# Table of Contents

Message from the Chairs ........................................................................................................................ xiv
Committees ............................................................................................................................................. xviii
Additional Reviewers .......................................................................................................................... xxxvii
Sponsors and Supporters ......................................................................................................................... xl

## Keynotes

- **Software Engineering in Ferrari F1** ................................................................. 3  
  Claudio Silenzi — Scuderia Ferrari, Italy
- **Mining the Metadata — and Its Consequences** ................................................................. 4  
  Susan Landau — Worcester Polytechnic Institute, USA

## Technical Research

### Reflections and Studies on Methodologies and Practices I

- **Views on Internal and External Validity in Empirical Software Engineering** ......................... 9  
  Janet Siegmund, Norbert Siegmund, Sven Apel — University of Passau, Germany
- **Developing and Evaluating Software Engineering Process Theories** ........................................ 20  
  Paul Ralph — University of Auckland, New Zealand
- **Automated Data Structure Generation: Refuting Common Wisdom** ........................................ 32  
  Kyle Dewey, Lawton Nichols, Ben Hardekopf — University of California at Santa Barbara, USA

### Testing I

- **Automated Modularization of GUI Test Cases** ................................................................. 44  
  Rahulkrishna Yandrapally, Giriprasad Sridhara, Saurabh Sinha — IBM Research, India
- **Making System User Interactive Tests Repeatable: When and What Should We Control?** .......... 55  
  Zebao Gao, Yalan Liang, Myra B. Cohen, Atif M. Memon, Zhen Wang  
  — University of Maryland, USA; University of Nebraska-Lincoln, USA
ZoomIn: Discovering Failures by Detecting Wrong Assertions ................................................................. 66  
Fabrizio Pastore, Leonardo Mariani — University of Luxembourg, Luxembourg;  
University of Milano Bicocca, Italy

Mobile Applications

Composite Constant Propagation: Application to Android Inter-Component Communication Analysis ............................................................................................................................. 77  
Damien Octeau, Daniel Luchaup, Matthew Dering, Somesh Jha, Patrick McDaniel  
— Pennsylvania State University, USA; University of Wisconsin-Madison, USA;  
Carnegie Mellon University, USA

Static Control-Flow Analysis of User-Driven Callbacks in Android Applications ........................................ 89  
Shengqian Yang, Dacong Yan, Haowei Wu, Yan Wang, Atanas Rountev  
— Ohio State University, USA

Truth in Advertising: The Hidden Cost of Mobile Ads for Software Developers ...................................... 100  
Jiaping Gui, Stuart Mcilroy, Meiyappan Nagappan, William G.J. Halfond  
— University of Southern California, USA; Queen's University, Canada; Rochester Institute of Technology, USA

Evolution and Maintenance

Interactive Code Review for Systematic Changes .................................................................................... 111  
Tianyi Zhang, Myoungkyu Song, Joseph Pinedo, Miryung Kim  
— University of California at Los Angeles, USA; The University of Texas at Austin, USA

Automated Decomposition of Build Targets ............................................................................................................................. 123  
Mohsen Vakilian, Raluca Sauciuc, J. David Morgenthaler, Vahab Mirrokni — Google, USA

Helping Developers Help Themselves: Automatic Decomposition of Code Review Changesets ................................................................. 134  
Mike Barnett, Christian Bird, João Brunet, Shuvendu K. Lahiri  
— Microsoft Research, USA; Federal University of Campina Grande, Brazil

Analysis I

Data-Delineation in Software Binaries and its Application to Buffer-Overrun Discovery .......................... 145  
Denis Gopan, Evan Driscoll, Ducson Nguyen, Dimitri Naydich, Alexey Loginov,  
David Melski — GrammaTech Inc., USA

Measuring Software Redundancy ............................................................................................................. 156  
Antonio Carzaniga, Andrea Mattavelli, Mauro Pezzè — University of Lugano, Switzerland;  
University of Milano Bicocca, Italy

Gray Computing: An Analysis of Computing with Background JavaScript Tasks ......................................... 167  
Yao Pan, Jules White, Yu Sun, Jeff Gray — Vanderbilt University, USA; California State Polytechnic University, USA; University of Alabama, USA
Highly Configurable and Adaptive Systems

Presence-Condition Simplification in Highly Configurable Systems
Alexander von Rhein, Alexander Grebhahn, Sven Apel, Norbert Siegmund, Dirk Beyer, Thorsten Berger — University of Passau, Germany; University of Waterloo, Canada

Symbolic Model Checking of Product-Line Requirements Using SAT-Based Methods
Shoham Ben-David, Baruch Sterin, Joanne M. Atlee, Sandy Beidu — University of Waterloo, Canada; University of California at Berkeley, USA

Lightweight Adaptive Filtering for Efficient Learning and Updating of Probabilistic Models
Antonio Filieri, Lars Grunske, Alberto Leva — University of Stuttgart, Germany; Politecnico di Milano, Italy

Tools and Environments

Tempura: Temporal Dimension for IDEs
Yun Young Lee, Darko Marinov, Ralph E. Johnson — University of Illinois at Urbana-Champaign, USA

Supporting Selective Undo in a Code Editor
YoungSeok Yoon, Brad A. Myers — Carnegie Mellon University, USA

Cascade: A Universal Programmer-Assisted Type Qualifier Inference Tool
Mohsen Vakilian, Amarin Phaosawasdi, Michael D. Ernst, Ralph E. Johnson — University of Illinois at Urbana-Champaign, USA; University of Washington, USA

Regression Testing

RECONTEST: Effective Regression Testing of Concurrent Programs
Valerio Terragni, Shing-Chi Cheung, Charles Zhang — The Hong Kong University of Science and Technology, Hong Kong

A Synergistic Analysis Method for Explaining Failed Regression Tests
Qiuping Yi, Zijiang Yang, Jian Liu, Chen Zhao, Chao Wang — University of Chinese Academy of Sciences, China; Western Michigan University, USA; Chinese Academy of Sciences, China; Virginia Tech, USA

An Information Retrieval Approach for Regression Test Prioritization Based on Program Changes
Ripon K. Saha, Lingming Zhang, Sarfraz Khurshid, Dewayne E. Perry — The University of Texas at Austin, USA; The University of Texas at Dallas, USA

Security and Privacy

IccTA: Detecting Inter-Component Privacy Leaks in Android Apps
Li Li, Alexandre Bartel, Tegawendé F. Bissyandé, Jacques Klein, Yves Le Traon, Steven Arzt, Siegfried Rasthofer, Eric Bodden, Damien Octeau, Patrick McDaniel — University of Luxembourg, Luxembourg; Technische Universität Darmstadt, Germany; Pennsylvania State University, USA; University of Wisconsin-Madison, USA
Do Security Patterns Really Help Designers? .......................................................................................... 292
Koen Yskout, Riccardo Scandariato, Wouter Joosen — KU Leuven, Belgium

AppContext: Differentiating Malicious and Benign Mobile App Behaviors Using Context ......................... 303
Wei Yang, Xusheng Xiao, Benjamin Andow, Sihan Li, Tao Xie, William Enck
— University of Illinois at Urbana-Champaign, USA; NEC Laboratories America, USA;
North Carolina State University, USA

Analysis II

TypeDevil: Dynamic Type Inconsistency Analysis for JavaScript ............................................................. 314
Michael Pradel, Parker Schuh, Koushik Sen — University of California at Berkeley, USA;
TU Darmstadt, Germany

Detecting Inconsistencies in JavaScript MVC Applications ........................................................................ 325
Frolin S. Ocariza Jr., Karthik Pattabiraman, Ali Mesbah — University of British Columbia, Canada

AutoCSP: Automatically Retrofitting CSP to Web Applications .................................................................. 336
Mattia Fazzini, Prateek Saxena, Alessandro Orso — Georgia Institute of Technology, USA;
National University of Singapore, Singapore

Reflections and Studies on Methodologies and Practices II

How Much Up-Front? A Grounded Theory of Agile Architecture .............................................................. 347
Michael Waterman, James Noble, George Allan — Specialised Architecture Services Ltd.,
New Zealand; Victoria University of Wellington, New Zealand

Work Practices and Challenges in Pull-Based Development: The Integrator's Perspective ........... 358
Georgios Gousios, Andy Zaidman, Margaret-Anne Storey, Arie van Deursen
— Radboud University Nijmegen, Netherlands; Delft University of Technology, Netherlands;
University of Victoria, Canada

Build It Yourself! Homegrown Tools in a Large Software Company ......................................................... 369
Edward K. Smith, Christian Bird, Thomas Zimmermann — University of Massachusetts, USA;
Microsoft Research, USA

Refactoring

Morpheus: Variability-Aware Refactoring in the Wild ................................................................................ 380
Jörg Liebig, Andreas Janker, Florian Garbe, Sven Apel, Christian Lengauer
— University of Passau, Germany

Does Automated Refactoring Obviate Systematic Editing? ...................................................................... 392
Na Meng, Lisa Hua, Mieryung Kim, Kathryn S. McKinley — The University of Texas
at Austin, USA; University of California at Los Angeles, USA; Microsoft Research, USA

When and Why Your Code Starts to Smell Bad ....................................................................................... 403
Michele Tufano, Fabio Palomba, Gabriele Bavota, Rocco Oliveto,
Massimiliano Di Penta, Andrea De Lucia, Denys Poshyvanyk
— College of William and Mary, USA; University of Salerno, Italy; University of Sannio, Italy;
University of Molise, Italy; Free University of Bozen-Bolzano, Italy
Mining

Learning to Log: Helping Developers Make Informed Logging Decisions ................................................ 415
Jieming Zhu, Pinjia He, Qiang Fu, Hongyu Zhang, Michael R. Lyu, Dongmei Zhang
— The Chinese University of Hong Kong, Hong Kong; Microsoft Research, USA;
Microsoft Research, China

Mining Apps for Abnormal Usage of Sensitive Data ................................................................................. 426
Vitalii Avdiienko, Konstantin Kuznetsov, Alessandra Gorla, Andreas Zeller,
Steven Arzt, Siegfried Rasthofer, Eric Bodden — Saarland University, Germany;
IMDEA Software Institute, Spain; TU Darmstadt, Germany; Fraunhofer SIT, Germany

Tracking Static Analysis Violations over Time to Capture Developer Characteristics.............................. 437
Pavel Avgustinov, Arthur I. Baars, Anders S. Henriksen, Greg Lavender, Galen Menzel,
Oege de Moor, Max Schäfer, Julian Tibble — Semmle Ltd., UK

Patching and Fixing I

DirectFix: Looking for Simple Program Repairs ........................................................................................ 448
Sergey Mechtaev, Jooyong Yi, Abhik Roychoudhury — National University of Singapore, Singapore

Safe Memory-Leak Fixing for C Programs .................................................................................................. 459
Qing Gao, Yingfei Xiong, Yaqing Mi, Lu Zhang, Weikun Yang, Zhaoping Zhou,
Bing Xie, Hong Mei — Peking University, China

relifix: Automated Repair of Software Regressions .................................................................................. 471
Shin Hwei Tan, Abhik Roychoudhury — National University of Singapore, Singapore

Testing II

The Art of Testing Less without Sacrificing Quality .................................................................................. 483
Kim Herzig, Michaela Greiler, Jacek Czerwonka, Brendan Murphy
— Microsoft Research, UK; Microsoft Corporation, USA

No PAIN, No Gain? The Utility of PArallel Fault IINjections ...................................................................... 494
Stefan Winter, Oliver Schwahn, Roberto Natella, Neeraj Suri, Domenico Cotroneo
— TU Darmstadt, Germany; Federico II University of Naples, Italy

A Flexible and Non-intrusive Approach for Computing Complex Structural Coverage Metrics.............. 506
Michael W. Whalen, Suzette Person, Neha Rungta, Matt Staats, Daniela Grijincu
— University of Minnesota, USA; NASA Langley Research Center, USA;
NASA Ames Research Center, USA; Google Inc., Switzerland; University of St. Andrews, UK

Search-Based

Combining Multi-Objective Search and Constraint Solving for Configuring Large
Software Product Lines ............................................................................................................................. 517
Christopher Henard, Mike Papadakis, Mark Harman, Yves Le Traon
— University of Luxembourg, Luxembourg; University College London, UK
A Genetic Algorithm for Detecting Significant Floating-Point Inaccuracies .............................................. 529  
Daming Zou, Ran Wang, Yingfei Xiong, Lu Zhang, Zhendong Su, Hong Mei  
— Peking University, China; University of California at Davis, USA

Learning Combinatorial Interaction Test Generation Strategies Using Hyperheuristic Search ......................... 540  
Yue Jia, Myra B. Cohen, Mark Harman, Justyna Petke — University College London, UK;  
University of Nebraska-Lincoln, USA

Collaboration and Coordination

Borrowing from the Crowd: A Study of Recombination in Software Design Competitions ............................. 551  
Thomas D. LaToza, Micky Chen, Luxi Jiang, Mengyao Zhao, André van der Hoek  
— University of California at Irvine, USA; University of Amsterdam, Netherlands

From Developer Networks to Verified Communities: A Fine-Grained Approach ........................................ 563  
Mitchell Joblin, Wolfgang Mauerer, Sven Apel, Janet Siegmund, Dirk Riehle  
— Siemens AG, Germany; OTH Regensburg, Germany; University of Passau, Germany;  
University of Erlangen-Nuremberg, Germany

Open Source-Style Collaborative Development Practices in Commercial Projects  
Using GitHub ............................................................................................................................................. 574  
Eirini Kalliamvakou, Daniela Damian, Kelly Blincoe, Leif Singer, Daniel M. German  
— University of Victoria, Canada

Analysis Infrastructure

Database-Backed Program Analysis for Scalable Error Propagation ............................................................ 586  
Cathrin Weiss, Cindy Rubio-González, Ben Liblit — University of California at Davis, USA; University of Wisconsin-Madison, USA

Tricorder: Building a Program Analysis Ecosystem .......................................................................................... 598  
Caitlin Sadowski, Jeffrey van Gogh, Ciera Jaspan, Emma Söderberg, Collin Winter  
— Google Inc., USA

Alloy*: A General-Purpose Higher-Order Relational Constraint Solver .......................................................... 609  
Aleksandar Milicevic, Joseph P. Near, Eunsuk Kang, Daniel Jackson  
— Massachusetts Institute of Technology, USA

Symbolic Execution

Edmund Wong, Lei Zhang, Song Wang, Taiyue Liu, Lin Tan — University of Waterloo, Canada

Compositional Symbolic Execution with Memoized Replay ............................................................................ 632  
Rui Qiu, Guowei Yang, Corina S. Păsăreanu, Sarfraz Khurshid  
— The University of Texas at Austin, USA; Texas State University, USA; CMU, USA;  
NASA Ames Research Center, USA

Regular Property Guided Dynamic Symbolic Execution ............................................................................... 643  
Yufeng Zhang, Zhenbang Chen, Ji Wang, Wei Dong, Zhiming Liu  
— National University of Defense Technology, China; Birmingham City University, UK
Combining Symbolic Execution and Model Checking for Data Flow Testing ........................................... 654
Ting Su, Zhourai Fu, Geguang Pu, Jifeng He, Zhendong Su
— East China Normal University, China; University of California at Davis, USA

Organizational and Human Factors

Are Students Representatives of Professionals in Software Engineering Experiments? ....................... 666
Iflaah Salman, Ayse Tosun Misirli, Natalia Juristo — University of Oulu, Finland; Istanbul Technical University, Turkey; Universidad Politécnica de Madrid, Spain

Why Good Developers Write Bad Code: An Observational Case Study of the Impacts of Organizational Factors on Software Quality .......................................................... 677
Mathieu Lavallée, Pierre N. Robillard — École Polytechnique de Montréal, Canada

What Makes a Great Software Engineer? ............................................................................................... 700
Paul Luo Li, Andrew J. Ko, Jiamin Zhu — University of Washington, USA; Microsoft, USA

Specification and Verification

Efficient Scalable Verification of LTL Specifications ................................................................................. 711
Luciano Baresi, Mohammad Mehdi Pourhashem Kallehbasti, Matteo Rossi
— Politecnico di Milano, Italy

Empirical Study Towards a Leading Indicator for Cost of Formal Software Verification ..................... 722
Daniel Matichuk, Toby Murray, June Andronick, Ross Jeffery, Gerwin Klein, Mark Staples
— NICTA, Australia; University of New South Wales, Australia

Specifying Event-Based Systems with a Counting Fluent Temporal Logic ........................................... 733
Germán Regis, Renzo Degiovanni, Nicolas D'Ippolito, Nazareno Aguirre
— Universidad Nacional de Río Cuarto, Argentina; Universidad de Buenos Aires, Argentina;
CONICET, Argentina

Coexecutability for Efficient Verification of Data Model Updates ............................................................ 744
Ivan Bocić, Tevfik Bultan — University of California at Santa Barbara, USA

Programming

Assert Use in GitHub Projects .............................................................................................................. 755
Casey Casalnuovo, Prem Devanbu, Abilio Oliveira, Vladimir Filkov, Baishakhi Ray
— UC Davis, USA

A Programming Model for Sustainable Software .................................................................................. 767
Haitao Steve Zhu, Chaoren Lin, Yu David Liu — SUNY Binghamton, USA

A Comparative Study of Programming Languages in Rosetta Code .................................................... 778
Sebastian Nanz, Carlo A. Furia — ETH Zurich, Switzerland
Prediction Models

Revisiting the Impact of Classification Techniques on the Performance of Defect Prediction Models.......................................................... 789
Baljinder Ghotra, Shane McIntosh, Ahmed E. Hassan — Queen's University, Canada

LACE2: Better Privacy-Preserving Data Sharing for Cross Project Defect Prediction ....................... 801
Fayola Peters, Tim Menzies, Lucas Layman — Lero, Ireland; University of Limerick, Ireland; North Carolina State University, USA; Fraunhofer Center for Experimental Software Engineering, USA

The Impact of Mislabelling on the Performance and Interpretation of Defect Prediction Models......... 812
Chakkrit Tantithamthavorn, Shane McIntosh, Ahmed E. Hassan, Akinori Ihara, Kenichi Matsumoto — Nara Institute of Science and Technology, Japan; Queen's University, Canada

Analysis III

ReCBuLC: Reproducing Concurrency Bugs Using Local Clocks ............................................................. 824
Xiang Yuan, Chenggang Wu, Zhenjiang Wang, Jianjun Li, Pen-Chung Yew, Jeff Huang, Xiaobing Feng, Yanyan Lan, Yunji Chen, Yong Guan — Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China; University of Minnesota at Twin-Cities, USA; Texas A&M University, USA; Capital Normal University, China

Dynamic Generation of Likely Invariants for Multithreaded Programs ..................................................... 835
Markus Kusano, Arijit Chattopadhyay, Chao Wang — Virginia Tech, USA

GPredict: Generic Predictive Concurrency Analysis ................................................................................. 847
Jeff Huang, Qingzhou Luo, Grigore Rosu — Texas A&M University, USA; University of Illinois at Urbana-Champaign, USA

Working with APIs

Graph-Based Statistical Language Model for Code ................................................................................. 858
Anh Tuan Nguyen, Tien N. Nguyen — Iowa State University, USA

Discovering Information Explaining API Types Using Text Classification .................................................. 869
Gayane Petrosyan, Martin P. Robillard, Renato De Mori — McGill University, Canada

How Can I Use This Method? ................................................................................................................... 880
Laura Moreno, Gabriele Bavota, Massimiliano Di Penta, Rocco Oliveto, Andrian Marcus — The University of Texas at Dallas, USA; Free University of Bozen-Bolzano, Italy; University of Sannio, Italy; University of Molise, Italy

Patching and Fixing II

Hercules: Reproducing Crashes in Real-World Application Binaries ....................................................... 891
Van-Thuan Pham, Wei Boon Ng, Konstantin Rubinov, Abhik Roychoudhury — National University of Singapore, Singapore
CARAMEL: Detecting and Fixing Performance Problems That Have Non-Intrusive Fixes ...................... 902
Adrian Nistor, Po-Chun Chang, Cosmin Radoi, Shan Lu — Chapman University, USA;
University of Wisconsin-Madison, USA; University of Illinois at Urbana-Champaign, USA;
University of Chicago, USA

An Empirical Study on Real Bug Fixes .....................................................................................................913
Hao Zhong, Zhendong Su — Shanghai Jiao Tong University, China; University of California at Davis, USA

Testing III

Does the Failing Test Execute a Single or Multiple Faults? An Approach to Classifying
Failing Tests .............................................................................................................................................. 924
Zhongxing Yu, Chenggang Bai, Kai-Yuan Cai — Beihang University, China

Trivial Compiler Equivalence: A Large Scale Empirical Study of a Simple, Fast
and Effective Equivalent Mutant Detection Technique ............................................................................. 936
Mike Papadakis, Yue Jia, Mark Harman, Yves Le Traon — University of Luxembourg,
Luxembourg; University College London, UK

Dynamic Data Flow Testing of Object Oriented Systems......................................................................... 947
Giovanni Denaro, Alessandro Margara, Mauro Pezzé, Mattia Vivanti
— University of Milano Bicocca, Italy; University of Lugano, Switzerland

Author Index
Table of Contents

Message from the Chairs ...................................................................................................................... xxiv
Committees ........................................................................................................................................... xxviii
Additional Reviewers ............................................................................................................................. xlvii
Sponsors and Supporters ........................................................................................................................... l

SEIP Keynote

The Future of Software Engineering (SEIP Keynote) .............................................................................. 3
   Grady Booch — IBM Research, USA

Software Engineering in Practice

Empirical I

Enron’s Spreadsheets and Related Emails: A Dataset and Analysis ....................................................... 7
   Felienne Hermans, Emerson Murphy-Hill — Delft University of Technology, Netherlands;
   North Carolina State University, USA

An Empirical Study on Quality Issues of Production Big Data Platform .................................................. 17
   Hucheng Zhou, Jian-Guang Lou, Hongyu Zhang, Haibo Lin, Haoxiang Lin, Tingting Qin
   — Microsoft Research, China; Microsoft, China

   Jacek Czerwonka, Michaela Greiler, Jack Tilford — Microsoft Corporation, USA

Testing

Systematic Testing of Reactive Software with Non-Deterministic Events: A Case Study
   on LG Electric Oven ................................................................................................................................. 29
   Yongbae Park, Shin Hong, Moonzoo Kim, Dongju Lee, Junhee Cho
   — KAIST, Republic of Korea; LG Electronics, Republic of Korea
Empirically Detecting False Test Alarms Using Association Rules ............................................................ 39
Kim Herzig, Nachiappan Nagappan — Microsoft Research, UK; Microsoft Research, USA

Striving for Failure: An Industrial Case Study about Test Failure Prediction .............................................. 49
Jeff Anderson, Saeed Salem, Hyunsook Do — North Dakota State University, USA

Architecture I

Automatic and Continuous Software Architecture Validation ................................................................. 59
Maayan Goldstein, Itai Segall — IBM Haifa Research Lab, Israel

Comparing Software Architecture Recovery Techniques Using Accurate Dependencies ....................... 69
Thibaud Lutellier, Devin Chollak, Joshua Garcia, Lin Tan, Derek Rayside,
Nenad Medvidović, Robert Kroeger — University of Waterloo, Canada;
George Mason University, USA; University of Southern California, USA; Google, Canada

SPF: A Middleware for Social Interaction in Mobile Proximity Environments ........................................... 79
Luciano Baresi, Laurent-Walter Goix, Sam Guinea, Valerio Panzica La Manna,
Jacopo Aliprandi, Dario Archetti — Politecnico di Milano, Italy; Econocom-Osiatis, France; MIT, USA

Quality

Merits of Organizational Metrics in Defect Prediction: An Industrial Replication ........................................ 89
Bora Caglayan, Burak Turhan, Ayse Bener, Mayy Habayeb, Andriy Miransky,
Enzo Cialini — Ryerson University, Canada; University of Oulu, Finland;
IBM Toronto Software Laboratory, Canada

Online Defect Prediction for Imbalanced Data ......................................................................................... 99
Ming Tan, Lin Tan, Sashank Dara, Caleb Mayeux — University of Waterloo, Canada;
Cisco Systems, India; Cisco Systems, USA

Measuring Dependency Freshness in Software Systems ....................................................................... 109
Joël Cox, Eric Bouwers, Marko van Eekelen, Joost Visser — Radboud University Nijmegen,
Netherlands; Software Improvement Group, Netherlands; Open University, Netherlands

Model-Based

A Large-Scale Technology Evaluation Study: Effects of Model-Based Analysis and Testing.................. 119
Michael Kläs, Thomas Bauer, Andreas Dereani, Thomas Söderqvist, Philipp Helle
— Fraunhofer Institute for Experimental Software Engineering, Germany;
Daimler AG, Germany; Volvo Group Trucks Technology, Sweden;
Airbus Group Innovations, Germany

Metamorphic Model-Based Testing Applied on NASA DAT - An Experience Report ............................ 129
Mikael Lindvall, Dharmalingam Ganesan, Ragnar Árdal, Robert E. Wiegand
— Fraunhofer Center for Experimental Software Engineering, USA;
Reykjavík University, Iceland; NASA Goddard Space Flight Center, USA

Improving Predictability, Efficiency and Trust of Model-Based Proof Activity ....................................... 139
Jean-Frédéric Etienne, Manuel Maarek, Florent Anseaume, Véronique Delebarre
— SafeRiver, France; Heriot-Watt University, UK
Performance and Logging

Performance Analysis Using Subsuming Methods: An Industrial Case Study ................................................. 149
David Maplesden, Karl von Randow, Ewan Tempero, John Hosking, John Grundy
— University of Auckland, New Zealand; Cactuslab, New Zealand;
Swinburne University of Technology, Australia

An Industrial Case Study on the Automated Detection of Performance Regressions in Heterogeneous Environments ............................................................................................................... 159
King Chun Foo, Zhen Ming (Jack) Jiang, Bram Adams, Ahmed E. Hassan, Ying Zou,
Parminder Flora — BlackBerry, Canada; York University, Canada;
École Polytechnique de Montréal, Canada; Queen's University, Canada

Antonio Pecchia, Marcello Cinque, Gabriella Carrozza, Domenico Cotroneo
— Critiware, Italy; Federico II University of Naples, Italy; Selex ES, Italy

Architecture II and Security

A Case Study in Locating the Architectural Roots of Technical Debt ............................................................... 179
Rick Kazman, Yuanfang Cai, Ran Mo, Qiong Feng, Lu Xiao, Serge Haziyev,
Volodymyr Fedak, Andriy Shapochka — CMU, USA; University of Hawaii, USA;
SoftServe Inc., Ukraine; Drexel University, USA

Design and Evaluation of a Customizable Multi-Domain Reference Architecture on Top of Product Lines of Self-Driving Heavy Vehicles - An Industrial Case Study ........................................... 189
Jan Schroeder, Daniela Holzner, Christian Berger, Carl-Johan Hoel, Leo Laine,
Anders Magnusson — University of Gothenburg, Sweden; Volvo Group Trucks Technology, Sweden

Approximating Attack Surfaces with Stack Traces ................................................................................... 199
Christopher Theisen, Kim Herzig, Patrick Morrison, Brendan Murphy, Laurie Williams
— North Carolina State University, USA; Microsoft Research, UK

Damien Doligez, Christèle Faure, Thérèse Hardin, Manuel Maarek
— INRIA, France; SafeRiver, France; UPMC, France; Heriot-Watt University, UK

Empirical II

"Should We Move to Stack Overflow?" Measuring the Utility of Social Media for Developer Support ............................................................... 219
Megan Squire — Elon University, USA

A Field Study on Fostering Structural Navigation with Prodet ........................................................................ 229
Vinay Augustine, Patrick Francis, Xiao Qu, David Shepherd, Will Snipes,
Christoph Bräunlich, Thomas Fritz — ABB Corporate Research, USA;
Wotan Engineering GmbH, Switzerland; University of Zurich, Switzerland

How and When to Transfer Software Engineering Research via Extensions ..................................................... 239
David Shepherd, Kostadin Damevski, Lori Pollock — ABB Corporate Research, USA;
Virginia State University, USA; University of Delaware, USA
# Joint SE Education and Training

## Developing Students' SE Skills

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolution of Software Development Strategies</td>
<td>243</td>
</tr>
<tr>
<td><em>Katrina Falkner, Claudia Szabo, Rebecca Vivian, Nickolas Falkner</em></td>
<td></td>
</tr>
<tr>
<td>— University of Adelaide, Australia</td>
<td></td>
</tr>
<tr>
<td>Drawing Insight from Student Perceptions of Reflective Design Learning</td>
<td>253</td>
</tr>
<tr>
<td><em>Thomas V. Wilkins, John C. Georgas</em></td>
<td></td>
</tr>
<tr>
<td>— Northern Arizona University, USA</td>
<td></td>
</tr>
<tr>
<td>Effectiveness of Persona with Personality Traits on Conceptual Design</td>
<td>263</td>
</tr>
<tr>
<td><em>Farshid Anvari, Deborah Richards, Michael Hitchens, Muhammad Ali Babar</em></td>
<td></td>
</tr>
<tr>
<td>— Macquarie University, Australia; University of Adelaide, Australia; IT University of Copenhagen, Denmark</td>
<td></td>
</tr>
</tbody>
</table>

### Panel - Industry/University Collaboration

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry/University Collaboration in Software Engineering Education: Refreshing and Retuning Our Strategies</td>
<td>273</td>
</tr>
<tr>
<td><em>Nancy R. Mead</em> — Carnegie Mellon University, USA</td>
<td></td>
</tr>
</tbody>
</table>

## SE Management and Processes, and Short Papers

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novice Code Understanding Strategies During a Software Maintenance Assignment</td>
<td>276</td>
</tr>
<tr>
<td><em>Claudia Szabo</em> — University of Adelaide, Australia</td>
<td></td>
</tr>
<tr>
<td>Learning Global Agile Software Engineering Using Same-Site and Cross-Site Teams</td>
<td>285</td>
</tr>
<tr>
<td><em>Maria Paasivaara, Kelly Blincoe, Casper Lassenius, Daniela Damian, Jyoti Sheoran, Francis Harrison, Prashant Chhabra, Aminah Yussuf, Veikko Isotalo</em></td>
<td></td>
</tr>
<tr>
<td>— Aalto University, Finland; University of Victoria, Canada</td>
<td></td>
</tr>
<tr>
<td>Code Repurposing as an Assessment Tool</td>
<td>295</td>
</tr>
<tr>
<td><em>Joseph Sant</em> — Sheridan College, Canada</td>
<td></td>
</tr>
<tr>
<td>Remote Development and Distance Delivery of Innovative Courses: Challenges and Opportunities</td>
<td>299</td>
</tr>
<tr>
<td><em>Kristina Marasović, Michael Lutz</em> — Rochester Institute of Technology, Croatia; Rochester Institute of Technology, USA</td>
<td></td>
</tr>
<tr>
<td>Improving Student Group Work with Collaboration Patterns: A Case Study</td>
<td>303</td>
</tr>
<tr>
<td><em>Christian Köppe, Marko van Eekelen, Stijn Hoppenbrouwers</em></td>
<td></td>
</tr>
<tr>
<td>— HAN University of Applied Sciences, Netherlands; Radboud University Nijmegen, Netherlands; Open University, Netherlands</td>
<td></td>
</tr>
<tr>
<td>Teaching Software Systems Thinking at The Open University</td>
<td>307</td>
</tr>
<tr>
<td><em>Michel Wermelinger, Jon G. Hall, Lucia Rapanotti, Leonor Barroca, Magnus Ramage, Arosha Bandara</em> — The Open University, UK</td>
<td></td>
</tr>
<tr>
<td>Masters-Level Software Engineering Education and the Enriched Student Context</td>
<td>311</td>
</tr>
<tr>
<td><em>Jon G. Hall, Lucia Rapanotti</em> — The Open University, UK</td>
<td></td>
</tr>
</tbody>
</table>
Combining Mastery Learning with Project-Based Learning in a First Programming Course:
An Experience Report ............................................................................................................................... 315
    Mehdi Jazayeri — University of Lugano, Switzerland

Collaborative and Cooperative-Learning in Software Engineering Courses ............................................ 319
    Neelam Soundarajan, Swaroop Joshi, Rajiv Ramnath — Ohio State University, USA

Case Studies

Using GSwE2009 for the Evaluation of a Master Degree in Software Engineering
in the Universidad de la República ........................................................................................................... 323
    Lucía Camilloni, Diego Vallespir, Mark Ardis — Universidad de la República, Uruguay;
    Stevens Institute of Technology, USA

System Thinking: Educating T-Shaped Software Engineers ................................................................. 333
    Barry Boehm, Supannika Koolmanojwong Mobasser — USC, USA

Transparetly Teaching in the Context of Game-Based Learning: The Case of SimulES-W .................. 343
    Elizabeth Suèsçún Monsalve, Julio Cesar Sampaio do Prado Leite, Vera Maria B. Werneck
    — PUC-Rio, Brazil; UERJ, Brazil

Specialised Domains in SE Education

Educatiing Software Engineering Managers - Revisited What Software Project Managers
Need to Know Today................................................................................................................................. 353
    Lawrence Peters, Ana M. Moreno — Universidad Politécnica de Madrid, Spain

Contest Based Learning with Blending Software Engineering and Business Management:
For Students’ High Motivation and High Practice Ability ........................................................................... 360
    Noriko Hanakawa — Hannan University, Japan

Concurrent Software Engineering and Robotics Education ...................................................................... 370
    Jiwon Shin, Andrey Rusakov, Bertrand Meyer — ETH Zurich, Switzerland;
    Innopolis University, Russia

Infrastructure Support in SE Education

The Development of a Dashboard Tool for Visualising Online Teamwork Discussions ........................... 380
    Rebecca Vivian, Hamid Tarmazdi, Katrina Falkner, Nickolas Falkner, Claudia Szabo
    — University of Adelaide, Australia

Software Design Studio: A Practical Example .......................................................................................... 389
    Jaejoon Lee, Gerald Kotonya, Jon Whittle, Christopher Bull — Lancaster University, UK

Code Hunt: Experience with Coding Contests at Scale ............................................................................ 398
    Judith Bishop, R. Nigel Horspool, Tao Xie, Nikolai Tillmann, Jonathan de Halleux
    — Microsoft Research, USA; University of Victoria, Canada; University of Illinois
    at Urbana-Champaign, USA

SE Teaching Methods and Technologies

Does Outside-In Teaching Improve the Learning of Object-Oriented Programming? .............................. 408
    Erica Janke, Philipp Brune, Stefan Wagner — Neu-Ulm University of Applied Sciences,
    Germany; University of Stuttgart, Germany
Active and Inductive Learning in Software Engineering Education .......................................................... 418
  Yvonne Sedelmaier, Dieter Landes — University of Applied Sciences and Arts Coburg, Germany

In Search of the Emotional Design Effect in Programming ....................................................................... 428
  Lassi Haaranen, Petri Ihantola, Juha Sorva, Arto Vihavainen — Aalto University, Finland;
  Tampere University of Technology, Finland; University of Helsinki, Finland

Experiences and Experiments

Experiences in Developing and Delivering a Programme of Part-Time Education in Software and Systems Security ............................................................................................................ 435
  Andrew Simpson, Andrew Martin, Cas Cremers, Ivan Flechais, Ivan Martinovic,
  Kasper Rasmussen — University of Oxford, UK

Teaching Software Architecture to Undergraduate Students: An Experience Report .............................. 445
  Chandan R. Rupakheti, Stephen Chenoweth — Rose-Hulman Institute of Technology, USA

CS/SE Instructors Can Improve Student Writing without Reducing Class Time Devoted to Technical Content: Experimental Results ............................................................................................. 455
  Paul V. Anderson, Sarah Heckman, Mladen Vouk, David Wright, Michael Carter,
  Janet E. Burge, Gerald C. Gannod — Elon University, USA; North Carolina State University, USA; Wesleyan University, USA; Miami University, USA

Software Engineering in Society

Panel: Software Systems and Sustainability - Principles and Commitments

Sustainability Design and Software: The Karlskrona Manifesto .................................................................. 467
  Christoph Becker, Ruzanna Chitchyan, Leticia Duboc, Steve Easterbrook,
  Birgit Penzenstadler, Norbert Seyff, Colin C. Venters — University of Toronto, Canada;
  University of Leicester, UK; State University of Rio de Janeiro, Brazil;
  University of California at Irvine, USA; University of Zurich, Switzerland;
  University of Huddersfield, UK

Values and Concerns in Society

Interdisciplinary Design Patterns for Socially Aware Computing .......................................................... 477
  Harun Baraki, Kurt Geihs, Christian Voigtmann, Axel Hoffmann, Romy Kniewel,
  Björn-Elmar Macek, Julia Zirfas — University of Kassel, Germany

The Role of Design Thinking and Physical Prototyping in Social Software Engineering .......................... 487
  Peter Newman, Maria Angela Ferrario, Will Simm, Stephen Forshaw, Adrian Friday,
  Jon Whittle — Lancaster University, UK

On the Role of Value Sensitive Concerns in Software Engineering Practice ........................................... 497
  Balbir Barn, Ravinder Barn, Franco Raimondi — Middlesex University, UK;
  Royal Holloway University of London, UK
SE Techniques as Enablers of Sustainability

Engineering Sustainability Through Language ................................................................. 501
  Ruzanna Chitchyan, Walter Cazzola, Awais Rashid — University of Leicester, UK;
  Università degli Studi di Milano, Italy; Lancaster University, UK

Enabling the Definition and Enforcement of Governance Rules in Open Source Systems .......... 505
  Javier Luis Cánovas Izquierdo, Jordi Cabot — AtlanMod, France; UOC, Spain

AppCivist - A Service-Oriented Software Platform for Socially Sustainable Activism .................. 515
  Animesh Pathak, Valérie Issarny, James Holston — INRIA, France; University of California at Berkeley, USA

SOA4DM: Applying an SOA Paradigm to Coordination in Humanitarian Disaster Response ........... 519
  Kelly Lyons, Christie Oh — University of Toronto, Canada

SE Impact on Users

Managing Emergent Ethical Concerns for Software Engineering in Society .................................. 523
  Awais Rashid, Karenza Moore, Corinne May-Chahal, Ruzanna Chitchyan
  — Lancaster University, UK; University of Leicester, UK

Dementia and Social Sustainability: Challenges for Software Engineering .................................. 527
  Pete Sawyer, Alistair Sutcliffe, Paul Rayson, Chris Bull — Lancaster University, UK

Cognitively Sustainable ICT with Ubiquitous Mobile Services - Challenges and Opportunities ....... 531
  Marcus Jägemar, Gordana Dodig-Crnkovic — Mälardalen University, Sweden;
  Chalmers University of Technology, Sweden

New Ideas and Emerging Results

New Dimensions

New Initiative: The Naturalness of Software ............................................................................. 543
  Premkumar Devanbu — University of California at Davis, USA

Virtual Reality in Software Engineering: Affordances, Applications, and Challenges .................. 547
  Anthony Elliott, Brian Peiris, Chris Parnin — North Carolina State University, USA

CodeAware: Sensor-Based Fine-Grained Monitoring and Management of Software Artifacts .......... 551
  Rui Abreu, Hakan Erdogmus, Alexandre Perez — Palo Alto Research Center, USA;
  Carnegie Mellon University, USA

Free Hugs - Praising Developers for Their Actions ..................................................................... 555
  Roberto Minelli, Andrea Mocci, Michele Lanza — University of Lugano, Switzerland

How (Much) Do Developers Test? ............................................................................................. 559
  Moritz Beller, Georgios Gousios, Andy Zaidman — TU Delft, Netherlands
Human and Crowd

A Vision of Crowd Development ................................................................. 563
Thomas D. LaToza, André van der Hoek — University of California at Irvine, USA

When App Stores Listen to the Crowd to Fight Bugs in the Wild .............................................................. 567
María Gómez, Matías Martínez, Martin Monperrus, Romain Rouvoy — INRIA, France; University of Lille 1, France

Incorporating Human Intention into Self-Adaptive Systems .............................................................. 571
Shihong Huang, Pedro Miranda — Florida Atlantic University, USA

An Initiative to Improve Reproducibility and Empirical Evaluation of Software Testing Techniques .......................................................... 575
Francisco G. de Oliveira Neto, Richard Torkar, Patricia D. L. Machado — Universidade Federal de Campina Grande, Brazil; Chalmers University of Technology, Sweden; University of Gothenburg, Sweden

Inferring Behavioral Specifications from Large-Scale Repositories by Leveraging Collective Intelligence ............................................................................................................................... 579
Hridesh Rajan, Tien N. Nguyen, Gary T. Leavens, Robert Dyer — Iowa State University, USA; University of Central Florida, USA; Bowling Green State University, USA

Fast Feedback Cycles in Empirical Software Engineering Research ....................................................... 583
Antonio Vetrò, Saahil Ognawala, Daniel Méndez Fernández, Stefan Wagner — Technische Universität München, Germany; University of Stuttgart, Germany

New Formalisms

Dynamic Safety Cases for Through-Life Safety Assurance ..................................................................................... 587
Ewen Denney, Ganesh Pai, Ibrahim Habli — SGT, USA; Nasa Ames, USA; University of York, UK

Correctness and Relative Correctness ..................................................................................................... 591
Nafi Diallo, Wided Ghardallou, Ali Mili — New Jersey Institute of Technology, USA; University of Tunis El Manar, Tunisia

On Architectural Diversity of Dynamic Adaptive Systems .............................................................................. 595
Hui Song, Amal Elgammal, Vivek Nallur, Franck Chauvel, Franck Fleurey, SiobhÁn Clarke — SINTEF ICT, Norway; Trinity College Dublin, Ireland

Information Transformation: An Underpinning Theory for Software Engineering .............................................. 599
David Clark, Robert Feldt, Simon Poulding, Shin Yoo — University College London, UK; Blekinge Institute of Technology, Sweden

Novel Programming

A Unified Framework for the Comprehension of Software’s Time Dimension ............................................... 603
Omar Benomar, Houari Sahraoui, Pierre Poulin — Université de Montréal, Canada

Smart Programming Playgrounds ............................................................................................................. 607
Rohan Padhye, Pankaj Dhoolia, Senthil Mani, Vibha Singhal Sinha — IBM Research, India
Capsule-Oriented Programming ................................................................. 611
  Hridesh Rajan — Iowa State University, USA

Evolution-Aware Monitoring-Oriented Programming ........................................ 615
  Owolabi Legunsen, Darko Marinov, Grigore Rosu — University of Illinois at Urbana-Champaign, USA

Towards Explicitly Elastic Programming Frameworks ....................................... 619
  K. R. Jayaram — IBM Research TJ Watson, USA

Optimising Energy Consumption of Design Patterns ........................................ 623
  Adel Noureddine, Ajitha Rajan — University of Edinburgh, UK

Commits and Repositories

Mining Software Repositories for Social Norms ................................................ 627
  Hoa Khanh Dam, Bastin Tony Roy Savarimuthu, Daniel Avery, Aditya Ghose
  — University of Wollongong, Australia; University of Otago, New Zealand

Commit Bubbles .............................................................................................. 631
  Titus Barik, Kevin Lubick, Emerson Murphy-Hill — ABB Corporate Research, USA;
  North Carolina State University, USA

Rapid Multi-Purpose, Multi-Commit Code Analysis ........................................... 635
  Carol V. Alexandru, Harald C. Gall — University of Zurich, Switzerland

Leveraging Informal Documentation to Summarize Classes and Methods in Context ....................................................... 639
  Latifa Guerrouj, David Bourque, Peter C. Rigby — Concordia University, Canada

Demonstrations

Assistance

Bixie: Finding and Understanding Inconsistent Code .......................................... 645
  Tim McCarthy, Philipp Rümmer, Martin Schäf — SRI International, USA;
  Uppsala University, Sweden

TaskNav: Task-Based Navigation of Software Documentation ................................ 649
  Christoph Treude, Mathieu Sicard, Marc Klocke, Martin Robillard — Universidade Federal
do Rio Grande do Norte, Brazil; McGill University, Canada

ViDI: The Visual Design Inspector .................................................................. 653
  Yuriy Tymchuk, Andrea Mocci, Michele Lanza — University of Lugano, Switzerland

Bootstrapping Mobile App Development ......................................................... 657
  Scott Barnett, Rajesh Vasa, John Grundy — Swinburne University of Technology, Australia

Source Code Curation on StackOverflow: The Vesperin System ......................... 661
  Huascar Sanchez, Jim Whitehead — UC Santa Cruz, USA
The ECCO Tool: Extraction and Composition for Clone-and-Own ................................. 665
Stefan Fischer, Lukas Linsbauer, Roberto E. Lopez-Herrejon, Alexander Egyed
— Johannes Kepler University, Austria

Extract Package Refactoring in ARIES ............................................................................. 669
Fabio Palomba, Michele Tufano, Gabriele Bavota, Rocco Oliveto, Andrian Marcus,
Denys Poshyvanyk, Andrea De Lucia — University of Salerno, Italy; College
of William and Mary, USA; Free University of Bozen-Bolzano, Italy; University of Molise, Italy;
The University of Texas at Dallas, USA

scvRipper: Video Scraping Tool for Modeling Developers' Behavior Using Interaction Data .......... 673
Lingfeng Bao, Jing Li, Zhenchang Xing, Xinyu Wang, Bo Zhou — Zhejiang University, China;
Nanyang Technological University, Singapore

Chiminey: Reliable Computing and Data Management Platform in the Cloud .......................... 677
Iman I. Yusuf, Ian E. Thomas, Maria Spichkova, Steve Androulakis, Grischa R. Meyer,
Daniel W. Drumm, George Opletai, Salvy P. Russo, Ashley M. Buckle, Heinz W. Schmidt
— Applied Data Science, Australia; RMIT University, Australia; Monash University, Australia

Authoring and Synthesis

Automated Program Repair in an Integrated Development Environment ............................. 681
Yu Pei, Carlo A. Furia, Martin Nordio, Bertrand Meyer — ETH Zurich, Switzerland

FLEXISKETCH TEAM: Collaborative Sketching and Notation Creation on the Fly ................. 685
Dustin Wüest, Norbert Seyff, Martin Glinz — University of Zurich, Switzerland

Interactive Synthesis Using Free-Form Queries ........................................................................ 689
Tihomir Gvero, Viktor Kuncak — EPFL, Switzerland

Varis: IDE Support for Embedded Client Code in PHP Web Applications ............................. 693
Hung Viet Nguyen, Christian Kästner, Tien N. Nguyen — Iowa State University, USA;
Carnegie Mellon University, USA

MU-MMINT: An IDE for Model Uncertainty ........................................................................... 697
Michalis Famelis, Naama Ben-David, Alessio Di Sandro, Rick Salay, Marsha Chechik
— University of Toronto, Canada

StriSynth: Synthesis for Live Programming ........................................................................... 701
Sumit Gulwani, Mikaël Mayer, Filip Niksic, Ruzica Piskac — Microsoft Research
Redmond, USA; EPFL, Switzerland; MPI-SWS, Germany; Yale University, USA

CACHECA: A Cache Language Model Based Code Suggestion Tool ..................................... 705
Christine Franks, Zhaopeng Tu, Premkumar Devanbu, Vincent Hellendoorn
— University of California at Davis, USA; Huawei Noah’s Ark Lab, Hong Kong;
Delft University of Technology, Netherlands

ChangeScribe: A Tool for Automatically Generating Commit Messages .............................. 709
Mario Linares-Vásquez, Luis Fernando Cortés-Coy, Jairo Aponte, Denys Poshyvanyk
— College of William and Mary, USA; Universidad Nacional de Colombia, Colombia
Test and Analysis

Ekstazi: Lightweight Test Selection ................................................................. 713
   Milos Gligoric, Lamyaa Eloussi, Darko Marinov — University of Illinois
   at Urbana-Champaign, USA

TesMa and CATG: Automated Test Generation Tools for Models of Enterprise Applications .......... 717
   Haruto Tanno, Xiaojing Zhang, Takashi Hoshino, Koushik Sen — NTT Laboratories, Japan;
   University of California at Berkeley, USA

StressCloud: A Tool for Analysing Performance and Energy Consumption
   of Cloud Applications .................................................................................. 721
   Feifei Chen, John Grundy, Jean-Guy Schneider, Yun Yang, Qiang He
   — Swinburne University of Technology, Australia

Analysis of Android Inter-App Security Vulnerabilities Using COVERT ........................................... 725
   Alireza Sadeghi, Hamid Bagheri, Sam Malek — George Mason University, USA

Ariadne: Topology Aware Adaptive Security for Cyber-Physical Systems ............................................. 729
   Christos Tsigkanos, Liliana Pasquale, Carlo Ghezzi, Bashar Nuseibeh
   — Politecnico di Milano, Italy; Lero, Ireland; The Open University, UK

Security Toolbox for Detecting Novel and Sophisticated Android Malware ...................................... 733
   Benjamin Holland, Tom Deering, Suresh Kothari, Jon Mathews, Nikhil Ranade
   — Iowa State University, USA; EnSoft Corp., USA

VERMEER: A Tool for Tracing and Explaining Faulty C Programs ................................................... 737
   Daniel Schwartz-Narbonne, Chanseok Oh, Martin Schäf, Thomas Wies
   — New York University, USA; SRI International, USA

JRebel.Android: Runtime Class- and Resource Reloading for Android ............................................ 741
   Rein Raudjärv, Allan Raundahl Gregersen — Zeroturnaround, Estonia

FormTester: Effective Integration of Model-Based and Manually Specified Test Cases....................... 745
   Rahul Dixit, Christof Lutteroth, Gerald Weber — University of Auckland, New Zealand

ACM Student Research Competition

Mining Temporal Properties of Data Invariants .............................................................................. 751
   Caroline Lemieux — University of British Columbia, Canada

Profiling Kernels Behavior to Improve CPU / GPU Interactions ...................................................... 754
   Ronie Salgado — University of Chile, Chile

Fast and Precise Statistical Code Completion .................................................................................. 757
   Pascal Roos — ETH Zurich, Switzerland

A Combined Technique of GUI Ripping and Input Perturbation Testing for Android Apps ............... 760
   Gennaro Imparato — Università degli Studi di Napoli Federico II, Italy

Enabling Testing of Android Apps ................................................................................................. 763
   Mario Linares-Vásquez — College of William and Mary, USA
An Approach to Detect Android Antipatterns ................................. 766
Geoffrey Hecht — Université Lille 1, France; INRIA, France; UQAM, Canada

Textual Analysis for Code Smell Detection ........................................ 769
Fabio Palomba — University of Salerno, Italy

A Large Scale Study of License Usage on GitHub .............................. 772
Christopher Vendome — College of William and Mary, USA

Understanding Conflicts Arising from Collaborative Development ........ 775
Paola Accioly — Federal University Of Pernambuco, Brazil

Mastering Global Exceptions with Policy-Aware Recommendations ..... 778
Eiji Adachi Barbosa — PUC-Rio, Brazil

Deep Representations for Software Engineering ............................... 781
Martin White — College of William and Mary, USA

Automatic Categorization of Software Libraries Using Bytecode ............ 784
Javier Escobar-Avila — Florida State University, USA

Post-Dominator Analysis for Precisely Handling Implicit Flows .............. 787
Abhishek Bichhawat — Saarland University, Germany

Casper: Using Ghosts to Debug Null Deferences with Dynamic Causality Traces .... 790
Benoit Cornu — University of Lille, France; INRIA, France

Posters

Poster: Static Detection of Configuration-Dependent Bugs in Configurable Software ................. 795
Jafar Al-Kofahi, Lisong Guo, Hung Viet Nguyen, Hoan Anh Nguyen, Tien N. Nguyen — Iowa State University, USA; INRIA, France; LIP6, France; Sorbonne Universités, France; UPMC, France

Poster: Improving Cloud-Based Continuous Integration Environments .................. 797
Alessio Gambi, Zabolotnyi Rostyslav, Schahram Dustdar — Vienna University of Technology, Austria

Poster: Interactive and Collaborative Source Code Annotation ...................... 799
Ryo Suzuki — University of Tokyo, Japan

Poster: Discovering Code Dependencies by Harnessing Developer's Activity ............ 801
Martin Konopka, Pavol Navrat, Maria Bielikova — Slovak University of Technology in Bratislava, Slovakia

Poster: Filtering Code Smells Detection Results ...................................... 803
Francesca Arcelli Fontana, Vincenzo Ferme, Marco Zanoni — University of Milano Bicocca, Italy; University of Luagno, Switzerland

Poster: Enhancing Partition Testing through Output Variation ....................... 805
Huai Liu, Pak-Lok Poon, Tsong Yueh Chen — RMIT University, Australia; The Hong Kong Polytechnic University, Hong Kong; Swinburne University of Technology, Australia
Poster: Segmentation Based Online Performance Problem Diagnosis .................................................... 807
  Jingwen Zhou, Zhenbang Chen, Ji Wang — National University of Defense Technology, China

Poster: Symbolic Execution of MPI Programs .......................................................................................... 809
  Xianjin Fu, Zhenbang Chen, Hengbiao Yu, Chun Huang, Wei Dong, Ji Wang
  — National University of Defense Technology, China

Poster: Automatically Fixing Real-World JavaScript Performance Bugs .................................................. 811
  Marija Selakovic, Michael Pradel — TU Darmstadt, Germany

Poster: Dynamic Analysis Using JavaScript Proxies ................................................................................ 813
  Laurent Christophe, Coen De Roover, Wolfgang De Meuter — Vrije Universiteit Brussel, Belgium

  Andrea Borg, Chris Porter, Mark Micallef — University of Malta, Malta

Poster: VIBeS, Transition System Mutation Made Easy ........................................................................... 817
  Xavier Devroey, Gilles Perrouin, Pierre-Yves Schobbens, Patrick Heymans
  — University of Namur, Belgium

Poster: ProNat: An Agent-Based System Design for Programming in Spoken Natural Language ....... 819
  Sebastian Weigelt, Walter F. Tichy — Karlsruhe Institute of Technology, Germany

Poster: Static Analysis of Concurrent Higher-Order Programs ................................................................. 821
  Quentin Stievenart, Jens Nicolay, Wolfgang De Meuter, Coen De Roover
  — Vrije Universiteit Brussel, Belgium

Poster: Conquering Uncertainty in Java Programming ............................................................................. 823
  Takuya Fukamachi, Naoyasu Ubayashi, Shintaro Hosoi, Yasutaka Kamei
  — Kyushu University, Japan

Poster: MAPP: The Berkeley Model and Algorithm Prototyping Platform ................................................ 825
  Tianshi Wang, Karthik Aadithya, Bichen Wu, Jaijeet Roychowdhury — UC Berkeley, USA

Poster: An Efficient Equivalence Checking Method for Petri Net Based Models of Programs ............... 827
  Soumyadip Bandypadhyay, Dipankar Sarkar, Chittaranjan Mandal
  — Indian Institute of Technology, India

Poster: Model-based Run-time Variability Resolution for Robotic Applications ........................................ 829
  Luca Gherardi, Nico Hochgeschwender — ETH Zurich, Switzerland; Bonn-Rhine-Sieg University of Applied Sciences, Germany

Poster: Tierless Programming in JavaScript ............................................................................................. 831
  Laure Philips, Wolfgang De Meuter, Coen De Roover — Vrije Universiteit Brussel, Belgium

  Harry Raymond Joseph — Indian Institute of Technology Madras, India

Poster: Reasoning based on Imperfect Context Data in Adaptive Security ............................................. 835
  Sara Sartoli, Akbar Siami Namin — Texas Tech University, USA
Doctoral Symposium

Student Presentations

Automated Planning for Self-Adaptive Systems ................................................................. 839
   Richard Gil — Universidade de Lisboa, Portugal

Understanding the Software Fault Introduction Process ............................................... 843
   Laura Inozemtseva — University of Waterloo, Canada

Scalable Formal Verification of UML Models ................................................................. 847
   Mohammad Mehdi Pourhashem Kallehbasti — Politecnico di Milano, Italy

Scalability Studies on Selective Mutation Testing ......................................................... 851
   Jie Zhang — Peking University, China

Qualitative Analysis of Knowledge Transfer in Pair Programming ............................. 855
   Franz Zieris — Freie Universität Berlin, Germany

DIETs: Recommender Systems for Mobile API Developers ......................................... 859
   Stefanie Beyer — University of Klagenfurt, Austria

Student Posters

Statistical Learning and Software Mining for Agent Based Simulation of Software Evolution .......... 863
   Verena Honsel — University of Göttingen, Germany

Towards Model Driven Architecture and Analysis of System of Systems Access Control .......... 867
   Jamal El Hachem — University of Pau and Pays de l'Adour, France

A Unified Approach to Automatic Testing of Architectural Constraints ....................... 871
   Andrea Caracciolo — University of Bern, Switzerland

Safe Evolution Patterns for Software Product Lines ....................................................... 875
   Nicolas Dintzner — Delft University of Technology, Netherlands

Strategies for Prioritizing Test Cases Generated through Model-Based Testing Approaches ........ 879
   João Felipe Silva Ouriques — Federal University of Campina Grande, Brazil

Towards a Practical Security Analysis Methodology ..................................................... 883
   Alexander van den Berghe — KU Leuven, Belgium

Measuring Software Developers' Perceived Difficulty with Biometric Sensors .................. 887
   Sebastian C. Müller — University of Zurich, Switzerland

Mining Patterns of Sensitive Data Usage ...................................................................... 891
   Vitalii Avdiienko — Saarland University, Germany

Search-Based Migration of Model Variants to Software Product Line Architectures ............ 895
   Wesley Klewerton Guez Assunção — Federal University of Paraná, Brazil

On the Architecture-Driven Development of Software-Intensive Systems-of-Systems ........... 899
   Everton Cavalcante — Federal University of Rio Grande do Norte, Brazil;
   Université de Bretagne-Sud, France
Automatic Documentation Generation via Source Code Summarization ......................................................... 903
Paul W. McBurney — University of Notre Dame, USA

A Declarative Foundation for Comprehensive History Querying .............................................................................. 907
Reinout Stevens — Vrije Universiteit Brussel, Belgium

An Integrated Multi-Agent-Based Simulation Approach to Support Software Project Management.......... 911
Davy de Medeiros Baia — Pontifical Catholic University of Rio de Janeiro, Brazil

Towards Generation of Software Development Tasks .......................................................................................... 915
C. Albert Thompson — University of British Columbia, Canada

Contributor's Performance, Participation Intentions, Its Influencers and Project Performance ................. 919
Ayushi Rastogi — Indraprastha Institute of Information Technology, India

Supporting Scientific SE Process Improvement ................................................................................................. 923
Erika S. Mesh — Rochester Institute of Technology, USA

A Comprehensive Framework for the Development of Dynamic Smart Spaces ................................................. 927
Adnan Shahzada — Politecnico di Milano, Italy

Verification of Android Applications ...................................................................................................................... 931
Heila van der Merwe — University of Stellenbosch, South Africa

A Security Practices Evaluation Framework ......................................................................................................... 935
Patrick Morrison — North Carolina State University, USA

Technical Briefings

The Green Lab: Experimentation in Software Energy Efficiency ........................................................................... 941
Giuseppe Procaccianti, Patricia Lago, Antonio Vetrò, Daniel Méndez Fernández, Roel Wieringa — VU University Amsterdam, Netherlands; Technische Universität München, Germany; University of Twente, Netherlands

Software Requirements Patterns: A State of the Art and the Practice ......................................................... 943
Xavier Franch — UPC, Spain

Agile Project Management: From Self-Managing Teams to Large-Scale Development .................................... 945
Tore Dybå, Torgeir Dingsøyr — SINTEF, Norway

Software Engineering for Privacy in-the-Large ................................................................................................. 947
Pauline Anthonysamy, Awais Rashid — Google, Switzerland; Lancaster University, UK

The Use of Text Retrieval and Natural Language Processing in Software Engineering .................................. 949
Venera Arnaoudova, Sonia Haiduc, Andrian Marcus, Giuliano Antoniol — The University of Texas at Dallas, USA; Florida State University, USA; École Polytechnique de Montréal, Canada

Exploration, Analysis, and Manipulation of Source Code using srcML .......................................................... 951
Jonathan I. Maletic, Michael L. Collard — Kent State University, USA; The University of Akron, USA
Workshop Summaries

10th International Workshop on Automation of Software Test (AST 2015) .............................................. 963
Rajesh Subramanyan, Leonardo Mariani, Dan Hao — Siemens, USA; University of Milano Bicocca, Italy; Peking University, China

1st International Workshop on Big Data Software Engineering (BIGDSE 2015) ........................................ 965
Luciano Baresi, Tim Menzies, Andreas Metzger, Thomas Zimmermann
— Politecnico di Milano, Italy; North Carolina State University, USA;
University of Duisburg-Essen, Germany; Microsoft Research, USA

Xavier Franch, Nazim H. Madhavji, Carlos Henrique C. Duarte
— Universitat Politècnica de Catalunya, Spain; University of Western Ontario, Canada;
National Bank of Social and Economic Development, Brazil

8th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE 2015) .......... 969
Andrew Begel, Rafael Prikladnicki, Yvonne Dittrich, Cleidson R. B. de Souza,
Anita Sarma, Sandeep Athavale — Microsoft Research, USA; PUCRS, Brazil;
IT University of Copenhagen, Denmark; Vale Institute of Technology, Brazil;
Federal University of Pará, Brazil; University of Nebraska-Lincoln, USA;
Tata Research Development and Design Centre, India

1st International Workshop on Complex Faults and Failures in Large Software Systems (COUFLESS 2015) ............................................................. 971
Mark Grechanik, Javier Alonso, Allen P. Nikora — University of Illinois at Chicago, USA;
University of León, Spain; Duke University, USA; Jet Propulsion Laboratory, USA

2nd International Workshop on Context for Software Development (CSD 2015) ................................................. 973
Kelly Blincoe, Daniela Damian, Giuseppe Valetto, James D. Herbsleb
— University of Victoria, Canada; Fondazione Bruno Kessler, Italy;
Carnegie Mellon University, USA

2nd International Workshop on Crowd Sourcing in Software Engineering (CSI-SE 2015) .............................. 975
Gordon Fraser, Thomas D. LaToza, Leonardo Mariani — University of Sheffield, UK;
University of California at Irvine, USA; University of Milano Bicocca, Italy
3rd FME Workshop on Formal Methods in Software Engineering (FormaliSE 2015) .............................. 977
Stefania Gnesi, Nico Plat — ISTI-CNR, Italy; West Consulting BV, Netherlands

4th International Workshop on Games and Software Engineering (GAS 2015)....................................... 979
Judith Bishop, Kendra M.L. Cooper, Walter Scacchi, Jim Whitehead
— Microsoft Research, USA; University of British Columbia, Canada;
University of California at Irvine, USA; University of California at Santa Cruz, USA

4th International Workshop on Green and Sustainable Software (GREENS 2015) ................................. 981
Maurizio Morisio, Patricia Lago, Niklaus Meyer, Hauzi A. Müller, Giuseppe Scanniello
— Politecnico di Torino, Italy; VU University Amsterdam, Netherlands;
Green IT Sig, Switzerland; University of Victoria, Canada; Università della Basilicata, Italy

4th SEMAT Workshop on General Theory of Software Engineering (GTSE 2015) ................................. 983
Paul Ralph, Gregor Engels, Ivar Jacobson, Michael Goedicke
— University of Auckland, New Zealand; University of Paderborn, Germany;
Ivar Jacobson International, Switzerland; University of Duisburg-Essen, Germany

7th International Workshop on Modeling in Software Engineering (MiSE 2015) ...................................... 985
Jeff Gray, Marsha Chechik, Vinay Kulkarni, Richard F. Paige — University of Alabama, USA;
University of Toronto, Canada; Tata Research Development and Design Centre, India;
University of York, UK

7th International Workshop on Principles of Engineering Service-Oriented
and Cloud Systems (PESOS 2015) .......................................................................................................... 987
M. Ali Babar, Hye-young Helen Paik, Malolan Chettur, Michael Bauer,
Amir Molzam Sharifloo — University of Adelaide, Australia; University of New South
Wales, Australia; IBM Research, India; University of Western Ontario, Canada;
University of Duisburg-Essen, Germany

5th International Workshop on Product LinE Approaches in Software Engineering PLE
for a Sustainable Society (PLEASE 2015) ................................................................................................ 989
Julia Rubin, Goetz Botterweck, Andreas Pleuss, David Weiss — Massachusetts Institute
of Technology, USA; Lero, Ireland; Iowa State University, USA

4th International Workshop on Realizing AI Synergies in Software Engineering (RAISE 2015) .............. 991
Burak Turhan, Ayse Bener, Rachel Harrison, Andriy Miranskyy, Çetin Meriçli,
Leandro L. Minku — University of Oulu, Finland; Ryerson University, Canada;
Oxford Brookes University, UK; CMU, USA; University of Birmingham, UK

RCoSE 2015 - 2nd International Workshop on Rapid Continuous Software Engineering .......................... 993
Matthias Tichy, Jan Bosch, Michael Goedicke, Brian Fitzgerald
— Chalmers University of Technology, Sweden; University of Gothenburg, Sweden;
University of Duisburg-Essen, Germany; Lero, Ireland; University of Limerick, Ireland

3rd International Workshop on Release Engineering (RELENG 2015) .................................................... 995
Bram Adams, Stephany Bellomo, Christian Bird, Foutse Khomh, Kim Moir
— École Polytechnique de Montréal, Canada; Carnegie Mellon University, USA;
Microsoft Research, USA; Mozilla, Canada

2nd International Workshop on Requirements Engineering and Testing (RET 2015) ................................. 997
Elizabeth Bjarnason, Mirko Morandini, Markus Borg, Michael Unterkalmsteiner,
Michael Felderer, Matthew Staats — Lund University, Sweden; Fondazione
Bruno Kessler, Italy; Blekinge Institute of Technology, Sweden;
University of Innsbruck, Austria; Google Inc., Switzerland
Second International Workshop on Software Architecture and Metrics (SAM 2015) ........................................... 999
Ipek Ozkaya, Robert L. Nord, Heiko Koziolek, Paris Avgeriou
— Carnegie Mellon University, USA; ABB Corporate Research, Germany;
University of Groningen, Netherlands

8th International Workshop on Search-Based Software Testing (SBST 2015) ..................................................... 1001
Gregory Gay, Giuliano Antoniol — University of Minnesota, USA;
École Polytechnique de Montréal, Canada

Jeffrey C. Carver, Neil Chue Hong, Paolo Ciancarini — University of Alabama, USA;
University of Edinburgh, UK; University of Bologna, Italy

Felienne Hermans, Richard F. Paige, Peter Sestoft — Delft University of Technology, Netherlands; University of York, UK; IT University of Copenhagen, Denmark

2nd International Workshop on Software Engineering Research and Industrial Practice (SER&IP 2015) ................... 1007
Judith Bishop, Rakesh Shukla, Forrest Shull, Sagar Sen — Microsoft Research, USA;
Infosys Limited, India; Carnegie Mellon University, USA; Simula Research Laboratory, Norway

1st International Workshop on Software Engineering for Smart Cyber-Physical Systems (SEsCPS 2015) ................. 1009
Tomas Bures, Danny Weyns, Mark Klein, Rodolfo E. Haber — Charles University, Czech Republic; Linnaeus University, Sweden; Carnegie Mellon University, USA;
UPM-CSIC, Spain

Flavio Oquendo, Paris Avgeriou, Carlos E. Cuesta, Khalil Drira, Elisa Yumi Nakagawa,
José Carlos Maldonado, Andrea Zisman — University of South Brittany, France;
University of Groningen, Netherlands; Rey Juan Carlos University, Spain;
University of Toulouse, France; University of São Paulo, Brazil; The Open University, UK

1st International Workshop on Software Protection (SPRO 2015) ................................................................. 1013
Paolo Falcarin, Brecht Wyseur — University of East London, UK; Nagravision S.A., Switzerland

1st International Workshop on TEchnical and LEgal aspects of data pRivacy and SEcurity (TELERISE 2015) .................. 1015
Ilaria Matteucci, Paolo Mori, Marinella Petrocchi — IIT-CNR, Italy

5th International Workshop on the Twin Peaks of Requirements and Architecture (TwinPeaks 2015) ...................... 1017
Matthias Galster, Mehdi Mirakhorli — University of Canterbury, New Zealand;
Rochester Institute of Technology, USA

Workshop on Applications of Human Error Research to Improve Software Engineering (WAHESE 2015) ......................... 1019
Gursimran S. Walia, Jeffrey C. Carver, Gary Bradshaw — North Dakota State University, USA;
University of Alabama, USA; Mississippi State University, USA
Author Index