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Project 6128 - FORMAT - Volume 1

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**Practical
Formal Methods
for Hardware Design**



Springer

Practical Formal Methods For Hardware Design

Michael G. Hinchey, Jonathan P. Bowen



Practical Formal Methods For Hardware Design:

Practical Formal Methods for Hardware Design Carlos Delgado Kloos, Werner Damm, 2012-12-06 Formal methods for hardware design still find limited use in industry Yet current practice has to change to cope with decreasing design times and increasing quality requirements This research report presents results from the Esprit project FORMAT formal methods in hardware verification which involved the collaboration of the enterprises Siemens Italtel Telefonica I D TGI and AHL the research institute OFFIS and the universities of Madrid and Passau The work presented involves advanced specification languages for hardware design that are intuitive to the designer like timing diagrams and state based languages as well as their relation to VHDL and formal languages like temporal logic and a process algebraic calculus The results of experimental tests of the tools are also presented Practical Formal Methods for Hardware Design. Project 6128 · FORMAT · Volume 1

,1997 Formal Methods for Hardware Verification Marco Bernardo, Alessandro Cimatti, 2006-05-15 This book presents 8 papers accompanying the lectures of leading researchers given at the 6th edition of the International School on Formal Methods for the Design of Computer Communication and Software Systems SFM 2006 SFM 2006 was devoted to formal techniques for hardware verification and covers several aspects of the hardware design process including hardware design languages and simulation property specification formalisms automatic test pattern generation symbolic trajectory evaluation and more *Industrial-Strength Formal Methods in Practice* Michael G. Hinchey, Jonathan P. Bowen, 2012-12-06 Industrial

Strength Formal Methods in Practice provides hands on experience and guidance for anyone who needs to apply formal methods successfully in an industrial context Each chapter is written by an expert in software engineering or formal methods and contains background information introductions to the techniques being used actual fragments of formalised components details of results and an analysis of the overall approach It provides specific details on how to produce high quality software that comes in on time and within budget Aimed mainly at practitioners in software engineering and formal methods this book will also be of interest to the following groups academic researchers working in formal methods who are interested in evidence of their success and in how they can be applied on an industrial scale and students on advanced software engineering courses who need real life specifications and examples on which to base their work **Formal Verification of**

Hardware Design Michael Yoeli, 1990 **Correct Hardware Design and Verification Methods** Dominique Borrione, 2005-09-19 This book constitutes the refereed proceedings of the 13th IFIP WG 10.5 Advanced Research Working Conference on Correct Hardware Design and Verification Methods CHARME 2005 held in Saarbrücken Germany in October 2005 The 21 revised full papers and 18 short papers presented together with 2 invited talks and one tutorial were carefully reviewed and selected from 79 submissions The papers are organized in topical sections on functional approaches to design description game solving approaches abstraction algorithms and techniques for speeding DD based verification real time and LTL model checking evaluation of SAT based tools model reduction and verification of memory hierarchy mechanisms

Correct Hardware Design and Verification Methods Laurence Pierre, Thomas Kropf, 2003-07-31 CHARME 99 is the tenth in a series of working conferences devoted to the development and use of leading edge formal techniques and tools for the design and verification of hardware and systems Previous conferences have been held in Darmstadt 1984 Edinburgh 1985 Grenoble 1986 Glasgow 1988 Leuven 1989 Torino 1991 Arles 1993 Frankfurt 1995 and Montreal 1997 This workshop and conference series has been organized in cooperation with IFIP WG 10.5 It is now the biannual counterpart of FMCAD which takes place every even numbered year in the USA The 1999 event took place in Bad Herrenalb a resort village located in the Black Forest close to the city of Karlsruhe The validation of functional and timing behavior is a major bottleneck in current VLSI design systems A predominantly academic area of study until a few years ago formal design and verification techniques are now migrating into industrial use The aim of CHARME 99 is to bring together researchers and users from academia and industry working in this active area of research Two invited talks illustrate major current trends the presentation by Gerard Berry Ecole des Mines de Paris Sophia Antipolis France is concerned with the use of synchronous languages in circuit design and the talk given by Peter Jansen BMW Munich Germany demonstrates an application of formal methods in an industrial environment The program also includes 20 regular presentations and 12 short presentations poster exhibitions that have been selected from the 48 submitted papers

Formal Techniques in Real-Time and Fault-Tolerant Systems Anders P. Ravn, Hans Rischel, 1998-09-02 This book constitutes the refereed proceedings of the 5th International Symposium on Formal Techniques in Real Time and Fault Tolerant Systems FTRTFT 98 held in Lyngby Denmark in September 1998 The 22 revised full papers presented were carefully selected and reviewed for inclusion in the book Also included are four invited contributions and five tool demonstrations The papers address the current aspects of the hot topic of embedded systems in particular temporal logic requirements engineering analysis techniques verification model checking and applications

Correct Hardware Design and Verification Methods George J. Milne, Laurence Pierre, 1993-05-12 These proceedings contain the papers presented at the Advanced Research Working Conference on Correct Hardware Design Methodologies held in Arles France in May 1993 and organized by the ESPRIT Working Group 6018 CHARME 2 and the Universit de Provence Marseille in cooperation with IFIP Working Group 10.2 Formal verification is emerging as a plausible alternative to exhaustive simulation for establishing correct digital hardware designs The validation of functional and timing behavior is a major bottleneck in current VLSI design systems slowing the arrival of products in the marketplace with its associated increase in cost From being a predominantly academic area of study until a few years ago formal design and verification techniques are now beginning to migrate into industrial use As we are now witnessing an increase in activity in this area in both academia and industry the aim of this working conference was to bring together researchers and users from both communities

Practical Design Verification Dhiraj K. Pradhan, Ian G. Harris, 2009-06-11 Improve design efficiency and reduce costs with this practical guide to formal and simulation based functional verification Giving you a theoretical and

practical understanding of the key issues involved expert authors including Wayne Wolf and Dan Gajski explain both formal techniques model checking equivalence checking and simulation based techniques coverage metrics test generation You get insights into practical issues including hardware verification languages HVLs and system level debugging The foundations of formal and simulation based techniques are covered too as are more recent research advances including transaction level modeling and assertion based verification plus the theoretical underpinnings of verification including the use of decision diagrams and Boolean satisfiability SAT

Correct Hardware Design and Verification Methods Tiziana Margaria, Tom Melham, 2003-06-30 This volume contains the proceedings of CHARME 2001 the Eleventh Advanced Research Working Conference on Correct Hardware Design and Verification Methods CHARME 2001 is the 11th in a series of working conferences devoted to the development and use of leading edge formal techniques and tools for the design and verification of hardware and hardware like systems Previous events in the CHARME series were held in Bad Herrenalb 1999 Montreal 1997 Frankfurt 1995 Arles 1993 and Torino 1991 This series of meetings has been organized in cooperation with IFIP WG 10.5 and WG 10.2 Prior meetings stretching back to the earliest days of formal hardware verification were held under various names in Miami 1990 Leuven 1989 Glasgow 1988 Grenoble 1986 Edinburgh 1985 and Darmstadt 1984 The convention is now well established whereby the European CHARME conference alternates with its biennial counterpart the International Conference on Formal Methods in Computer Aided Design FMCAD which is held on even numbered years in the USA The conference took place during 4-7 September 2001 at the Institute for System Level Integration in Livingston Scotland It was co hosted by the Institute and the Department of Computing Science of Glasgow University and co sponsored by the IFIP TC10 WG10.5 Working Group on Design and Engineering of Electronic Systems CHARME 2001 also included a scientific session and social program held jointly with the 14th International Conference on Theorem Proving in Higher Order Logics TPHOLs which was co located in nearby Edinburgh

Formal Methods: State of the Art and New Directions Paul Boca, Jonathan P.

Bowen, Jawed Siddiqi, 2009-12-04 Through fundamental contributions from leading researchers this volume describes the use of formal modeling methods in the areas of requirements design and validation The self contained chapters provide readers with rich background information and a diverse breadth of specialist material

SOFSEM 2001: Theory and Practice of Informatics Leszek Pacholski, Peter Ruzicka, 2003-06-30 SOFSEM 2001 the International Conference on Current Trends in Theory and Practice of Informatics was held on November 24-December 1 2001 in the well known spa Piešťany Slovak Republic This was the 28th annual conference in the SOFSEM series organized either in the Slovak or the Czech Republic SOFSEM has a well established tradition Currently it is a broad multidisciplinary conference devoted to the theory and practice of software systems Its aim is to foster cooperation among professionals from academia and industry working in various areas of informatics The scientific program of SOFSEM consists of invited talks which determine the topics of the conference and short contributed talks presenting original results The topics of the invited talks are chosen so as to cover the

whole range from theory to practice and to bring interesting research areas to the attention of conference participants For the year 2001 the following three directions were chosen for presentation by the SOFSEM Steering Committee Trends in Informatics Enabling Technologies for Global Computing Practical Systems Engineering and Applications The above directions were covered through 12 invited talks presented by prominent researchers There were 18 contributed talks selected by the international Program Committee from among 46 submitted papers The conference was also accompanied by workshops on Electronic Commerce Systems coordinated by H D Zimmermann and Soft Computing coordinated by P H ajek

Introduction to Formal Hardware Verification Thomas Kropf, 2013-03-09 Hardware verification is a hot topic in circuit and system design due to rising circuit complexity This advanced textbook presents an almost complete overview of techniques for hardware verification It covers all approaches used in existing tools such as binary and word level decision diagrams symbolic methods for equivalence checking and temporal logic model checking and introduces the use of higher order logic theorem proving for verifying circuit correctness It enables the reader to understand the advantages and limitations of each technique Each chapter contains an introduction and a summary as well as a section for the advanced reader Thus a broad audience is addressed from beginners in system design to experts Formal Verification of Floating-Point Hardware Design David M. Russinoff, 2018-10-13 This is the first book to focus on the problem of ensuring the correctness of floating point hardware designs through mathematical methods Formal Verification of Floating Point Hardware Design advances a verification methodology based on a unified theory of register transfer logic and floating point arithmetic that has been developed and applied to the formal verification of commercial floating point units over the course of more than two decades during which the author was employed by several major microprocessor design companies The book consists of five parts the first two of which present a rigorous exposition of the general theory based on the first principles of arithmetic Part I covers bit vectors and the bit manipulation primitives integer and fixed point encodings and bit wise logical operations Part II addresses the properties of floating point numbers the formats in which they are encoded as bit vectors and the various modes of floating point rounding In Part III the theory is extended to the analysis of several algorithms and optimization techniques that are commonly used in commercial implementations of elementary arithmetic operations As a basis for the formal verification of such implementations Part IV contains high level specifications of correctness of the basic arithmetic instructions of several major industry standard floating point architectures including all details pertaining to the handling of exceptional conditions Part V illustrates the methodology applying the preceding theory to the comprehensive verification of a state of the art commercial floating point unit All of these results have been formalized in the logic of the ACL2 theorem prover and mechanically checked to ensure their correctness They are presented here however in simple conventional mathematical notation The book presupposes no familiarity with ACL2 logic design or any mathematics beyond basic high school algebra It will be of interest to verification engineers as well as arithmetic circuit

designers who appreciate the value of a rigorous approach to their art and is suitable as a graduate text in computer arithmetic *Formal Methods in Circuit Design* Victoria Stavridou, 1993-07-22 Graduate level account of hardware verification and algebraic specification *Formal Methods in Computer-Aided Design* Alan J. Hu, Andrew K. Martin, 2005-01-18 These are the proceedings of the fifth international conference Formal Methods in Computer Aided Design FMCAD held 15-17 November 2004 in Austin Texas USA The conference provides a forum for presenting state of the art tools methods algorithms and theory for the application of formalized reasoning to all aspects of computer aided system design including specification verification synthesis and testing FMCAD's heritage dates back 20 years to some of the earliest conferences on the subject of formal reasoning and computer aided design Since 1996 FMCAD has assumed its present form held biennially in North America alternating with its sister conference CHARME in Europe We are delighted to report that our research community continues to flourish we received 69 paper submissions with many more high quality papers than we had room to accept After a rigorous review process in which each paper received at least three and typically four or more independent reviews we accepted 29 papers for the conference and inclusion in this volume The conference also included invited talks from Greg Spirakis of Intel Corporation and Wayne Wolf of Princeton University A conference of this size requires the contributions of numerous people On the technical side we are grateful to the program committee and the additional reviewers for their countless hours reviewing submissions and ensuring the intellectual quality of the conference We would also like to thank the steering committee for their wisdom and guidance On the logistical side we thank Christa Mace for designing our website and attending to countless organizational tasks And we thank our corporate sponsors AMD IBM Intel and Synopsys for financial support that helped make this conference possible **Applied Formal Methods - FM-Trends 98** Dieter Hutter, Werner Stephan, Paolo Traverso, Markus Ullmann, 2007-07-21 This volume contains the contributions presented at the International Workshop on Current Trends in Applied Formal Methods organized October 7-9 1998 in Boppard Germany The main objective of the workshop was to draw a map of the key issues facing the practical application of formal methods in industry This appears to be particularly timely with safety and security issues becoming a real obstacle to industrial software and hardware development As a consequence almost all major companies have now set up departments or groups to work with formal methods and many European countries face a severe labour shortage in this new field Tony Hoare's prediction of the art of software and hardware development becoming a proper engineering science with its own body of tools and techniques is now becoming a reality So the focus of this application oriented workshop was not so much on special academic topics but rather on the many practical aspects of this emerging new technology verification and validation and tool support and integration into the software life cycle By evaluating the state of the art with respect to industrial applications a discussion emerged among scientists practising engineers and members of regulatory and funding agencies about future needs and developments This discussion led to roadmaps with respect to the future of

this field to tool support and potential application areas and promising market segments The contributions of the participants from industry as well as from the respective national security bureaus were particularly valuable and highly appreciated

FM'99 - Formal Methods Jeannette M. Wing, Jim Woodcock, Jim Davies, 1999-09-13 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

Computer Aided Verification Orna Grumberg, 1997-06-04 This book constitutes the strictly refereed proceedings of the 9th International Conference on Computer Aided Verification CAV 97 held in Haifa Israel in June 1997 The volume presents 34 revised full papers selected from a total of 84 submissions Also included are 7 invited contributions as well as 12 tool descriptions The volume is dedicated to the theory and practice of computer aided formal methods for software and hardware verification with an emphasis on verification tools and algorithms and the techniques needed for their implementation The book is a unique record documenting the recent progress in the area

Practical Formal Methods For Hardware Design Book Review: Unveiling the Power of Words

In a global driven by information and connectivity, the energy of words has be much more evident than ever. They have the capacity to inspire, provoke, and ignite change. Such could be the essence of the book **Practical Formal Methods For Hardware Design**, a literary masterpiece that delves deep into the significance of words and their effect on our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we will explore the book is key themes, examine its writing style, and analyze its overall effect on readers.

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Practical Formal Methods For Hardware Design Introduction

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