

2012 IEEE Fifth International Conference on Software Testing, Verification and Validation

(ICST 2012)

**Montreal, Quebec, Canada
17-21 April 2012**



**IEEE Catalog Number: CFP12TVV-PRT
ISBN: 978-1-4577-1906-6**

2012 IEEE Fifth International Conference on Software Testing, Verification and Validation

ICST 2012

Table of Contents

Message from the General Chair.....	xvii
Message from the Program Chairs.....	xviii
Organizing Committee.....	xx
Program Committee.....	xxi
Additional Reviewers.....	xxiii
ICST 2012 Supporters.....	xxiv
Welcome from the AMOST 2012 Chairs.....	xxvi
AMOST 2012 Workshop Organization.....	xxvii
Welcome from the CT 2012 Chairs.....	xxviii
CT 2012 Workshop Organization.....	xxix
Welcome from the LT 2012 Chairs.....	xxx
LT 2012 Workshop Organization.....	xxxi
Welcome from the Mutation 2012 Chairs.....	xxxii
Mutation 2012 Workshop Organization.....	xxxiii
Welcome from the Regression 2012 Chairs.....	xxxiv
Regression 2012 Workshop Organization.....	xxxv
Welcome from the CSTVA 2012 Chairs.....	xxxvi
CSTVA 2012 Workshop Organization.....	xxxvii
Welcome from the SBST 2012 Chairs.....	xxxviii
SBST 2012 Workshop Organization.....	xxxix
Welcome from the SecTest 2012 Chairs.....	xl
SecTest 2012 Workshop Organization.....	xli
Welcome from the TAIC PART 2012 Chairs.....	xlii
TAIC PART 2012 Workshop Organization.....	xliii
Welcome from the VOLT 2012 Chairs.....	xliv
VOLT 2012 Workshop Organization.....	xlv
Poster Organization	xlvi
Keynote Speakers.....	xlvii

Research Session 1: Handling Models

Dynamic Backward Slicing of Model Transformations	1
<i>Zoltán Ujhelyi, Ákos Horváth, and Dániel Varró</i>	
X10X: Model Checking a New Programming Language with an “Old” Model Checker	11
<i>Milos Gligoric, Peter C. Mehlitz, and Darko Marinov</i>	
Finding the Optimal Balance between Over and Under Approximation of Models	
Inferred from Execution Logs	21
<i>Paolo Tonella, Alessandro Marchetto, Cu Duy Nguyen, Yue Jia, Kiran Lakhota, and Mark Harman</i>	

Research Session 2: Fault Localization

AutoFLox: An Automatic Fault Localizer for Client-Side JavaScript	31
<i>Frolin S. Ocariza Jr., Karthik Pattabiraman, and Ali Mesbah</i>	
Tester Feedback Driven Fault Localization	41
<i>Aritra Bandyopadhyay and Sudipto Ghosh</i>	
A Unified Approach for Localizing Non-deadlock Concurrency Bugs	51
<i>Sangmin Park, Richard Vuduc, and Mary Jean Harrold</i>	

Research Session 3: Database and GUI Testing

Empirical Studies on Test Effectiveness for Database Applications	61
<i>Chixiang Zhou and Phyllis Frankl</i>	
Test Adequacy Evaluation for the User-database Interaction: A Specification-Based Approach	71
<i>Raquel Blanco, Javier Tuya, and Rubén V. Seco</i>	
AutoBlackTest: Automatic Black-Box Testing of Interactive Applications	81
<i>Leonardo Mariani, Mauro Pezzè, Oliviero Riganelli, and Mauro Santoro</i>	

Research Session 4: Constraint Solving

Lightweight Data-Flow Analysis for Execution-Driven Constraint Solving	91
<i>Junaid Haroon Siddiqui, Darko Marinov, and Sarfraz Khurshid</i>	
Bounded Program Verification Using an SMT Solver: A Case Study	101
<i>Tianhai Liu, Michael Nagel, and Mana Taghdiri</i>	
Symbolic Execution with Interval Solving and Meta-heuristic Search	111
<i>Mateus Borges, Marcelo d’Amorim, Saswat Anand, David Bushnell, and Corina S. Pasareanu</i>	

Research Session 5: Search-Based Testing

The Seed is Strong: Seeding Strategies in Search-Based Software Testing	121
<i>Gordon Fraser and Andrea Arcuri</i>	
Searching the Boundaries of a Modeling Space to Test Metamodels	131
<i>Juan José Cadavid Gómez, Benoit Baudry, and Houari Sahraoui</i>	
Search-Based Test Input Generation for String Data Types Using the Results of Web Queries	141
<i>Phil McMinn, Muzammil Shahbaz, and Mark Stevenson</i>	

Research Session 6: Web Applications

Crawlability Metrics for Web Applications	151
<i>Nadia Alshahwan, Mark Harman, Alessandro Marchetto, Roberto Tiella, and Paolo Tonella</i>	
Leveraging User-Privilege Classification to Customize Usage-based Statistical Models of Web Applications	161
<i>Sara Sprenkle, Camille Cobb, and Lori Pollock</i>	
CrossCheck: Combining Crawling and Differencing to Better Detect Cross-browser Incompatibilities in Web Applications	171
<i>Shauvik Roy Choudhary, Mukul R. Prasad, and Alessandro Orso</i>	

Research Session 7: Faults Studies

An Empirical Study of Pre-release Software Faults in an Industrial Product Line	181
<i>Thomas R. Devine, Katerina Goseva-Popstajanova, Sandeep Krishnan, Robyn R. Lutz, and J. Jenny Li</i>	
Software Behavior and Failure Clustering: An Empirical Study of Fault Causality	191
<i>Nicholas DiGiuseppe and James A. Jones</i>	
Random Testing: Evaluation of a Law Describing the Number of Faults Found	201
<i>Manuel Oriol</i>	

Research Session 8: Test Evolution

Dynamic Shape Analysis Using Spectral Graph Properties	211
<i>Muhammad Zubair Malik and Sarfraz Khurshid</i>	
An Effective Regression Testing Approach for PHP Web Applications	221
<i>Aaron Marback, Hyunsook Do, and Nathan Ehresmann</i>	
Supporting Test Suite Evolution through Test Case Adaptation	231
<i>Mehdi Mirzaaghaei, Fabrizio Pastore, and Mauro Pezzè</i>	

Research Session 9: Domain-Specific Testing

Testing Conformance of Life Cycle Dependent Properties of Mobile Applications	241
<i>Dominik Franke, Stefan Kowalewski, Carsten Weise, and Nath Prakobkosol</i>	
Formal Model-Based Test for AUTOSAR Multicore RTOS	251
<i>Ling Fang, Takashi Kitamura, Thi Bich Ngoc Do, and Hitoshi Ohsaki</i>	
@tComment: Testing Javadoc Comments to Detect Comment-Code Inconsistencies	260
<i>Shin Hwei Tan, Darko Marinov, Lin Tan, and Gary T. Leavens</i>	

Research Session 10: White-Box Techniques

Generating String Test Data for Code Coverage	270
<i>Michael Beyene and James H. Andrews</i>	
Better Algorithms to Minimize the Cost of Test Paths	280
<i>Nan Li, Fei Li, and Jeff Offutt</i>	
Semantic Mutation Analysis of Floating-Point Comparison	290
<i>Haitao Dan and Robert M. Hierons</i>	

Research Session 11: State-Based Testing

Behaviourally Adequate Software Testing	300
<i>Gordon Fraser and Neil Walkinshaw</i>	
Generating Checking Sequences for Nondeterministic Finite State Machines	310
<i>Alexandre Petrenko, Adenilso Simao, and Nina Yevtushenko</i>	
Evaluating Machine-Independent Metrics for State-Space Exploration	320
<i>Vilas Jagannath, Matt Kirn, Yu Lin, and Darko Marinov</i>	

Research Session 12: Empirical Studies

Comparing the Effectiveness of Equivalence Partitioning, Branch Testing and Code Reading by Stepwise Abstraction Applied by Subjects	330
<i>N. Juristo, S. Vegas, M. Solari, S. Abrahao, and I. Ramos</i>	
A Scalable Distributed Concolic Testing Approach: An Empirical Evaluation	340
<i>Moonzoo Kim, Yunho Kim, and Gregg Rothermel</i>	
Automated System Testing Using Visual GUI Testing Tools: A Comparative Study in Industry	350
<i>Emil Börjesson and Robert Feldt</i>	

Research Session 13: Failure Analysis

CARIAL: Cost-Aware Software Reliability Improvement with Active Learning	360
<i>Boya Sun, Gang Shu, Andy Podgurski, and Soumya Ray</i>	
Identifying Failure-Inducing Combinations in a Combinatorial Test Set	370
<i>Laleh Shikh Gholamhossein Ghandehari, Yu Lei, Tao Xie, Richard Kuhn, and Raghu Kacker</i>	
Weighted System Dependence Graph	380
<i>Fang Deng and James A. Jones</i>	

Industrial Session 1: Case Studies

Industrial Application of Concolic Testing on Embedded Software: Case Studies	390
<i>Moonzoo Kim, Yunho Kim, and Yoonkyu Jang</i>	
Automated Unit Testing of a SCADA Control Software: An Industrial Case Study	
Based on Action Research	400
<i>Shahnewaz Amin Jolly, Vahid Garousi, and Matt M. Eskandar</i>	
A Large Scale Empirical Study on User-Centric Performance Analysis	410
<i>Shahed Zaman, Bram Adams, and Ahmed E. Hassan</i>	

Industrial Session 2: Analysis and Validation

Analyzing a Controller of a Power Distribution Unit Using Formal Methods	420
<i>Jan Friso Groote, Ammar Osaiweran, and Jacco Wesselius</i>	
Securing Opensource Code via Static Analysis	429
<i>Raghudeep Kannavara</i>	
Towards Automated Anomaly Report Assignment in Large Complex Systems Using Stacked Generalization	437
<i>Leif Jonsson, David Broman, Kristian Sandahl, and Sigrid Eldh</i>	

Industrial Session 3: Test Automation

An Integrated Model-Driven Approach for Mechatronic Systems Testing	447
<i>Roberto S. Silva Filho and Christof J. Budnik</i>	
CAST: Automating Software Tests for Embedded Systems	457
<i>Michael Wahler, Ettore Ferranti, Robin Steiger, Rahul Jain, and Kristian Nagy</i>	
When a GUI Regression Test Failed, What Should be Blamed?	467
<i>Jin Chen, Mengxiang Lin, Kai Yu, and Bing Shao</i>	

Ph.D. Symposium

A Smart Structured Test Automation Language (SSTAL)	471
<i>Nan Li</i>	
Industrial Applicability of Visual GUI Testing for System and Acceptance Test Automation	475
<i>Emil Börjesson</i>	
Mitigating the Effect of Coincidental Correctness in Spectrum Based Fault Localization	479
<i>Aritra Bandyopadhyay</i>	
Prioritization of Test Cases Using Software Agents and Fuzzy Logic	483
<i>Christoph Malz, Nasser Jazdi, and Peter Göhner</i>	
Towards Practical Debugging for Regression Faults	487
<i>Kai Yu and Mengxiang Lin</i>	
Using Control Charts for Detecting and Understanding Performance Regressions in Large Software	491
<i>Thanh H.D. Nguyen</i>	
Web Mutation Testing	495
<i>Upsorn Praphamontripong</i>	

The Eighth Workshop on Advances in Model Based Testing (A-MOST 2012)

Session 1: From Models to Runtime Execution

A Runtime Monitoring Framework for Event Streams with Non-primitive Arguments	499
<i>Jérôme Calvar, Raphaël Tremblay-Lessard, and Sylvain Hallé</i>	
Grammar-Based Testing Using Realistic Domains in PHP	509
<i>Ivan Enderlin, Frédéric Dadeau, Alain Giorgetti, and Fabrice Bouquet</i>	

Session 2: Industrial Challenges

From AUTOSAR Models to Co-simulation for MiL-Testing in the Automotive Domain	519
<i>Marcus Mews, Jaroslav Svacina, and Stephan Weißleder</i>	
An Extended LLRP Model for RFID System Test and Diagnosis	529
<i>Rafik Kheddam, Oum-El-Kheir Aktouf, and Ioannis Parassis</i>	

Session 3: Test Case Generation

Test Sequence Generation from Classification Trees	539
<i>Peter M. Kruse and Joachim Wegener</i>	

Experimental Comparison of Test Case Generation Methods for Finite State Machines	549
<i>Andre Takeshi Endo and Adenilso Simao</i>	

Workshop on Combinatorial Testing (CT 2012)

Session 1: CT Environments and Tools

CITLAB: A Laboratory for Combinatorial Interaction Testing	559
<i>Angelo Gargantini and Paolo Vavassori</i>	
Combinatorial Test Design in the TOSCA Testsuite: Lessons Learned and Practical Implications	569
<i>Rudolf Ramler, Theodorich Kopetzky, and Wolfgang Platz</i>	
Simplified Modeling of Combinatorial Test Spaces	573
<i>Itai Segall, Rachel Tzoref-Brill, and Aviad Zlotnick</i>	

Session 2: Experience Reports I

Effectiveness of Pair-Wise Testing for Software with Boolean Inputs	580
<i>William Alton Ballance, Sergiy Vilkomir, and William Jenkins</i>	
Combinatorial Testing on ID3v2 Tags of MP3 Files	587
<i>Zhiqiang Zhang, Xiaojian Liu, and Jian Zhang</i>	
Combinatorial Testing of ACTS: A Case Study	591
<i>Mehra N. Borazjany, Linbin Yu, Yu Lei, Raghu Kacker, and Rick Kuhn</i>	

Session 3: CT Test Generation and Fault Localization

Combinatorial Methods for Event Sequence Testing	601
<i>D. Richard Kuhn, James M. Higdon, James F. Lawrence, Raghu N. Kacker, and Yu Lei</i>	
Combinatorial Interaction Testing for Test Selection in Grammar-Based Testing	610
<i>Elke Salecker and Sabine Glesner</i>	
Isolating Failure-Inducing Combinations in Combinatorial Testing Using Test Augmentation and Classification	620
<i>Kiran Shakya, Tao Xie, Nuo Li, Yu Lei, Raghu Kacker, and Richard Kuhn</i>	

Session 4: Experience Reports II

Common Patterns in Combinatorial Models	624
<i>Itai Segall, Rachel Tzoref-Brill, and Aviad Zlotnick</i>	
A System Analysis Study Comparing Reverse Engineered Combinatorial Testing to Expert Judgment	630
<i>Atlee M. Cunningham Jr., Jon Hagar, and Ryan J. Holman</i>	

The First International Workshop on Load Testing of Large Software Systems (LT 2012)

Automated Performance Model Construction through Event Log Analysis	636
<i>Ahmad Mizan and Greg Franks</i>	
Peer-to-Peer Load Testing	642
<i>Jorge Augusto Meira, Eduardo Cunha de Almeida, Yves Le Traon, and Gerson Sunye</i>	
Overcoming Web Server Benchmarking Challenges in the Multi-core Era	648
<i>Raoufehsadat Hashemian, Diwakar Krishnamurthy, and Martin Arlitt</i>	

Seventh International Workshop on Mutation Analysis (Mutation 2012)

SMT-C: A Semantic Mutation Testing Tools for C	654
<i>Haitao Dan and Robert M. Hierons</i>	
Mutant Execution Cost Reduction: Through MUSIC (Mutant Schema Improved with Extra Code)	664
<i>Pedro Reales Mateo and Macario Polo Usaola</i>	
Testing Obligation Policy Enforcement Using Mutation Analysis	673
<i>Yehia Elrakaiby, Tejeddine Mouelhi, and Yves Le Traon</i>	
Toward Harnessing High-Level Language Virtual Machines for Further Speeding Up Weak Mutation Testing	681
<i>Vinicio H.S. Durelli, Jeff Offutt, and Marcio E. Delamaro</i>	
Using Mutants to Locate “Unknown” Faults	691
<i>Mike Papadakis and Yves Le Traon</i>	
Isolating First Order Equivalent Mutants via Second Order Mutation	701
<i>Marinos Kintis, Mike Papadakis, and Nicos Malevris</i>	
MESSI: Mutant Evaluation by Static Semantic Interpretation	711
<i>Matthew Patrick, Manuel Oriol, and John A. Clark</i>	
Do Redundant Mutants Affect the Effectiveness and Efficiency of Mutation Analysis?	720
<i>René Just, Gregory M. Kapfhammer, and Franz Schweiggert</i>	

The Second International Workshop on Regression Testing (Regression 2012)

Session 1: Approaches and Applications

Test Case Prioritization Due to Database Changes in Web Applications	726
<i>Deepak Garg and Amitava Datta</i>	
Dependency-Based Test Case Selection and Prioritization in Embedded Systems	731
<i>Philipp Caliebe, Thomas Herpel, and Reinhard German</i>	
Analysis of Test Clusters for Regression Testing	736
<i>Bo Guo, Mahadevan Subramaniam, and Parvathi Chundi</i>	

Session 2: Visualizations and Viewpoints

Enhancing Fault Localization via Multivariate Visualization	737
<i>Wes Masri, Rawad Abou Assi, Fadi Zaraket, and Nour Fatairi</i>	
Software Product Line Testing—A 3D Regression Testing Problem	742
<i>Per Runeson and Emelie Engström</i>	
GUICOP: Specification-Based GUI Testing	747
<i>Fadi Zaraket, Wes Masri, Marc Adam, Dalal Hammoud, Raghd Hamzeh, Raja Farhat, Elie Khamissi, and Joseph Noujaim</i>	

Fourth International Workshop on Constraints in Software Testing, Verification and Analysis (CSTVA 2012)

Papers

Towards Symbolic Model-Based Mutation Testing: Pitfalls in Expressing Semantics as Constraints	752
<i>Bernhard K. Aichernig and Elisabeth Jöbstl</i>	
Numerical Constraints for Combinatorial Interaction Testing	758
<i>Peter M. Kruse, Jürgen Bauer, and Joachim Wegener</i>	
Testing Deadline Misses for Real-Time Systems Using Constraint Optimization Techniques	764
<i>Stefano Di Alesio, Arnaud Gotlieb, Shiva Nejati, and Lionel Briand</i>	

Fast Abstracts

Open Research Challenges of Localizing Faults in Programs Using Constraints	770
<i>Franz Wotawa</i>	
Statechart Analysis with Symbolic PathFinder	772
<i>Corina S. Pasareanu and Daniel Balasubramanian</i>	
Minimum Pairwise Coverage Using Constraint Programming Techniques	773
<i>Arnaud Gotlieb, Aymeric Hervieu, and Benoit Baudry</i>	
Combining Constraint Programming and Abstract Interpretation for Value Analysis of Floating-point Programs	775
<i>Olivier Ponsini, Claude Michel, and Michel Rueher</i>	

Fifth International Workshop on Search-Based Software Testing (SBST 2012)

Semi-automatic Search-Based Test Generation	777
<i>Yury Pavlov and Gordon Fraser</i>	
A Parallel Genetic Algorithm Based on Hadoop MapReduce for the Automatic Generation of JUnit Test Suites	785
<i>Linda Di Geronimo, Filomena Ferrucci, Alfonso Murolo, and Federica Sarro</i>	

Search-Based Stress Testing of Wireless Network Protocol Stacks	794
<i>Matthias Woehrle</i>	
A Genetic Algorithm for Computing Class Integration Test Orders for Aspect-Oriented Systems	804
<i>Romain Delamare and Nicholas A. Kraft</i>	

The Third International Workshop on Security Testing (SecTest 2012)

Session 1

Model-Based Fuzz Testing	814
<i>Ina Schieferdecker</i>	
XSS Vulnerability Detection Using Model Inference Assisted Evolutionary Fuzzing	815
<i>Fabien Duchene, Roland Groz, Sanjay Rawat, and Jean-Luc Richier</i>	
A Taint Based Approach for Smart Fuzzing	818
<i>Sofia Bekrar, Chaouki Bekrar, Roland Groz, and Laurent Mounier</i>	

Session 2

A Testing Model for Dynamic Malware Analysis Systems	826
<i>Frédéric Massicotte, Mathieu Couture, Hugues Normandin, and Frédéric Michaud</i>	
Managing Evolution by Orchestrating Requirements and Testing Engineering Processes	834
<i>Federica Paci, Fabio Massacci, Fabrice Bouquet, and Stephane Debricon</i>	

Session 3

Automatic XACML Requests Generation for Policy Testing	842
<i>Antonia Bertolino, Said Daoudagh, Francesca Lonetti, and Eda Marchetti</i>	
Solving Some Modeling Challenges when Testing Rich Internet Applications for Security	850
<i>Suryakant Choudhary, Mustafa Emre Dincturk, Gregor V. Bochmann, Guy-Vincent Jourdan, Iosif Viorel Onut, and Paul Ionescu</i>	

Session 4

SPaCiTE—Web Application Testing Engine	858
<i>Matthias Büchler, Johan Oudinet, and Alexander Pretschner</i>	
Events-Based Security Monitoring Using MMT Tool	860
<i>Bachar Wehbi, Edgardo Montes de Oca, and Michel Bourdellès</i>	
The SmartLogic Tool: Analysing and Testing Smart Card Protocols	864
<i>Gerhard de Koning Gans and Joeri de Ruiter</i>	

Testing: Academic & Industrial Conference—Practice and Research Techniques (TAIC PART 2012)

Experiences

It Takes Two to Tango—An Experience Report on Industry–Academia Collaboration	872
<i>Per Runeson</i>	
Adding Criteria-Based Tests to Test Driven Development	878
<i>William Shelton, Nan Li, Paul Ammann, and Jeff Offutt</i>	
Technical Debt in Test Automation	887
<i>Kristian Wiklund, Sigrid Eldh, Daniel Sundmark, and Kristina Lundqvist</i>	

Testing Distributed Systems

Symbolic System Time in Distributed Systems Testing	893
<i>Oscar Soria Dustmann, Raimondas Sasnauskas, and Klaus Wehrle</i>	
Robustness Testing of Mobile Telecommunication Systems: A Case Study on Industrial Practice and Challenges	895
<i>Sigrid Eldh and Daniel Sundmark</i>	
Testing of Evolving Protocols	901
<i>Jacek Chrzaszcz, Patryk Czarnik, Aleksy Schubert, and Andrzej Tarlecki</i>	

Code Analysis, Test Case Generation, Regression

A Framework to Support Research in and Encourage Industrial Adoption of Regression Testing Techniques	907
<i>Jonathan Miller Kauffman and Gregory M. Kapfhammer</i>	
GEMS: A Generic Model Based Source Code Instrumentation Framework	909
<i>Pavan Kumar Chittimalli and Vipul Shah</i>	
Combining Static Analysis and Constraint Solving for Automatic Test Case Generation	915
<i>Kostyantyn Vorobyov and Padmanabhan Krishnan</i>	

ICST Workshop on Verification and Validation of Model Transformations (VOLT 2012)

A Tridimensional Approach for Studying the Formal Verification of Model Transformations	921
<i>Moussa Amrani, Levi Lúcio, Gehan Selim, Benoît Combemale, Jürgen Dingel, Hans Vanheluwe, Yves Le Traon, and James R. Cordy</i>	
Challenges for Addressing Quality Factors in Model Transformation	929
<i>Eugene Syriani and Jeff Gray</i>	
Towards a Methodology for Verifying Partial Model Refinements	938
<i>Rick Salay, Marsha Chechik, and Jan Gorzny</i>	

Towards a Rule-Level Verification Framework for Property-Preserving Graph Transformations	946
<i>Hanh Nhi Tran and Christian Percebois</i>	
Verified Operational Patterns with Graph Transformation	954
<i>Tamás Mészáros and Tihamér Levendovszky</i>	
 Posters	
Incremental Test Case Generation for UML-RT Models Using Symbolic Execution	962
<i>Eric James Rapos and Juergen Dingel</i>	
Towards a Method for Reducing the Test Suites of Database Applications	964
<i>Gregory M. Kapfhammer</i>	
Property-Driven Software Engineering Approach	966
<i>Antinisca Di Marco, Francesca Lonetti, and Guglielmo De Angelis</i>	
 Author Index	968