

Hardware Design and Simulation in VAL/VHDL

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Hardware Design and Simulation in VAL/VHDL Larry M. Augustin, David C. Luckham, Benoit A. Gennart, Youm Huh, A. Stanculescu, 2012-12-06 The VHSIC Hardware Description Language VHDL provides a standard machine processable notation for describing hardware VHDL is the result of a collaborative effort between IBM Intermetrics and Texas Instruments sponsored by the Very High Speed Integrated Circuits VHSIC program office of the Department of Defense beginning in 1981 Today it is an IEEE standard 1076 1987 and several simulators and other automated support tools for it are available commercially By providing a standard notation for describing hardware especially in the early stages of the hardware design process VHDL is expected to reduce both the time lag and the cost involved in building new systems and upgrading existing ones VHDL is the result of an evolutionary approach to language development starting with high level hardware description languages existing in 1981 It has a decidedly programming language flavor resulting both from the orientation of hardware languages of that time and from a major requirement that VHDL use Ada constructs wherever appropriate During the 1980 s there has been an increasing current of research into high level specification languages for systems particularly in the software area and new methods of utilizing specifications in systems development This activity is worldwide and includes for example object oriented design various rigorous development methods mathematical verification and synthesis from high level specifications VAL VHDL Annotation Language is a simple further step in the evolution of hardware description languages in the direction of applying new methods that have developed since VHDL was designed

VHDL Designer's Reference Jean-Michel Bergé, Alain Fonkoua, Serge Maginot, Jacques Rouillard, 2012-12-06 too vast too complex too grand for description John Wesley Powell 1870 discovering the Grand Canyon VHDL is a big world A beginner can be easily disappointed by the generality of this language This generality is explained by the large number of domains covered from specifications to logical simulation or synthesis To the very beginner VHDL appears as a kit He is quickly aware that his problem may be solved with VHDL but does not know how He does not even know how to start In this state of mind all the constraints that can be set to his modeling job by using a subset of the language or a given design methodology may be seen as a life preserver The success of the introduction of VHDL in a company depends on solutions to many questions that should be answered months before the first line of code is written Why choose VHDL Which VHDL tools should be chosen Which modeling methodology should be adopted How should the VHDL environment be customized What are the tricks Where are the traps What are the differences between VHDL and other competing HDLs Answers to these questions are organized according to different concerns buying the tools organizing the environment and designing Decisions taken in each of these areas may have many consequences on the way to the acceptance and efficient use of VHDL in a company

VHDL'92 Jean-Michel Bergé, Alain Fonkoua, Serge Maginot, Jacques Rouillard, 2012-12-06 An open process of restandardization conducted by the IEEE has led to the definitions of the new VHDL standard The changes make VHDL safer

more portable and more powerful VHDL also becomes bigger and more complete The canonical simulator of VHDL is enriched by new mechanisms the predefined environment is more complete and the syntax is more regular and flexible Discrepancies and known bugs of VHDL 87 have been fixed However the new VHDL 92 is compatible with VHDL 87 with some minor exceptions This book presents the new VHDL 92 for the VHDL designer New features are explained and classified Examples are provided each new feature is given a rationale and its impact on design methodology and performance is analysed Where appropriate pitfalls and traps are explained The VHDL designer will quickly be able to find the feature needed to evaluate the benefits it brings to modify previous VHDL 87 code to make it more efficient more portable and more flexible VHDL 92 is the essential update for all VHDL designers and managers involved in electronic design

Hardware Annealing in Analog VLSI Neurocomputing Bank W. Lee, Bing J. Sheu, 2012-12-06 Rapid advances in neural sciences and VLSI design technologies have provided an excellent means to boost the computational capability and efficiency of data and signal processing tasks by several orders of magnitude With massively parallel processing capabilities artificial neural networks can be used to solve many engineering and scientific problems Due to the optimized data communication structure for artificial intelligence applications a neurocomputer is considered as the most promising sixth generation computing machine Typical applications of artificial neural networks include associative memory pattern classification early vision processing speech recognition image data compression and intelligent robot control VLSI neural circuits play an important role in exploring and exploiting the rich properties of artificial neural networks by using programmable synapses and gain adjustable neurons Basic building blocks of the analog VLSI neural networks consist of operational amplifiers as electronic neurons and synthesized resistors as electronic synapses The synapse weight information can be stored in the dynamically refreshed capacitors for medium term storage or in the floating gate of an EEPROM cell for long term storage The feedback path in the amplifier can continuously change the output neuron operation from the unity gain configuration to a high gain configuration The adjustability of the voltage gain in the output neurons allows the implementation of hardware annealing in analog VLSI neural chips to find optimal solutions very efficiently Both supervised learning and unsupervised learning can be implemented by using the programmable neural chips

High-Level System Modeling Ronald Waxman, Jean-Michel Bergé, Oz Levia, Jacques Rouillard, 2012-12-06 In system design generation of high level abstract models that can be closely associated with evolving lower level models provides designers with the ability to incrementally test an evolving design against a model of a specification Such high level models may deal with areas such as performance reliability availability maintainability and system safety Abstract models also allow exploration of the hardware versus software design space in an incremental fashion as a fuller detailed design unfolds leaving behind the old practice of hardware software binding too early in the design process Such models may also allow the inclusion of non functional aspects of design e.g. space power heat in a simulatable information model dealing with the system's operation This book addresses Model Generation and Application

specifically in the following domains Specification modeling linking object data modeling behavior modeling and activity modeling Operational specification modeling modeling the way the system is supposed to operate from a user's viewpoint Linking non functional parameters with specification models Hybrid modeling linking performance and functional elements Application of high level modeling to hardware software approaches Mathematical analysis techniques related to the modeling approaches Reliability modeling Applications of High Level Modeling Reducing High Level Modeling to Practice High Level System Modeling Specification and Design Methodologies describes the latest research and practice in the modeling of electronic systems and as such is an important update for all researchers design engineers and technical managers working in design automation and circuit design

Formal Semantics for VHDL Carlos Delgado Kloos, P. Breuer, 2012-12-06 It is recognized that formal design and verification methods are an important requirement for the attainment of high quality system designs The field has evolved enormously during the last few years resulting in the fact that formal design and verification methods are nowadays supported by several tools both commercial and academic If different tools and users are to generate and read the same language then it is necessary that the same semantics is assigned by them to all constructs and elements of the language The current IEEE standard VHDL language reference manual LRM tries to define VHDL as well as possible in a descriptive way explaining the semantics in English But rigor and clarity are very hard to maintain in a semantics defined in this way and that has already given rise to many misconceptions and contradictory interpretations Formal Semantics for VHDL is the first book that puts forward a cohesive set of semantics for the VHDL language The chapters describe several semantics each based on a different underlying formalism two of them use Petri nets as target language and two of them higher order logic Two use functional concepts and finally another uses the concept of evolving algebras Formal Semantics for VHDL is essential reading for researchers in formal methods and can be used as a text for an advanced course on the subject

Monte Carlo Device Simulation Karl Hess, 2012-12-06 Monte Carlo simulation is now a well established method for studying semiconductor devices and is particularly well suited to highlighting physical mechanisms and exploring material properties Not surprisingly the more completely the material properties are built into the simulation up to and including the use of a full band structure the more powerful is the method Indeed it is now becoming increasingly clear that phenomena such as reliability related hot electron effects in MOSFETs cannot be understood satisfactorily without using full band Monte Carlo The IBM simulator DAMOCLES therefore represents a landmark of great significance DAMOCLES sums up the total of Monte Carlo device modeling experience of the past and reaches with its capabilities and opportunities into the distant future This book therefore begins with a description of the IBM simulator The second chapter gives an advanced introduction to the physical basis for Monte Carlo simulations and an outlook on why complex effects such as collisional broadening and intracollisional field effects can be important and how they can be included in the simulations References to more basic introductory material can

be found throughout describes a typical relationship of Monte Carlo simulations to experimental data and indicates a major difficulty the vast number of deformation potentials required to simulate transport throughout the entire Brillouin zone The fourth chapter addresses possible further extensions of the Monte Carlo approach and subtleties of the electron-electron interaction

High-Level VLSI Synthesis Raul Camposano, Wayne Wolf, 2012-12-06 The time has come for high level synthesis When research into synthesizing hardware from abstract program like descriptions started in the early 1970 s there was no automated path from the register transfer design produced by high level synthesis to a complete hardware implementation As a result it was very difficult to measure the effectiveness of high level synthesis methods it was also hard to justify to users the need to automate architecture design when low level design had to be completed manually Today s more mature CAD techniques help close the gap between an automatically synthesized design and a manufacturable design Market pressures encourage designers to make use of any and all automated tools Layout synthesis logic synthesis and specialized datapath generators make it feasible to quickly implement a register transfer design in silicon leaving designers more time to consider architectural improvements As IC design becomes more automated customers are increasing their demands today s leading edge designers using logic synthesis systems are training themselves to be tomorrow s consumers of high level synthesis systems The need for very fast turnaround a competitive fabrication market Which makes small quantity ASIC manufacturing possible and the ever growing complexity of the systems being designed all make higher level design automation inevitable

Synchronization Design for Digital Systems Teresa H. Meng, 2012-12-06

Synchronization is one of the important issues in digital system design While other approaches have always been intriguing up until now synchronous operation using a common clock has been the dominant design philosophy However we have reached the point with advances in technology where other options should be given serious consideration This is because the clock periods are getting much smaller in relation to the interconnect propagation delays even within a single chip and certainly at the board and backplane level To a large extent this problem can be overcome with careful clock distribution in synchronous design and tools for computer aided design of clock distribution However this places global constraints on the design making it necessary for example to redesign the clock distribution each time any part of the system is changed In this book some alternative approaches to synchronization in digital system design are described and developed We owe these techniques to a long history of effort in both digital system design and in digital communications the latter field being relevant because large propagation delays have always been a dominant consideration in design While synchronous design is discussed and contrasted to the other techniques in Chapter 6 the dominant theme of this book is alternative approaches

VLSI Design of Neural Networks Ulrich Ramacher, Ulrich Rückert, 2012-12-06 The early era of neural network hardware design starting at 1985 was mainly technology driven Designers used almost exclusively analog signal processing concepts for the recall mode Learning was deemed not to cause a problem because the number of implementable synapses was still so

low that the determination of weights and thresholds could be left to conventional computers. Instead designers tried to directly map neural parallelity into hardware. The architectural concepts were accordingly simple and produced the so called interconnection problem which in turn made many engineers believe it could be solved by optical implementation in adequate fashion only. Furthermore the inherent fault tolerance and limited computation accuracy of neural networks were claimed to justify that little effort is to be spend on careful design but most effort be put on technology issues. As a result it was almost impossible to predict whether an electronic neural network would function in the way it was simulated to do. This limited the use of the first neuro chips for further experimentation not to mention that real world applications called for much more synapses than could be implemented on a single chip at that time. Meanwhile matters have matured. It is recognized that isolated definition of the effort of analog multiplication for instance would be just as inappropriate on the part of the chip designer as determination of the weights by simulation without allowing for the computing accuracy that can be achieved on the part of the user.

FM'99 - Formal Methods Jeannette M. Wing, Jim Woodcock, Jim Davies, 2003-07-31
Formal methods are coming of age. Mathematical techniques and tools are now regarded as an important part of the development process in a wide range of industrial and governmental organisations. A transfer of technology into the mainstream of systems development is slowly but surely taking place. FM 99 the First World Congress on Formal Methods in the Development of Computing Systems is a result and a measure of this new found maturity. It brings an impressive array of industrial and applications oriented papers that show how formal methods have been used to tackle real problems. These proceedings are a record of the technical symposium of FM 99 also side the papers describing applications of formal methods you will find technical reports, papers and abstracts detailing new advances in formal techniques from mathematical foundations to practical tools. The World Congress is the successor to the four Formal Methods Europe Symposia which in turn succeeded the four VDM Europe Symposia. This session reflects an increasing openness within the international community of researchers and practitioners. Papers were submitted covering a wide variety of formal methods and application areas. The programme committee reflects the Congress's international nature with a membership of 84 leading researchers from 38 different countries. The committee was divided into 19 tracks each with its own chair to oversee the reviewing process. Our collective task was a difficult one there were 259 high quality submissions from 35 different countries.

Neural Networks and Speech Processing David P. Morgan, Christopher L. Scofield, 2012-12-06
We would like to take this opportunity to thank all of those individuals who helped us assemble this text including the people of Lockheed Sanders and Nestor Inc whose encouragement and support were greatly appreciated. In addition we would like to thank the members of the Laboratory for Engineering Man Machine Systems LEMS and the Center for Neural Science at Brown University for their frequent and helpful discussions on a number of topics discussed in this text. Although we both attended Brown from 1983 to 1985 and had offices in the same building it is surprising that we did not meet until 1988. We also wish to thank Kluwer Academic

Publishers for their professionalism and patience and the reviewers for their constructive criticism Thanks to John McCarthy for performing the final proof and to John Adcock Chip Bachmann Deborah Farrow Nathan Intrator Michael Perrone Ed Real Lance Riek and Paul Zeman for their comments and assistance We would also like to thank Khrisna Nathan our most unbiased and critical reviewer for his suggestions for improving the content and accuracy of this text A special thanks goes to Steve Hoffman who was instrumental in helping us perform the experiments described in Chapter 9

Digital Speech Processing A. Nejat Ince, 2013-03-09 After almost three scores of years of basic and applied research the field of speech processing is at present undergoing a rapid growth in terms of both performance and applications and this is fuelled by the advances being made in the areas of microelectronics computation and algorithm design Speech processing relates to three aspects of voice communications Speech Coding and transmission which is mainly concerned with man to man voice communication Speech Synthesis which deals with machine to man communication Speech Recognition which is related to man to machine communication Widespread application and use of low bit rate voice codec synthesizers and recognizers which are all speech processing products requires ideally internationally accepted quality assessment and evaluation methods as well as speech processing standards so that they may be interconnected and used independently of their designers and manufacturers without costly interfaces This book presents in a tutorial manner both fundamental and applied aspects of the above topics which have been prepared by well known specialists in their respective areas The book is based on lectures which were sponsored by AGARD NATO and delivered by the authors in several NATO countries to audiences consisting mainly of academic and industrial R D engineers and physicists as well as civil and military C3I systems planners and designers

Integrating Functional and Temporal Domains in Logic Design Patrick C. McGeer, Robert K. Brayton, 2012-12-06 This book is an extension of one author's doctoral thesis on the false path problem The work was begun with the idea of systematizing the various solutions to the false path problem that had been proposed in the literature with a view to determining the computational expense of each versus the gain in accuracy However it became clear that some of the proposed approaches in the literature were wrong in that they underestimated the critical delay of some circuits under reasonable conditions Further some other approaches were vague and so of questionable accuracy The focus of the research therefore shifted to establishing a theory the viability theory and algorithms which could be guaranteed correct and then using this theory to justify or not existing approaches Our quest was successful enough to justify presenting the full details in a book After it was discovered that some existing approaches were wrong it became apparent that the root of the difficulties lay in the attempts to balance computational efficiency and accuracy by separating the temporal and logical or functional behaviour of combinational circuits This separation is the fruit of several unstated assumptions first that one can ignore the logical relationships of wires in a network when considering timing behaviour and second that one can ignore timing considerations when attempting to discover the values of wires in a circuit

Symbolic Analysis for Automated Design

of Analog Integrated Circuits Georges Gielen, Willy M.C. Sansen, 2012-12-06 It is a great honor to provide a few words of introduction for Dr Georges Gielen and Prof Willy Sansen's book *Symbolic analysis for automated design of analog integrated circuits*. The symbolic analysis method presented in this book represents a significant step forward in the area of analog circuit design. As demonstrated in this book, symbolic analysis opens up new possibilities for the development of computer aided design CAD tools that can analyze an analog circuit topology and automatically size the components for a given set of specifications. Symbolic analysis even has the potential to improve the training of young analog circuit designers and to guide more experienced designers through second order phenomena such as distortion. This book can also serve as an excellent reference for researchers in the analog circuit design area and creators of CAD tools as it provides a comprehensive overview and comparison of various approaches for analog circuit design automation and an extensive bibliography. The world is essentially analog in nature hence most electronic systems involve both analog and digital circuitry. As the number of transistors that can be integrated on a single integrated circuit IC substrate steadily increases over time an ever increasing number of systems will be implemented with one or a few very complex ICs because of their lower production costs.

The Design of Communicating Systems C.J. Koomen, 2012-12-06 The professional schools will resume their professional responsibilities just to the degree that they can discover a science of design a body of intellectually tough partly formalizable partly empirical teachable doctrine about the design process. H.A. Simon 1968 Design is aimed at the transformation or translation of a specification or high level description into a description in terms of some real world primitives. As such it involves the removal of the uncertainty about the way in which a required system can be realized. To optimally support the design of systems we must look at the design process as a whole and at the strong relationship that exists between a designer the applied design method the required design tools and the ways in which designs can be expressed. This book focuses on that relationship. The application field we are concerned with is the design of systems in which the communication between system elements is a major design feature. Examples of such communicating systems are communication protocols telephone exchange control systems process control systems highly modular systems embedded software interactive systems and VLSI systems. In summary we are concerned with systems in which concurrency plays a major role. Concurrency defines the mutual relationship between the activities in the different parts of a system or within a collection of systems.

Computational Electronics Karl Hess, J.P. Leburton, U. Ravaioli, 2013-03-14 Large computational resources are of ever increasing importance for the simulation of semiconductor processes devices and integrated circuits. The Workshop on Computational Electronics was intended to be a forum for the discussion of the state of the art of device simulation. Three major research areas were covered: conventional simulations based on the drift diffusion and the hydrodynamic models Monte Carlo methods and other techniques for the solution of the Boltzmann transport equation and computational approaches to quantum transport which are relevant to novel devices based on quantum interference and

resonant tunneling phenomena Our goal was to bring together researchers from various disciplines that contribute to the advancement of device simulation These include Computer Science Electrical Engineering Applied Physics and Applied Mathematics The success of this multidisciplinary formula was proven by numerous interactions which took place at the Workshop and during the following three day Short Course on Computational Electronics The format of the course including a number of tutorial lectures and the large attendance of graduate students stimulated many discussions and has proven to us once more the importance of cross fertilization between the different disciplines

VHDL for Simulation, Synthesis and Formal Proofs of Hardware Jean Mermet, 2012-12-06 The success of VHDL since it has been balloted in 1987 as an IEEE standard may look incomprehensible to the large population of hardware designers who had never heard of Hardware Description Languages before for at least 90% of them as well as to the few hundreds of specialists who had been working on these languages for a long time 25 years for some of them Until 1988 only a very small subset of designers in a few large companies were used to describe their designs using a proprietary HDL or sometimes a HDL inherited from a University when some software environment happened to be developed around it allowing usability by third parties A number of benefits were definitely recognized to this practice such as functional verification of a specification through simulation first performance evaluation of a tentative design and sometimes automatic microprogram generation or even automatic high level synthesis As there was apparently no market for HDLs the ECAD vendors did not care about them start up companies were seldom able to survive in this area and large users of proprietary tools were spending more and more people and money just to maintain their internal system

Iterative Identification and Restoration of Images Reginald L. Lagendijk, Jan Biemond, 2012-12-06 One of the most intriguing questions in image processing is the problem of recovering the desired or perfect image from a degraded version In many instances one has the feeling that the degradations in the image are such that relevant information is close to being recognizable if only the image could be sharpened just a little This monograph discusses the two essential steps by which this can be achieved namely the topics of image identification and restoration More specifically the goal of image identification is to estimate the properties of the imperfect imaging system blur from the observed degraded image together with some statistical characteristics of the noise and the original uncorrupted image On the basis of these properties the image restoration process computes an estimate of the original image Although there are many textbooks addressing the image identification and restoration problem in a general image processing setting there are hardly any texts which give an indepth treatment of the state of the art in this field This monograph discusses iterative procedures for identifying and restoring images which have been degraded by a linear spatially invariant blur and additive white observation noise As opposed to non iterative methods iterative schemes are able to solve the image restoration problem when formulated as a constrained and spatially variant optimization problem In this way restoration results can be obtained which outperform the best results of conventional restoration filters

Subband Image Coding John W.

Woods, 2013-06-29 This book concerns a new method of image data compression which will may supplant the well established block transform methods that have been state of the art for the last 15 years Subband image coding or SBC was first performed as such in 1985 and as the results became known at first through conference proceedings and later through journal papers the research community became excited about both the theoretical and practical aspects of this new approach This excitement is continuing today with many major research laboratories and research universities around the world investigating the subband approach to coding of color images high resolution images video including video conferencing and advanced television and the medical application of picture archiving systems Much of the fruits of this work is summarized in the eight chapters of this book which were written by leading practitioners in this field The subband approach to image coding starts by passing the image through a two or three dimensional filter bank The two dimensional 2 D case usually is hierarchical consisting of two stages of four filters each Thus the original image is split into 16 subband images with each one decimated or subsampled by 4x4 resulting in a data conservation The individual channel data is then quantized for digital transmission In an attractive variation an octave like approach herein termed subband pyramid is taken for the decomposition resulting in a total of just eleven subbands

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