



**Association for  
Computing Machinery**

*Advancing Computing as a Science & Profession*

July 18, 2023  
Seattle, WA, USA



# VORTEX '23

Proceedings of the 6th International Workshop on

## **Verification and Monitoring at Runtime Execution**

*Edited by:*

**Daide Ancona and Giorgio Audrito**

*Sponsored by:*

**ACM SIGSOFT, AITO**

*Co-located with:*

**ISSTA '23**

Association for Computing Machinery, Inc.  
1601 Broadway, 10th Floor  
New York, NY 10019-7434  
USA

Copyright © 2023 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 the 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. Copyrights 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 E-mail [permissions@acm.org](mailto: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.

ACM ISBN: 979-8-4007-0249-5

Cover photo:

Title: "Seattle Skyline view from Queen Anne Hill"

Photographer: Daniel Schwen, 2010

License: Creative Commons Attribution-Share Alike 4.0 International

<https://creativecommons.org/licenses/by-sa/4.0/deed.en>

Cropped from original:

[https://commons.wikimedia.org/wiki/File:Seattle\\_3.jpg](https://commons.wikimedia.org/wiki/File:Seattle_3.jpg)

**Production:** Conference Publishing Consulting  
D-94034 Passau, Germany, [info@conference-publishing.com](mailto:info@conference-publishing.com)

# Message from the Chairs

Welcome to the 6th Workshop on Verification and Monitoring at Runtime Execution (VORTEX 2023), hosted in Seattle (WA), USA, July 18, 2023, co-located with ECOOP/ISSTA 2023.

Runtime Monitoring (RM) is concerned with the runtime analysis of software and hardware system executions in order to infer properties relating to system behaviour. Example applications include telemetry, log aggregation, threshold alerting, performance monitoring and adherence to correctness properties (more commonly referred to as runtime verification).

RM has gained popularity as a solution to ensure software reliability, bridging the gap between formal verification and testing: on the one hand, the notion of event trace abstracts over system executions, thus favouring system agnosticism to better support reuse and interoperability; on the other hand, monitoring a system offers more opportunities for addressing error recovery, self-adaptation, and issues that go beyond software reliability.

The goal of VORTEX is to bring together researchers contributing on all aspects of RM covering and possibly integrating both theoretical and practical aspects, with particular focus on hybrid approaches inspired by formal methods, program analysis, and testing.

The proceedings include one full and three short papers, proposing and discussing original and partially developed contributions on topics relevant for the workshop; all manuscripts underwent a lightweight revision with 3 reviews per paper.

We are grateful to all authors and the PC members who contributed to the success of VORTEX 2023.

Seattle (WA), USA  
Davide Ancona, Giorgio Audrito  
July 2023  
VORTEX 2023 Chairs

# VORTEX 2023 Organization

## Organizing Committee

### Chairs

Davide Ancona DIBRIS - University of Genova, Italy  
Giorgio Audrito Università di Torino, Italy

## Program Committee

Antonis Achilleos Reykjavik University, Iceland  
Daniela Briola University of Milan Bicocca, Italy  
Marie Farrell University of Manchester, UK  
Angelo Ferrando DIBRIS - Università di Genova, Italy  
José Fragoso Santos Instituto Superior Técnico, Portugal  
Adrian Francalanza University of Malta, Malta  
Hannah Gommerstadt Vassar College, US  
Klaus Havelund NASA/Caltech Jet Propulsion Laboratory, US  
Laura Nenzi University of Trieste, Italy  
Srinivas Pinisetty IIT Bhubaneswar, India  
Jose Ignacio Requeno Complutense University of Madrid, Spain  
Kristin Yvonne Rozier Iowa State University, US  
Alceste Scalas DTU Compute - Technical University, Denmark  
Volker Stolz Høgskulen på Vestlandet, Norway  
Gianluca Torta Università di Torino, Italy  
Nobuko Yoshida University of Oxford, UK

# Contents

## Frontmatter

Message from the Chairs . . . . .	iii
VORTEX 2023 Organization . . . . .	iv

## Full Paper

<b>RV4Rasa: A Formalism-Agnostic Runtime Verification Framework for Verifying ChatBots in Rasa</b> Angelo Ferrando, Andrea Gatti, and Viviana Mascardi — <i>University of Genoa, Italy</i> . . . . .	1
---	---

## Short Papers

<b>On Stream Runtime Verification and Aggregate Programming</b> Ferruccio Damiani and Gianluca Torta — <i>University of Turin, Italy</i> . . . . .	9
---	---

<b>Monitoring for Resource-Awareness</b> Riccardo Bianchini — <i>University of Genoa, Italy</i> . . . . .	13
--	----

<b>Combining Static and Runtime Verification with AC and Coq</b> Giorgio Audrito and Daniel Haures — <i>University of Turin, Italy</i> . . . . .	17
---	----

<b>Author Index</b> . . . . .	21
-------------------------------	----