-verification of Hardware and Software for ARM SoC Design** Jason Andrews, 2004-08-30 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

Readings in Hardware/Software Co-Design Giovanni De Micheli,Rolf Ernst,Wayne Wolf,2002 This title serves as an introduction ans reference for the field with the papers that have shaped the hardware software co design since its inception in the early 90s System Level Hardware/Software Co-Design Joris van den Hurk,Jochen A.G. Jess,2013-04-17 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 finterest to all managers designers and researchers working in the semiconductor industry Hardware/Software Co-Design for Data Flow Dominated Embedded Systems Ralf Niemann, 1998-10-31 Introduces different tasks of hardware software co design including system specification hardware software partitioning co synthesis and co simulation Summarizes and classifies co design tools and methods for these tasks and presents the co design tool COOL useful for solving co design tasks for the class of data flow dominated embedded systems Primary emphasis is on hardware software partitioning and the co synthesis phase and their coupling A mathematical formulation of the hardware software partitioning problem is given and several novel approaches are presented and compared for solving the partitioning problem Annotation copyrighted by Book News Inc Portland OR

Fundamental Approaches to Software Engineering Michel Wermelinger, Tiziana Margaria-Steffen, 2004-03-01 ETAPS 2004 was the seventh instance of the European Joint Conferences on Theory and Practice of Software ETAPS is an annual federated conference that was established in 1998 by combining a number of existing and new conferences This year it comprised ve conferences FOSSACS FASE ESOP CC TACAS 23 satellite workshops 1 tutorial and 7 invited lectures not including those that are specic to the satellite events The events that comprise ETAPS address various aspects of the system velopment process including specication design implementation analysis and improvement The languages methodologies and tools that support these act ities are all well within its scope Dierent blends of theory and practice are resented with an inclination towards theory with a practical motivation on the one hand and soundly based practice on the other Many of the issues involved in software design apply to systems in general including hardware systems and theemphasisonsoftware isnotintended to be exclusive

Co-verification of Hardware and Software for ARM SoC Design Jason Andrews, 2004-09-04 Hardware software coverification 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-Design of a Multimedia SOC Platform Sao-Jie Chen, Guang-Huei Lin, Pao-Ann Hsiung, Yu-Hen Hu,2009-01-25 Hardware Software Co Design of a Multimedia SOC Platform is one of the first of its kinds to provide a comprehensive overview of the design and implementation of the hardware and software of an SoC platform for multimedia applications Topics covered in this book range from system level design methodology multimedia algorithm implementation a sub word parallel single instruction multiple data SIMD processor design and its virtual platform implementation to the development of an SIMD parallel compiler as well as a real time operating system RTOS Hardware Software Co Design of a Multimedia SOC Platform is written for practitioner engineers and technical managers who want to gain first hand knowledge about the hardware software design process of an SoC platform It offers both tutorial like details to help readers become familiar with a diverse range of subjects and in depth analysis for advanced readers to pursue further Specification & Design Languages Eugenio Villar, Jean Mermet, 2007-05-08 In this fourth book in the CHDL Series a selection of the best papers presented in FDL 02 is published System Specification and Design Languages contains outstanding research contributions in the four areas mentioned above So The Analog and Mixed Signal system design contributions cover the new methodological approaches like AMS behavioral specification mixed signal modeling and simulation AMS reuse and MEMs design using the new modeling languages such as VHDL AMS Verilog AMS Modelica and analog mixed signal extensions to SystemC UML is the de facto standard for SW development covering the early development stages of requirement analysis and system specification The UML based system specification and design contributions address latest results on hot topic areas such as system profiling performance analysis and UML application to complex HW SW embedded systems and SoC design C C for HW SW systems design is entering standard industrial design flows Selected papers cover system modeling system verification and SW generation The papers from the Specification Formalisms for Proven design workshop present formal methods for system modeling and design semantic integrity and formal languages such as ALPHA

HANDLE and B **Secure IT Systems** Nicola Tuveri, Antonis Michalas, Billy Bob Brumley, 2021-11-13 This book constitutes the refereed proceedings of the 26th Nordic Conference on Secure IT Systems NordSec 2021 which was held online during November 2021 The 11 full papers presented in this volume were carefully reviewed and selected from 29 submissions They were organized in topical sections named Applied Cryptography Security in Internet of Things Machine Learning and Security Network Security and Trust Computers as Components Wayne Hendrix Wolf, 2005 This work unravels the complexity of embedded systems e g cell phones microwaves and information appliances and of the process tools and techniques necessary for designing them **Architecture and Design of Distributed Embedded Systems** Bernd Kleinjohann, 2013-04-18 Due to the decreasing production costs of IT systems applications that had to be realised as expensive PCBs formerly can now be realised as a system on chip Furthermore low cost broadband communication media for wide area communication as well as for the realisation of local distributed systems are available Typically the market requires IT systems that realise a set of specific features for the end user in a given environment so called embedded systems Some examples for such embedded systems are control systems in cars airplanes houses or plants information and communication devices like digital TV mobile phones or autonomous systems like service or edutainment robots For the design of embedded systems the designer has to tackle three major aspects The application itself including the man machine interface The target architecture of the system including all functional and non functional constraints and the design methodology including modelling specification synthesis test and validation The last two points are a major focus of this book This book documents the high quality approaches and results that were presented at the International Workshop on Distributed and Parallel Embedded Systems DIPES 2000 which was sponsored by the International Federation for Information Processing IFIP and organised by IFIP working groups WG10 3 WG10 4 and WG10 5 The workshop took place on October 18 19 2000 in Schlo Eringerfeld near Paderborn Germany Architecture and Design of Distributed Embedded Systems is organised similar to the workshop Chapters 1 and 4 Methodology I and II deal with different modelling and specification paradigms and the corresponding design methodologies Generic system architectures for different classes of embedded systems are presented in Chapter 2 In Chapter 3 several design environments for the support of specific design methodologies are presented Problems concerning test and validation are discussed in Chapter 5 The last two chapters include distribution and communication aspects Chapter 6 and synthesis techniques for embedded systems Chapter 7 This book is essential reading for computer science researchers and application developers Models in System Design Jean-Michel Bergé, Oz Levia, Jacques Rouillard, 2012-12-06 Models in System Design tracks the general trend in electronics in terms of size complexity and difficulty of maintenance System design is by nature combined with prototyping mixed domain design and verification and it is no surprise that today s modeling and models are used in various levels of system design and verification In order to deal with constraints induced by volume and complexity new methods and techniques have been

defined Models in System Design provides an overview of the latest modeling techniques for use by system designers The first part of the book considers system level design discussing such issues as abstraction performance and trade offs There is also a section on automating system design The second part of the book deals with some of the newest aspects of embedded system design These include co verification and prototyping Finally the book includes a section on the use of the MCSE methodology for hardware software co design Models in System Design will help designers and researchers to understand these latest techniques in system design and as such will be of interest to all involved in embedded system design

Hardware-software Co-design for Embedded Systems Anuradha Mulukutla,1998 **Embedded Systems Design** Arnold Berger, 2001-12-15 Hardware Software Partitioning Cross Platform Development Firmware Debugging Performance Analysis Testing Integration Get into embedded systems programming with a clear understanding of the development cycle and the specialized aspects of Hardware-Software Co-Design of Embedded Systems F. Balarin, Paolo Giusto, Attila Jurecska, Claudio Passerone, Ellen Sentovich, Bassam Tabbara, M. Chiodo, Harry Hsieh, Luciano Lavagno, Alberto Sangiovanni-Vincentelli, Kei Suzuki, 2012-12-06 Embedded systems are informally defined as a collection of programmable parts surrounded by ASICs and other standard components that interact continuously with an environment through sensors and actuators The programmable parts include micro controllers and Digital Signal Processors DSPs Embedded systems are often used in life critical situations where reliability and safety are more important criteria than performance Today embedded systems are designed with an ad hoc approach that is heavily based on earlier experience with similar products and on manual design Use of higher level languages such as C helps structure the design somewhat but with increasing complexity it is not sufficient Formal verification and automatic synthesis of implementations are the surest ways to quarantee safety Thus the POLIS system which is a co design environment for embedded systems is based on a formal model of computation POLIS was initiated in 1988 as a research project at the University of California at Berkeley and over the years grew into a full design methodology with a software system supporting it Hardware Software Co Design of Embedded Systems The POLIS Approach is intended to give a complete overview of the POLIS system including its formal and algorithmic aspects Hardware Software Co Design of Embedded Systems The POLIS Approach will be of interest to embedded system designers automotive electronics consumer electronics and telecommunications micro controller designers CAD developers and students Embedded and Ubiquitous Computing - EUC 2005 Laurence T. Yang, Makoto Amamiya, Zhen Liu, Minyi Guo, Franz J. Rammig, 2005-11-24 Welcome to the proceedings of the 2005 IFIP International Conference on bedded and Ubiquitous Computing EUC 2005 which was held in Nagasaki Japan December 6 9 2005 Embedded and ubiquitous computing is emerging rapidly as an exciting new paradigm to provide computing and communication services all the time erywhere Its systems are now pervading every aspect of life to the point that they are hidden inside various appliances or can be worn unobtrusively as part of clothing and jewelry This emergence is a natural

outcome of research and technological advances in embedded systems pervasive computing and c munications wireless networks mobile computing distributed computing and agent technologies etc Its tremendous impact on academics industry gove ment and daily life can be compared to that of electric motors over the past century in fact it but promises to revolutionize life much more profoundly than elevators electric motors or even personal computers The EUC 2005 conference provided a forum for engineers and scientists in academia industry and government to address profound issues including te nical challenges safety and social legal political and economic issues and to present and discuss their ideas results work in progress and experience on all aspects of embedded and ubiquitous computing **Bebop to the Boolean Boogie** Clive Maxfield, 2008-12-05 This entertaining and readable book provides a solid comprehensive introduction to contemporary electronics It s not a how to do electronics book but rather an in depth explanation of how today s integrated circuits work how they are designed and manufactured and how they are put together into powerful and sophisticated electronic systems In addition to the technical details it s packed with practical information of interest and use to engineers and support personnel in the electronics industry It even tells how to pronounce the alphabet soup of acronyms that runs rampant in the industry Written in conversational fun style that has generated a strong following for the author and sales of over 14 000 copies for the first two editions The Third Edition is even bigger and better with lots of new material illustrations and an expanded glossary Ideal for training incoming engineers and technicians and for people in marketing or other related fields or anyone else who needs to familiarize themselves with electronics terms and technology

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