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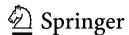
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Paula Herber · Anton Wijs Editors

iFM 2023

18th International Conference, iFM 2023 Leiden, The Netherlands, November 13–15, 2023 Proceedings



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Preface

This volume contains the papers presented at the 18th International Conference on integrated Formal Methods (iFM 2023), held in the charming city of Leiden, The Netherlands, and hosted by the Leiden Institute of Advanced Computer Science of Leiden University. These proceedings also contain three papers selected by the Program Committee of the PhD Symposium (PhD-iFM 2023), chaired by Crystal Chang Din and Gidon Ernst.

In recent years, we have witnessed a proliferation of approaches that integrate several modeling, verification, and simulation techniques, facilitating more versatile and efficient analysis of software-intensive systems. These approaches provide powerful support for the analysis of different functional and non-functional properties of the systems, and the complex interaction of components of different natures, as well as validation of diverse aspects of system behavior. The iFM conference series is a forum for discussing recent research advances in the development of integrated approaches to formal modeling and analysis. The conference series covers all aspects of the design of integrated techniques, including language design, verification and validation, automated tool support, and the use of such techniques in software engineering practice.

The iFM 2023 conference solicited high-quality papers reporting research results and/or experience reports related to the overall theme of formal methods integration. The Program Committee (PC) received a total of 51 paper submissions from authors in 17 different countries: 43 regular papers and 8 short papers. All submissions were rigorously reviewed by three PC members, with the help of many external reviewers, after which the reviewers had a short but intense discussion. The decision to accept or reject a submission was based on both the review reports with their scores and the outcomes of these in-depth discussions.

Ultimately, the PC of iFM 2023 selected 18 papers for presentation during the conference and inclusion in these proceedings: 16 regular papers and 2 short papers. This amounts to an overall acceptance rate of 35.3% (37% for regular papers and 25% for short papers). The PC of PhD-iFM 2023 received 12 submissions and selected 7 submissions for presentation at the symposium and 3 of those submissions for inclusion in these proceedings.

This edition of iFM continued the use of the EAPLS artifact badging scheme, which was introduced at iFM 2022, to credit tool developers and stimulate reproducibility of the reported results. The Artifact Evaluation Committee, chaired by Anna-Lena Lamprecht and Muhammad Osama, received 8 submissions and intensively tested the quality of the artifacts. All artifacts achieved the available and the functional badges, while 6 artifacts additionally were awarded the reusable badge.

The iFM 2023 conference featured keynotes by the following speakers:

- Erika Ábrahám (RWTH Aachen University, Germany);
- Barbara Jobstmann (EPFL and Cadence Design Systems, Switzerland);
- K. Rustan M. Leino (Amazon Web Services, USA).

Preface

The first speaker was an invited speaker for both iFM 2023 and the colocated Fifth Workshop on Formal Methods for Autonomous Systems. We heartily thank these invited speakers for accepting our invitation and sharing their research results and views with the iFM 2023 audience.

We thank everybody involved in iFM 2023. First of all, all PC members and external reviewers for their in-depth and timely reviewing, all authors for submitting their work, and all attendees for participating. We also thank the chairs and committees for the Artifact Evaluation and the PhD Symposium, listed on the following pages, and the excellent local organization team, including the Publicity Chair Alfons Laarman and the General Chair Marcello M. Bonsangue.

We are very grateful to the organizations that sponsored iFM 2023, namely the Leiden Institute of Advanced Computer Science, Springer, and the European Association for Programming Languages and Systems (EAPLS).

Finally, we thank Springer for publishing these proceedings in their FM subline, and we gratefully acknowledge the support from EasyChair in assisting us in managing the complete process from submissions to the proceedings.

We hope you enjoyed the conference!

September 2023

Paula Herber Anton Wijs

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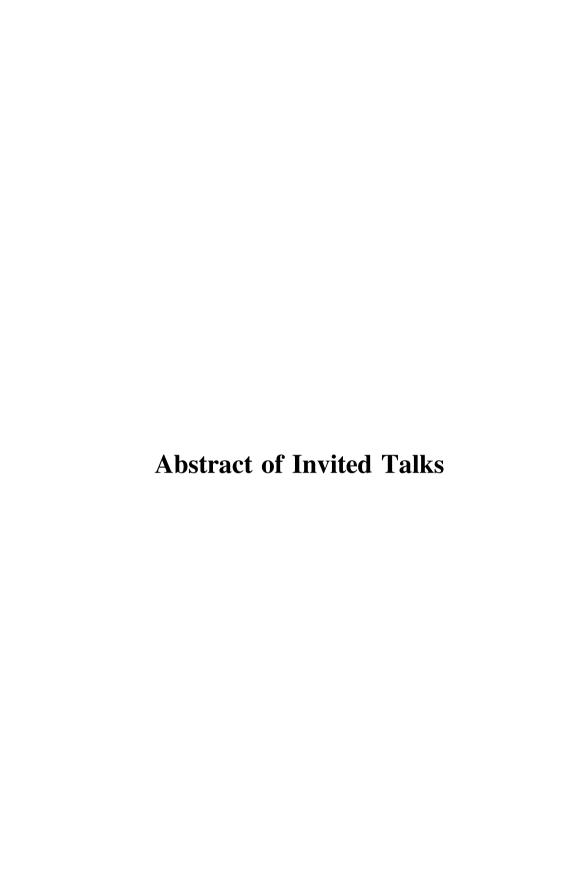
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Formal Signoff Flows

Barbara Jobstmann

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Abstract. Verification sign-off flows aims to answer the question of when to stop the verification effort, i.e., when the design is good enough for tape-out (manufacturing). Classical functional verification sign-off flows are based on simulation coverage metrics, which allow one to track the performed verification effort. With the rise of formal verification in industry, formal verification sign-off flows are becoming more and more critical. In this talk, we will first discuss coverage models and metrics used in formal verification in the industry. These metrics allow analysis of a verification setup from two different angles: (1) From a controllability angle, to answer questions like does the verification setup exercise all parts of the design? Did I over-constrain my design? (2) From the observability angle, to know if the set of checks is sufficient to catch potential faults in the design. To be meaningful, the metrics need to be tailored to a design. Therefore, we will next discuss methods to ensure coverage is measured in the context of design-specific scenarios. Finally, we will discuss dedicated techniques like bound aggregation and bug hunting to increase the coverage numbers.

Industrial Experience with a Verification-Aware Programming Language

K. Rustan M. Leino

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Abstract. The programming language Dafny was designed to support specifications and formal verification in a modern software-engineering setting. As a language, it blends imperative and functional features with specifications and proof authoring. The Dafny ecosystem includes not just compilers, but also, conspicuously, an automated program verifier. Following a decade of use in teaching and in research projects, the language and its verifier now also have several years of industrial use. In this talk, I reflect on some of the lessons learned from working with engineers to write and maintain verified software and how this has impacted the language and its tooling.

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