

Handshake Circuits

An asynchronous
architecture for VLSI
programming

Kees van Berkel



Cambridge International Series
on Parallel Computation

5

Handshake Circuits An Asynchronous Architecture For Vlsi Programming

Wojciech Penczek, Grzegorz Rozenberg



Handshake Circuits An Asynchronous Architecture For Vlsi Programming:

Handshake Circuits Kees van Berkel, 1993 This volume describes a programming approach to the design of digital VLSI circuits Programs written in the VLSI programming language Tangram can be compiled automatically in full asynchronous delay insensitive circuits Handshake circuits serve as an intermediary in this translation separating programming concerns from concerns of efficient VLSI circuit implementation Handshake circuits have been invented by Kees van Berkel and were further developed at Philips Research Laboratories The book presents a mathematical theory of handshake circuits and a silicon compiler supported by a correctness proof The treatment of VLSI realizations of handshake circuits includes various forms of optimization handshake refinement message encoding circuit initialization and testing The approach is illustrated by a host of examples drawn from a wide range of application areas including FIFO queues shift registers FIR filters median filters block sorters a greatest common divisor modulo N counters stacks a nacking arbiter and a simple processor The treatment of these examples emphasizes concerns for circuit cost performance and power consumption The book includes an evaluation of a compiled and fabricated IC

A Designer's Guide to Asynchronous VLSI Peter A. Beerel, Recep O. Ozdag, Marcos Ferretti, 2010-02-04 Create low power higher performance circuits with shorter design times using this practical guide to asynchronous design This practical alternative to conventional synchronous design enables performance close to full custom designs with design times that approach commercially available ASIC standard cell flows It includes design trade offs specific design examples and end of chapter exercises Emphasis throughout is placed on practical techniques and real world applications making this ideal for circuit design students interested in alternative design styles and system on chip circuits as well as circuit designers in industry who need new solutions to old problems

Asynchronous Circuit Design Chris J. Myers, 2004-04-05 With asynchronous circuit design becoming a powerful tool in the development of new digital systems circuit designers are expected to have asynchronous design skills and be able to leverage them to reduce power consumption and increase system speed This book walks readers through all of the different methodologies of asynchronous circuit design emphasizing practical techniques and real world applications instead of theoretical simulation The only guide of its kind it also features an ftp site complete with support materials Market Electrical Engineers Computer Scientists Device Designers and Developers in industry An Instructor Support FTP site is available from the Wiley editorial department

Design Automation of Real-Life Asynchronous Devices and Systems Alexander Taubin, Jordi Cortadella, Luciano Lavagno, 2007 The number of gates on a chip is quickly growing toward and beyond the one billion mark Keeping all the gates running at the beat of a single or a few rationally related clocks is becoming impossible In static timing analysis process variations and signal integrity issues stretch the timing margins to the point where they become too conservative and result in significant overdesign Importance and difficulty of such problems push some developers to once again turn to asynchronous alternatives However the electronics industry for the most part is still reluctant to adopt

asynchronous design with a few notable exceptions due to a common belief that we still lack a commercial quality Electronic Design Automation tools similar to the synchronous RTL to GDSII flow for asynchronous circuits The purpose of this paper is to counteract this view by presenting design flows that can tackle large designs without significant changes with respect to synchronous design flow We are limiting ourselves to four design flows that we believe to be closest to this goal We start from the Tangram flow because it is the most commercially proven and it is one of the oldest from a methodological point of view The other three flows Null Convention Logic de synchronization and gate level pipelining could be considered together as asynchronous re implementations of synchronous RTL or gate level specifications The main common idea is substituting the global clocks by local synchronizations Their most important aspect is to open the possibility to implement large legacy synchronous designs in an almost push button manner where all asynchronous machinery is hidden so that synchronous RTL designers do not need to be re educated These three flows offer a trade off from very low overhead almost synchronous implementations to very high performance extremely robust dual rail pipelines

Asynchronous System-on-Chip Interconnect John Bainbridge,2013-11-11 Asynchronous System on Chip Interconnect describes the use of an entirely asynchronous system bus for the modular construction of integrated circuits Industry is just awakening to the benefits of asynchronous design in avoiding the problems of clock skew and multiple clock domains and in parallel with this is coming to grips with Intellectual Property IP based design flows which emphasise the need for a flexible interconnect strategy In this book John Bainbridge investigates the design of an asynchronous on chip interconnect looking at all the stages of the design from the choice of wiring layout through asynchronous signalling protocols to the higher level problems involved in supporting split transactions The MARBLE bus the first asynchronous SoC bus used in a commercial demonstrator chip containing a mixture of asynchronous and synchronous macrocells is used as a concrete example throughout the book

Communicating Sequential Processes. The First 25 Years Ali E. Abdallah,2005-05-03 This book commemorates the work done by Tony Hoare and published under the title Communicating Sequential Processes in the 1978 August issue of the Communications of ACM The British Computer Society's specialist group Formal Aspects of Computing Science organized a meeting on July 7 8 2004 in London to mark the occasion of 25 years of CSP The 19 carefully reviewed and revised full papers by leading researchers celebrate reflect upon and look beyond the first quarter century of CSP's contributions to computer science The papers explore the impact of CSP on many areas ranging from semantics and logic through the design of parallel programming languages to applications varying from distributed software and parallel computing to information security Web services and concurrent hardware circuits

Completion Detection in Asynchronous Circuits Pallavi Srivastava,2022-11-08 This book is intended for designers with experience in traditional clocked circuit design seeking information about asynchronous circuit design in order to determine if it would be advantageous to adopt asynchronous methodologies in their next design project The author introduces a generic approach for implementing a deterministic

completion detection scheme for asynchronous bundled data circuits that incorporates a data dependent computational process taking advantage of the average case delay The author validates the architecture using a barrel shifter as shifting is the basic operation required by all the processors The generic architecture proposed in this book for a deterministic completion detection scheme for bundled data circuits will facilitate researchers in considering the asynchronous design style for developing digital circuits

Principles of Asynchronous Circuit Design Jens Sparsø, Steve Furber, 2013-04-17

Principles of Asynchronous Circuit Design A Systems Perspective addresses the need for an introductory text on asynchronous circuit design Part I is an 8 chapter tutorial which addresses the most important issues for the beginner including how to think about asynchronous systems Part II is a 4 chapter introduction to Balsa a freely available synthesis system for asynchronous circuits which will enable the reader to get hands on experience of designing high level asynchronous systems Part III offers a number of examples of state of the art asynchronous systems to illustrate what can be built using asynchronous techniques The examples range from a complete commercial smart card chip to complex microprocessors The objective in writing this book has been to enable industrial designers with a background in conventional clocked design to be able to understand asynchronous design sufficiently to assess what it has to offer and whether it might be advantageous in their next design task

Asynchronous Digital Circuit Design Graham Birtwistle, Alan Davis, 2013-04-17

As the costs of power and timing become increasingly difficult to manage in traditional synchronous systems designers are being forced to look at asynchronous alternatives Based on reworked and expanded papers from the VII Banff Higher Order Workshop this volume examines asynchronous methods which have been used in large circuit design ranging from initial formal specification to more standard finite state machine based control models Written by leading practitioners in the area the papers cover many aspects of current practice including practical design silicon compilation and applications of formal specification It also includes a state of the art survey of asynchronous hardware design The resulting volume will be invaluable to anyone interested in designing correct asynchronous circuits which exhibit high performance or low power operation

Mathematics of Program Construction Johan Jeuring, 1998-05-27

This book constitutes the refereed proceedings of the 4th International Conference on Mathematics of Program Construction MPC 98 held in Marstrand near Goteborg Sweden in June 1998 The 17 revised full papers presented were selected from 57 submissions also included are three invited contributions The volume is devoted to the use of crisp clear mathematics in the discovery and design of algorithms and in the development of corresponding software and hardware various approaches to formal methods for systems design and analysis are covered

VLSI: Integrated Systems on Silicon Ricardo A. Reis, Luc Claesen, 2013-06-05

This book contains the papers that have been presented at the ninth Very Large Scale Integrated Systems conference VLSI 97 that is organized biannually by IFIP Working Group 10.5 It took place at Hotel Serra Azul in Gramado Brazil from 26-30 August 1997 Previous conferences have taken place in Edinburgh Trondheim Vancouver Munich

Grenoble and Tokyo The papers in this book report on all aspects of importance to the design of the current and future integrated systems The current trend towards the realization of versatile Systems on a Chip require attention of embedded hardware software systems dedicated ASIC hardware sensors and actuators mixed analog digital design video and image processing low power battery operation and wireless communication The papers as presented in Jhis book have been organized in two tracks where one is dealing with VLSI System Design and Applications and the other presents VLSI Design Methods and CAD The following topics are addressed VLSI System Design and Applications Track VLSI for Video and Image Processing Microsystem and Mixed mode design Communication And Memory System Design Cow voltage Low power Analog Circuits High Speed Circuit Techniques Application Specific DSP Architectures VLSI Design Methods and CAD Track Specification and Simulation at System Level Synthesis and Technology Mapping CAD Techniques for Low Power Design Physical Design Issues in Sub micron Technologies Architectural Design and Synthesis Testing in Complex Mixed Analog and Digital Systems

Sequential Optimization of Asynchronous and Synchronous Finite-State Machines Robert M. Fuhrer, Steven M. Nowick, 2012-12-06 Asynchronous or unclocked digital systems have several potential advantages over their synchronous counterparts In particular they address a number of challenging problems faced by the designers of large scale synchronous digital systems power consumption worst case timing constraints and engineering and design reuse issues associated with the use of a fixed rate global clock Moreover while for synchronous systems these problems are exacerbated by increasing system size asynchronous systems promise to scale more gracefully Sequential Optimization of Asynchronous and Synchronous Finite State Machines Algorithms and Tools makes three contributions to the field of sequential optimization for finite state machines 1 it introduces several new provably optimal algorithms for the synthesis and optimization of asynchronous finite state machines FSMs 2 it presents practical software implementations of each of these algorithms and 3 it introduces a complete new CAD package called MINIMALIST binding these tools into a state of the art technology independent synthesis path for burst mode asynchronous circuits Throughout this book real world industrial designs are used as benchmark circuits to validate the usefulness of the tools As an additional benefit some of the theory and tools also provide new methods for the optimization of synchronous FSMs

Programming Methodology Annabelle McIver, Carroll Morgan, 2002-10-01 Written by the members of the IFIP Working Group 2 3 Programming Methodology this text constitutes an exciting reference on the front line of research activity in programming methodology The range of subjects reflects the current interests of the members and will offer insightful and controversial opinions on modern programming methods and practice The material is arranged in thematic sections each one introduced by a problem which epitomizes the spirit of that topic The exemplary problem will encourage vigorous discussion and will form the basis for an introduction tutorial for its section

Embedded Systems Specification and Design Languages Eugenio Villar, 2008-05-15 This book is the latest contribution to the Chip Design Languages series and it consists of selected papers presented at the

Forum on Specifications and Design Languages FDL 07 in September 2007 The book represents the state of the art in research and practice and it identifies new research directions It highlights the role of specification and modelling languages and presents practical experiences with specification and modelling languages Asynchronous Circuits Janusz A. Brzozowski, Carl-Johan H. Seger, 2012-12-06 Although asynchronous circuits date back to the early 1950s most of the digital circuits in use today are synchronous because traditionally asynchronous circuits have been viewed as difficult to understand and design In recent years however there has been a great surge of interest in asynchronous circuits largely through the development of new asynchronous design methodologies This book provides a comprehensive theory of asynchronous circuits including modelling analysis simulation specification verification and an introduction to their design It is based on courses given to graduate students and will be suitable for computer scientists and engineers involved in the research and development of asynchronous designs

Applications and Theory of Petri Nets 2004 Jordi Cortadella, Wolfgang Reisig, 2004-06-15 This book constitutes the refereed proceedings of the 25th International Conference on Applications and Theory of Petri Nets ICATPN 2004 held in Bologna Italy in June 2004 The 19 revised full regular papers and 5 revised tool presentation papers presented together with 6 invited papers were carefully reviewed and selected from 62 submissions All current issues on research and development in the area of Petri nets are addressed in particular concurrent systems design and analysis modular systems development formal specification model validation model checking workflow management flow charts networking formal methods in software engineering etc Half a Century of Inspirational Research Wojciech Penczek, Grzegorz Rozenberg, 2007 Honors Professor Antoni Mazurkiewicz who during his long scientific career made fundamental contributions to theoretical computer science This book includes contributions which span a range of research areas including the theory of programming models of concurrent and distributed systems and decomposition methods for Petri nets

VLSI-SOC: From Systems to Chips Manfred Glesner, 2006-05-17 This book contains extended and revised versions of the best papers that have been presented during the twelfth edition of the IFIP TC10 WG10.5 International Conference on Very Large Scale Integration a Global System on a Chip Design CAD Conference The 12 edition was held at the Lufthansa Training Center in Seeheim-Jugenheim south of Darmstadt Germany December 1-3 2003 Previous conferences have taken place in Edinburgh 81 Trondheim 83 Tokyo 85 Vancouver 87 Munich 89 Edinburgh 91 Grenoble 93 Tokyo 95 Gramado 97 Lisbon 99 and Montpellier 01 The purpose of this conference sponsored by IFIP TC 10 Working Group 10.5 is to provide a forum to exchange ideas and show research results in the field of microelectronics design The current trend toward increasing chip integration brings about exhilarating new challenges both at the physical and system design levels this conference aims to address these exciting new issues The 2003 edition of VLSI SoC conserved the traditional structure which has been successful in previous editions The quality of submissions 142 papers made the selection process difficult but finally 57 papers and 14 posters were accepted for presentation in VLSI SoC 2003 Submissions came from Austria Bulgaria Brazil

Canada Egypt England Estonia Finland France Germany Greece Hungary India Iran Israel Italy Japan Korea Malaysia Mexico Netherlands Poland Portugal Romania Spain Sweden Taiwan and the United States of America From 57 papers presented at the conference 18 were selected to have an extended and revised version included in this book **System-on-Chip**

Methodologies & Design Languages Peter J. Ashenden, Jean Mermet, Ralf Seepold, 2013-03-14 System on Chip

Methodologies the Forum on Design Languages FDL held in Europe and the Asia Pacific Chip Design Language APChDL Conference The papers cover a range of topics including design methods specification and modeling languages tool issues formal verification simulation and synthesis The results presented in these papers will help researchers and practicing engineers keep abreast of developments in this rapidly evolving field *Petri Nets and Other Models of Concurrency -*

ICATPN 2007 Jetty Kleijn, Alex Yakovlev, 2007-07-05 This book constitutes the refereed proceedings of the 28th International Conference on Applications and Theory of Petri Nets and Other Models of Concurrency ICATPN 2007 held in Siedlce Poland It covers all current issues on research and development in the area of Petri nets and modeling of concurrent systems including system design and verification structure and behavior of nets logical and algebraic calculi and standardization of nets

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Table of Contents Handshake Circuits An Asynchronous Architecture For Vlsi Programming

1. Understanding the eBook Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - The Rise of Digital Reading Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Advantages of eBooks Over Traditional Books
2. Identifying Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - User-Friendly Interface
4. Exploring eBook Recommendations from Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Personalized Recommendations
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming User Reviews and Ratings
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming and Bestseller Lists

5. Accessing Handshake Circuits An Asynchronous Architecture For Vlsi Programming Free and Paid eBooks
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming Public Domain eBooks
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming eBook Subscription Services
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming Budget-Friendly Options
6. Navigating Handshake Circuits An Asynchronous Architecture For Vlsi Programming eBook Formats
 - ePub, PDF, MOBI, and More
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming Compatibility with Devices
 - Handshake Circuits An Asynchronous Architecture For Vlsi Programming Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Highlighting and Note-Taking Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Interactive Elements Handshake Circuits An Asynchronous Architecture For Vlsi Programming
8. Staying Engaged with Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Handshake Circuits An Asynchronous Architecture For Vlsi Programming
9. Balancing eBooks and Physical Books Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Handshake Circuits An Asynchronous Architecture For Vlsi Programming
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Setting Reading Goals Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Fact-Checking eBook Content of Handshake Circuits An Asynchronous Architecture For Vlsi Programming
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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