Niklas **Deworetzki**

Development Engineer · Programming Language Researcher

Niklas-Deworetzki | niklas-deworetzki | 0000-0002-7276-7708

Summary

I'm a passionate software developer and graduate researcher interested in programming languages and their implementations. As part of the RC3 research group I had the opportunity to draft, develop and implement novel program analysis and optimisation techniques for reversible programming languages. I am capable of familiarising myself with complex topics, advancing them with my own creative ideas, and turning abstract concepts into software.

Education & Experience

Associate Scientist

Giessen, Germany

University of Applied Sciences, Technische Hochschule Mittelhessen — *Dec. 2022 – now*

- Part time participation and assistance in research projects on reversible programming languages.
- Invitation to the 15th International Conference on Reversible Computation.

Development Engineer

Haiger, Germany

ipoque — a Rohde & Schwarz Company — *Oct. 2022 – now*

- Development of microservices in Java and Kotlin using the Quarkus framework.
- Automation of acceptance tests, software analysis and documentation generation.
- Participation in Clean Code lessons.

M.Sc. in Computer Science

Giessen, Germany

University of Applied Sciences, Technische Hochschule Mittelhessen — *Oct. 2020 – Oct. 2022*

- Graduation project: Design & development of a reversible stack-based machine for reversible computing.
- Research and development work as part of the RC3 research group on reversible programming.
- Publication of 4 research papers on programm analysis and optimization techniques for reversible programming languages.

B.Sc. in Computer Science

Giessen, Germany

University of Applied Sciences, Technische Hochschule Mittelhessen — *Oct. 2017 – Sep. 2020*

- Graduation project: Development of a compiler for the reversible programming language Janus.
- Participation in advanced seminar on academic and social challenges of computer science.
- Teaching assistance for compiler construction courses.

Publications

Program Analysis for Reversible Languages

Niklas Deworetzki, Uwe Meyer

10th ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis, Virtual Event, Canada — *2021*

A presentation of a compiler capable of translating programs from the reversible programming language Janus into a non-reversible intermediate language, making reversible programs executable on common hardware. The compiler was developed as part of my bachelor's project and laid the foundation for further research on program analysis and optimization for reversible programs.

Compiling Janus to RSSA

Martin Kutrib, Uwe Meyer, Niklas Deworetzki, Marc Schuster

13th International Conference on Reversible Computation, RC 2021, Virtual Event — *2021*

The world's first optimising compiler for reversible programming languages is presented in this publication. As the lead software developer in the RC3 research project I implemented the constant propagation and common subexpression elimination optimisations.

Optimizing Reversible Programs

Niklas Deworetzki, Martin Kutrib, Uwe Meyer, Pia Ritzke

14th International Conference on Reversible Computation, RC 2022, Urbino, Italy — *2022*

Further classical optimisation techniques and their adaption for reversible programming languages are described in this publication. My contribution is the implementation of an optimisation inlining function bodies at call site as well as the formalisation and implementation of a lattice-based optimisation detecting and eliminating dead code.

Designing a Reversible Stack Machine

Niklas Deworetzki, Uwe Meyer

14th International Conference on Reversible Computation, RC 2022, Urbino, Italy *2022*

This publication presents the contents of my master's project to the scientific community, explaining the details of a reversible stack-based machine designed for minimal-overhead high-performance computing.

Optimization of Reversible Control Flow Graphs

Niklas Deworetzki, Lukas Gail

15th International Conference on Reversible Computation, RC 2023, Giessen, Germany *2023*

A novel approach for control flow analysis and optimisation for reversible programs is presented, formalised and evaluated in this publication. My contributions are the formalisation of reversible programs as a bi-directional control flow graph and the implementation of foundational, conservative optimisation techniques.

Honors & Awards

2022	**1.0 award — Best Graduate**, M.Sc. Computer Science	*Giessen, Germany*
2020	**1.0 award — Best Graduate**, B.Sc. Computer Science	*Giessen, Germany*
2017	**MINT-EC-Certificate — With Particular Success**, Award for extracurricular engagement in STEM topics	*Herborn, Germany*
2017	**Special Price**, National Youth Science Competition *Jugend forscht*	*Erlangen, Germany*
2017	**State Winner**, State Youth Science Competition *Jugend forscht*	*Darmstadt, Germany*

Projects & Extracurricular Activity

RC3 — Reversible Computing Compiler Collection

Research project

Originally designed as a compiler for the reversible programming language Janus as part of my bachelor's project, the RC3 grew to a compiler collection for different reversible languages. It employs the reversible intermediate language (RSSA) for automated program analysis and optimisation.

Reversible stack machine

Master's project

A virtual machine for a reversible stack machine architecture designed as part of my master's degree. The machine's design explores the synergies of a low-level stack-based machine and the reversible programming paradigm, as stacks with their basic operations (push and pop) are inherently reversible. The low-overhead design and implementation aim to provide a high-performance computing environment.

German Informatics Society – GI

Member

The German Informatics Society is an association of computer science professionals in the German-speaking world. It offers a network to exchange knowledge and experiences in relevant topics in computer science via conferences, dedicated lectures and other in-person events.

German Network of Young Scientists – juFORUM

Member

The German Network of Young Scientists is a network by and for young scientists and other people interested in STEM and sourrounding fields. It provides a plattform for young scientists to exchange ideas, establish contacts and promote a broad range of relevant research topics.

Skills

Research Experience	Program Analysis, Program Optimisations, Programming Language Design
Programming Languages	Java, Kotlin, Scala, C, C++, Haskell
Natural Languages	German, English