

Zohar Manna  
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# Temporal Verification of Reactive Systems

• Safety •



Springer

# Temporal Verification Of Reactive Systems Safety

**Richard Bailey**



## **Temporal Verification Of Reactive Systems Safety:**

**Temporal Verification of Reactive Systems** Zohar Manna, Amir Pnueli, 2012-12-06 This book is about the verification of reactive systems A reactive system is a system that maintains an ongoing interaction with its environment as opposed to computing some final value on termination The family of reactive systems includes many classes of programs whose correct and reliable construction is considered to be particularly challenging including concurrent programs embedded and process control programs and operating systems Typical examples of such systems are an air traffic control system programs controlling mechanical devices such as a train or perpetually ongoing processes such as a nuclear reactor With the expanding use of computers in safety critical areas where failure is potentially disastrous correctness is crucial This has led to the introduction of formal verification techniques which give both users and designers of software and hardware systems greater confidence that the systems they build meet the desired specifications Framework The approach promoted in this book is based on the use of temporal logic for specifying properties of reactive systems and develops an extensive verification methodology for proving that a system meets its temporal specification Reactive programs must be specified in terms of their ongoing behavior and temporal logic provides an expressive and natural language for specifying this behavior Our framework for specifying and verifying temporal properties of reactive systems is based on the following four components 1 A

computational model to describe the behavior of reactive systems The model adopted in this book is that of a Fair Transition System FTS , **Implementation and Application of Automata** Oscar H. Ibarra, 2003-07-07 Automata theory is the

foundation of computer science Its applications have spread to almost all areas of computer science and many other disciplines In addition there is a growing number of software systems designed to manipulate automata regular expressions grammars and related structures This volume contains 24 regular papers from the 8th International Conference on Implementation and Application of Automata CIAA 2003 held in Santa Barbara CA USA in July 2003 covering various topics in the theory implementation and application of automata and related structures It also includes the abstracts of two invited lectures as well as the abstracts of the poster papers displayed during the conference Data Refinement W.-P. de

Roever, Kai Engelhardt, 1998-12-03 The goal of this book is to provide a comprehensive and systematic introduction to the important and highly applicable method of data refinement and the simulation methods used for proving its correctness The authors concentrate in the first part on the general principles needed to prove data refinement correct They begin with an explanation of the fundamental notions showing that data refinement proofs reduce to proving simulation The book's second part contains a detailed survey of important methods in this field which are carefully analysed and shown to be either incomplete with counterexamples to their application or to be always applicable whenever data refinement holds This is shown by proving for the first time that all these methods can be described and analysed in terms of two simple notions forward and backward simulation The book is self contained going from advanced undergraduate level and taking the reader

to the state of the art in methods for proving simulation      KI-98: Advances in Artificial Intelligence Otthein Herzog, Andreas Günter, 1998-09-09 This book constitutes the refereed proceedings of the 22nd Annual German Conference on Artificial Intelligence KI 98 held in Bremen Germany in September 1998 The 16 revised full papers presented were carefully reviewed and selected for inclusion in the proceedings Also included are three invited papers and abstracts of two invited talks as well as an appendix containing up to date descriptions of German AI projects Thus the volume gives a unique overview of AI research in Germany      **Models, Algebras and Logic of Engineering Software** Manfred Broy, Markus Pizka, 2003 This volume focuses on the education of researchers teachers students and practitioners As usual in engineering a study and application of the relevant branches of mathematics is crucial both in education and practice      **Automata, Languages and Programming** Kim G. Larsen, Sven Skyum, Glynn Winskel, 1998-07-06 This book constitutes the refereed proceedings of the 25th International Colloquium on Automata Languages and Programming ICALP 98 held in Aalborg Denmark in July 1998 The 70 revised full papers presented together with eight invited contributions were carefully selected from a total of 182 submissions The book is divided in topical sections on complexity verification data structures concurrency computational geometry automata and temporal logic algorithms infinite state systems semantics approximation theorem proving formal languages pi calculus automata and BSP rewriting networking and routing zero knowledge quantum computing etc

**NASA Formal Methods** Ritchie Lee, Susmit Jha, Anastasia Mavridou, Dimitra Giannakopoulou, 2020-08-10 This book constitutes the proceedings of the 12th International Symposium on NASA Formal Methods NFM 2020 held in Moffett Field CA USA in May 2020 The 20 full and 5 short papers presented in this volume were carefully reviewed and selected from 62 submissions The papers are organized in the following topical sections learning and formal synthesis formal methods for DNNs high assurance systems requirement specification and testing validation and solvers solvers and program analysis verification and times systems autonomy and other applications and hybrid and cyber physical systems The conference was held virtually due to the COVID 19 pandemic The chapter Verifying a Solver for Linear Mixed Integer Arithmetic in Isabelle HOL is available open access under a Creative Commons Attribution 4 0 International License via link [springer.com](https://www.springer.com)

CONCUR 2002 - Concurrency Theory Lubos Brim, Petr Jancar, Mojmir Kretinsky, Antonin Kucera, 2003-08-02 This book constitutes the refereed proceedings of the 13th International Conference on Concurrency Theory CONCUR 2002 held in Brno Czech Republic in August 2002 The 32 revised full papers presented together with abstracts of seven invited contributions were carefully reviewed and selected from 101 submissions The papers are organized in topical sections on verification and model checking logic mobility probabilistic systems models of computation and process algebra security Petri nets and bisimulation      Real Time and Such Susanne Graf, Paul Pettersson, Bernhard Steffen, 2024-10-22 This Festschrift reflects Professor Wang Yi s contributions to the fields of formal methods real time systems and scheduling and multicore systems Wang Yi received a PhD in Computer Science from Chalmers University of Technology in 1991 since 2000

he has been Chair in Embedded Systems at Uppsala University He has not only pushed the boundaries of theoretical research but also pioneered practical implementations in software tools that have had a profound impact on both academia and industry He codeveloped the UPPAAL tool the foremost system for verifying timed automata now widely used in both academia and industry Over the years he expanded his research to include scheduling theories and he developed the TIMES and TIMES Pro tools which enhanced the analysis and implementation of real time systems His innovative work has significantly influenced the design and verification of complex multicore real time systems Among many awards honours and responsibilities Wang received a grant from the Knut and Alice Wallenberg Foundation an ERC Advanced Grant from the European Research Council in 2019 Uppsala University s Rudbeck Medal the IEEE TCRTS Award for technical achievement and leadership in real time computing and the CAV Award he is a Fellow of the ACM and the IEEE and a member of the Royal Society of Sciences in Uppsala and the Academia Europaea and he has chaired major software engineering and embedded system conferences and served on ACM SIGBED and IEEE TCRTS executive committees His guidance and mentorship have shaped the careers of many researchers and professionals in the field and the contributions in this volume celebrate his enduring impact

**Computer Aided Verification** Rajeev Alur, Doron A. Peled, 2004-07-30 This book constitutes the refereed proceedings of the 16th International Conference on Computer Aided Verification CAV 2004 held in Boston MA USA in July 2004 The 32 revised full research papers and 16 tool papers were carefully reviewed and selected from 144 submissions The papers cover all current issues in computer aided verification and model checking ranging from foundational and methodological issues to the evaluation of major tools and systems

**Knowledge-Based and Intelligent Information and Engineering Systems, Part I** Andreas Koenig, Andreas Dengel, Knut Hinkelmann, Koichi Kise, Robert J. Howlett, Lakhmi C. Jain, 2011-09-15 The four volume set LNAI 6881 LNAI 6884 constitutes the refereed proceedings of the 15th International Conference on Knowledge Based Intelligent Information and Engineering Systems KES 2011 held in Kaiserslautern Germany in September 2011 Part 1 The total of 244 high quality papers presented were carefully reviewed and selected from numerous submissions The 61 papers of Part 1 are organized in topical sections on artificial neural networks connectionist systems and evolutionary computation machine learning and classical AI agent multi agents systems knowledge based and expert systems intelligent vision image processing and signal processing knowledge management ontologies and data mining

**Computational Logic in Multi-Agent Systems** Francesca Toni, 2006-05-03 The sixth edition of CLIMA was held at City University London UK on June 27 29 2005

*Network-Oriented Modeling* Jan Treur, 2016-10-03 This book presents a new approach that can be applied to complex integrated individual and social human processes It provides an alternative means of addressing complexity better suited for its purpose than and effectively complementing traditional strategies involving isolation and separation assumptions Network oriented modeling allows high level cognitive affective and social models in the form of cyclic graphs to be constructed which can be automatically

transformed into executable simulation models The modeling format used makes it easy to take into account theories and findings about complex cognitive and social processes which often involve dynamics based on interrelating cycles Accordingly it makes it possible to address complex phenomena such as the integration of emotions within cognitive processes of all kinds of internal simulations of the mental processes of others and of social phenomena such as shared understandings and collective actions A variety of sample models including those for ownership of actions fear and dreaming the integration of emotions in joint decision making based on empathic understanding and evolving social networks illustrate the potential of the approach Dedicated software is available to support building models in a conceptual or graphical manner transforming them into an executable format and performing simulation experiments The majority of the material presented has been used and positively evaluated by undergraduate and graduate students and researchers in the cognitive social and AI domains Given its detailed coverage the book is ideally suited as an introduction for graduate and undergraduate students in many different multidisciplinary fields involving cognitive affective social biological and neuroscience domains

*Mathematical Foundations of Computer Science 1998* Lubos Brim, Jiri Zlatuska, Josef Gruska, 1998-08-12 This book constitutes the refereed proceedings of the 23rd International Symposium on the Mathematical Foundations of Computer Science MFCS 98 held in Brno Czech Republic in August 1998 The 71 revised full papers presented were carefully reviewed and selected from a total of 168 submissions Also included are 11 full invited surveys by prominent leaders in the area The papers are organized in topical sections on problem complexity logic semantics and automata rewriting automata and transducers typing concurrency semantics and logic circuit complexity programming structural complexity formal languages graphs Turing complexity and logic binary decision diagrams etc

**Larisa Maksimova on Implication, Interpolation, and Definability** Sergei Odintsov, 2018-01-30 This edited volume focuses on the work of Professor Larisa Maksimova providing a comprehensive account of her outstanding contributions to different branches of non classical logic The book covers themes ranging from rigorous implication relevance and algebraic logic to interpolation definability and recognizability in superintuitionistic and modal logics It features both her scientific autobiography and original contributions from experts in the field of non classical logics Professor Larisa Maksimova s influential work involved combining methods of algebraic and relational semantics Readers will be able to trace both influences on her work and the ways in which her work has influenced other logicians In the historical part of this book it is possible to trace important milestones in Maksimova s career Early on she developed an algebraic semantics for relevance logics and relational semantics for the logic of entailment Later Maksimova discovered that among the continuum of superintuitionistic logics there are exactly three pretabular logics She went on to obtain results on the decidability of tabularity and local tabularity problems for superintuitionistic logics and for extensions of S4 Further investigations by Maksimova were aimed at the study of fundamental properties of logical systems different versions of interpolation and definability disjunction property etc in big classes of logics and on decidability

and recognizability of such properties To this end she determined a powerful combination of algebraic and semantic methods which essentially determine the modern state of investigations in the area as can be seen in the later chapters of this book authored by leading experts in non classical logics These original contributions bring the reader up to date on the very latest work in this field

**Formal Methods: Foundations and Applications** Rohit Gheyi, David Naumann, 2012-09-17 This book constitutes the refereed proceedings of the 15th Brazilian Symposium on Formal Methods SBMF 2012 held in Natal Brazil in September 2012 co located with CBSoft 2012 the Third Brazilian Conference on Software Theory and Practice The 14 revised full papers presented together with 2 keynotes were carefully reviewed and selected from 29 submissions The papers presented cover a broad range of foundational and methodological issues in formal methods for the design and analysis of software and hardware systems as well as applications in various domains

Dependable Computing EDCC-4 Fabrizio Grandoni, 2003-08-02 It was with great pleasure that on behalf of the entire organizing committee I welcomed participants to EDCC 4 the Fourth European Dependable Computing Conference held for the first time in France The fourth issue of EDCC carried on the traditions established by the previous conferences in this series EDCC 1 was held in Berlin Germany in October 1994 EDCC 2 in Taormina Italy in October 1996 and EDCC 3 in Prague Czech Republic in September 1999 EDCC evolved from a merger of two other conference series at the moment when the Iron Curtain fell One of these known as the International Conference on Fault Tolerant Computing Systems was organized during the period 1982 1991 by the German Technical Interest Group Fault Tolerant Computing Systems The other series known as the International Conference on Fault Tolerant Systems and Diagnostics was organized during the period 1975 1990 in the former Czechoslovakia Poland Bulgaria and the former GDR The composition of the EDCC steering committee and the organizing committees of the successive issues of the conference have mirrored the East West unification character of the conference series The EDCC conference is becoming a unique meeting point for researchers and practitioners from all over the world in the field of Dependable Systems It is organized by the SEE Working Group Dependable Computing in France the GI ITG GMA Technical Committee on Dependability and Fault Tolerance in Germany and the AICA Working Group Dependability of Computer Systems in Italy Furthermore committees of several global professional organizations such as IEEE and IFIP support the conference

*Automata, Languages and Programming* Jos C.M. Baeten, Jan Karel Lenstra, Joachim Parrow, Gerhard J. Woeginger, 2003-01-01 The refereed proceedings of the 30th International Colloquium on Automata Languages and Programming ICALP 2003 held in Eindhoven The Netherlands in June July 2003 The 84 revised full papers presented together with six invited papers were carefully reviewed and selected from 212 submissions The papers are organized in topical sections on algorithms process algebra approximation algorithms languages and programming complexity data structures graph algorithms automata optimization and games graphs and bisimulation online problems verification the Internet temporal logic and model checking graph problems logic and lambda calculus data structures and algorithms types

and categories probabilistic systems sampling and randomness scheduling and geometric problems      **Artificial Intelligence and Soft Computing - ICAISC 2008** Leszek Rutkowski, Ryszard Tadeusiewicz, Lofti A. Zadeh, Jacek M. Zurada, 2008-06-16 This book constitutes the refereed proceedings of the 9th International Conference on Artificial Intelligence and Soft Computing ICAISC 2008 held in Zakopane Poland in June 2008 The 116 revised contributed papers presented were carefully reviewed and selected from 320 submissions The papers are organized in topical sections on neural networks and their applications fuzzy systems and their applications evolutionary algorithms and their applications classification rule discovery and clustering image analysis speech and robotics bioinformatics and medical applications various problems of artificial intelligence and agent systems

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