# 2023 IEEE International Conference on Software Testing, Verification and Validation Workshops (ICSTW 2023)

Dublin, Ireland 16-20 April 2023



**IEEE Catalog Number: CFP2302F-POD** 

ISBN: 979-8-3503-3336-7

## Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

 IEEE Catalog Number:
 CFP2302F-POD

 ISBN (Print-On-Demand):
 979-8-3503-3336-7

 ISBN (Online):
 979-8-3503-3335-0

ISSN: 2159-4848

#### **Additional Copies of This Publication Are Available From:**

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400

Fax: (845) 758-2633

E-mail: curran@proceedings.com Web: www.proceedings.com



## 2023 IEEE International Conference on Software Testing, Verification and Validation Workshops (ICSTW)

### **ICSTW 2023**

#### **Table of Contents**

Message from A-MOST 2023 Workshop Chairs	xiii
Welcome from the AIST 2023 Chairs	xiv
Message from CCIW 2023 Chairs	xv
Welcome from the CoAST 2023 Chairs	<b>xv</b> i
Message from InSTA 2023 Chairs	xvi
Message from INTUITESTBEDS 2023 Workshop Chairs	xviii
Message from ITEQS 2023 Workshop Chairs	xix
Message from IWCT 2023 Chairs	xx
Message from Mutation 2023 Workshop Chairs	<b>xx</b> i
Message from TestEd 2023 Chairs	xxii
The 19th Workshop on Advances in Model Based Testing 2023)  We Tried and Failed: An Experience Report on a Collaborative Workflow for GU Testing	UI-Based 1
<b>2023)</b> We Tried and Failed: An Experience Report on a Collaborative Workflow for GU	UI-Based 1
We Tried and Failed: An Experience Report on a Collaborative Workflow for GU Testing	1
We Tried and Failed: An Experience Report on a Collaborative Workflow for GU Testing	for PLC Systems 10

ADAS Verification in Co-Simulation: Towards a Meta-Model for Defining Test Scenarios
From BDD Scenarios to Test Case Generation
Improving Model Learning by Inferring Separating Sequences from Traces
MUPPAAL: Reducing and Removing Equivalent and Duplicate Mutants in UPPAAL
3rd International Workshop on Artificial Intelligence in Software Testing (AIST 2023)
Automating GUI-Based Software Testing with GPT-3
Towards Explainable Test Case Prioritisation with Learning-to-Rank Models
Generating Concrete Test Cases from Vehicle Data using Models Obtained from Clustering
Similarities of Testing Programmed and Learnt Software
Regression Test Generation by Usage Coverage Driven Clustering on User Traces

Evaluating the Effectiveness of Attacks and Defenses on Machine Learning Through
Adversarial Samples 90
Viraj R. Gala (Business Unit Quality Engineering, Germany) and Martin
A. Schneider (Business Unit Quality Engineering, Germany)
CI/CD Industry Workshop (CCIW 2023)
Enabling Pre-Merge CI on your TV 98  Jose Soltren (Roku, Inc.) and Kyle Mulligan (Roku, Inc.)
How we use Hermetic, Ephemeral Test Environments at Google to reduce Test Flakiness
1th International Workshop on Context aware and Adaptive Software systems Testing (CoAST 2023)
Beyond Combinatorial Interaction Testing: On the Need for Transition Testing in Dynamically Adaptive Context-Aware Systems
Deep Industry Use Cases on Context-Aware Adaptive Mobile Systems Experience Testing
International Workshop on User Interface Test Automation and Testing Techniques for Event Based Software (INTUITESTBEDS 2023)
Action-Based Test Carving for Android Apps
An Analysis of Widget Layout Attributes to Support Android GUI-Based Testing
Open Benchmark Testbed to Evaluate Effectiveness of Path-Based Tests

Identifying Redundancies and Gaps Across Testing Levels During Verification of Automotive
Software
Kindu Ejigu (Chalmers, University of Gothenburg, Sweden), Gregory Gay
(Chalmers, University of Gothenburg, Sweden), and Predrag Filipovikj
(Scania CV AB, Sweden)
From User Stories to End-to-end Web Testing
Humaid Mollah (University of Twente, The Netherlands) and Petra van
den Bos (University of Twente, The Netherlands)
The 7th International Workshop on Testing Extra-Functional Properties and Quality Characteristics of Software Systems (ITEQS 2023)
Automated and Systematic Digital Twins Testing for Industrial Processes
Yunpeng Ma (Karlstad University, Sweden), Khālil Younis (Karlstad
University, Sweden), Bestoun S. Ahmed (Karlstad University, Sweden),
Andreas Kassler (Karlstad University, Sweden), Pavel Krakhmalev (Karlstad University, Sweden), Andreas Thore (RISE Research Institutes
of Sweden, Sweden), and Hans Lindbäck (Bharat Forge Kilsta AB, Sweden)
Preliminary Results in using Attention for Increasing Attack Identification Efficiency
Tanwir Ahmad (Åbo Akademi University, Finland), Dragos Truscan (Åbo
Akademi University, Finland), and Jüri Vain (Abo Akademi University,
Finland;Tallinn University of Technology, Estonia)
Lightweight Method for On-the-Fly Detection of Multivariable Atomicity Violations
Chang-Hui Bae (Gyeongsang National University, Republic of Korea),
Euteum Choi (Gyeongsang National University, Republic of Korea),
Yong-Kee Jun (Gyeongsang National University, Republic of Korea), and
Ok-Kyoon Ha (Kyungwoon University, Republic of Korea)
Using Assurance Cases to Assure the Fulfillment of non-Functional Requirements of AI-Based
Systems - Lessons Learned
Marc P. Hauer (RPTU Kaiserslautern-Landau, Germany), Lena Müller-Kress
(winnovation consulting gmbh, Austria), Gertraud Leimüller
(winnovation consulting gmbh & leiwand.ai gmbh, Austria), and
Katharina Zweig (RPTU Kaiserslautern-Landau, Germany)
Bottleneck Analysis via Grammar-Based Performance Fuzzing
Yavuz Koroglu (Graz University of Technology, Austria) and Franz
Wotawa (Graz University of Technology, Austria)
Test Generation and Mutation Analysis of Energy Consumption using UPPAAL SMC and MATS . 186
Jonatan Larsson (Mälardalen University, Sweden) and Eduard Enoiu
(Mälardalen University, Sweden)
12th International Workshop on Combinatorial Testing (IWCT 2023)
Meta-Heuristic Algorithm for Constructing Higher-Index Covering Arrays for Combinatorial
Interaction Testing 190
Gang Qin (Osaka University, Japan), Junjun Zheng (Osaka Univeristy, Japan), and Tatsuhiro Tsuchiya (Osaka Univeristy, Japan)
jupuni, unu 1010 ininingi (Osuku Amvensiy, jupuni)

Incremental Generation of Combinatorial Test Suites Starting from Existing Seed Tests	7
Metric Learning Improves the Ability of Combinatorial Coverage Metrics to Anticipate  Classification Error	5
Challenging Autonomy with Combinatorial Testing	1
Hints in Unified Combinatorial Interaction Testing	3
Synthetic Data Generation using Combinatorial Testing and Variational Autoencoder	3
Applying CT-FLA for AEB Function Testing: A Virtual Driving Case Study	7
Ordered t-way Combinations for Testing State-Based Systems	6
Combinatorial Methods for HTML Sanitizer Security Testing	5
Journal-First Papers	
Summary of Locating Hardware Trojans using Combinatorial Testing for Cryptographic Circuits	)
Summary of Combinatorial Methods for Dynamic Gray-Box SQL Injection Testing	3

Summary of Combinatorial Methods for Testing Internet of Things Smart Home Systems	266
Summary of In-Parameter-Order Strategies for Covering Perfect Hash Families	268
10th International Workshop on Software Test Architecture (InSTA)	
Defining Software Test Architectures with the UML Testing Profile  Jon Hagar (Grand Software Testing, USA) and Marc-Florian Wendland (Fraunhofer Institut FOKUS, Germany)	271
Semantic-based and Learning-based Regression Test Selection focusing on Test Objectives  Junji Suzuki (The University of Electro-Communications, Japan), Yasuharu Nishi (The University of Electro-Communications, Japan), Shoma Tanaka (The University of Electro-Communications, Japan), Kimihiko Naruse (NTT DATA Automobiligence Research Center, Ltd.), Minako Shimoji (NTT DATA Automobiligence Research Center, Ltd.), and Zhen Zhong (NTT DATA Automobiligence Research Center, Ltd.)	281
Semantic Metamorphic Testing Focusing on Object Rarity  Yasuharu Nishi (The University of Electro-Communications, Japan),  Hidenori Ito (The University of Electro-Communications, Japan), and  Yuma Torikoshi (The University of Electro-Communications, Japan)	288
Elements for a Test(-ware) Architecture Language	292
Mutation 2023	
Analysis of Mutation Operators for FSM Testing	.300
A Tool for Mutation Analysis in Racket	308
The Inversive Relationship Between Bugs and Patches: An Empirical Study  Jinhan Kim (KAIST, Republic of Korea), Jongchan Park (KAIST, Republic  of Korea), and Shin Yoo (KAIST, Republic of Korea)	314
Mutation Testing in Continuous Integration: An Exploratory Industrial Case Study  Jonathan Örgård (Chalmers, University of Gothenburg, Sweden), Gregory  Gay (Chalmers, University of Gothenburg, Sweden), Francisco Gomes de  Oliveira Neto (Chalmers, University of Gothenburg, Sweden), and Kim  Viggedal (Zenseact, Sweden)	324

Validation of Mutation Testing in the Safety Critical Industry Through a Pilot Study	334
6th International Workshop on the Next Level of Test Automation (NEXTA 2023)	
Systematically Generated Formulas for Spectrum-Based Fault Localization  Qusay Idrees Sarhan (University of Szeged, Hungary; University of Duhok, Iraq), Tamas Gergely (University of Szeged, Hungary), and Arpad Beszedes (University of Szeged, Hungary)	344
An Intelligent Monitoring Algorithm to Detect Dependencies Between Test Cases in the	252
Manual Integration Process	353
university, Sweden), Martin Längkvist (Örebro university, Sweden), and Amy Loutfi (Örebro university, Sweden)	
Cloudify the RAN System Test Strategy	361
Theofilos Toronidis (Ericsson AB, Sweden), Carlos Valdivia Yagüe (Ericsson AB, Sweden), and Yulin Cui (Ericsson AB, Sweden)	
Modification-Impact Based Test Prioritization for Process-Driven Applications	365
Test Cost Reduction for 5G and Beyond using Machine Learning	373
Marco Polo - A Tool for Automated Exploratory Testing of Previously Unseen Online Stores 3  Cristina Gatt (University of Malta, Malta), Mark Micallef (University of Malta, Malta), and Mark Bugeja (University of Malta, Malta)	377
On Factors that Impact the Relationship Between Code Coverage and Test Suite	
Effectiveness: A Survey	381
Software Testing Education workshop (TestEd)	
ISTQB-Based Software Testing Education: Advantages and Challenges	389
On the Current State of Academic Software Testing Education in Sweden	397

An Empirical Evaluation of Regular and Extreme Mutation Testing for Teaching Software	
Testing  Martin Balfroid (University of Namur, Belgium), Pierre Luycx  (University of Namur, Belgium), Benoît Vanderose (University of Namur,  Belgium), and Xavier Devroey (University of Namur, Belgium)	. 405
Teaching Test-Driven Development and Object-Oriented Design by Example	. 413
Intracompany Training in Software Testing: Experience Report	. 422
Code Critters: A Block-Based Testing Game Philipp Straubinger (University of Passau, Germany), Laura Caspari (University of Passau, Germany), and Gordon Fraser (University of Passau, Germany)	. 426
ChatGPT and Software Testing Education: Promises & Perils Sajed Jalil (George Mason University, USA), Suzzana Rafi (George Mason University, USA), Thomas D. LaToza (George Mason University, USA), Kevin Moran (George Mason University, USA), and Wing Lam (George Mason University, USA)	. 430
Process Oriented Guided Inquiry-based learning -like pedagogy (POGIL-like) in Online Software Testing and DevOps – A Replication Study  Bhuvaneswari Gopal (University of Nebraska-Lincoln, USA) and Stephen Cooper (University of Nebraska-Lincoln, USA)	. 438
Author Index	447