

Dominik H. Cebulla

Curriculum Vitae

Technische Universität Braunschweig
Institute for Mathematical Optimization
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Employment

Since July 2017 **Scientific Assistant**, *Institute for Mathematical Optimization, Technische Universität Braunschweig*, Braunschweig, Germany.

Education

April 2017 – May 2023 **Ph.D. in Mathematics**, *Department of Mathematics, Technische Universität Braunschweig*, Braunschweig, Germany.

Advisor: Christian Kirches, Grade: *summa cum laude* (with highest distinction)

Feb 2014 – Feb 2017 **M.S. in Mathematics**, *Heidelberg University*, Heidelberg, Germany.

Advisor: Hans Georg Bock, Average: 1.0

Sep 2010 – Feb 2014 **B.S. in Computer Science**, *Heidelberg University*, Heidelberg, Germany.

Advisor: Hans Georg Bock, Average: 1.2

Publications

Peer-reviewed Articles

- Model-based optimization of an ion exchange chromatography process for the separation of von Willebrand factor fragments and human serum albumin**
with C. Kirches, N. Kümmerer, A. Potschka, *Proceedings of the 93rd Annual Meeting of the International Association of Applied Mathematics and Mechanics*, (2023), e202300027. DOI: [10.1002/pamm.202300027](https://doi.org/10.1002/pamm.202300027)
- Mixed-integer optimal control for multimodal chromatography**
with H. G. Bock, C. Kirches, A. Potschka, *Computers & Chemical Engineering* 153, (2021), 107435. DOI: [10.1016/j.compchemeng.2021.107435](https://doi.org/10.1016/j.compchemeng.2021.107435)
- Mixed-integer nonlinear PDE-constrained optimization for multi-modal chromatography**
with C. Kirches, A. Potschka, *Operations Research Proceedings 2019*, (2020), 81–87. DOI: [10.1007/978-3-030-48439-2_10](https://doi.org/10.1007/978-3-030-48439-2_10)
- Parameter identifiability in a novel kinetic adsorption isotherm for multi-modal chromatography**
with C. Kirches, A. Potschka, *Proceedings of the 2019 IEEE 58th Conference on Decision and Control (CDC), Nice, France*, (2019), 4755–4760. DOI: [10.1109/CDC40024.2019.9029813](https://doi.org/10.1109/CDC40024.2019.9029813)

Theses

- Mathematical modeling and mixed-integer optimization of multimodal chromatographic processes**
Ph.D. thesis, Technische Universität Braunschweig, 2023
- Preprocessing for quadratic programming**

Master's thesis, Heidelberg University, 2017

3. **Simulation einer Destillationskolonne mit Brüdenkompression**

Bachelor's thesis (in German), Heidelberg University, 2013

In Preparation

1. **A novel homotopy-based globalization approach for the reliable determination of model parameters for column chromatography processes** (working title)

with C. Kirches, N. Kümmerer, A. Potschka

Talks & Presentations

- Sep 25–27, 2023 **6th European Conference on Computational Optimization (EUCCO)**, Heidelberg University, Heidelberg, Germany.
Talk: A novel homotopy approach for the reliable determination of model parameters for chromatographic processes
- Aug 13–18, 2023 **Workshop “Mixed-integer Nonlinear Optimization: A Hatchery for Modern Mathematics”**, Oberwolfach Research Institute for Mathematics, Oberwolfach, Germany.
Research announcement: Mixed-integer optimal control for chromatographic processes
- May 30 – **GAMM 93rd Annual Meeting**, TU Dresden, Dresden, Germany.
- June 2, 2023 Talk: A novel homotopy approach based on exponentially modified Gaussian functions for the reliable determination of model parameters for chromatographic processes
- Sep 26–29, 2022 **SQUIRREL Retreat**, Bilm (Hannover), Germany.
Talk: Optimization of a real-world ion exchange chromatography process for protein purification
- Oct 24–27, 2021 **INFORMS Annual Meeting**, Anaheim (CA), USA, (online attendance).
Talk: Mixed-integer optimal control for multimodal chromatography
- July 9, 2021 **Group Seminar Mathematical Optimization**, Institute for Mathematical Optimization, Technische Universität Braunschweig, Braunschweig, Germany.
Talk: Parameter estimation for ion exchange chromatography
- July 17, 2020 **Group Seminar Mathematical Optimization**, Institute for Mathematical Optimization, Technische Universität Braunschweig, Braunschweig, Germany.
Talk: Mixed-integer optimization for multimodal chromatography
- Feb 10–12, 2020 **Workshop on Mathematical Physics, Algebra, Analysis and Optimization (WOMBAT)**, Ilsenburg, Germany.
Teaser talk: Optimum experimental design for column chromatography
- Dec 11–13, 2019 **58th Conference on Decision and Control (CDC)**, Nice, France.
Talk: Parameter identifiability in a novel kinetic adsorption isotherm for multi-modal chromatography
- Oct 7–10, 2019 **Autumn School “Optimal Control and Optimization with PDEs”**, Trier University, Trier, Germany.
Poster presentation: Mixed-integer nonlinear PDE-constrained optimization for multi-modal chromatography (Best Poster Award)
- Sep 3–6, 2019 **Operations Research (OR) 2019**, TU Dresden, Dresden, Germany.
Talk: Towards optimal control of an industrial multi-modal chromatography process

- July 23, 2019 **Workshop on Computation and Optimization**, *Interdisciplinary Center for Scientific Computing (IWR), Heidelberg University*, Heidelberg, Germany.
Talk: MSO for multi-modal chromatography
- Sep 19–21, 2018 **Meeting of European SIAM and GAMM Student Chapters (MESIGA)**, *TU Berlin*, Berlin, Germany.
Talk: Parameter identification of an ion exchange chromatography process
- June 2, 2017 **Model-based Optimizing Control Group Seminar**, *Interdisciplinary Center for Scientific Computing (IWR), Heidelberg University*, Heidelberg, Germany.
Talk: Preprocessing for quadratic programming: computation of an optimal working set
- March 10–15, 2017 **HGS MathComp / BMBF GOSSIP Project Workshop**, Kleinwalsertal, Austria.
Talk: Preprocessing for quadratic programming

Conferences, Workshops, and further Activities

- Nov 7–8, 2023 **KoMSO Academy “TorchPhysics: Deep Learning for partial differential equations”**, *Heidelberger Akademie der Wissenschaften*, Heidelberg, Germany.
- Sep 25–27, 2023 **6th European Conference on Computational Optimization (EUCCO)**, *Heidelberg University*, Heidelberg, Germany.
- Sep 11–15, 2023 **Summer School on “Direct Methods for Optimal Control of Nonsmooth Systems”**, *University of Freiburg*, Freiburg, Germany.
- Aug 13–18, 2023 **Workshop “Mixed-integer Nonlinear Optimization: A Hatchery for Modern Mathematics”**, *Oberwolfach Research Institute for Mathematics*, Oberwolfach, Germany.
- May 30 – June 2, 2023 **GAMM 93rd Annual Meeting**, *TU Dresden*, Dresden, Germany.
- Sep 26–29, 2022 **SQUIRREL Retreat**, Bilm (Hannover), Germany.
- March 1–10, 2022 **Compact Course “Scientific Software Development”**, *Scientific Software Center, Heidelberg University*, Heidelberg, Germany, (online attendance).
- Oct 24–27, 2021 **INFORMS Annual Meeting**, Anaheim (CA), USA, (online attendance).
- July 19–23, 2021 **SIAM Annual Meeting (AN21)**, *online due to COVID-19*.
- April 19, 2021 **Workshop “Exact methods for large-scale discrete optimization in SE²A”**, *Technische Universität Braunschweig*, Braunschweig, Germany.
- Feb 10–12, 2020 **Workshop on Mathematical Physics, Algebra, Analysis and Optimization (WOMBAT)**, Ilsenburg, Germany.
- Dec 11–13, 2019 **58th Conference on Decision and Control (CDC)**, Nice, France.
- Nov 4–7, 2019 **Short Course “Goal-oriented Adaptivity for PDEs with Random Data”**, *Interdisciplinary Center for Scientific Computing (IWR), Heidelberg University*, Heidelberg, Germany.
Lecturer: Prof. David Silvester

- Oct 7–10, 2019 **Autumn School “Optimal Control and Optimization with PDEs”**, *Trier University*, Trier, Germany.
- Sep 3–6, 2019 **Operations Research (OR) 2019**, *TU Dresden*, Dresden, Germany.
- Aug 5–8, 2019 **6th International Conference on Continuous Optimization (ICCOPT)**, Berlin, Germany.
- July 23, 2019 **Workshop on Computation and Optimization**, *Interdisciplinary Center for Scientific Computing (IWR)*, *Heidelberg University*, Heidelberg, Germany.
- July 22, 2019 **Short Course “Markov Chain Monte Carlo for Inverse Problems in PDEs”**,
24–26, 2019 *Interdisciplinary Center for Scientific Computing (IWR)*, *Heidelberg University*, Heidelberg, Germany.
Lecturer: Prof. Colin Fox
- May 7–8, 2019 **KoMSO Challenge Workshop “Digital Twins: Industrial and Mathematical Challenges”**, *Heidelberger Akademie der Wissenschaften*, Heidelberg, Germany.
- Oct 8–12, 2018 **IWR School on “Advances in Mathematical Optimization”**, *Interdisciplinary Center for Scientific Computing (IWR)*, *Heidelberg University*, Heidelberg, Germany.
- Sep 19–21, 2018 **Meeting of European SIAM and GAMM Student Chapters (MESIGA)**, *TU Berlin*, Berlin, Germany.
- Aug 13–16, 2018 **Summer School “Mixed-Integer Nonlinear Programming”**, *Trier University*, Trier, Germany.
- July 9–13, 2018 **SIAM Annual Meeting (AN18)**, *Oregon Convention Center*, Portland (OR), USA.
Representative of the Heidelberg Student Chapter of SIAM
- June 14–15, 2018 **KoMSO Challenge Workshop “Mathematical Modeling, Simulation, and Optimization in the Pharmaceutical Industry”**, *Interdisciplinary Center for Scientific Computing (IWR)*, *Heidelberg University*, Heidelberg, Germany.
- April 12–13, 2018 **Workshop on Optimization, Machine Learning, and Data Science**, *Technische Universität Braunschweig*, Braunschweig, Germany.
- Aug 28–31, 2017 **Autumn School “Optimization in Machine Learning and Data Science”**, *Trier University*, Trier, Germany.
- March 10–15, 2017 **HGS MathComp / BMBF GOSSIP Project Workshop**, Kleinwalsertal, Austria.

Professional Memberships

- 2017 – Present **Member of the Society for Industrial and Applied Mathematics (SIAM).**

Academic Service & Organization

- 2019 **Co-organizer of a field trip to the Bosch Center for Artificial Intelligence**, Renningen, Germany.
Audience: Members of the SIAM Student Chapter of Heidelberg

- 2018 **Co-organizer of a field trip to Lufthansa Systems**, Raunheim (Frankfurt), Germany.
Audience: Members of the SIAM Student Chapter of Heidelberg
- 2017 **Co-organizer of a field trip to NEC Laboratories**, Heidelberg, Germany.
Audience: Members of the SIAM Student Chapter of Heidelberg
- 2017 – 2020 **Board member of the Heidelberg Student Chapter of SIAM**, Heidelberg University, Heidelberg, Germany.
(2017: Secretary, 2018+2019: President, 2020: Vice President)

Honors

- 2019 **SIAM Certificate of Recognition**, “for outstanding efforts and accomplishments on behalf of the SIAM Chapter at Heidelberg University” (Academic Year 2018-2019).

Teaching Experience

TU Braunschweig

- Winter 2023/24 **“How computers beat us at Hex” (Seminar / Praktikum)**, TA.
Lecturer: Maximilian Merkert
- Winter 2023/24 **“Mathematische Algorithmen und Programmieren 1”**, TA.
Lecturer: Christian Kirches
- Summer 2023 **“Fortgeschrittenenpraktikum Optimierung”**, TA / Recitation Instructor.
Lecturer: Christian Kirches
- Summer 2023 **“Computerorientierte Mathematik 2”**, TA.
Lecturer: Christian Kirches
- Winter 2022/23 **“Dynamische Optimierung”**, TA / Recitation Instructor.
Lecturer: Christian Kirches
- Summer 2022 **“Einführung in die Mathematische Optimierung”**, TA.
Lecturer: Christian Kirches
- Winter 2021/22 **“Computerpraktikum Optimierung”**, TA / Recitation Instructor.
Lecturer: Christian Kirches
- Summer 2021 **“Computerorientierte Mathematik 2”**, TA.
Lecturer: Christian Kirches
- Winter 2020/21 **“Computerorientierte Mathematik 1”**, TA.
Lecturer: Sebastian Stiller
- Winter 2020/21 **“Lineare und Kombinatorische Optimierung”**, TA.
Lecturer: Sebastian Stiller

Heidelberg University

- Winter 2015/16 **“Einführung in die Praktische Informatik”**, Recitation Instructor.
Lecturer: Filip Sadlo
- Winter 2013/14 **“Einführung in die Praktische Informatik”**, Recitation Instructor.
Lecturer: Barbara Paech

Summer 2013 **“Einführung in die Theoretische Informatik”**, *Recitation Instructor*.
Lecturer: Klaus Ambos-Spies

Winter 2011/12 **“Einführung in die Praktische Informatik”**, *Recitation Instructor*.
Lecturer: Peter Bastian

Work Experience

2017 – **Scientific Assistant**, *Institute for Mathematical Optimization, Technische Universität Braunschweig*, Braunschweig, Germany.
Present
Oct 2014 – **Industrial Internship**, *Daimler AG*, Stuttgart, Germany.
Feb 2015

Skills

Languages German (mother tongue), English (fluent), Modern Hebrew (lower intermediate)
Programming Languages C, C++, Python, Matlab, Julia
Other Tools \LaTeX , Git, MS Office
Operating Systems macOS, Linux (Debian-based), Windows