

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, Lancaster, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Zurich, Switzerland

John C. Mitchell

Stanford University, Stanford, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbrücken, Germany

More information about this series at <http://www.springer.com/series/7407>

Tiziana Margaria · Bernhard Steffen (Eds.)

Leveraging Applications of Formal Methods, Verification and Validation

Discussion, Dissemination,
Applications

7th International Symposium, ISoLA 2016
Imperial, Corfu, Greece, October 10–14, 2016
Proceedings, Part II

Editors
Tiziana Margaria
Lero
Limerick
Ireland

Bernhard Steffen
TU Dortmund
Dortmund
Germany

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-47168-6 ISBN 978-3-319-47169-3 (eBook)
DOI 10.1007/978-3-319-47169-3

Library of Congress Control Number: 2016953300

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer International Publishing AG 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Welcome to ISoLA 2016, the 7th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation, that was held in Corfu, Greece during October 10–14, 2016, endorsed by EASST, the European Association of Software Science and Technology.

This year's event followed the tradition of its forerunners held 2004 and 2006 in Cyprus, 2008 in Chalkidiki, 2010 and 2012 in Crete, and 2014 in Corfu, and the series of ISoLA Workshops in Greenbelt (USA) in 2005, Poitiers (France) in 2007, Potsdam (Germany) in 2009, in Vienna (Austria) in 2011, and 2013 in Palo Alto (USA).

As in the previous editions, ISoLA 2016 provided a forum for developers, users, and researchers to discuss issues related to the *adoption and use of rigorous tools and methods* for the specification, analysis, verification, certification, construction, test, and maintenance of systems from the point of view of their different application domains. Thus, since 2004 the ISoLA series of events serves the purpose of bridging the gap between designers and developers of rigorous tools, on one hand, and users in engineering and in other disciplines on the other hand. It fosters and exploits synergetic relationships among scientists, engineers, software developers, decision makers, and other critical thinkers in companies and organizations. By providing a specific, dialogue-oriented venue for the discussion of common problems, requirements, algorithms, methodologies, and practices, ISoLA aims in particular at supporting researchers in their quest to improve the usefulness, reliability, flexibility, and efficiency of tools for building systems and users in their search for adequate solutions to their problems.

The program of the symposium consisted of a collection of *special tracks* devoted to the following hot and emerging topics:

- Correctness-by-Construction and Post-Hoc Verification: Friends or Foes?
(Organizers: Maurice ter Beek, Reiner Haehnle, Ina Schaefer)
- Static and Runtime Verification: Competitors or Friends?
(Organizers: Dilian Gurov, Klaus Havelund, Marieke Huisman, Rosemary Monahan)
- Testing the Internet of Things
(Organizers: Michael Felderer, Ina Schieferdecker)
- Rigorous Engineering of Collective Adaptive Systems
(Organizers: Stefan Jähnichen, Martin Wirsing)
- RVE: Runtime Verification and Enforcement, the (Industrial) Application Perspective
(Organizers: Ezio Bartocci, Ylies Falcone)
- ModSyn-PP: Modular Synthesis of Programs and Processes
(Organizers: Boris Döder, George Heineman, Jakob Rehof)
- Variability Modelling for Scalable Software Evolution
(Organizers: Ferruccio Damiani, Christoph Seidl, Ingrid Chieh Yu)
- Statistical Model Checking
(Organizers: Kim Larsen, Axel Legay)

- Detecting and Understanding Software Doping (Organizers: Christel Baier, Holger Hermanns)
- Formal Methods and Safety Certification: Challenges in the Railways Domain (Organizers: Alessandro Fantechi, Stefania Gnesi)
- Semantic Heterogeneity in the Formal Development of Complex Systems (Organizers: Idir Ait Sadoune, Paul Gibson, Marc Pantel)
- Privacy and Security Issues in Information Systems (Organizers: Axel Legay, Fabrizio Biondi)
- Evaluation and Reproducibility of Program Analysis and Verification (Organizers: Markus Schordan, Dirk Beyer, Jonas Lundberg)
- Towards a Unified View of Modeling and Programming (Organizers: Manfred Broy, Klaus Havelund, Rahul Kumar, Bernhard Steffen)
- Learning Systems: Machine-Learning in Software Products and Learning-Based Analysis of Software Systems (Organizers: Falk Howar, Andreas Rausch, Karl Meinke)

The following embedded events were also hosted:

- RERS: Challenge on Rigorous Examination of Reactive Systems (Falk Howar, Markus Schordan, Bernhard Steffen, Jaco van de Pol)
- Doctoral Symposium and Poster Session (Anna-Lena Lamprecht)
- Tutorial: Automata Learning in Practice (Falk Howar, Karl Meinke)
- Industrial Day (Axel Hessenkämper)

Co-located with the ISoLA Symposium was:

- STRESS 2016 – 4th International School on Tool-Based Rigorous Engineering of Software Systems (J. Hatcliff, T. Margaria, Robby, B. Steffen)

In addition to the contributions of the main conference, the proceedings also comprise contributions of the four embedded events and tutorial papers for STRESS. We thank the track organizers, the members of the Program Committee and their reviewers for their effort in selecting the papers to be presented, the local organization chair, Petros Stratis, and the EasyConferences team for their continuous precious support during the week as well as during the entire two-year period preceding the events, and Springer for being, as usual, a very reliable partner for the publication of the proceedings. Finally, we are grateful to Kyriakos Georgiades for his continuous support for the website and the program, and to Markus Frohme, Johannes Neubauer, and Julia Rehder for their help with the online conference service (OCS).

Special thanks are due to the following organizations for their endorsement: EASST (European Association of Software Science and Technology) and Lero – The Irish Software Research Centre, and our own institutions – the TU Dortmund and the University of Limerick.

Organization

Symposium Chair

Tiziana Margaria Lero, Ireland

Program Chair

Bernhard Steffen TU Dortmund, Germany

Program Committee

Yamine Ait Ameur	IRIT-ENSEEIH, France
Idir Ait-Sadoune	SUPELEC, France
Christel Baier	TU Dresden, Germany
Ezio Bartocci	TU Wien, Austria
Dirk Beyer	LMU Munich, Germany
Fabrizio Biondi	Inria, France
Manfred Broy	TUM, Germany
Ferruccio Damiani	University of Turin, Italy
Boris Duedder	TU Dortmund, Germany
Ylies Falcone	University of Grenoble, France
Alessandro Fantechi	Università di Firenze, Italy
Michael Felderer	University of Innsbruck, Austria
Paul Gibson	Telecom Sud Paris, France
Stefania Gnesi	CNR, Italy
Kim Guldstrand Larsen	Aalborg University, Denmark
Dilian Gurov	KTH Royal Institute of Technology, Sweden
Klaus Havelund	Jet Propulsion Laboratory, USA
George Heineman	WPI, USA
Holger Hermanns	Saarland University, Germany
Axel Hessenkämper	Hottinger Baldwin Messtechnik GmbH, Germany
Falk Howar	Clausthal University of Technology, Germany
Marieke Huisman	University of Twente, The Netherlands
Reiner Hähnle	TU Darmstadt, Germany
Stefan Jaehnichen	TU Berlin, Germany
Jens Knoop	TU Wien, Austria
Anna-Lena Lamprecht	University of Limerick, Ireland
Axel Legay	Inria, France
Martin Leucker	University of Lübeck, Germany
Jonas Lundberg	Linneaus University, Sweden
Tiziana Margaria	Lero, Ireland

Karl Meinke	KTH Royal Institute of Technology, Sweden
Rosemary Monahan	NUI Maynooth, Ireland
Marc Pantel	Université de Toulouse, France
Jakob Rehof	TU Dortmund, Germany
Ina Schaefer	TU Braunschweig, Germany
Ina Schieferdecker	Fraunhofer FOKUS/TU Berlin, Germany
Markus Schordan	Lawrence Livermore National Laboratory, USA
Christoph Seidl	TU Braunschweig, Germany
Bernhard Steffen	TU Dortmund, Germany
Maurice ter Beek	ISTI-CNR, Italy
Martin Wirsing	LMU, Germany
Ingrid Chieh Yu	University of Oslo, Norway

Additional Reviewers

Vahdat Abdelzad	University of Ottawa, Canada
Michał Antkiewicz	University of Waterloo, Canada
Davide Basile	ISTI-CNR Pisa, Italy
Bernhard Beckert	Karlsruhe Institute of Technology, Germany
Lenz Belzner	LMU, Germany
Saddek Bensalem	Verimag, France
Gérard Berry	Collège de France, France
Marius Bozga	Verimag, France
Tomas Bures	Charles University Prag, Czech Republic
Laura Carnevali	STLAB, Italy
Sofia Cassel	Uppsala University, Sweden
Vincenzo Ciancia	ISTI-CNR, Italy
Loek Cleophas	TU Eindhoven, The Netherlands
Franco Luca De Angelis	University Geneva, Switzerland
Rocco De Nicola	IMT Lucca, Italy
Julien Delange	CMU-SEI, USA
Giovanna Di Marzo	CUI, Switzerland
Serugendo	
Maged Elaasar	Modelware Solutions, USA
Hilding Elmqvist	Mogram AB, Sweden
Uli Fahrenberg	Inria, France
Alessio Ferrari	CNR, Italy
John Fitzgerald	Newcastle University, UK
Thomas Given-Wilson	Inria, France
Sorren Hanvey	University of Limerick, Ireland
Anne E. Haxthausen	Technical University of Denmark, Denmark
Robert Heinrichs	TU Berlin, Germany
Rolf Hennicker	LMU, Germany
Phillip James	Swansea University, UK
Einar Broch Johnsen	University of Oslo, Norway
Gabor Karsai	Vanderbilt University, USA

Jetty Kleijn	Leiden University, The Netherlands
Rahul Kumar	Microsoft Research, USA
Peter Gorm Larsen	Aarhus University, Denmark
Diego Latella	ISTI-CNR, Italy
Timothy Lethbridge	University of Ottawa, Canada
Jia-Chun Lin	University of Oslo, Norway
Michele Loreti	University of Florence, Italy
Hugo Macedo	DTU, Denmark
Mieke Massink	ISTI-CNR, Italy
Jacopo Mauro	University of Oslo, Norway
Philip Mayer	LMU, Germany
Franco Mazzanti	CNR, Italy
Alexandra Mehlhase	TU Berlin, Germany
Marco Muniz	Aalborg University, Denmark
Radu Muschevici	TU Darmstadt, Germany
Dominique Méry	Université de Lorraine, France
Min-Young Nam	Carnegie Mellon University, USA
Stefan Naujokat	TU Dortmund, Germany
Johannes Neubauer	TU Dortmund, Germany
Henrik Peters	TU Clausthal, Germany
Danny Bøgsted Poulsen	Aalborg, Denmark
James Power	NUI Maynooth, Ireland
Christian W. Probst	Technical University of Denmark
Rosario Pugliese	University of Florence, Italy
Daniela Rabiser	CDL MEVSS, JKU Linz, Austria
Andrea Rosà	Università della Svizzera italiana (USI), Switzerland
Nicolas Rouquette	JPL, USA
Rudolf Schlatte	University of Oslo, Norway
Rupert Schlick	AIT, Austria
Gerardo Schneider	University of Gothenburg, Sweden
Sean Sedwards	Inria, France
Laura Semini	University of Pisa, Italy
Stefan Stanculescu	IT University of Copenhagen, Denmark
Francesco Tiezzi	University of Camerino, Italy
Louis-Marie Traonouez	Inria, France
Mirco Tribastone	IMT Lucca, Italy
Andrea Vandin	IMT Lucca, Italy
David Wille	TU Braunschweig, Germany
James Woodcock	University of York, UK
Erik de Vink	Eindhoven University of Technology, The Netherlands

Contents – Part II

Towards a Unified View of Modeling and Programming

Towards a Unified View of Modeling and Programming (Track Summary)	3
<i>Manfred Broy, Klaus Havelund, Rahul Kumar, and Bernhard Steffen</i>	
Programming \subset Modeling \subset Engineering	11
<i>Bran Selic</i>	
On a Unified View of Modeling and Programming Position Paper	27
<i>Ed Seidewitz</i>	
On the Feasibility of a Unified Modelling and Programming Paradigm	32
<i>Anne E. Haxthausen and Jan Peleska</i>	
Modeling Meets Programming: A Comparative Study in Model Driven Engineering Action Languages	50
<i>Maged Elaasar and Omar Badreddin</i>	
Abstractions for Modeling Complex Systems	68
<i>Zsolt Lattmann, Tamás Kecskés, Patrik Meijer, Gábor Karsai, Péter Völgyesi, and Ákos Lédeczi</i>	
Specifying and Verifying Advanced Control Features	80
<i>Gary T. Leavens, David Naumann, Hridayesh Rajan, and Tomoyuki Aotani</i>	
Simplifying OMG MOF-Based Metamodeling	97
<i>Nicolas F. Rouquette</i>	
Modelling and Testing of Real Systems	119
<i>Andreas Prinz, Birger Møller-Pedersen, and Joachim Fischer</i>	
Unifying Modelling and Programming: A Systems Biology Perspective	131
<i>Hillel Kugler</i>	
Formally Unifying Modeling and Design for Embedded Systems - A Personal View.	134
<i>G. Berry</i>	
Interactive Model-Based Compilation Continued – Incremental Hardware Synthesis for SCCharts	150
<i>Francesca Rybicki, Steven Smyth, Christian Motika, Alexander Schulz-Rosengarten, and Reinhard von Hanxleden</i>	

Towards Semantically Integrated Models and Tools for Cyber-Physical Systems Design	171
<i>Peter Gorm Larsen, John Fitzgerald, Jim Woodcock, René Nilsson, Carl Gamble, and Simon Foster</i>	
Merging Modeling and Programming Using Umlle.	187
<i>Timothy C. Lethbridge, Vahdat Abdelzad, Mahmoud Husseini Orabi, Ahmed Husseini Orabi, and Opeyemi Adesina</i>	
Systems Modeling and Programming in a Unified Environment Based on Julia	198
<i>Hilding Elmqvist, Toivo Henningsson, and Martin Otter</i>	
Meta-Level Reuse for Mastering Domain Specialization.	218
<i>Stefan Naujokat, Johannes Neubauer, Tiziana Margaria, and Bernhard Steffen</i>	
Towards a Unified View of Modeling and Programming	238
<i>Manfred Broy, Klaus Havelund, and Rahul Kumar</i>	
Formal Methods and Safety Certification: Challenges in the Railways Domain	
Formal Methods and Safety Certification: Challenges in the Railways Domain	261
<i>Alessandro Fantechi, Alessio Ferrari, and Stefania Gnesi</i>	
On the Use of Static Checking in the Verification of Interlocking Systems. . .	266
<i>Anne E. Haxthausen and Peter H. Østergaard</i>	
Compositional Verification of Multi-station Interlocking Systems	279
<i>Hugo D. Macedo, Alessandro Fantechi, and Anne E. Haxthausen</i>	
OnTrack: The Railway Verification Toolset: Extended Abstract	294
<i>Phillip James, Faron Moller, Hoang Nga Nguyen, Markus Roggenbach, Helen Treharne, and Xu Wang</i>	
Experiments in Formal Modelling of a Deadlock Avoidance Algorithm for a CBTC System.	297
<i>Franco Mazzanti, Alessio Ferrari, and Giorgio O. Spagnolo</i>	
Tuning Energy Consumption Strategies in the Railway Domain: A Model-Based Approach	315
<i>Davide Basile, Felicita Di Giandomenico, and Stefania Gnesi</i>	

RVE: Runtime Verification and Enforcement, the (Industrial) Application Perspective

Runtime Verification and Enforcement, the (Industrial) Application Perspective (Track Introduction)	333
<i>Ezio Bartocci and Ylies Falcone</i>	
What Is a Trace? A Runtime Verification Perspective	339
<i>Giles Reger and Klaus Havelund</i>	
Execution Trace Analysis Using LTL-FO ⁺	356
<i>Raphaël Khoury, Sylvain Hallé, and Omar Waldmann</i>	
Challenges in Fault-Tolerant Distributed Runtime Verification	363
<i>Borzoo Bonakdarpour, Pierre Fraigniaud, Sergio Rajsbaum, and Corentin Travers</i>	
The HARMONIA Project: Hardware Monitoring for Automotive Systems-of-Systems.	371
<i>Thang Nguyen, Ezio Bartocci, Dejan Ničković, Radu Grosu, Stefan Jaksic, and Konstantin Selyunin</i>	
Runtime Verification for Interconnected Medical Devices.	380
<i>Martin Leucker, Malte Schmitz, and Danilo à Tellinghusen</i>	
Dynamic Analysis of Regression Problems in Industrial Systems: Challenges and Solutions	388
<i>Fabrizio Pastore and Leonardo Mariani</i>	
Towards a Logic for Inferring Properties of Event Streams.	394
<i>Sean Kauffman, Rajeev Joshi, and Klaus Havelund</i>	
Runtime Verification for Stream Processing Applications.	400
<i>Christian Colombo, Gordon J. Pace, Luke Camilleri, Claire Dimech, Reuben Farrugia, Jean Paul Grech, Alessio Magro, Andrew C. Sammut, and Kristian Zarb Adami</i>	
On the Runtime Enforcement of Evolving Privacy Policies in Online Social Networks	407
<i>Gordon J. Pace, Raúl Pardo, and Gerardo Schneider</i>	
On the Specification and Enforcement of Privacy-Preserving Contractual Agreements	413
<i>Gerardo Schneider</i>	

Variability Modeling for Scalable Software Evolution

Introduction to the Track on Variability Modeling for Scalable Software Evolution	423
<i>Ferruccio Damiani, Christoph Seidl, and Ingrid Chieh Yu</i>	
Towards Incremental Validation of Railway Systems	433
<i>Reiner Hähnle and Radu Muschevici</i>	
Modeling and Optimizing Automotive Electric/Electronic (E/E) Architectures: Towards Making Clafer Accessible to Practitioners	447
<i>Eldar Khalilov, Jordan Ross, Michał Antkiewicz, Markus Völter, and Krzysztof Czarnecki</i>	
Variability-Based Design of Services for Smart Transportation Systems	465
<i>Maurice H. ter Beek, Alessandro Fantechi, Stefania Gnesi, and Laura Semini</i>	
Comparing AWS Deployments Using Model-Based Predictions	482
<i>Einar Broch Johnsen, Jia-Chun Lin, and Ingrid Chieh Yu</i>	
A Toolchain for Delta-Oriented Modeling of Software Product Lines	497
<i>Cristina Chesta, Ferruccio Damiani, Liudmila Dobriakova, Marco Guernieri, Simone Martini, Michael Nieke, Vítor Rodrigues, and Sven Schuster</i>	
A Technology-Neutral Role-Based Collaboration Model for Software Ecosystems	512
<i>Ștefan Stănculescu, Daniela Rabiser, and Christoph Seidl</i>	
Adaptable Runtime Monitoring for the Java Virtual Machine	531
<i>Andrea Rosà, Yudi Zheng, Haiyang Sun, Omar Javed, and Walter Binder</i>	
Identifying Variability in Object-Oriented Code Using Model-Based Code Mining	547
<i>David Wille, Michael Tiede, Sandro Schulze, Christoph Seidl, and Ina Schaefer</i>	
User Profiles for Context-Aware Reconfiguration in Software Product Lines . . .	563
<i>Michael Nieke, Jacopo Mauro, Christoph Seidl, and Ingrid Chieh Yu</i>	
Refactoring Delta-Oriented Product Lines to Enforce Guidelines for Efficient Type-Checking	579
<i>Ferruccio Damiani and Michael Lienhardt</i>	

Detecting and Understanding Software Doping

Detecting and Understanding Software Doping — Track Introduction	598
<i>Christel Baier and Holger Hermanns</i>	
Facets of Software Doping	601
<i>Gilles Barthe, Pedro R. D’Argenio, Bernd Finkbeiner, and Holger Hermanns</i>	
Software that Meets Its Intent	609
<i>Marieke Huisman, Herbert Bos, Sjaak Brinkkemper, Arie van Deursen, Jan Friso Groote, Patricia Lago, Jaco van de Pol, and Eelco Visser</i>	
Compliance, Functional Safety and Fault Detection by Formal Methods.	626
<i>Christof Fetzer, Christoph Weidenbach, and Patrick Wischnewski</i>	
What the Hack Is Wrong with Software Doping?	633
<i>Kevin Baum</i>	

Learning Systems: Machine-Learning in Software Products and Learning-Based Analysis of Software Systems

Learning Systems: Machine-Learning in Software Products and Learning-Based Analysis of Software Systems: Special Track at ISO/IEC JTC1 SC30 2016	651
<i>Falk Howar, Karl Meinke, and Andreas Rausch</i>	
ALEX: Mixed-Mode Learning of Web Applications at Ease.	655
<i>Alexander Bainsczyk, Alexander Schieweck, Malte Isberner, Tiziana Margaria, Johannes Neubauer, and Bernhard Steffen</i>	
Assuring the Safety of Advanced Driver Assistance Systems Through a Combination of Simulation and Runtime Monitoring.	672
<i>Malte Mauritz, Falk Howar, and Andreas Rausch</i>	
Enhancement of an Adaptive HEV Operating Strategy Using Machine Learning Algorithms	688
<i>Mark Schudeleit, Meng Zhang, Xiaofei Qi, Ferit Küçükay, and Andreas Rausch</i>	

Testing the Internet of Things

Testing the Internet of Things.	704
<i>Michael Felderer and Ina Schieferdecker</i>	

Data Science Challenges to Improve Quality Assurance of Internet of Things Applications.	707
<i>Harald Foidl and Michael Felderer</i>	
Model-Based Testing as a Service for IoT Platforms	727
<i>Abbas Ahmad, Fabrice Bouquet, Elizabeta Fournernet, Franck Le Gall, and Bruno Legeard</i>	
Doctoral Symposium	
ISoLA Doctoral Symposium.	744
<i>Anna-Lena Lamprecht</i>	
Handling Domain Knowledge in Formal Design Models: An Ontology Based Approach	747
<i>Kahina Hacid</i>	
Industrial Track	
A Retrospective of the Past Four Years with Industry 4.0	754
<i>Axel Hessenkämper</i>	
Effective and Efficient Customization Through Lean Trans-Departmental Configuration	757
<i>Barbara Steffen, Steve Boßelmann, and Axel Hessenkämper</i>	
A Fully Model-Based Approach to Software Development for Industrial Centrifuges.	774
<i>Nils Wortmann, Malte Michel, and Stefan Naujokat</i>	
RERS Challenge	
RERS 2016: Parallel and Sequential Benchmarks with Focus on LTL Verification	787
<i>Maren Geske, Marc Jasper, Bernhard Steffen, Falk Howar, Markus Schordan, and Jaco van de Pol</i>	
STRESS	
Introduction	806
DIME: A Programming-Less Modeling Environment for Web Applications . . .	809
<i>Steve Boßelmann, Markus Frohme, Dawid Kopetzki, Michael Lybecait, Stefan Naujokat, Johannes Neubauer, Dominic Wirkner, Philip Zweihoff, and Bernhard Steffen</i>	

Verification Techniques for Hybrid Systems <i>Pavithra Prabhakar, Miriam Garcia Soto, and Ratan Lal</i>	833
On the Power of Statistical Model Checking. <i>Kim G. Larsen and Axel Legay</i>	843
Erratum to: Verification Techniques for Hybrid Systems <i>Pavithra Prabhakar, Miriam Garcia Soto, and Ratan Lal</i>	E1
Author Index	863

Contents – Part I

Statistical Model Checking

Statistical Model Checking: Past, Present, and Future	3
<i>Kim G. Larsen and Axel Legay</i>	
Hypothesis Testing for Rare-Event Simulation: Limitations and Possibilities . . .	16
<i>Daniël Reijsbergen, Pieter-Tjerk de Boer, and Werner Scheinhardt</i>	
Survey of Statistical Verification of Linear Unbounded Properties: Model Checking and Distances	27
<i>Jan Křetínský</i>	
Feedback Control for Statistical Model Checking of Cyber-Physical Systems	46
<i>K. Kalajdzic, C. Jegourel, A. Lukina, E. Bartocci, A. Legay, S.A. Smolka, and R. Grosu</i>	
Probabilistic Model Checking of Incomplete Models	62
<i>Shiraj Arora and M.V. Panduranga Rao</i>	
Plasma Lab: A Modular Statistical Model Checking Platform	77
<i>Axel Legay, Sean Sedwards, and Louis-Marie Traonouez</i>	
Synthesizing Energy-Optimal Controllers for Multiprocessor Dataflow Applications with UPPAAL STRATEGO	94
<i>Waheed Ahmad and Jaco van de Pol</i>	
Statistical Model Checking for Product Lines	114
<i>Maurice H. ter Beek, Axel Legay, Alberto Lluch Lafuente, and Andrea Vandin</i>	
Towards Adaptive Scheduling of Maintenance for Cyber-Physical Systems. . . .	134
<i>Alexis Linard and Marcos L.P. Bueno</i>	
Better Railway Engineering Through Statistical Model Checking	151
<i>Enno Ruijters and Mariëlle Stoelinga</i>	
On Creation and Analysis of Reliability Models by Means of Stochastic Timed Automata and Statistical Model Checking: Principle	166
<i>Josef Strnadel</i>	
Automatic Synthesis of Code Using Genetic Programming	182
<i>Doron Peled</i>	

Evaluation and Reproducibility of Program Analysis and Verification

Evaluation and Reproducibility of Program Analysis and Verification (Track Introduction)	191
<i>Markus Schordan, Dirk Beyer, and Jonas Lundberg</i>	
Symbolic Execution with CEGAR.	195
<i>Dirk Beyer and Thomas Lemberger</i>	
Multi-core Model Checking of Large-Scale Reactive Systems Using Different State Representations	212
<i>Marc Jasper and Markus Schordan</i>	
Sparse Analysis of Variable Path Predicates Based upon SSA-Form	227
<i>Thomas S. Heinze and Wolfram Amme</i>	
A Model Interpreter for Timed Automata.	243
<i>M. Usman Iftikhar, Jonas Lundberg, and Danny Weyns</i>	

ModSyn-PP: Modular Synthesis of Programs and Processes

ModSyn-PP: Modular Synthesis of Programs and Processes Track Introduction	261
<i>Boris Döder, George T. Heineman, and Jakob Rehof</i>	
Combinatory Process Synthesis.	266
<i>Jan Bessai, Andrej Dudenhefner, Boris Döder, Moritz Martens, and Jakob Rehof</i>	
Synthesis from a Practical Perspective	282
<i>Sven Jörges, Anna-Lena Lamprecht, Tiziana Margaria, Stefan Naujokat, and Bernhard Steffen</i>	
A Long and Winding Road Towards Modular Synthesis	303
<i>George T. Heineman, Jan Bessai, Boris Döder, and Jakob Rehof</i>	

Semantic Heterogeneity in the Formal Development of Complex Systems

Semantic Heterogeneity in the Formal Development of Complex Systems: An Introduction	321
<i>J. Paul Gibson, Idir Ait-Sadoune, and Marc Pantel</i>	
On the Use of Domain and System Knowledge Modeling in Goal-Based Event-B Specifications.	325
<i>Amel Mammam and Régine Laleau</i>	
Strengthening MDE and Formal Design Models by References to Domain Ontologies. A Model Annotation Based Approach.	340
<i>Kahina Hacid and Yamine Ait-Ameur</i>	

Towards Functional Requirements Analytics.	358
<i>Zouhir Djilani, Nabila Berkani, and Ladjel Bellatreche</i>	
Heterogeneous Semantics and Unifying Theories	374
<i>Jim Woodcock, Simon Foster, and Andrew Butterfield</i>	
Static and Runtime Verification: Competitors or Friends?	
Static and Runtime Verification, Competitors or Friends? (Track Summary) . . .	397
<i>Dilian Gurov, Klaus Havelund, Marieke Huisman, and Rosemary Monahan</i>	
StaRVOORs — Episode II: Strengthen and Distribute the Force	402
<i>Wolfgang Ahrendt, Gordon J. Pace, and Gerardo Schneider</i>	
A Model-Based Approach to Combining Static and Dynamic Verification Techniques	416
<i>Shaun Azzopardi, Christian Colombo, and Gordon Pace</i>	
Information Flow Analysis for Go.	431
<i>Eric Bodden, Ka I. Pun, Martin Steffen, Volker Stolz, and Anna-Katharina Wickert</i>	
Challenges in High-Assurance Runtime Verification	446
<i>Alwyn Goodloe</i>	
Static versus Dynamic Verification in Why3, Frama-C and SPARK 2014 . . .	461
<i>Nikolai Kosmatov, Claude Marché, Yannick Moy, and Julien Signoles</i>	
Considering Typestate Verification for Quantified Event Automata	479
<i>Giles Reger</i>	
Combining Static and Runtime Methods to Achieve Safe Standing-Up for Humanoid Robots	496
<i>Francesco Leofante, Simone Vuotto, Erika Ábrahám, Armando Tacchella, and Nils Jansen</i>	
On Combinations of Static and Dynamic Analysis – Panel Introduction.	515
<i>Martin Leucker</i>	
Safer Refactorings.	517
<i>Anna Maria Eilertsen, Anya Helene Bagge, and Volker Stolz</i>	
Rigorous Engineering of Collective Adaptive Systems	
Rigorous Engineering of Collective Adaptive Systems Track Introduction . . .	535
<i>Stefan Jähnichen and Martin Wirsing</i>	

Programming of CAS Systems by Relying on Attribute-Based Communication.	539
<i>Yehia Abd Alrahman, Rocco De Nicola, and Michele Loreti</i>	
Towards Static Analysis of Policy-Based Self-adaptive Computing Systems . . .	554
<i>Andrea Margheri, Hanne Riis Nielson, Flemming Nielson, and Rosario Pugliese</i>	
A Calculus for Open Ensembles and Their Composition	570
<i>Rolf Hennicker</i>	
Logic Fragments: Coordinating Entities with Logic Programs	589
<i>Francesco Luca De Angelis and Giovanna Di Marzo Serugendo</i>	
Mixed-Critical Systems Design with Coarse-Grained Multi-core Interference	605
<i>Peter Poplavko, Rany Kahil, Dario Soggi, Saddek Bensalem, and Marius Bozga</i>	
A Library and Scripting Language for Tool Independent Simulation Descriptions	622
<i>Alexandra Mehlhase, Stefan Jähnichen, Amir Czwinck, and Robert Heinrichs</i>	
Adaptation to the Unforeseen: Do we Master our Autonomous Systems? Questions to the Panel – Panel Introduction	639
<i>Stefan Jähnichen and Martin Wirsing</i>	
Smart Coordination of Autonomic Component Ensembles in the Context of Ad-Hoc Communication	642
<i>Tomas Bures, Petr Hnetynka, Filip Krijt, Vladimir Matena, and Frantisek Plasil</i>	
A Tool-Chain for Statistical Spatio-Temporal Model Checking of Bike Sharing Systems	657
<i>Vincenzo Ciancia, Diego Latella, Mieke Massink, Rytis Paškauskas, and Andrea Vandin</i>	
Rigorous Graphical Modelling of Movement in Collective Adaptive Systems	674
<i>N. Zoń, S. Gilmore, and J. Hillston</i>	
Integration and Promotion of Autonomy with the ARE Framework	689
<i>Emil Vassev and Mike Hinchey</i>	
Safe Artificial Intelligence and Formal Methods (Position Paper)	704
<i>Emil Vassev</i>	

Engineering Adaptivity, Universal Autonomous Systems Ethics and Compliance Issues: ISOLA’2016 - Panel Discussion Position Paper. 714
Giovanna Di Marzo Serugendo

Correctness-by-Construction and Post-hoc Verification: Friends or Foes?

Correctness-by-Construction and Post-hoc Verification: Friends or Foes? 723
Maurice H. ter Beek, Reiner Hähnle, and Ina Schaefer

Correctness-by-Construction and Post-hoc Verification: A Marriage of Convenience? 730
Bruce W. Watson, Derrick G. Kourie, Ina Schaefer, and Loek Cleophas

Deductive Verification of Legacy Code 749
Bernhard Beckert, Thorsten Bormer, and Daniel Grahl

Correctness-by-Construction \wedge Taxonomies \Rightarrow Deep Comprehension of Algorithm Families 766
Loek Cleophas, Derrick G. Kourie, Vreda Pieterse, Ina Schaefer, and Bruce W. Watson

Conditions for Compatibility of Components: The Case of Masters and Slaves 784
Maurice H. ter Beek, Josep Carmona, and Jetty Kleijn

A Logic for the Statistical Model Checking of Dynamic Software Architectures 806
Jean Quilbeuf, Everton Cavalcante, Louis-Marie Traonouez, Flavio Oquendo, Thais Batista, and Axel Legay

On Two Friends for Getting Correct Programs: Automatically Translating Event B Specifications to Recursive Algorithms in RODIN 821
Zheng Cheng, Dominique Méry, and Rosemary Monahan

Proof-Carrying Apps: Contract-Based Deployment-Time Verification 839
Sönke Holthusen, Michael Nieke, Thomas Thüm, and Ina Schaefer

Supervisory Controller Synthesis for Product Lines Using CIF 3. 856
Maurice H. ter Beek, Michel A. Reniers, and Erik P. de Vink

Partial Verification and Intermediate Results as a Solution to Combine Automatic and Interactive Verification Techniques 874
Dirk Beyer

Privacy and Security Issues in Information Systems

Security and Privacy of Protocols and Software with Formal Methods. 883
Fabrizio Biondi and Axel Legay

A Model-Based Approach to Secure Multipart Distributed Systems	893
<i>Najah Ben Said, Takoua Abdellatif, Saddek Bensalem, and Marius Bozga</i>	
Information Leakage Analysis of Complex C Code and Its application to OpenSSL	909
<i>Pasquale Malacaria, Michael Tautchning, and Dino DiStefano</i>	
Integrated Modeling Workflow for Security Assurance	926
<i>Min-Young Nam, Julien Delange, and Peter Feiler</i>	
A Privacy-Aware Conceptual Model for Handling Personal Data	942
<i>Thibaud Antignac, Riccardo Scandariato, and Gerardo Schneider</i>	
Guaranteeing Privacy-Observing Data Exchange	958
<i>Christian W. Probst</i>	
Erratum to: Leveraging Applications of Formal Methods, Verification and Validation (Part I).	E1
<i>Tiziana Margaria and Bernhard Steffen</i>	
Author Index	971