Computer-Aided Reasoning
ACL2 Case Studies

edited by
Matt Kaufmann
Panagiotis Manolios
J Strother Moore

Computer Aided Reasoning Acl2 Case Studies

Manfred Broy,Johannes Gruenbauer,David Harel,Tony Hoare

Computer Aided Reasoning Acl2 Case Studies:

  Computer-Aided Reasoning Matt Kaufmann,Panagiotis Manolios,J Strother Moore,2013-04-17 Computer Aided Reasoning ACL2 Case Studies illustrates how the computer aided reasoning system ACL2 can be used in productive and innovative ways to design build and maintain hardware and software systems Included here are technical papers written by twenty one contributors that report on self contained case studies some of which are sanitized industrial projects The papers deal with a wide variety of ideas including floating point arithmetic microprocessor simulation model checking symbolic trajectory evaluation compilation proof checking real analysis and several others Computer Aided Reasoning ACL2 Case Studies is meant for two audiences those looking for innovative ways to design build and maintain hardware and software systems faster and more reliably and those wishing to learn how to do this The former audience includes project managers and students in survey oriented courses The latter audience includes students and professionals pursuing rigorous approaches to hardware and software engineering or formal methods Computer Aided Reasoning ACL2 Case Studies can be used in graduate and upper division undergraduate courses on Software Engineering Formal Methods Hardware Design Theory of Computation Artificial Intelligence and Automated Reasoning The book is divided into two parts Part I begins with a discussion of the effort involved in using ACL2 It also contains a brief introduction to the ACL2 logic and its mechanization which is intended to give the reader sufficient background to read the case studies A more thorough textbook introduction to ACL2 may be found in the companion book Computer Aided Reasoning An Approach The heart of the book is Part II where the case studies are presented The case studies contain exercises whose solutions are on the Web In addition the complete ACL2 scripts necessary to formalize the models and prove all the properties discussed are on the Web For example when we say that one of the case studies formalizes a floating point multiplier and proves it correct we mean that not only can you read an English description of the model and how it was proved correct but you can obtain the entire formal content of the project and replay the proofs if you wish with your copy of ACL2 ACL2 may be obtained from its home page The results reported in each case study as ACL2 input scripts as well as exercise solutions for both books are available from this page

  Computer-Aided Reasoning Matt Kaufmann,Panagiotis Manolios,J Strother Moore,2012-12-06 Computer Aided Reasoning An Approach is a textbook introduction to computer aided reasoning It can be used in graduate and upper division undergraduate courses on software engineering or formal methods It is also suitable in conjunction with other books in courses on hardware design discrete mathematics or theory especially courses stressing formalism rigor or mechanized support It is also appropriate for courses on artificial intelligence or automated reasoning and as a reference for business and industry Current hardware and software systems are often very complex and the trend is towards increased complexity Many of these systems are of critical importance therefore making sure that they behave as expected is also of critical importance By modeling computing systems mathematically we obtain models that we can prove behave correctly The complexity of

computing systems makes such proofs very long complicated and error prone To further increase confidence in our reasoning we can use a computer program to check our proofs and even to automate some of their construction In this book we present A practical functional programming language closely related to Common Lisp which is used to define functions which can model computing systems and to make assertions about defined functions A formal logic in which defined functions correspond to axioms the logic is first order includes induction and allows us to prove theorems about the functions The computer aided reasoning system ACL2 which includes the programming language the logic and mechanical support for the proof process The ACL2 system has been successfully applied to projects of commercial interest including microprocessor modeling hardware verification microcode verification and software verification This book gives a methodology for modeling computing systems formally and for reasoning about those models with mechanized assistance The practicality of computer aided reasoning is further demonstrated in the companion book Computer Aided Reasoning ACL2 Case Studies Approximately 140 exercises are distributed throughout the book Additional material is freely available from the ACL2 home page on the Web including solutions to the exercises additional exercises case studies from the companion book research papers and the ACL2 system with detailed documentation **Computer-Aided Reasoning** Matt Kaufmann,Panagiotis Manolios,J Strother Moore,2000-06-30 Computer Aided Reasoning ACL2 Case Studies illustrates how the computer aided reasoning system ACL2 can be used in productive and innovative ways to design build and maintain hardware and software systems Included here are technical papers written by twenty one contributors that report on self contained case studies some of which are sanitized industrial projects The papers deal with a wide variety of ideas including floating point arithmetic microprocessor simulation model checking symbolic trajectory evaluation compilation proof checking real analysis and several others Computer Aided Reasoning ACL2 Case Studies is meant for two audiences those looking for innovative ways to design build and maintain hardware and software systems faster and more reliably and those wishing to learn how to do this The former audience includes project managers and students in survey oriented courses The latter audience includes students and professionals pursuing rigorous approaches to hardware and software engineering or formal methods Computer Aided Reasoning ACL2 Case Studies can be used in graduate and upper division undergraduate courses on Software Engineering Formal Methods Hardware Design Theory of Computation Artificial Intelligence and Automated Reasoning The book is divided into two parts Part I begins with a discussion of the effort involved in using ACL2 It also contains a brief introduction to the ACL2 logic and its mechanization which is intended to give the reader sufficient background to read the case studies A more thorough textbook introduction to ACL2 may be found in the companion book Computer Aided Reasoning An Approach The heart of the book is Part II where the case studies are presented The case studies contain exercises whose solutions are on the Web In addition the complete ACL2 scripts necessary to formalize the models and prove all the properties discussed are on the Web For example when we say that one of the case studies formalizes a floating point

multiplier and proves it correct we mean that not only can you read an English description of the model and how it was proved correct but you can obtain the entire formal content of the project and replay the proofs if you wish with your copy of ACL2 ACL2 may be obtained from its home page The results reported in each case study as ACL2 input scripts as well as exercise solutions for both books are available from this page *COMPUTER-AIDED REASONING* MATT. KAUFMANN,2011

Engineering Theories of Software Intensive Systems Manfred Broy,Johannes Gruenbauer,David Harel,Tony Hoare,2005-07-15 Software engineering has over the years been applied in many different fields ranging from telecommunications to embedded systems in car and aircraft industry as well as in production engineering and computer networks Foundations in software technology lie in models allowing to capture application domains detailed requirements but also to understand the structure and working of software systems like software architectures and programs These models have to be expressed in techniques based on discrete mathematics algebra and logics However according to the very specific needs in applications of software technology formal methods have to serve the needs and the quality of advanced software engineering methods especially taking into account security aspects in Information Technology This book presents mathematical foundations of software engineering and state of the art engineering methods in their theoretical substance in the step towards practical applications to examine software engineering techniques and foundations used for industrial tasks The contributions in this volume emerged from lectures of the 25th International Summer School on Engineering Theories of Software Intensive Systems held at Marktoberdorf Germany from August 3 to August 15 2004 *Design and Verification of Microprocessor Systems for High-Assurance Applications* David S. Hardin,2010-03-02 Microprocessors increasingly control and monitor our most critical systems including automobiles airliners medical systems transportation grids and defense systems The relentless march of semiconductor process technology has given engineers exponentially increasing transistor budgets at constant recurring cost This has encouraged increased functional integration onto a single die as well as increased architectural sophistication of the functional units themselves Additionally design cycle times are decreasing thus putting increased schedule pressure on engineers Not surprisingly this environment has led to a number of uncaught design flaws Traditional simulation based design verification has not kept up with the scale or pace of modern microprocessor system design Formal verification methods offer the promise of improved bug finding capability as well as the ability to establish functional correctness of a detailed design relative to a high level specification However widespread use of formal methods has had to await breakthroughs in automated reasoning integration with engineering design languages and processes scalability and usability This book presents several breakthrough design and verification techniques that allow these powerful formal methods to be employed in the real world of high assurance microprocessor system design

Scalable Techniques for Formal Verification Sandip Ray,2010-08-12 This book is about formal veri cation that is the use of mathematical reasoning to ensure correct execution of computing systems With the increasing use of c puting systems in

safety critical and security critical applications it is becoming increasingly important for our well being to ensure that those systems execute c rectly Over the last decade formal veri cation has made signi cant headway in the analysis of industrial systems particularly in the realm of veri cation of hardware A key advantage of formal veri cation is that it provides a mathematical guarantee of their correctness up to the accuracy of formal models and correctness of r soning tools In the process the analysis can expose subtle design errors Formal veri cation is particularly effective in nding corner case bugs that are dif cult to detect through traditional simulation and testing Nevertheless and in spite of its promise the application of formal veri cation has so far been limited in an ind trial design validation tool ow The dif culties in its large scale adoption include the following 1 deductive veri cation using theorem provers often involves cessive and prohibitive manual effort and 2 automated decision procedures e g model checking can quickly hit the bounds of available time and memory This book presents recent advances in formal veri cation techniques and d cusses the applicability of the techniques in ensuring the reliability of large scale systems We deal with the veri cation of a range of computing systems from quential programsto concurrentprotocolsand pipelined machines   **Formal Methods in Computer-aided Design** ,2002   **Computer-aided Verification** ,2004   **Computer-Aided Reasoning** Matt Kaufmann,Panagiotis Manolios,J. Strother Moore,2014-01-15   **Proceedings of the Java Virtual Machine Research and Technology Sy[m]posium (JVM '01)** ,2001   Proceedings ,2004   *Logic for Programming, Artificial Intelligence, and Reasoning* ,2001   **Proceedings of the Java Virtual Machine Research and Technology Symposium** ,2001   Formal Methods and Software Engineering ,2003   **Proceedings of the ... International ACM SIGPLAN Conference on Principles and Practice of Declarative Programming** ,2009   **Artificial Intelligence and Symbolic Computation** ,2000   *Algebraic Methodology and Software Technology* ,2004   **Tools and Algorithms for the Construction and Analysis of Systems** ,2003   **Proceedings of the ... ACM Great Lakes Symposium on VLSI.** ,2005

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