

ISSTA'10

Proceedings of the 2010
International Symposium on Software Testing & Analysis,
and Co-Located Workshops
MIT'10, PADTAD'10, STOV'10 and WODA'10

**July 12-16, 2010
Trento, Italy**



Association for
Computing Machinery

Sponsored by:

ACM SIGSOFT

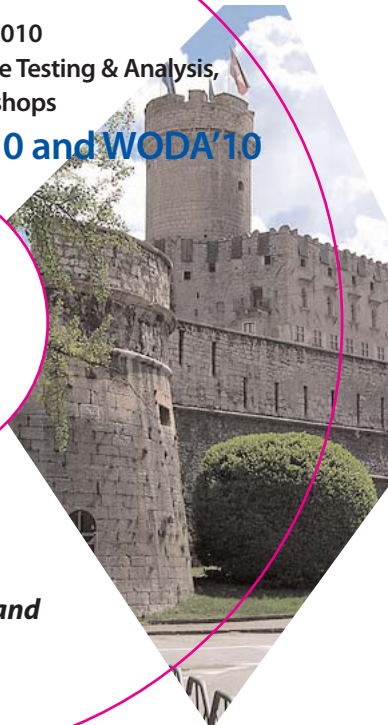
In cooperation with:

ACM SIGPLAN

Supported by:

**Google, IBT, IBM Research and
Microsoft Research**

ACM Order No 594101
ISBN 978-1-60558-823-0





ISSTA 2010

International Symposium on Software Testing and Analysis

Trento, Italy - July 12-16, 2010



[Main Page](#)

[ISSTA'10 Table of Contents](#)

[ISSTA'10 Author Index](#)

[Co-located Workshops](#)

[Sponsors & Supporters](#)

Welcome to the E-Proceedings of the 2010 ACM International Symposium on Software Testing and Analysis

These proceedings are a cross-platform medium that allows Windows and Mac users to share the same directory structure and access a common set of files. To navigate these proceedings, a graphical web browser is required. The full-text content on this disk is in Adobe PDF format. A version of Adobe Acrobat Reader is required to view the content. Please be sure you have the latest version and updates of [Adobe Acrobat Reader](#) installed.



Copyright © 2010 by the Association for Computing Machinery, Inc. (ACM). Permission to make digital or hard copies of portions of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyright for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permission to republish from: Publications Dept., ACM, Inc. Fax +1 (212) 869-0481 or permissions@acm.org

For other copying of articles that carry a code at the bottom of the first or last page, copying is permitted provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923 (USA).

Notice to Past Authors of ACM-Published Articles

ACM intends to create a complete electronic archive of all articles and/or other material previously published by ACM. If you have written a work that has been previously published by ACM in any journal or conference proceedings prior to 1978, or any SIG Newsletter at any time, and you do NOT want this work to appear in the ACM Digital Library, please inform permissions@acm.org, stating the title of the work, the author(s), and where and when published.

ISBN: 978-1-60558-823-0

Additional copies may be ordered prepaid from:
ACM Order Department
General Post Office
P.O. Box 30777, New York, NY 10087-0777

[\(Return to Top\)](#)

ACM Order Number: 594101

Phone: 1-800-342-6626 (USA and Canada)
+1-212-626-0500 (Global)
Fax: +1-212-944-1318
E-mail: acmhelp@acm.org
Hours of Operation: 8:30 am – 4:30 pm ET

Message from the Chairs

It is our great pleasure to welcome you to Trento for ISSTA 2010, the 19th International Symposium on Software Testing and Analysis. ISSTA is the leading research conference in software testing and analysis and brings together academics, industrial researchers, and practitioners to exchange new ideas, problems, and experience on how to analyze and test software systems. The ISSTA 2010 program includes keynotes, technical, tool, and doctoral symposium papers, tutorials and workshops.

ISSTA 2010 attracted over 100 submissions, which demonstrates the ongoing interest in the field. Each submission was evaluated by at least three members of the Program Committee. The Program Committee met to discuss the submissions and accepted 23 papers that cover a variety of topics, including formal verification, symbolic execution, test input generation, debugging, and concurrency testing and analysis. In addition, the program includes two distinguished keynote speakers: Christian Ferdinand (AbsInt) and Patrice Godefroid (Microsoft Research).

The ISSTA week includes five workshops and two tutorials:

- PADTAD: Workshop on *Parallel and Distributed Systems: Testing, Analysis, and Debugging*
- SSEAT: Workshop on *State-space Exploration for Automated Testing*
- STOV/MIIT: Joint Workshop on *Software Test Output Validation & Model Inference In Testing*
- WODA: Workshop on *Dynamic Analysis*
- SBT: Tutorial on *Search-based Testing*, given by Phil McMinn
- JPF: Tutorial on *Automated Testing with Java PathFinder*, given by Corina Pasareanu and Willem Visser

Bringing ISSTA 2010 into existence involved a great effort from the members of our community, and we would like to extend our most heartfelt thanks to everyone who worked hard to make this possible. We thank the authors and the keynote speakers, who provide the content of our program and are presenting their contributions at the conference. We cannot thank enough the Program Committee members, who reviewed many papers, wrote detailed reviews, traveled at their own expense to the Program Committee meeting, and helped us select this great program for the conference. Special thanks go to Alfonso Fuggetta and Cristiano Mossa, who let us use the great CEFRIEL facilities for the Program Committee meeting and helped facilitating the meeting in any way possible. Alessandro Marchetto of Fondazione Bruno Kessler managed the ISSTA web site and responded to our countless requests with incredible promptness. We gratefully acknowledge our sponsor (ACM SIGSOFT), supporters (Fondazione Bruno Kessler, CEFRIEL, Georgia Tech, and SIGPLAN), and corporate donors (Google, IBT, IBM Research, and Microsoft Research) for their generous contributions.

Finally, we want to thank all of the conference attendees for contributing to making the conference a success. We hope that you will find the ISSTA 2010 program interesting, thought-provoking, and inspiring, and that the conference will give you valuable opportunities to share ideas with researchers and practitioners from our vibrant and growing testing and analysis community.

Paolo Tonella
ISSTA 2010 General Chair
Fondazione Bruno Kessler, Italy

Alessandro Orso
ISSTA 2010 Program Chair
Georgia Institute of Technology, USA



ISSTA 2010

International Symposium on Software Testing and Analysis
Trento, Italy - July 12-16, 2010



[Main Page](#)

[ISSTA'10 Table of Contents](#)

[ISSTA'10 Author Index](#)

[Co-located Workshops](#)

[Sponsors & Supporters](#)

Table of Contents



Message from the Chairs

Paolo Tonella (*ISSTA 2010 General Chair*)

Alessandro Orso (*ISSTA 2010 Program Chair*)



ISSTA 2010 Conference Organization



ISSTA 2010 Sponsors & Supporters

Technical Session 1: Formal Verification and Analysis

Session Chair: Patrizio Pelliccione (*University of L'Aquila, Italy*)

Proving Memory Safety of Floating-Point Computations by Combining Static and Dynamic Program Analysis (Page 1)

Patrice Godefroid (*Microsoft Research*)

Johannes Kinder (*Technische Universität Darmstadt*)

Strict Control Dependence and Its Effect on Dynamic Information Flow Analyses (Page 13)

Tao Bao (*Purdue University*)

Yunhui Zheng (*Purdue University*)

Zhiqiang Lin (*Purdue University*)

Xiangyu Zhang (*Purdue University*)

Dongyan Xu (*Purdue University*)

[\(Return to Top\)](#)

Analysis of Invariants for Efficient Bounded Verification (Page 25)

Juan P. Galeotti (*Universidad de Buenos Aires*)

Nicolás Rosner (*Universidad de Buenos Aires*)

Carlos G. López Pombo (*Universidad de Buenos Aires*)

Marcelo F. Frias (*Buenos Aires Institute of Technology*)

Automatically Identifying Critical Input Regions and Code in Applications (Page 37)

Michael Carbin (*Massachusetts Institute of Technology*)

Martin C. Rinard (*Massachusetts Institute of Technology*)

Technical Session 2: Debugging

Session Chair: James Jones (*University of California, Irvine*)

Directed Test Generation for Effective Fault Localization (Page 49)

Shay Artzi (*IBM Thomas J. Watson Research Center*)

Julian Dolby (*IBM Thomas J. Watson Research Center*)

Frank Tip (*IBM Thomas J. Watson Research Center*)

Marco Pistoia (*IBM Thomas J. Watson Research Center*)

Automated Fixing of Programs with Contracts (Page 61)

Yi Wei (*ETH Zürich*)

Yu Pei (*ETH Zürich*)

Carlo A. Furia (*ETH Zürich*)

Lucas S. Silva (*ETH Zürich*)

Stefan Buchholz (*ETH Zürich*)

Bertrand Meyer (*ETH Zürich*)

Andreas Zeller (*Saarland University - Computer Science*)

[\(Return to Top\)](#)

Causal Inference for Statistical Fault Localization (Page 73)

George K. Baah (*Georgia Institute of Technology*)

Andy Podgurski (*Case Western Reserve University*)

Mary Jean Harrold (*Georgia Institute of Technology*)

Technical Session 3: Mining and Taxonomies

Session Chair: Antonia Bertolino (*Italian National Research Council, Italy*)

Generating Test Cases for Specification Mining (Page 85)

Valentin Dallmeier (*Saarland University*)

Nikolai Knopp (*Saarland University*)

Christoph Mallon (*Saarland University*)
 Sebastian Hack (*Saarland University*)
 Andreas Zeller (*Saarland University*)

Modeling Consumer-Perceived Web Application Fault Severities for Testing (Page 97)

Kinga Dobolyi (*University of Virginia*)
 Westley Weimer (*University of Virginia*)

Technical Session 4: Anomaly Detection

Session Chair: Frank Tip (*IBM Research*)

Automatic Detection of Unsafe Component Loadings (Page 107)

Taeho Kwon (*University of California, Davis*)
 Zhendong Su (*University of California, Davis*)

Learning from 6,000 Projects: Lightweight Cross-Project Anomaly Detection (Page 119)

Natalie Gruska (*Queen's University*)
 Andrzej Wasylkowski (*Saarland University*)
 Andreas Zeller (*Saarland University*)

Perturbing Numerical Calculations for Statistical Analysis of Floating-Point Program (In)Stability (Page 131)

Enyi Tang (*Nanjing University*)
 Earl Barr (*University of California, Davis*)
 Xuandong Li (*Nanjing University*)
 Zhendong Su (*University of California, Davis*)

Doctoral Symposium

Session Chair: Mauro Pezzè (*University of Lugano, Switzerland & University of Milano Bicocca, Italy*)

Automated Analysis of Load Testing Results (Page 143)

Zhen Ming Jiang (*Queen's University*)

Technical Session 5: Test Input Generation and Fuzzing

Session Chair: Leonardo Mariani (*University of Milan Bicocca, Italy*)

Mutation-Driven Generation of Unit Tests and Oracles (Page 147)

Gordon Fraser (*Saarland University*)
 Andreas Zeller (*Saarland University*)

OCAT: Object Capture Based Automated Testing (Page 159)

Hojun Jaygarl (*Iowa State University*)
 Sunghun Kim (*The Hong Kong University of Science and Technology*)
 Tao Xie (*North Carolina State University*)
 Carl K. Chang (*Iowa State University*)

Testing System Virtual Machines (Page 171)

Lorenzo Martignoni (*Università degli Studi di Udine*)
 Roberto Paleari (*Università degli Studi di Milano*)
 Giampaolo Fresi Roglia (*Università degli Studi di Milano*)
 Danilo Bruschi (*Università degli Studi di Milano*)

Technical Session 6: Symbolic Execution

Session Chair: Willem Visser (*University of Stellenbosch, South Africa*)

Parallel Symbolic Execution for Structural Test Generation (Page 183)

Matt Staats (*University of Minnesota*)
 Corina Păsăreanu (*Carnegie Mellon University & NASA Ames Research Center*)

Exploiting Program Dependencies for Scalable Multiple-Path Symbolic Execution (Page 195)

Raul Santelices (*Georgia Institute of Technology*)
 Mary Jean Harrold (*Georgia Institute of Technology*)

On Test Repair Using Symbolic Execution (Page 207)

Brett Daniel (*University of Illinois at Urbana-Champaign*)
 Tihomir Gvero (*École Polytechnique Fédérale de Lausanne*)
 Darko Marinov (*University of Illinois at Urbana-Champaign*)

Technical Session 7: Empirical Studies

Session Chair: David Rosenblum (*University College London*)

Formal Analysis of the Effectiveness and Predictability of Random Testing (Page 219)

Andrea Arcuri (*Simula Research Laboratory*)
 Muhammad Zohaib Iqbal (*Simula Research Laboratory*)
 Lionel Briand (*Simula Research Laboratory*)

[\(Return to Top\)](#)

[\(Return to Top\)](#)

[\(Return to Top\)](#)

[\(Return to Top\)](#)

A Study on Agility and Testing Processes in Software Organizations (Page 231)Vesa Kettunen (*Lappeenranta University of Technology*)Jussi Kasurinen (*Lappeenranta University of Technology*)Ossi Taipale (*Lappeenranta University of Technology*)Kari Smolander (*Lappeenranta University of Technology*)**The Google FindBugs Fixit** (Page 241)Nathaniel Ayewah (*University of Maryland*)William Pugh (*University of Maryland*)**Technical Session 8: Concurrency and Differential Testing**Session Chair: Darko Marinov (*University of Illinois at Urbana-Champaign*)**Analyzing Concurrency Bugs Using Dual Slicing** (Page 253)Dasarath Weeratunge (*Purdue University*)Xiangyu Zhang (*Purdue University*)William N. Sumner (*Purdue University*)Suresh Jagannathan (*Purdue University*)**N-Version Disassembly: Differential Testing of x86 Disassemblers** (Page 265)Roberto Paleari (*Università degli Studi di Milano*)Lorenzo Martignoni (*Università degli Studi di Udine*)Giampaolo Fresi Roglia (*Università degli Studi di Milano*)Danilo Bruschi (*Università degli Studi di Milano*)**Formal Demos**Session Chair: Andreas Zeller (*Saarland University*)**Software Fault Prediction Tool** (Page 275)Thomas J. Ostrand (*AT&T Labs - Research*)Elaine J. Weyuker (*AT&T Labs - Research*)**ASSURE: Automated Support for Secure and Usable Requirements Engineering** (Page 279)Jose Romero-Mariona (*University of California, Irvine*)Hadar Ziv (*University of California, Irvine*)Debra Richardson (*University of California, Irvine*)[\(Return to Top\)](#)

ISSTA 2010 Conference Organization

General Chair: Paolo Tonella (*Fondazione Bruno Kessler – IRST, Italy*)

Program Chair: Alessandro Orso (*Georgia Institute of Technology, USA*)

Local Arrangements Chairs: Mariano Ceccato (*Fondazione Bruno Kessler – IRST, Italy*)
Angelo Susi (*Fondazione Bruno Kessler – IRST, Italy*)

Web Chair: Alessandro Marchetto (*Fondazione Bruno Kessler – IRST, Italy*)

Steering Committee: George Avrunin (*University of Massachusetts Amherst, USA*)
Antonia Bertolino (*I.S.T.I., Italy*)
Laura Dillon (*Michigan State University, US*)
Sebastian Elbaum (*University of Nebraska, USA*)
Phyllis Frankl (*Polytechnic University, in Brooklyn, USA*)
Mary Jean Harrold (*Georgia Institute of Technology, USA*)
Alessandro Orso (*Georgia Institute of Technology, US*)
Mauro Pezzè (*University of Milano-Bicocca, Italy*)
Lori Pollock (*University of Delaware, USA*)
Debra Richardson (*University of California, USA*)
David Rosenblum (*University College London, UK*)
Gregg Rothermel (*University of Nebraska, USA*)
Barbara Ryder (*Virginia Tech, USA*)
Paolo Tonella (*Fondazione Bruno Kessler – IRST, Italy*)
Andreas Zeller (*Saarland University, Germany*)

Program Committee: Jamie Andrews (*University of Western Ontario, Canada*)
Antonia Bertolino (*Italian National Research Council, Italy*)
Victor Braberman (*Universidad de Buenos Aires, Argentina*)
Tevfik Bultan (*UC Santa Barbara, USA*)
S.C. Cheung (*Hong Kong University of Science & Technology, China*)
Myra Cohen (*University of Nebraska Lincoln, USA*)
Mark Harman (*King's College London, UK*)
James Jones (*UC Irvine, USA*)
Leonardo Mariani (*University of Milan Bicocca, Italy*)
Darko Marinov (*University of Illinois at Urbana-Champaign, USA*)
Patrizio Pelliccione (*University of L'Aquila, Italy*)
Lori Pollock (*University of Delaware, USA*)
David Rosenblum (*University College London, UK*)
Barbara Ryder (*Virginia Tech, USA*)
Saurabh Sinha (*IBM Research, India*)
Zhendong Su (*UC Davis, USA*)

Program Committee (continued): Frank Tip (*IBM Research, USA*)
 Willem Visser (*University of Stellenbosch, South Africa*)
 Andreas Zeller (*Saarland University, Germany*)
 Xiangyu Zhang (*Purdue University, USA*)

Tool/Demo Program Committee: Henry Muccini (*Universita de L'Aquila, Italy*)
 Corina Pasareanu (*NASA Ames, USA*)
 Charles Pecheur (*Université catholique de Louvain, Belgium*)
 Andy Podgurski (*Case Western Reserve University, USA*)
 Yannis Smaragdakis (*University of Massachusetts Amherst, USA*)
 Elaine Weyuker (*AT&T Research Labs, USA*)
 Thomas Zimmermann (*Microsoft Research, USA*)

Additional reviewers:

Muath Alkhalaf	Zhifeng Lai
Nadia Alshahwan	Francesca Lonetti
Earl Barr	Eda Marchetti
Emanuela Cartaxo	Hernan Melgratti
Guglielmo De Angelis	Esteban Pavese
Guido De Caso	Marco Pistoia
Bjorn De Sutter	Nasko Rountev
Giovanni Denaro	Fernando Schapachnik
Julian Dolby	Zalia Shams
Stephen Fink	Manu Sridharan
Marc Fisher II	Fangqi Sun
Mark Gabel	Jan Tretmans
Diego Garbervetsky	Xinming Wang
Milos Gligoric	Shiyi Wei
Mangala Gowri	Chang Xu
William Halfond	Guoqing Xu
Lingxiao Jiang	Liang Xu
Galeotti Juan	Shin Yoo
Sarfraz Khurshid	

ISSTA 2010 Sponsors & Supporters

Sponsor:



In cooperation with:



Supporters:



IBM Research

Microsoft
Research

