Nils Froleyks

Johannes Kepler University Linz, Austria
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RESEARCH INTERESTS

Model Checking, Formal Verification, Planning, SAT Solving, Optimization.

Leveraging artificial intelligence and formal methods to enable trusted automated reasoning at scale.

EDUCATION

Johannes Kepler University Linz, Linz, Austria   March 2020 – August 2025
PhD in Computer Science
Thesis: Deep Integration of SAT Solving and Model Checking
Supervisors: Prof. Armin Biere, Prof. Martina Seidl

Karlsruhe Institute of Technology, Karlsruhe, Germany   2018 – 2020
M.Sc in Computer Science   **Best Thesis Award**
Thesis: PASAR – Planning as Satisfiability with Abstraction Refinement
Supervisors: Prof. Peter Sanders, Dr. Tomáš Balyo, Dr. Dominik Schreiber

Karlsruhe Institute of Technology, Karlsruhe, Germany   2013 – 2017
B.Sc in Computer Science
Thesis: Using an Algorithm Portfolio to Solve Sokoban
Supervisors: Prof. Peter Sanders, Dr. Tomáš Balyo

ACADEMIC EXPERIENCE

University Assistant   Linz, Austria
Johannes Kepler University Linz, Austria   March 2020 – August 2025

Postdoctoral Researcher   Leuven, Belgium
KU Leuven, Belgium   October 2025 – Present

CAREER BREAKS

Paternity Leave   February – November 2022

AWARDS

CAV Distingushed Paper Award   2025
37th International Conference on Computer Aided Verification

Third Place in Combinatorial Reconfiguration Challenge   2022
CoRe Challenge 2022, Virtual

Best Master's Thesis   2020
Karlsruhe Institute of Technology, Germany

First Prize (Partial Gold Medal)   2019
The Sparkle Planning Challenge, ICAPS, Berkeley, USA

SCIENTIFIC EVENT ORGANIZATION

Organizer, Hardware Model Checking Competition (HWMCC) 2025	FMCAD, Menlo Park, USA
Organizer, Hardware Model Checking Competition (HWMCC) 2024	FMCAD, Prague, Czech Republic
Organizer, SAT Competition 2021	SAT Conference, Barcelona
Organizer, Hardware Model Checking Competition (HWMCC) 2020	FMCAD, Virtual
Organizer, SAT Competition 2020	SAT Conference, Alghero, Italy

INTERNATIONAL COLLABORATION

Intel Corporation   Since Nov 2023
Contributed to certification for hardware model checking. Monthly meetings and joint workshops.

Research Visit   June 2024
Prof. Joost-Pieter Katoen, RWTH Aachen University
Model checking for probabilistic systems.

Woodpecker Technologies, Singapore   2022 – 2023
Pre-silicon verification using symbolic formal methods.

SKILLS

Programming Languages: C++, Python
Languages: German (native), English (fluent)

TEACHING & SUPERVISION

Supervised Bachelor's Thesis   **2024**
Johannes Kepler University Linz, Austria
Ternary simulation for IC3 Model Checking.

Lecturer in Debugging   **Summer Semester 2024**
Johannes Kepler University Linz, Austria
Advanced course for master's students in computer science and artificial intelligence.

Lecturer in Model Checking   **Winter Semester 2024**
Johannes Kepler University Linz, Austria
Advanced course for master's students in computer science and artificial intelligence.

Teaching Assistant in Computer Science and Artificial Intelligence Courses   **2020–2024**
Johannes Kepler University Linz, Austria
At both the Master's and Bachelor's levels, hands-on teaching courses include Model Checking, Formal Models, Logic, SAT Solving, Practical Work in AI, and Computational Logics for AI.

Teaching Assistant in Algorithms for Planar Graphs   **2018**
Karlsruhe Institute of Technology, Germany

Teaching Assistant in Theoretical Foundations of Informatics   **2015–2019**
Karlsruhe Institute of Technology, Germany

TOOLS

Certifaiger: a certificate checker for the hardware model checking certificates
https://github.com/Froleyks/certifaiger

Voiraig: a certifying model checker
https://github.com/Froleyks/voiraig

Cerbotor: a word-level certificate checker for hardware model checking
https://github.com/Froleyks/cerbotor

CaDiCaL: an award-wining state-of-the-art SAT solver
https://github.com/arminbiere/cadical

PUBLICATIONS

[1] **Nils Froleyks**, Emily Yu, Armin Biere, and Keijo Heljanko. *Certificates for Model Checking under Constraints.* Submitted

[2] Florian Pollitt Mathias Fleury, Katalin Fazekas, **Nils Froleyks**, and Armin Biere. *CaDiCaL 3.0: Proofs, Algorithms, Implied Literals, and Robust Scheduling.* Submitted

[3] Armin Biere, Katalin Fazekas, Mathias Fleury, **Nils Froleyks**, and Florian Pollitt. *Clausal Equivalence Checking.* Journal Submission

[4] **Nils Froleyks**, Emily Yu, Mathias Preiner, Armin Biere, and Keijo Heljanko. *Introducing Certificates to the Hardware Model Checking Competition.* International Conference on Computer Aided Verification (CAV), 2025

[5] Armin Biere, Tobias Faller, Katalin Fazekas, Mathias Fleury, **Nils Froleyks**, and Florian Pollitt. *CaDiCaL 2.0.* International Conference on Computer Aided Verification (CAV), 2024

[6] Armin Biere, Katalin Fazekas, Mathias Fleury, and **Nils Froleyks**. *Clausal equivalence sweeping.* Formal Methods in Computer Aided Design (FMCAD), 2024

[7] Armin Biere, **Nils Froleyks**, and Mathias Preiner. *Hardware Model Checking Competition 2024.* Formal Methods in Computer Aided Design (FMCAD), 2024

[8] Armin Biere, Katalin Fazekas, Mathias Fleury, and **Nils Froleyks**. *Clausal congruence closure.* Theory and Applications of Satisfiability Testing (SAT), 2024

[9] **Nils Froleyks**, Emily Yu, Armin Biere, and Keijo Heljanko. *Certifying phase abstraction.* International Joint Conference on Automated Reasoning (IJCAR), 2024

[10] **Nils Froleyks**, Emily Yu, and Armin Biere. *Ternary Simulation as Abstract Interpretation (Work in Progress).* Methoden und Beschreibungssprachen zur Modellierung und Verifikation von Schaltungen und Systemen (MBMV), 2024

[11] Armin Biere, **Nils Froleyks**, and Wenxi Wang. *Cadiback: Extracting backbones with cadical.* Theory and Applications of Satisfiability Testing (SAT), 2023

[12] Armin Biere, Mathias Fleury, **Nils Froleyks**, and Marijn JH Heule. *The SAT Museum.* Pragmatics of SAT, 2023

[13] **Nils Froleyks**, Emily Yu, and Armin Biere. *BIG Backbones.* Formal Methods in Computer-Aided Design (FMCAD), 2023

[14] Emily Yu, **Nils Froleyks**, Armin Biere, and Keijo Heljanko. *Towards compositional hardware model checking certification.* Formal Methods in Computer-Aided Design (FMCAD), 2023

[15] Emily Yu, **Nils Froleyks**, Armin Biere, and Keijo Heljanko. *Stratified certification for k-induction.* Formal Methods in Computer-Aided Design (FMCAD), 2022

[16] **Nils Froleyks**, and Armin Biere. *Single clause assumption without activation literals to speed-up IC3.* Formal Methods in Computer-Aided Design (FMCAD), 2021

[17] Tomás Balyo, and **Nils Froleyks**. *Ai assisted design of sokoban puzzles using automated planning.* International Conference on ArtsIT, Interactivity and Game Creation, 2021

[18] **Nils Froleyks**, Marijn Heule, Markus Iser, Matti Järvisalo, and Martin Suda. *SAT competition 2020.* Journal of Artificial Intelligence, 2021

[19] **Nils Froleyks**, Tomas Balyo, and Dominik Schreiber. *PASAR—Planning as Satisfiability with Abstraction Refinement.* International Symposium on Combinatorial Search, 2019

[20] **Nils Froleyks**, and Tomás Balyo: *Using an algorithm portfolio to solve Sokoban.* International Symposium on Combinatorial Search, 2017

TECHNICAL REPORTS

[1] Armin Biere, Tobias Faller, Katalin Fazekas, Mathias Fleury, **Nils Froleyks**, Florian Pollitt, and André Schidler. *CaDiCaL, IsaSAT and Kissat Entering the SAT Competition 2025.* Submitted

[2] **Nils Froleyks**, Emily Yu, and Armin Biere. *Challenging Certificates from Model Checking.* Submitted

[3] Armin Biere, Tobias Faller, Katalin Fazekas, Mathias Fleury, **Nils Froleyks**, and Florian Pollitt. *Hardware Equivalence Checking Problems Submitted to the SAT Competition 2024.* SAT Competition 2024.

[4] Armin Biere, Tobias Faller, Katalin Fazekas, Mathias Fleury, **Nils Froleyks**, and Florian Pollitt. *CaDiCaL, Gimsatul, IsaSAT and Kissat Entering the SAT Competition 2024.* SAT Competition 2024.

[5] **Nils Froleyks**, Emily Yu, and Armin Biere. *ReconfAIGERation entering Core Challenge 2022.* Core Challenge 2022.

[6] **Nils Froleyks**, Emily Yu, and Armin Biere. *Unique Reconfiguration Sequence.* SAT Competition 2022.

[7] Emily Yu, **Nils Froleyks**, Armin Biere, and Mathias Fleury. *Hardware Model Checking Certificates.* SAT Competition 2022.

[8] Tomáš Balyo, **Nils Froleyks**, Marijn JH Heule, Markus Iser, Matti Järvisalo, and Martin Suda. *Proceedings of SAT Competition 2020 : Solver and Benchmark Descriptions.* 2020

[9] **Nils Froleyks**, Tomáš Balyo, and Dominik Schreiber. *PASAR Entering the Sparkle Planning Challenge 2019.* Sparkle Planning Challenge 2019.