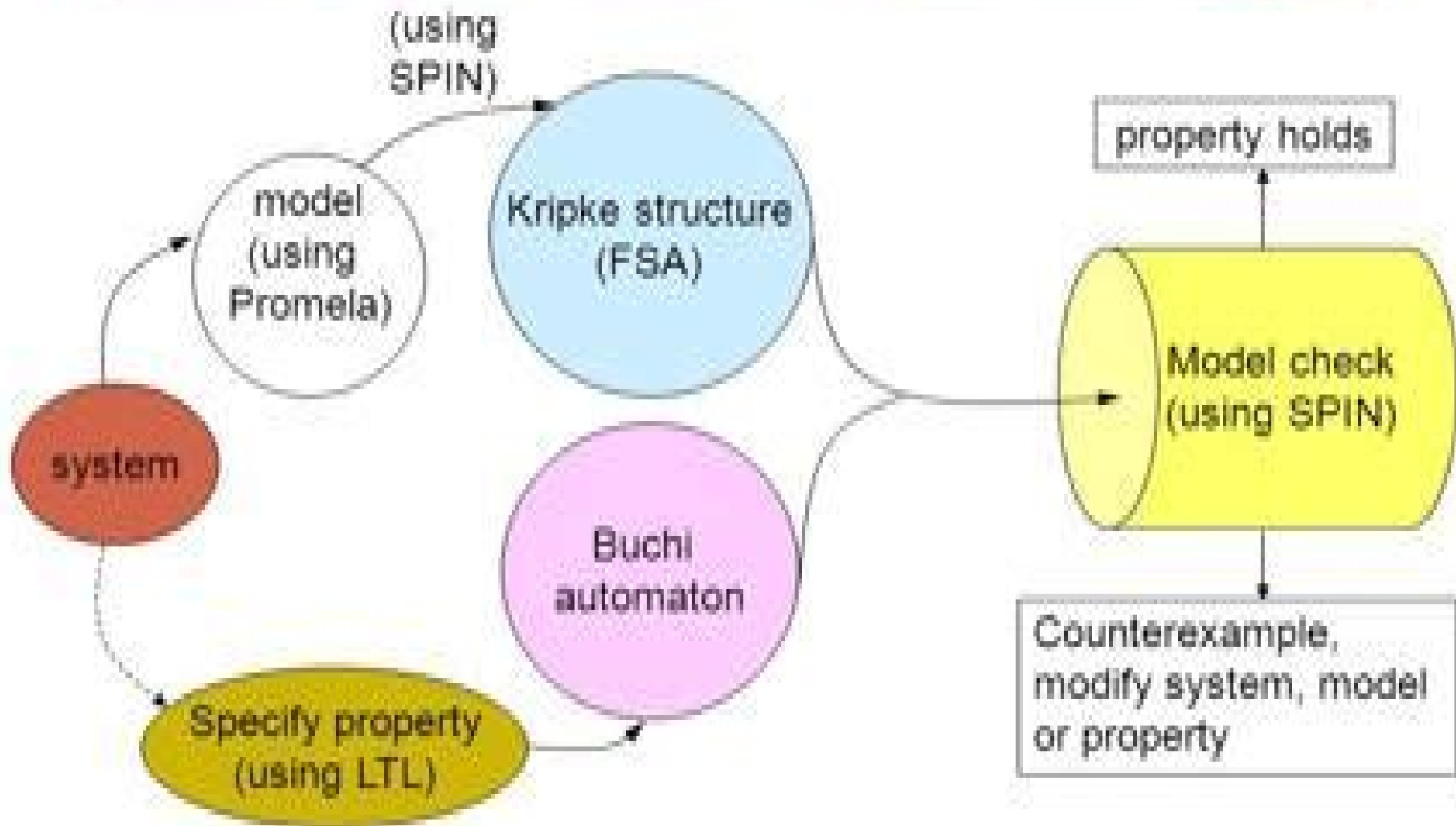


Model Checking



Model Checking

**Edmund M. Clarke, Jr., Orna
Grumberg, Daniel Kroening, Doron
Peled, Helmut Veith**

Model Checking:

Principles of Model Checking Christel Baier, Joost-Pieter Katoen, 2008-04-25 A comprehensive introduction to the foundations of model checking a fully automated technique for finding flaws in hardware and software with extensive examples and both practical and theoretical exercises Our growing dependence on increasingly complex computer and software systems necessitates the development of formalisms techniques and tools for assessing functional properties of these systems One such technique that has emerged in the last twenty years is model checking which systematically and automatically checks whether a model of a given system satisfies a desired property such as deadlock freedom invariants and request response properties This automated technique for verification and debugging has developed into a mature and widely used approach with many applications *Principles of Model Checking* offers a comprehensive introduction to model checking that is not only a text suitable for classroom use but also a valuable reference for researchers and practitioners in the field The book begins with the basic principles for modeling concurrent and communicating systems introduces different classes of properties including safety and liveness presents the notion of fairness and provides automata based algorithms for these properties It introduces the temporal logics LTL and CTL compares them and covers algorithms for verifying these logics discussing real time systems as well as systems subject to random phenomena Separate chapters treat such efficiency improving techniques as abstraction and symbolic manipulation The book includes an extensive set of examples most of which run through several chapters and a complete set of basic results accompanied by detailed proofs Each chapter concludes with a summary bibliographic notes and an extensive list of exercises of both practical and theoretical nature

Model Checking, second edition Edmund M. Clarke, Jr., Orna Grumberg, Daniel Kroening, Doron Peled, Helmut Veith, 2018-12-04 An expanded and updated edition of a comprehensive presentation of the theory and practice of model checking a technology that automates the analysis of complex systems Model checking is a verification technology that provides an algorithmic means of determining whether an abstract model representing for example a hardware or software design satisfies a formal specification expressed as a temporal logic formula If the specification is not satisfied the method identifies a counterexample execution that shows the source of the problem Today many major hardware and software companies use model checking in practice for verification of VLSI circuits communication protocols software device drivers real time embedded systems and security algorithms This book offers a comprehensive presentation of the theory and practice of model checking covering the foundations of the key algorithms in depth The field of model checking has grown dramatically since the publication of the first edition in 1999 and this second edition reflects the advances in the field Reorganized expanded and updated the new edition retains the focus on the foundations of temporal logic model while offering new chapters that cover topics that did not exist in 1999 propositional satisfiability SAT based model checking counterexample guided abstraction refinement and software model checking The book serves as an introduction to the field

suitable for classroom use and as an essential guide for researchers *Handbook of Model Checking* Edmund M. Clarke, Thomas A. Henzinger, Helmut Veith, Roderick Bloem, 2018-05-18 Model checking is a computer assisted method for the analysis of dynamical systems that can be modeled by state transition systems Drawing from research traditions in mathematical logic programming languages hardware design and theoretical computer science model checking is now widely used for the verification of hardware and software in industry The editors and authors of this handbook are among the world's leading researchers in this domain and the 32 contributed chapters present a thorough view of the origin theory and application of model checking In particular the editors classify the advances in this domain and the chapters of the handbook in terms of two recurrent themes that have driven much of the research agenda the algorithmic challenge that is designing model checking algorithms that scale to real life problems and the modeling challenge that is extending the formalism beyond Kripke structures and temporal logic The book will be valuable for researchers and graduate students engaged with the development of formal methods and verification tools **Model Checking** Edmund M. Clarke, Orna Grumberg, Doron Peled, Doron A. Peled, 1999 This presentation of the theory and practice of model checking includes basic as well as state of the art techniques algorithms and tools and can be used as an introduction to the subject or a reference for researchers

Systems and Software Verification B. Berard, M. Bidoit, A. Finkel, F. Laroussinie, A. Petit, L. Petrucci, P. Schnoebelen, 2013-04-17 Model checking is a powerful approach for the formal verification of software When applicable it automatically provides complete proofs of correctness or explains via counter examples why a system is not correct This book provides a basic introduction to this new technique The first part describes in simple terms the theoretical basis of model checking transition systems as a formal model of systems temporal logic as a formal language for behavioral properties and model checking algorithms The second part explains how to write rich and structured temporal logic specifications in practice while the third part surveys some of the major model checkers available *Model Checking, second edition* Edmund M. Clarke, Jr., Orna Grumberg, Daniel Kroening, Doron Peled, Helmut Veith, 2018-12-04 An expanded and updated edition of a comprehensive presentation of the theory and practice of model checking a technology that automates the analysis of complex systems Model checking is a verification technology that provides an algorithmic means of determining whether an abstract model representing for example a hardware or software design satisfies a formal specification expressed as a temporal logic formula If the specification is not satisfied the method identifies a counterexample execution that shows the source of the problem Today many major hardware and software companies use model checking in practice for verification of VLSI circuits communication protocols software device drivers real time embedded systems and security algorithms This book offers a comprehensive presentation of the theory and practice of model checking covering the foundations of the key algorithms in depth The field of model checking has grown dramatically since the publication of the first edition in 1999 and this second edition reflects the advances in the field Reorganized expanded and updated the new

edition retains the focus on the foundations of temporal logic model while offering new chapters that cover topics that did not exist in 1999 propositional satisfiability SAT based model checking counterexample guided abstraction refinement and software model checking The book serves as an introduction to the field suitable for classroom use and as an essential guide for researchers

Model Checking Software Antti Valmari,2006-03-29 This book constitutes the refereed proceedings of the 13th International SPIN workshop on Model Checking Software SPIN 2006 held in Vienna Austria in March April 2006 as satellite event of ETAPS 2006 The 16 revised full papers presented together with three tool presentation papers were carefully reviewed and selected from 44 submissions The papers are organized in topical sections

Model Checking and Artificial Intelligence Stefan Edelkamp,Alessio Lomuscio,2007-08-09 The refereed post proceedings of the 4th Workshop on Model Checking and Artificial Intelligence are presented in this volume Eight full workshop papers are presented along with three post proceedings papers Papers are organized into topical sections covering planning and model checking heuristics for real time model checking verification of multi agent systems and logics for model checking and artificial intelligence

25 Years of Model Checking Orna Grumberg,Helmut Veith,2008-07-03 Model checking technology is among the foremost applications of logic to computer science and computer engineering The model checking community has achieved many breakthroughs bridging the gap between theoretical computer science and hardware and software engineering and it is reaching out to new challenging areas such as system biology and hybrid systems Model checking is extensively used in the hardware industry and has also been applied to the verification of many types of software Model checking has been introduced into computer science and electrical engineering curricula at universities worldwide and has become a universal tool for the analysis of systems This Festschrift volume published in celebration of the 25th Anniversary of Model Checking includes a collection of 11 invited papers based on talks at the symposium 25 Years of Model Checking 25MC which was part of the 18th International Conference on Computer Aided Verification CAV 2006 which in turn was part of the Federated Logic Conference FLoC 2006 held in Seattle WA USA in August 2006 Model checking is currently attracting considerable attention beyond the core technical community and the ACM Turing Award 2007 was given in recognition of the paradigm shifting work on this topic initiated a quarter century ago Here we honor that achievement with the inclusion of facsimile reprints of the visionary papers on model checking by Edmund Clarke and Allen Emerson and by Jean Pierre Queille and Joseph Sifakis

Model Checking Software Thomas Neele,Anton Wijs,2024-10-12 This book constitutes the refereed proceedings of the 30th International Symposium on Model Checking Software SPIN 2024 held in Luxembourg City Luxembourg during April 10 11 2024 The 9 full papers 3 short papers and 2 invited papers included in this book were carefully reviewed and selected from 23 submissions They are organized in topical sections as follows model checking anniversary automated reasoning and verification tools

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based on talks at the symposium 25 Years of Model Checking 25MC which was part of the 18th International Conference on Computer Aided Verification Abstraction Refinement for Large Scale Model Checking Chao Wang, Gary D. Hachtel, Fabio Somenzi, 2006-09-15 Abstraction Refinement for Large Scale Model Checking summarizes recent research on abstraction techniques for model checking large digital system Considering both the size of today's digital systems and the capacity of state of the art verification algorithms abstraction is the only viable solution for the successful application of model checking techniques to industrial scale designs This book describes recent research developments in automatic abstraction refinement techniques The suite of algorithms presented in this book has demonstrated significant improvement over prior art some of them have already been adopted by the EDA companies in their commercial in house verification tools *Symbolic Model Checking* Kenneth L. McMillan, 2012-12-06 Formal verification means having a mathematical model of a system a language for specifying desired properties of the system in a concise comprehensible and unambiguous way and a method of proof to verify that the specified properties are satisfied When the method of proof is carried out substantially by machine we speak of automatic verification Symbolic Model Checking deals with methods of automatic verification as applied to computer hardware The practical motivation for study in this area is the high and increasing cost of correcting design errors in VLSI technologies There is a growing demand for design methodologies that can yield correct designs on the first fabrication run Moreover design errors that are discovered before fabrication can also be quite costly in terms of engineering effort required to correct the error and the resulting impact on development schedules Aside from pure cost considerations there is also a need on the theoretical side to provide a sound mathematical basis for the design of computer systems especially in areas that have received little theoretical attention *Theoretical and Practical Aspects of SPIN Model Checking* Dennis Dams, Robert Gerth, Stefan Leue, Mieke Massinek, 2003-05-21 Increasing the designer's confidence that a piece of software or hardware is compliant with its specification has become a key objective in the design process for software and hardware systems Many approaches to reaching this goal have been developed including rigorous specification formal verification automated validation and testing Finite state model checking as it is supported by the explicit state model checker SPIN is enjoying a constantly increasing popularity in automated property validation of concurrent message based systems SPIN has been in large parts implemented and is being maintained by Gerard Hoermann and is freely available via ftp from netlib bell labs com or from URL <http://cm.bell-labs.com/cm/cs/what/spin-Man-README.html> The beauty of finite state model checking lies in the possibility of building push button validation tools When the state space is finite the state space traversal will eventually terminate with a definite verdict on the property that is being validated Equally helpful is the fact that in case the property is invalidated the model checker will return a counterexample a feature that greatly facilitates fault identification On the downside the time it takes to obtain a verdict may be very long if the state space is large and the type of properties that can be validated is restricted to a logic of rather limited expressiveness **Model Checking Software** Matthew

Dwyer,2003-06-29 This book constitutes the refereed proceedings of the 8th International SPIN Workshop held in Toronto Canada in May 2001 The SPIN model checker is one of the most powerful and popular systems for the analysis and verification of distributed and concurrent systems The 13 revised full papers presented together with one invited survey paper and three invited industrial experience reports were carefully reviewed and selected from 26 submissions Besides foundational issues of program analysis and formal verification the papers focus on tools for model checking and practical applications in a variety of fields *Model Checking Software* Thomas Ball,Sriram K. Rajamani,2003-08-03 This book constitutes the refereed proceedings of the 10th International SPIN workshop on Model Checking of Software SPIN 2003 held in Portland OR USA in May 2003 as an ICSE 2003 satellite workshop The 14 revised full papers and 3 revised tool papers presented were carefully reviewed and selected from 30 submissions The book presents state of the art results on the analysis and verification of distributed software systems using the SPIN model checker as one of the most powerful and widely applied systems Model Checking Software Matthew Dwyer,2003-06-29 This book constitutes the refereed proceedings of the 8th International SPIN Workshop held in Toronto Canada in May 2001 The SPIN model checker is one of the most powerful and popular systems for the analysis and verification of distributed and concurrent systems The 13 revised full papers presented together with one invited survey paper and three invited industrial experience reports were carefully reviewed and selected from 26 submissions Besides foundational issues of program analysis and formal verification the papers focus on tools for model checking and practical applications in a variety of fields **Model Checking Software** Dragan Bosnacki,Stefan Edelkamp,2007-08-30 This book presents the proceedings of the 14th International SPIN workshop on Model Checking Software held in Berlin Germany Fourteen full papers are presented together with four tool presentation papers and the abstracts of two invited talks The papers are organized into topical sections covering directed model checking partial order reduction program analysis exploration advances modeling and case studies and tool demonstrations *Verification, Model Checking, and Abstract Interpretation* Lenore D. Zuck,Paul D. Attie,Agostino Cortesi,Supratik Mukhopadhyay,2003-07-01 This volume contains the proceedings of the 4th International Conference on Verification Model Checking and Abstract Interpretation VMCAI 2003 held in New York city January 9 11 2003 The purpose of VMCAI was to provide a forum for researchers from three communities Verification Model Checking and Abstract Interpretation that will facilitate interaction cross fertilization and the advance of hybrid methods that combine the three areas With the growing need for formal tools to reason about complex in nite state and embedded systems such hybrid methods are bound to be of great importance Topics covered by VMCAI include program verification static analysis techniques model checking program certification type systems abstract domains debugging techniques compiler optimization embedded systems and formal analysis of security protocols VMCAI 2003 was the fourth VMCAI meeting The previous three were held as workshops Port Jefferson 1997 Pisa 1998 and Venice 2002 It is the success of the last meeting and the wide response it generated that made it

clear the time had come to make it an annual conference
Systems Martin R. Neuhäuser, 2010

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