

Patrice Godefroid

**Partial-Order Methods
for the Verification
of Concurrent Systems**

**An Approach to the
State-Explosion Problem**



Springer

Partialorder Methods For The Verification Of Concurrent Systems An Approach To The Stateexplosion Problem

Kurt Jensen, Andreas Podelski



Partialorder Methods For The Verification Of Concurrent Systems An Approach To The Stateexplosion Problem:

Partial-Order Methods for the Verification of Concurrent Systems Patrice Godefroid, 1996-01-24 This monograph is a revised version of the author's Ph D thesis submitted to the University of Liège Belgium with Pierre Wolper as thesis advisor. The general pattern of this work is to turn logical and semantic ideas into exploitable algorithms. Thus it perfectly fits the modern trend viewing verification as a computer aided activity and as algorithmic as possible not as a paper and pencil one dealing exclusively with semantic and logical issues. Patrice Godefroid uses state space exploration as the key technique which as such or elaborated into model checking is attracting growing attention for the verification of concurrent systems. For most realistic examples the methods presented provide a significant reduction of memory and time requirements for protocol verification.

International Conference on Computing and Information Technologies George Antoniou, 2001 This book is a balanced presentation of the latest techniques, algorithms and applications in computer science and engineering. The papers written by eminent researchers in their fields provide a vehicle for new research and development. The proceedings have been selected for coverage in OCo Index to Scientific Computing in Biology, Human Computer Interface, Parallel Computing, Techniques, Computing Education, Learning, Algorithms, Communication Systems, Networks, Information Technology, Linguistics, Computing Formalism, Algorithms, AI, Fuzzy Sets, Application and Theory, Imaging Applications, Readership: Researchers in artificial intelligence, databases, fuzzy logic, neural networks, software engineering, programming, theoretical computer science, machine perception, computer vision, computer engineering, biomedical engineering, biocomputing, bioinformatics, biophysics and computational physics.

Formal Modeling and Analysis of Timed Systems Catalin Dima, Mahsa Shirmohammadi, 2021-08-16 This book constitutes the refereed proceedings of the 19th International Conference on Formal Modeling and Analysis of Timed Systems FORMATS 2021 held in Paris, France, in August 2021. The 8 full papers that were carefully reviewed and selected from 19 submissions are presented in this volume with 2 invited talks. The papers focus on topics such as probabilistic computation, logic and verification, robotic planning, complexity of timed pattern matching, safety violations in real time systems, modal and temporal logics and others.

Tools and Algorithms for the Construction and Analysis of Systems Dirk Beyer, Marieke Huisman, 2018-04-13 This book is Open Access under a CC BY licence. The LNCS 10805 and 10806 proceedings set constitutes the proceedings of the 24th International Conference on Tools and Algorithms for the Construction and Analysis of Systems TACAS 2018 which took place in Thessaloniki, Greece, in April 2018, held as part of the European Joint Conference on Theory and Practice of Software ETAPS 2018. The total of 43 full and 11 short papers presented in these volumes was carefully reviewed and selected from 154 submissions. The papers are organized in topical sections as follows: Part I: theorem proving, SAT and SMT, I: deductive verification, software verification and optimization, model checking and machine learning; Part II: concurrent and distributed systems, SAT and SMT, II: security and reactive systems, static and dynamic program

analysis hybrid and stochastic systems temporal logic and mu calculus 7th Competition on Software Verification SV COMP

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

Tools and Algorithms for the Construction and Analysis of Systems Kurt Jensen, Andreas Podelski, 2004-03-09 This volume contains the proceedings of the 10th International Conference on Tools and Algorithms for the Construction and Analysis of Systems TACAS 2004 TACAS 2004 took place in Barcelona Spain from March 29th to April 2nd as part of the 7th European Joint Conferences on Theory and Practice of Software ETAPS 2004 whose aims organization and history are detailed in a foreword by the ETAPS Steering Committee Chair Jos e Luiz Fiadeiro TACAS is a forum for researchers developers and users interested in rigorously based tools for the construction and analysis of systems The conference serves to bridge the gaps between different communities including but not limited to those devoted to formal methods software and hardware verification static analysis programming languages software engineering real time systems and communication protocols that share common interests in and techniques for tool development In particular by providing a venue for the discussion of common problems heuristics algorithms data structures and methodologies TACAS aims to support researchers in their quest to improve the utility reliability flexibility and efficiency of tools for building systems TACAS seeks theoretical papers with a clear link to tool construction papers describing relevant algorithms and practical aspects of their implementation papers giving descriptions of tools and associated

methodologies and case studies with a conceptual message **Application and Theory of Petri Nets 1998** Jörg Desel, Manuel Silva, 2003-06-26 This volume contains the proceedings of the 19th annual International Conference on Application and Theory of Petri Nets The aim of the Petri net conference is to create a forum for the dissemination of the latest results in the application and theory of Petri nets It always takes place in the last week of June Typically there are 150 200 participants About one third of these come from industry while the rest are from universities and research institutions The conferences and a number of other activities are coordinated by a steering committee with the following members G Balbo Italy J Billington Australia G DeMichelis Italy C Girault France K Jensen Denmark S Kumagai Japan T Murata USA C A Petri Germany honorary member W Reisig Germany G Roucairol France G Rozenberg The Netherlands chairman M Silva Spain The 19th conference has been organized for the first time in Portugal by the Department of Electrical Engineering of the Faculty of Sciences and Technology of the New University of Lisbon together with the Center for Intelligent Robotics of UNINOVA It takes place in Lisbon at the same time as EXPO 98 the last world exhibition of the 20th century

Programming Languages and Systems Gilles Barthe, 2011-03-14 This book constitutes the refereed proceedings of the 20th European Symposium on Programming ESOP 2011 held in Saarbrücken Germany March 30 April 1 2011 as part of ETAPS 2011 the European Joint Conferences on Theory and Practice of Software The 24 revised full papers presented together with one full length invited talk were carefully reviewed and selected from 93 full paper submissions Papers were invited on all aspects of programming language research including programming paradigms and styles methods and tools to write and specify programs and languages methods and tools for reasoning about programs methods and tools for implementation and concurrency and distribution *Formal Modeling and Analysis of Timed Systems* Kim G. Larsen, Peter Niebert, 2004-04-08 This book constitutes the thoroughly refereed post proceedings of the First International Workshop on Formal Modeling and Analysis of Timed Systems FORMATS 2003 held in Marseille France in September 2003 The 19 revised full papers presented together with an invited paper and the abstracts of two invited talks were carefully selected from 36 submissions during two rounds of reviewing and improvement All current aspects of formal method for modeling and analyzing timed systems are addressed among the timed systems dealt with are timed automata timed Petri nets max plus algebras real time systems discrete time systems timed languages and real time operating systems **Model Checking**

Software Susanne Graf, 2004-03-18 This book constitutes the refereed proceedings of the 11th International SPIN workshop on Model Checking Software SPIN 2004 held in Barcelona Spain in April 2004 The 19 revised full papers presented together with the abstracts of an invited talk and 2 tutorials were carefully reviewed and selected from 48 submissions The papers are organized in topical sections on heuristics and probabilities improvements of SPIN validation of timed systems tool presentations abstraction and symbolic methods and applications **Transactions on Petri Nets and Other Models of**

Concurrency III, 2009-11-11 This volume contains papers from the 29th International Conference on Application and

Theory of Petri Nets and Other Models of Concurrency and from the 8th and 9th Workshops and Tutorials on Practical Use of Coloured Petri Nets and the CPN Tools Tools and Algorithms for the Construction and Analysis of Systems Orna Grumberg, Michael Huth, 2007-07-05 This book constitutes the refereed proceedings of the 13th International Conference on Tools and Algorithms for the Construction and Analysis of Systems TACAS 2007 held in Braga Portugal Coverage includes software verification probabilistic model checking and markov chains automata based model checking security software and hardware verification decision procedures and theorem provers as well as infinite state systems **A Mosaic of Computational Topics: from Classical to Novel** M.H. ter Beek, M. Koutny, G. Rozenberg, 2020-11-20 This book A Mosaic of Computational Topics from Classical to Novel is a collection of papers published to honor Professor Jetty Kleijn on the occasion of her 65th birthday The scope and reach of her research is truly broad She has made significant and lasting contributions in several research areas both through the solving of challenging problems and in her pioneering of new research directions She has published influential papers contributing to the foundations of computer science in particular in the area of formal languages and automata theory to concurrency theory in particular Petri nets and to natural computing in particular bio inspired computing and the computational modeling of bio processes A significant part of Professor Kleijn's research portfolio is interdisciplinary including her work on the Petri net modeling of biological processes and the development of novel models of information processing in bio systems such as reaction systems She is also passionately engaged in promoting the involvement of women in computer science Jetty and her work are well recognized by the scientific community a fact demonstrated by the enthusiastic response to the invitation to contribute to this book and the 14 carefully refereed papers collected together here explore a number of research topics that are either directly or indirectly related to research directions pursued by Jetty Kleijn in the course of her career **Advances in Computers**, 2018-02-14 Advances in Computers Volume 108 the latest volume in a series published since 1960 presents detailed coverage of innovations in computer hardware software theory design and applications This book provides contributors with a medium in which they can explore subjects in greater depth and breadth than similar topics in journal articles allow Provides in depth surveys and tutorials on new computer technology Covers well known authors and researchers in the field Presents extensive bibliographies with most chapters Includes volumes that are devoted to single themes or subfields of computer science

Petri Nets for Systems Engineering Claude Girault, Rüdiger Valk, 2013-03-14 Formal methods for the specification and verification of hardware and software systems are becoming more and more important as systems increase in size and complexity The aim of the book is to illustrate progress in formal methods based on Petri net formalisms It contains a collection of examples arising from different fields such as flexible manufacturing telecommunication and workflow management systems The book covers the main phases in the life cycle of design and implementation of a system i.e specification model checking techniques for verification analysis of properties code generation and execution of models

These techniques and their tool support are discussed in detail including practical issues Amongst others fundamental concepts such as composition abstraction and reusability of models model verification and verification of properties are systematically introduced

Distributed, Parallel and Biologically Inspired Systems Mike Hinchey, Bernd Kleinjohann, Lisa Kleinjohann, Peter Lindsay, Franz J. Rammig, Jon Timmis, Marilyn Wolf, 2010-08-06 This volume contains the proceedings of two conferences held as part of the 21 IFIP World Computer Congress in Brisbane Australia 20 23 September 2010 th The first part of the book presents the proceedings of DIPES 2010 the 7 IFIP Conference on Distributed and Parallel Embedded Systems The conference introduced in a separate preface by the Chairs covers a range of topics from specification and design of embedded systems through to dependability and fault tolerance rd The second part of the book contains the proceedings of BICC 2010 the 3 IFIP Conference on Biologically Inspired Collaborative Computing The conference is concerned with emerging techniques from research areas such as organic computing autonomic computing and self adaptive systems where inspiration for techniques comes from exhibited behaviour in nature and biology Such techniques require the use of research developed by the DIPES community in supporting collaboration over multiple systems We hope that the combination of the two proceedings will add value for the reader and advance our related work

Embedded Systems Kiyofumi Tanaka, 2012-03-02 Nowadays embedded systems the computer systems that are embedded in various kinds of devices and play an important role of specific control functions have permitted various aspects of industry Therefore we can hardly discuss our life and society from now onwards without referring to embedded systems For wide ranging embedded systems to continue their growth a number of high quality fundamental and applied researches are indispensable This book contains 19 excellent chapters and addresses a wide spectrum of research topics on embedded systems including basic researches theoretical studies and practical work Embedded systems can be made only after fusing miscellaneous technologies together Various technologies condensed in this book will be helpful to researchers and engineers around the world

Application and Theory of Petri Nets 2000 Mogens Nielsen, Dan Simpson, 2000-06-14 This book constitutes the thoroughly refereed post conference proceedings of the 6th Congress of the Italian Association for Artificial Intelligence AI IA 99 held in Bologna Italy in September 1999 The 33 revised full papers presented were carefully reviewed and selected for inclusion in the book from a total of 64 congress submissions The papers are organized in topical sections on knowledge representation automated reasoning temporal and qualitative reasoning machine learning data mining and theory revision natural language processing and web interfaces multi agent systems perception and robotics and planning and scheduling

Application and Theory of Petri Nets and Concurrency Victor Khomenko, Olivier H. Roux, 2018-05-29 This book constitutes the proceedings of the 39th International Conference on Application and Theory of Petri Nets and Concurrency PETRI NETS 2018 held in Bratislava Slovakia in June 2018 Petri Nets 2017 is co located with the 19th International Conference on Application of Concurrency to System Design ACSD 2018 The 15 regular and 8 tool papers with 1 invited talk presented

together in this volume were carefully reviewed and selected from 33 submissions The focus of the conference is on following topics Petri Nets Synthesis Analysis and Model Checking Languages Semantics and Expressiveness and Tools *Critical Information Infrastructure Security* Christos Xenakis, Stephen Wolthusen, 2012-02-10 This book constitutes the thoroughly refereed post proceedings of the 5th International Workshop on Critical Information Infrastructure Security CRITIS 2010 held in Athens Greece in September 2010 The 12 revised full papers and two poster papers presented went through two rounds of reviewing and improvement and were selected from 30 submissions The papers included address various techniques to realize the security of systems communications and data

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