

THE SPIN MODEL CHECKER

PRIMER AND REFERENCE MANUAL

Gerard J. Holzmann

Master SPIN, the breakthrough tool for improving software reliability

SPIN is the world's most popular, and arguably one of the world's most powerful, tools for detecting software defects in concurrent system designs. Tens of thousands of people have used SPIN since it was first produced almost three years ago. The tool has been applied to everything from the verification of complex real-time systems that is used in telephone exchanges, to the validation of critical control software for interplanetary spacecraft.

This is the most comprehensive reference guide to SPIN, written by the principal designer of the tool. It covers the tool's specification language and Promela's foundations, and gives detailed advice on methods for solving the most complex software verification problems.

- Design and verify both abstract and detailed verification models of complex systems software
- Develop a solid understanding of the theory behind logic model checking
- Become an expert user of the SPIN command-line interface, the Spin graphical user interface, and the SpinView editing tool
- Learn the basic theory of image automata, linear temporal logic, depth-first and breadth-first search, weak optimisation, and model execution from source code

The SPIN software was awarded the prestigious Software System Award by the Association for Computing Machinery (ACM), which previously recognised systems such as UNIX, Smalltalk, RISC/P, and the World Wide Web.

About the Author

DR GERARD J. HOLZMANN is the principal designer of the SPIN system. Formerly Director of Computing Principles Research at Bell Laboratories in Murray Hill, NJ, he recently joined Xerox in Palo Alto, California as Principal, CA, to help set up a new Laboratory for Reliable Software. Holzmann's earlier books include *Design and Validation of Computer Hardware* (Prentice Hall), and *The Early History of Data Networks* (IEEE CS Press).

1 Introduction
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The Spin Model Checker Gerard J. Holzmann, 2004 The SPIN Model Checker is used for both teaching software verification techniques and for validating large scale applications The growing number of users has created a need for a more comprehensive user guide and a standard reference manual that describes the most recent version of the tool This book fills that need SPIN is used in over 40 countries The official SPIN web site spinroot.com receives between 2500 and 3000 hits per day It has been estimated that up to three quarters of the 400 billion spent annually to hire programmers in the United States is ultimately spent on debugging

Verification, Model Checking, and Abstract Interpretation Francesco Logozzo, Doron A. Peled, Leonore D. Zuck, 2008-02-26 The book constitutes the refereed proceedings of the 9th International Conference on Verification Model Checking and Abstract Interpretation VMCAI 2007 held in San Francisco USA in January 2008 The 21 revised full papers presented together with 2 invited lectures and 2 invited tutorials were carefully reviewed and selected from a total of over 60 submissions The papers feature current research from the communities of verification program certification model checking debugging techniques abstract interpretation abstract domains static analysis cross fertilization and advancement of hybrid methods

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

Formal Methods for Industrial Critical Systems Stefania Gnesi, Tiziana Margaria, 2012-11-27 Today formal methods are widely recognized as an essential step in the design process of industrial safety critical systems In its more general definition the term formal methods encompasses all notations having a precise mathematical semantics together with their associated analysis methods that allow description and reasoning about the behavior of a system in a formal manner Growing out of more than a decade of award winning collaborative work within the European Research Consortium for Informatics and Mathematics Formal Methods for Industrial Critical Systems A Survey of Applications presents a number of mainstream formal methods currently used for designing industrial critical systems with a focus on model checking The purpose of the book is threefold to reduce the effort required to learn formal

methods which has been a major drawback for their industrial dissemination to help designers to adopt the formal methods which are most appropriate for their systems and to offer a panel of state of the art techniques and tools for analyzing critical systems

Theoretical Aspects of Computing - ICTAC 2008 John S. Fitzgerald, Anne E. Haxthausen, Husnu Yenigun, 2008-08-25 Research on theoretical aspects of computing has a direct impact on the practice of computer systems development. Over many decades fundamental theories have emerged to describe functionality, temporal behavior and resource consumption. Theories of application domains are beginning to be exploited for modelling and analyzing intended computing systems before the expensive commitment is made to real programs and hardware. Recent years have seen major improvements in the cost effectiveness of tools supporting the exploitation of theories through proof model checking and testing. Against this encouraging background we are pleased to present papers that show something of the liveliness and diversity of research in theoretical aspects of computing today. ICTAC 2008, the 5th International Colloquium on Theoretical Aspects of Computing, was held on 1-3 September 2008 in Istanbul, Turkey, hosted by Bilkent University. The ICTAC series was founded by the International Institute for Software Technology of the United Nations University (UNU-IIST). It brings together practitioners and researchers from academia, industry and government to present results and to exchange ideas and experience addressing challenges in both theoretical aspects of computing and in the exploitation of theory through methods and tools for system development. This series also promotes cooperation in research and education between participants and their institutions from developing and industrial countries in accordance with the mandate of the United Nations University. The previous ICTAC colloquia were held in Guiyang, China 2004 (LNCS 3407), Hanoi, Vietnam 2005 (LNCS 3722), Tunis, Tunisia 2006 (LNCS 4281) and Macau, SAR, China 2007 (LNCS 4711).

Perspectives of System Informatics Andrei Voronkov, Irina Virbitskaite, 2015-04-20 This book contains the thoroughly refereed papers from the 9th International Ershov Informatics Conference (PSI 2014) held in St. Petersburg, Russia, in June 2014. The 17 revised full papers, 11 revised short papers and 2 system and experimental papers presented in this book were carefully reviewed and selected from 80 submissions. The volume also contains 5 keynote talks which cover a range of hot topics in computer science and informatics. The papers cover various topics related to the foundations of program and system development and analysis, programming methodology and software engineering and information technologies.

Formal Methods for Components and Objects Frank S. de Boer, Marcello M. Bonsangue, Susanne Graf, Willem-Paul de Roever, 2006-09-30 This book presents 19 revised invited keynote lectures and revised tutorial lectures given at the 4th International Symposium on Formal Methods for Components and Objects (FMCO 2005) in Amsterdam, November 2005. The book provides a unique combination of ideas on software engineering and formal methods that reflect the current interest in the application or development of formal methods for large scale software systems such as component based systems and object systems.

Formal Methods for Components and Objects, 2007

Advanced Information Systems Engineering Pascal van Eck, Jaap Gordijn, Roel J. Wieringa, 2009-06-06 This book

constitutes the refereed proceedings of the 21st International Conference on Advanced Information Systems Engineering CAiSE 2009 held in Amsterdam The Netherlands on June 8 12 2009 The 36 papers presented in this book together with 6 keynote papers were carefully reviewed and selected from 230 submissions The topics covered are model driven engineering conceptual modeling quality and data integration goal oriented requirements engineering requirements and architecture service orientation Web service orchestration value driven modeling workflow business process modeling and requirements engineering

Automated Technology for Verification and Analysis Sungdeok Cha, Jin-Young Choi, Moonzoo Kim, Mahesh Viswanathan, 2008-10-11 This book constitutes the refereed proceedings of the 6th International Symposium on Automated Technology for Verification and Analysis ATVA 2008 held in Seoul Korea in October 2008 The 21 revised full papers 5 short papers and 7 tool papers presented together with 3 invited talks were carefully reviewed and selected from 82 submissions The focus lies on theoretical methods to achieve correct software or hardware systems including both functional and non functional aspects as well as on applications of theory in engineering methods and particular domains and handling of practical problems occurring in tools The papers are organized in topical sections on model checking software verification decision procedures linear time analysis tool demonstration papers timed and stochastic systems theory and short papers

Computer Aided Verification Isil Dillig, Serdar Tasiran, 2019-07-12 The open access two volume set LNCS 11561 and 11562 constitutes the refereed proceedings of the 31st International Conference on Computer Aided Verification CAV 2019 held in New York City USA in July 2019 The 52 full papers presented together with 13 tool papers and 2 case studies were carefully reviewed and selected from 258 submissions The papers were organized in the following topical sections Part I automata and timed systems security and hyperproperties synthesis model checking cyber physical systems and machine learning probabilistic systems runtime techniques dynamical hybrid and reactive systems Part II logics decision procedures and solvers numerical programs verification distributed systems and networks verification and invariants and concurrency

Tools and Algorithms for the Construction and Analysis of Systems Nicolas Halbwachs, Lenore Zuck, 2005-02-26 ETAPS 2005 was the eighth instance of the European Joint Conferences on Theory and Practice of Software ETAPS is an annual federated conference that was established in 1998 by combining a number of existing and new conferences This year it comprised five conferences CC ESOP FASE FOSSACS TACAS 17 satellite workshops AVIS BYTECODE CEES CLASE CMSB COCV FAC FESCA FINCO GCW DSE GLPL LDTA QAPL SC SLAP TGC UITP seven invited lectures not including those that were specific to the satellite events and several tutorials We received over 550 submissions to the five conferences this year giving acceptance rates below 30% for each one Congratulations to all the authors who made it to the final program I hope that most of the other authors still found a way of participating in this exciting event and I hope you will continue submitting The events that comprise ETAPS address various aspects of the system development process including specification design implementation analysis and improvement The languages methodologies and tools which support these activities are all well

within its scope Different blends of theory and practice are represented with an inclination towards theory with a practical motivation on the one hand and soundly based practice on the other Many of the issues involved in software design apply to systems in general including hardware systems and the emphasis on software is not intended to be exclusive **Tools and Algorithms for the Construction and Analysis of Systems** Stefan Kowalewski, Anna Philippou, 2009-03-27 This book constitutes the refereed proceedings of the 15th International Conference on Tools and Algorithms for the Construction and Analysis of Systems TACAS 2009 held in York UK in March 2009 as part of ETAPS 2009 the European Joint Conferences on Theory and Practice of Software The 27 full papers and 8 tool demonstrations included in the volume were thoroughly reviewed and selected from 131 submissions The papers are organized in topical sections on Model Checking Tools Verification of Concurrent Programs Parametric Analysis Program Analysis and Hybrid Systems **Handbook of Research on Web Information Systems Quality** Calero, Coral, Angeles Moraga, M., Piattini, Mario, 2008-02-28 Web information systems engineering resolves the multifaceted issues of Web based systems development however as part of an emergent yet prolific industry Web site quality assurance is a continually adaptive process needing a comprehensive reference tool to merge all cutting edge research and innovations The Handbook of Research on Web Information Systems Quality integrates 30 authoritative contributions by 72 of the world's leading experts on the models measures and methodologies of Web information systems software quality and Web engineering into one practical guide to Web information systems quality making this handbook of research an essential addition to all library collections **Mathematical Logic for Computer Science** Mordechai Ben-Ari, 2012-06-16 Mathematical Logic for Computer Science is a mathematics textbook with theorems and proofs but the choice of topics has been guided by the needs of students of computer science The method of semantic tableaux provides an elegant way to teach logic that is both theoretically sound and easy to understand The uniform use of tableaux based techniques facilitates learning advanced logical systems based on what the student has learned from elementary systems The logical systems presented are propositional logic first order logic resolution and its application to logic programming Hoare logic for the verification of sequential programs and linear temporal logic for the verification of concurrent programs The third edition has been entirely rewritten and includes new chapters on central topics of modern computer science SAT solvers and model checking **SDL 2005: Model Driven** Andreas Prinz, Rick Reed, Jeanne Reed, 2005-06-09 This volume contains the papers presented at the 12th SDL Forum Grimstad Norway The SDL Forum was first held in 1982 and then every two years from 1985 Initially the Forum was concerned only with the Specification and Description Language that was first standardized in the 1976 Orange Book of the International Telecommunication Union ITU Since then many developments took place and the language has undergone several changes However the main underlying paradigm has survived and it is the reason for the success of the Specification and Description Language in many projects This paradigm is based on the following important principles of distributed applications Communication large systems tend to

be described using smaller parts that communicate with each other State the systems are described on the basis of an explicit notion of state State change the behavior of the system is described in terms of local changes of the state The original language is not the only representative for this kind of paradigm so the scope of the SDL Forum was extended quite soon after the first few events to also include other ITU standardized languages of the same family such as MSC ASN.1 and TTCN This led to the current scope of System Design Languages

covering all stages of the development process including in particular SDL MSC UML ASN.1 eODL TTCN and URN The focus is clearly on the advantages to users and how to get from these languages the same advantage given by the ITU Specification and Description Language code generation from high level specifications

SOFSEM 2015: Theory and Practice of Computer Science Giuseppe Italiano, Tiziana Margaria-Steffen, Jaroslav Pokorný, Jean-Jacques Quisquater, Roger Wattenhofer, 2015-01-14 This book constitutes the proceedings of the 41st International Conference on Current Trends in Theory and Practice of Computer Science held in Písek, Czech Republic during January 24-29, 2015. The book features 8 invited talks and 42 regular papers which were carefully reviewed and selected from 101 submissions. The papers are organized in topical sections named foundations of computer science software and Web engineering data information and knowledge engineering and cryptography security and verification

Computer and Information Science 2015 Roger Lee, 2015-10-16 This edited book presents scientific results of the 14th IEEE ACIS International Conference on Computer and Information Science ICIS 2015 which was held on June 28-July 1, 2015 in Las Vegas, USA. The aim of this conference was to bring together researchers and scientists, businessmen and entrepreneurs, teachers, engineers, computer users and students to discuss the numerous fields of computer science and to share their experiences and exchange new ideas and information in a meaningful way. Research results about all aspects: theory, applications and tools of computer and information science and to discuss the practical challenges encountered along the way and the solutions adopted to solve them

Embedded Systems Handbook Richard Zurawski, 2005-08-16 Embedded systems are nearly ubiquitous and books on individual topics or components of embedded systems are equally abundant. Unfortunately for those designers who thirst for knowledge of the big picture of embedded systems, there is not a drop to drink. Until now, *The Embedded Systems Handbook* is an oasis of information offering a mix of basic and advanced information.

Handbook of Networked and Embedded Control Systems Dimitrios Hristu-Varsakelis, William S. Levine, 2007-11-14 The vast majority of control systems built today are embedded; that is, they rely on built-in special-purpose digital computers to close their feedback loops. Embedded systems are common in aircraft, factories, chemical processing plants, and even in cars: a single high-end automobile may contain over eighty different computers. The design of embedded controllers and of the intricate automated communication networks that support them raises many new questions, practical as well as theoretical, about network protocols, compatibility of operating systems, and ways to maximize the effectiveness of the embedded hardware. This handbook, the first of its kind, provides engineers

computer scientists mathematicians and students a broad comprehensive source of information and technology to address many questions and aspects of embedded and networked control Separated into six main sections Fundamentals Hardware Software Theory Networking and Applications this work unifies into a single reference many scattered articles websites and specification sheets Also included are case studies experiments and examples that give a multifaceted view of the subject encompassing computation and communication considerations

Unveiling the Power of Verbal Beauty: An Psychological Sojourn through **Spin Model Checker Primer And Reference Manual**

In a global inundated with screens and the cacophony of instantaneous transmission, the profound energy and psychological resonance of verbal beauty often disappear into obscurity, eclipsed by the constant assault of sound and distractions. Yet, located within the lyrical pages of **Spin Model Checker Primer And Reference Manual**, a interesting function of literary brilliance that pulses with fresh thoughts, lies an wonderful journey waiting to be embarked upon. Published by way of a virtuoso wordsmith, that mesmerizing opus instructions readers on an emotional odyssey, gently exposing the latent possible and profound impact stuck within the delicate internet of language. Within the heart-wrenching expanse of this evocative analysis, we can embark upon an introspective exploration of the book is central themes, dissect its charming writing type, and immerse ourselves in the indelible impact it leaves upon the depths of readers souls.

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