

Leon Sering

POSTDOCTORAL RESEARCHER AT ETH ZÜRICH

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Summary

I am a highly motivated mathematician and computer scientist with a real passion for **operations research**, **combinatorial optimization**, and **high-performance algorithm design**. As a PostDoc at the institute of operations research at ETH Zurich, I am currently in the lead of several industry-collaborations in the area of **vehicle routing** and **scheduling**. I use my strong analytical and logical thinking and my solid experience in several programming languages to achieve **state-of-the-art** results. While I am an efficient and well-organized individual worker, I always prefer to work as part of a team, where I am proactive in **solving any challenges** and often step up to take on responsibilities. Most importantly, I am a curious person and therefore I am always eager to **learn new skills** and to dig deep into a new challenging topic. In the last two years I became very enthusiastic about the programming language **Rust**, which has sparked an entirely new **passion for programming** within me.

Work Experience

Operations Research Expert (Freelancer)

OPTANO GMBH

Paderborn, Germany

May 2023 - June 2023

- consulting services in operations research and algorithm design for a line haul solution
- implementation of a fast multi-objective routing algorithm

Postdoctoral Researcher

INSTITUTE FOR OPERATIONS RESEARCH, DEPARTMENT OF MATHEMATICS, ETH ZÜRICH

Zurich, Switzerland

April 2021 - today

- leading scientific project in collaboration with SwissPost and SBB (swiss federal railways)
- research in operations research, efficient algorithms, heuristics, concurrency

Research Associate

RESEARCH GROUP: COMBINATORIAL OPTIMIZATION & GRAPH ALGORITHMS, INSTITUTE OF MATHEMATICS, TU BERLIN

Berlin, Germany

May 2017 - March 2021

- ECMath und MATH+ research projects: dynamic models and algorithms for equilibria in traffic networks
- research goal: improve mathematical flow over time models to connect with large-scale simulations such as MATSim

Education

Dr. rer. Nat. in Mathematics

DISSERTATION TITLE: NASH FLOWS OVER TIME, GRADE: SUMMA CUM LAUDE, MATH+ DISSERTATION AWARD

TU Berlin, Germany

Sep. 2016 - Sep. 2020

- PhD topic: traffic simulation and optimization by using flows over time including game theoretical aspects

Master of Advanced Studies

PART III OF THE MATHEMATICAL TRIPOS, GRADE: WITH HONOURS

University of Cambridge, UK

Oct. 2013 - Jul. 2014

Bachelor and Master of Science in Mathematics

GRADES: 1.0 / 1.0, AWARDS: 2X OTTO-VOLK-MEDAL FOR EXCELLENT PERFORMANCES

University of Würzburg, Germany

Oct. 2010 - Sep. 2014

Bachelor of Science in Computer Science

GRADE: 1.0, AWARD FOR EXCELLENT PERFORMANCES

University of Würzburg, Germany

Oct. 2010 - Apr. 2013

Selected Programming Projects

Rolling Stock Rotation Planning

ETH - SBB - Collaboration

LANGUAGES: RUST

- scheduling trains (rolling stock) for a given time tabel to minimize dead head trips
- approach: local-search heuristic using concurrency

Vehicle Routing

ETH - SwissPost - Collaboration

LANGUAGES AND TOOLS: SCALA | GUROBI

- scheduling capacitated drivers to deliver shipments within time windows
- approaches: mixed integer program, local search heuristic, fast k-opt for TSP-subproblem

Fair and Fast k-Center

Research Project at ETH Zurich

LANGUAGES: RUST | PYTHON

- linear-time algorithm for k-center with fairness criteria that runs very fast in practice
- highly optimized for concurrency
- <https://proceedings.mlr.press/v162/angelidakis22a.html>

Nash Flow Computation

Research Project at TU Berlin

LANGUAGES AND TOOLS: PYTHON | QT | SCIP

- tool for computing Nash flows over time with mixed integer programming
- <https://github.com/LeonSering/NashFlowComputation>

Drawing Road Networks with Focus Regions

Research Project

LANGUAGES AND TOOLS: JAVA | QT | CPLEX

- tool for computing road network visualization with enlarged user-defined focus regions
- <https://doi.org/10.1109/TVCG.2011.191>

Computer Skills

Programming Languages

RUST | SCALA | PYTHON

Optimization Tools

GUROBI | CPLEX | SCIP

Miscellaneous

GIT | GITLAB | DOCKER | LATEX | LINUX | WINDOWS | OFFICE SOFTWARE

Scholarships and Competitions

Deutschlandstipendium

University of Würzburg

NATIONAL SCHOLARSHIP

May 2011 - Sep. 2015

Vereinigte Stipendien- und Preisstiftung

University of Würzburg

SCHOLARSHIP OF THE UNIVERSITY OF WÜRZBURG

Aug. 2010 - Apr. 2011

Award Winner in the Final Round of 26. Bundeswettbewerb Informatik

High School

NATIONAL COMPETITION IN COMPUTER SCIENCE

Dec. 2007 - Sep. 2008

Languages

| | |
|--------|---------|
| Fluent | English |
| Native | German |

Interests

being a great dad | traveling | photography | scuba diving | running | computer games | virtual reality

- [1] Christoph Hertrich and Leon Sering. “ReLU Neural Networks of Polynomial Size for Exact Maximum Flow Computation”. In: *International Conference on Integer Programming and Combinatorial Optimization (IPCO ’23)*. 2023.
- [2] Neil Olver, Leon Sering, and Laura Vargas Koch. “Convergence of Approximate and Packet Routing Equilibria to Nash Flows Over Time”. In: *Annual Symposium on Foundations of Computer Science (FOCS’23)*. accepted; not published yet. IEEE. 2023.
- [3] Theresa Ziemke, Leon Sering, and Kai Nagel. “Spillback changes the long-term behavior of dynamic equilibria in fluid queuing networks”. In: *Workshop on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems (ATMOS’23)*. OpenAccess Series in Informatics (OASICS). accepted; not published yet. Dagstuhl, Germany, 2023.
- [4] Antonia Adamik and Leon Sering. “Atomic Splittable Flow Over Time Games”. In: *Symposium on Algorithmic Foundations of Dynamic Networks (SAND’22)*. 2022, p. 53.
- [5] Haris Angelidakis, Adam Kurpisz, Leon Sering, and Rico Zenklusen. “Fair and Fast k-Center Clustering for Data Summarization”. In: *International Conference on Machine Learning (ICML’22)*. PMLR. 2022, pp. 669–702.
- [6] Neil Olver, Leon Sering, and Laura Vargas Koch. “Continuity, Uniqueness and Long-Term Behavior of Nash Flows Over Time”. In: *Annual Symposium on Foundations of Computer Science (FOCS’21)*. IEEE. 2022, pp. 851–860.
- [7] Leon Sering, Laura Vargas Koch, and Theresa Ziemke. “Convergence of a Packet Routing Model to Flows over Time”. In: *Mathematics of Operations Research (MOR) 0.0* (2022). A preliminary version was presented at the 22nd ACM Conference on Economics and Computation (EC’21).
- [8] Stefan Felsner, Linda Kleist, Torsten Mütze, and Leon Sering. “Rainbow Cycles in Flip Graphs”. In: *SIAM Journal on Discrete Mathematics* 34.1 (2020). A preliminary version was presented at the International Symposium on Computational Geometry (SoCG’18), pp. 1–39.
- [9] Lukas Graf, Tobias Harks, and Leon Sering. “Dynamic flows with adaptive route choice”. In: *Mathematical Programming* 183.1 (2020), pp. 309–335.
- [10] Jonas Israel and Leon Sering. “The Impact of Spillback on the Price of Anarchy for Flows over Time”. In: *International Symposium on Algorithmic Game Theory (SAGT’20)*. Springer. 2020, pp. 114–129.
- [11] Hoang Minh Pham and Leon Sering. “Dynamic Equilibria in Time-Varying Networks”. In: *International Symposium on Algorithmic Game Theory (SAGT’20)*. Springer. 2020, pp. 130–145.
- [12] Leon Sering. “Nash Flows Over Time”. PhD thesis. Technische Universität Berlin, 2020.
- [13] Theresa Ziemke, Leon Sering, Laura Vargas Koch, Max Zimmer, Kai Nagel, and Martin Skutella. “Flows Over Time as Continuous Limits of Packet-Based Network Simulations”. In: *Transportation Research Procedia* (2020). A preliminary version was presented at The Euro Working Group on Transportation (EWGT’20).
- [14] Leon Sering and Laura Vargas Koch. “Nash Flows Over Time with Spillback”. In: *ACM-SIAM Symposium on Discrete Algorithms (SODA’19)*. 2019, pp. 935–945.
- [15] Leon Sering and Martin Skutella. “Multi-Source Multi-Sink Nash Flows over Time”. In: *Workshop on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems (ATMOS’18)*. Vol. 65. OpenAccess Series in Informatics (OASICS). Dagstuhl, Germany, 2018, 12:1–12:20.
- [16] Leon Sering. “A Combinatorial Upper Bound on the Length of Twang Cascades”. In: *European Workshop on Computational Geometry (EuroCG’17)*. Malmö, 2017, pp. 177–180.
- [17] Jan-Henrik Haunert and Leon Sering. “Drawing Road Networks with Focus Regions”. In: *IEEE Transactions on Visualization and Computer Graphics* 17.12 (2011). A preliminary version was presented at IEEE Information Visualization Conference (INFOVIS’11), pp. 2555–2562.