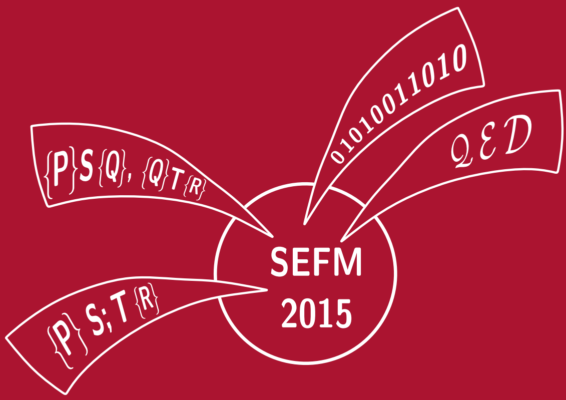
Radu Calinescu
Bernhard Rumpe (Eds.)

LNCS 9276

Software Engineering and Formal Methods

13th International Conference, SEFM 2015
York, UK, September 7–11, 2015
Proceedings



Springer

Lecture Notes in Computer Science 9276

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, Zürich, 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

[CR15] R. Calinescu, B. Rumpe (Eds.):
Software Engineering and Formal Methods (SEFM'15).
LNCS 9276, Springer, 2015.
www.se-rwth.de/publications

More information about this series at http://www.springer.com/series/7408

Radu Calinescu · Bernhard Rumpe (Eds.)

Software Engineering and Formal Methods

13th International Conference, SEFM 2015 York, UK, September 7–11, 2015 Proceedings

Springer

Editors
Radu Calinescu
Department of Computer Science
University of York
York
UK

Bernhard Rumpe
Software Engineering
Department of Computer Science
RWTH Aachen University
Aachen
Germany

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-22968-3 ISBN 978-3-319-22969-0 (eBook)
DOI 10.1007/978-3-319-22969-0

Library of Congress Control Number: 2015946575

LNCS Sublibrary: SL2 – Programming and Software Engineering

Springer Cham Heidelberg New York Dordrecht London
© Springer International Publishing Switzerland 2015
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

Springer International Publishing AG Switzerland is part of Springer Science+Business Media
(www.springer.com)

Preface

The 13th edition of the International Conference on Software Engineering and Formal Methods (SEFM) was held in York, UK, during September 7–11, 2015. The conference brought together researchers and practitioners from academia, industry, and government to advance the state of the art in formal methods, to facilitate their uptake in the software industry, and to encourage their integration within practical software engineering methods and tools.

Authors were invited to submit full research papers describing original research results, case studies, and tools; and short new ideas/work-in-progress papers describing new approaches, techniques, and/or tools not fully validated yet. The topics of interest included the following aspects of software engineering and formal methods:

- Formal requirement analysis, modelling, specification and design
- Abstraction and refinement
- Formal methods for probabilistic verification and synthesis
- Programming languages, program analysis, and type theory
- Formal methods for self-adaptive systems, service-oriented, and cloud computing
- Formal aspects of security and mobility
- Model checking, theorem proving, and decision procedures
- Formal methods for real-time, hybrid, and embedded/cyber-physical systems
- Formal methods for safety-critical, fault-tolerant, and secure systems
- Software architecture and coordination languages
- Software verification and validation
- Component, object, and multi-agent systems
- Formal aspects of software evolution and maintenance
- Formal methods for testing, re-engineering, and reuse
- Light-weight and scalable formal methods
- Tool integration
- Applications of formal methods, industrial case studies, and technology transfer
- Education and formal methods
- Interactive systems and human error analysis
- Formal methods for HCI
- Formal analysis of human behavior

SEFM 2015 received 96 submissions. All submitted papers underwent a rigorous review process, each paper receiving three reviews. After a careful discussion phase, the international Program Committee decided to select 17 research papers and six new ideas/work-in-progress papers. These papers cover a wide variety of topics from areas where formal methods can be applied to software engineering. They also address a broad range of application domains.

The conference featured three keynote talks, by Peter OHearn (University College London and Facebook, UK), Cliff Jones (Newcastle University, UK), and Edward A. Lee

(University of California at Berkeley, USA). Their talks are partially reflected through invited papers that can be found at the beginning of this volume.

Four international workshops were colocated with SEFM 2015:

- ATSE – 6th Workshop on Automating Test Case Design, Selection and Evaluation
- HOFM – Human-Oriented Formal Methods: From Readability to Automation
- MoKMaSD – 4th International Symposium on Modelling and Knowledge Management Applications: Systems and Domains
- VERY*SCART: International Workshop on the Art of Service Composition and Formal Verification for Self-* Systems

We would first like to thank the SEFM 2015 General Chair, Jim Woodcock, for his support with planning and running the conference. We thank our Program Committee assistant, Robert Eikermann, for his great assistance with the review process and with putting the present volume together, the local Organization Committee Simon Foster, Bob French, Simos Gerasimou, Seyyed Shah, and Chris Walker for taking care of the local arrangements, the SEFM Steering Committee for their assistance, and the Workshop Chair Domenico Bianculli for supervising the workshop organization. We are grateful to EasyChair for the support with the paper submission and reviewing process, and with the preparation of this volume. We have been able to put together an exciting technical program that would not have been possible without the excellent work of the Program Committee and their external reviewers. Finally, we would like to thank the authors of all submitted papers, our invited speakers, and all the participants of the conference in York, all of whom contributed to the success of the 2015 edition of SEFM.

June 2015

Radu Calinescu
Bernhard Rumpe

Organization

Program Committee

Wolfgang Ahrendt	Chalmers University of Technology, Sweden
Bernhard K. Aichernig	TU Graz, Austria
Dalal Alrajeh	Imperial College London, UK
Farhad Arbab	CWI and Leiden University, The Netherlands
Luis Barbosa	Universidade do Minho, Portugal
Howard Barringer	The University of Manchester, UK
Christian Berger	Chalmers - University of Gothenburg, Sweden
Domenico Bianculli	SnT Centre - University of Luxembourg, Luxembourg
Jonathan P. Bowen	Birmingham City University, UK
Mario Bravetti	University of Bologna, Italy
Yuriy Brun	University of Massachusetts, USA
Tevfik Bultan	University of California at Santa Barbara, USA
Benoit Combemale	IRISA, Université de Rennes 1, France
Hung Dang Van	UET, Vietnam National University, Vietnam
Francisco Durán	University of Málaga, Spain
George Eleftherakis	The University of Sheffield International Faculty, CITY College, UK
José Luiz Fiadeiro	Royal Holloway, University of London, UK
Mamoun Filali-Amine	IRIT, France
Marc Frappier	University of Sherbrooke, Canada
Martin Fränzle	Carl von Ossietzky Universität Oldenburg, Germany
Hubert Garavel	Inria Rhone-Alpes / VASY, France
Stefania Gnesi	ISTI-CNR, France
Klaus Havelund	Jet Propulsion Laboratory, California Institute of Technology, USA
Rob Hierons	Brunel University, UK
Mike Hinchey	Lero, The Irish Software Engineering Research Centre, Ireland
Falk Howar	IPSSE, TU Clausthal, Germany
Michaela Huhn	Institut für Informatik, TU Clausthal, Germany
Kenneth Johnson	Auckland University of Technology, New Zealand
Gabor Karsai	Vanderbilt University, USA
Joost-Pieter Katoen	RWTH Aachen University, Germany
Shinji Kikuchi	Fujitsu Laboratories Ltd., Japan
Alexander Knapp	University of Augsburg, Germany
Martin Leucker	University of Lübeck, Germany
Antónia Lopes	University of Lisbon, Portugal

Shahar Maoz	Tel Aviv University, Israel
Mercedes Merayo	Universidad Complutense de Madrid, Spain
Stephan Merz	Inria Nancy, France
Mizuhito Ogawa	Advanced Institute of Science and Technology, Japan
Fernando Orejas	UPC, Spain
Gordon Pace	University of Malta, Malta
David Parker	University of Birmingham, UK
Corina Pasareanu	CMU/NASA Ames Research Center, USA
Anna Philippou	University of Cyprus, Cyprus
Sanjiva Prasad	Indian Institute of Technology, India
Jakob Rehof	University of Dortmund, Germany
Leila Ribeiro	Universidade Federal do Rio Grande do Sul, Brazil
Jan Oliver Ringert	Tel Aviv University, Israel
Gwen Salaün	Grenoble INP, Inria, LIG, France
Augusto Sampaio	Federal University of Pernambuco, Brazil
Ina Schaefer	Technische Universität Braunschweig, Germany
Gerardo Schneider	Chalmers - University of Gothenburg, Sweden
Marjan Sirjani	Reykjavik University, Iceland
Martin Steffen	University of Oslo, Norway
Jing Sun	The University of Auckland, New Zealand
Jun Sun	Singapore University of Technology and Design, Singapore
Giordano Tamburrelli	Vrije Universiteit Amsterdam, The Netherlands
Massimo Tivoli	University of L'Aquila, Italy
Danny Weyns	Linnaeus University, Sweden
Jianjun Zhao	Shanghai Jiao Tong University, China

Additional Reviewers

Akroun, Lakhdar
Bessai, Jan
Bhargavan, Karthikeyan
Bodeveix, Jean-Paul
Bousse, Erwan
Dang Duc, Hanh
Do Thi Bich, Ngoc
Foster, Nate
Gu, Zhongxian
Gupta, Ashutosh
Jansen, Christina
Khamespanah, Ehsan
Lachmann, Remo
Madeira, Alexandre
Markin, Grigory
Mendez-Acuna, David
Mohagheghi, Morteza
Nguyen Minh, Hai
Nogueira, Sidney
Peters, Henrik
Plouzeau, Noël
Riely, James
Ringert, Jan Oliver
Sabouri, Hamideh
Savary, Aymerick
Scheffel, Torben
Stümpel, Annette
Swaminathan, Mani
Terauchi, Tachio
Varshosaz, Mahsa
Yan, Dacong
Zuck, Lenore

Contents

Invited Papers

Program Verification

Testing

Certification

Formal Specification and Proof

Testing and Model Checking

Planning

Modelling and Model Transformation