

Evelyn Christin Herberg

Dr. rer. nat.

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Personal Information

Born 1993
Citizenship German

Academic Career

- Sep 2022 – **Postdoctoral Researcher**, *Interdisciplinary Center for Scientific Computing* (IWR), Heidelberg University, Germany (group of Prof. Dr. Roland Herzog)
present
Aug 2021 – **Postdoctoral Researcher**, *Center for Mathematics and Artificial Intelligence* (CMAI), George Mason University, U.S.A. (group of Prof. Dr. Harbir Antil)
Aug 2022
Apr 2019 – **Research Assistant**, *Mathematical Institute*, University of Koblenz-Landau, Germany (group of Prof. Dr. Michael Hinze)
Aug 2021
Oct 2017 – **Research Assistant**, *Department of Mathematics*, University of Hamburg, Germany (group of Prof. Dr. Michael Hinze)
Mar 2019

Education

- Jun 2021 **Dr. rer. nat. Mathematics**, *University of Koblenz-Landau*, Germany
Dissertation: “Sparse discretization of sparse control problems with measures”
Supervisor: Prof. Dr. Michael Hinze, Second Supervisor: Prof. Dr. Christian Clason
Sep 2017 **M. Sc. Business Mathematics**, *University of Hamburg*, Germany
Master Thesis: “Variational discretization of parabolic control problems in space-time measure spaces”
Supervisor: Prof. Dr. Michael Hinze, Second Supervisor: Dr. Henrik Schumacher
Sep 2015 **B. Sc. Business Mathematics**, *University of Hamburg*, Germany
Bachelor Thesis: “Das augmentierte Lagrange-Verfahren und dessen Anwendung auf semidefinite Programme”
Supervisor: Prof. Dr. Winnifried Wollner, Second Supervisor: Prof. Dr. Michael Hinze
May 2011 **Abitur**, *Marion-Dönhoff Gymnasium*, Mölln, Germany

External Funding

- Oct 2024 – **Project: Operator Learning for Optimal Control: Approximation and Statistical Theory**
Sep 2027
Principal Investigators: *Evelyn Herberg*, Sven Wang (Humboldt University Berlin) and Jakob Zech (Heidelberg University)
Funding Agency: Deutsche Forschungsgemeinschaft (DFG) within SPP 2298 “Theoretical Foundations of Deep Learning”
Total Funding: 398 400 €

Sep 2023 **Travel Support for Young Researchers attending the European Conference on Computational Optimization**, Heidelberg University

Funding Agency: Heidelberg Graduate School of Mathematical and Computational Methods for the Sciences (HGS MathComp)

Funding: 5000€

Sep 2018 **Model Order Reduction Summer School**

Funding Agencies:

○ University of Hamburg, Mathematics, Informatics, and Natural Sciences (MIN) Graduate School

○ DFG SPP 1962 “Non-smooth and Complementarity-based Distributed Parameter Systems: Simulation and Hierarchical Optimization”

○ Control and Optimization, Nonlinear PDEs, Calculus of Variations, Scientific Computing and Numerical Analysis (COPDESC)

Total Funding: 15 500€

Publications

Preprints

1. E. Herberg, R. Herzog, F. Köhne, L. Kreis, and A. Schiela (2023). *Sensitivity-Based Layer Insertion for Residual and Feedforward Neural Networks*. arXiv: 2311.15995

Journal Articles (peer reviewed)

2. M. Alshehri, H. Antil, E. Herberg, and D. P. Kouri (2024). “An inexact semismooth Newton method with application to adaptive randomized sketching for dynamic optimization”. In: *Finite Elements in Analysis and Design* 228. DOI: 10.1016/j.finel.2023.104052
3. H. Antil, H. Díaz, and E. Herberg (2023). “An optimal time variable learning framework for deep neural networks”. In: *Annals of Mathematical Sciences and Applications* 8, pp. 501–543. DOI: 10.4310/AMSA.2023.v8.n3.a4
4. E. Herberg and M. Hinze (2022b). “Variational discretization of one-dimensional elliptic optimal control problems with BV functions based on the mixed formulation”. In: *Mathematical Control & Related Fields* 13, pp. 695–720. DOI: 10.3934/mcrf.2022013
5. E. Herberg and M. Hinze (2022a). “Variational discretization approach applied to an optimal control problem with bounded measure controls”. In: *Optimization and Control for Partial Differential Equations*. De Gruyter, pp. 113–136. DOI: 10.1515/9783110695984-006
6. E. Herberg, M. Hinze, and H. Schumacher (2020). “Maximal discrete sparsity in parabolic optimal control with measures”. In: *Mathematical Control & Related Fields* 10, pp. 735–759. DOI: 10.3934/mcrf.2020018

Conference Proceedings (peer reviewed)

7. E. Herberg, R. Herzog, and F. Köhne (2024). “Time regularization in optimal time variable learning”. In: *Proceedings in Applied Mathematics and Mechanics* 24. DOI: 10.1002/pamm.202300299
8. R. J. Baraldi, E. Herberg, D. P. Kouri, and H. Antil (2023). “Adaptive randomized sketching for dynamic nonsmooth optimization”. In: *Model Validation and Uncertainty Quantification*. Vol. 3. Springer Nature Switzerland, pp. 107–116. DOI: 10.1007/978-3-031-37003-8_17

9. E. Herberg, M. Hinze, and H. Schumacher (2019). “Sparse discretization of sparse control problems”. In: *Proceedings in Applied Mathematics and Mechanics* 19. DOI: 10.1002/pamm.201900105

Theses

10. E. Herberg (2021). “Sparse Discretization of Sparse Control Problems with Measures”. PhD thesis. University of Koblenz-Landau, Germany. URN: urn:nbn:de:kola-22019
11. E. Herberg (2017). “Variational discretization of parabolic control problems in space-time measure spaces”. Master Thesis. University of Hamburg, Germany
12. E. Herberg (2015). “Das augmentierte Lagrange-Verfahren und dessen Anwendung auf semidefinite Programme”. Bachelor Thesis. University of Hamburg, Germany

Further Documents

13. E. Herberg (2023b). “Variationelle Diskretisierung für Optimale Steuerung mit Maßkontrollen”. In: *Mitteilungen der Deutschen Mathematiker-Vereinigung* 31.3, pp. 156–159. DOI: 10.1515/dmvm-2023-0053
14. E. Herberg (2023a). *Lecture Notes: Neural Network Architectures*. arXiv: 2304.05133

Honors

- 2024 – 2026 Elected GAMM Junior
- 2023 – 2026 Elected member of the inaugural cohort of European Mathematical Society Young Academy (EMYA)
- 2018 GAMM Certificate of Recognition

Talks and Posters

- Sep 2024 Workshop Control and Optimization in the Age of Data, *Bayreuth, Germany*
Talk: “Adaptive deep neural network architectures: Time-adaptive pruning and sensitivity-based layer insertion”
- Jul 2024 European Congress of Mathematics (ECM), *Seville, Spain*
Talk: “Adaptive Layer Pruning and Insertion in Deep Neural Networks”
- Jun 2024 Oberseminar Numerical Optimization, *Konstanz, Germany*
Talk: “Adaptive Deep Neural Network Architectures: Time-adaptive pruning and sensitivity-based layer insertion”
- Apr 2024 Women in Optimization, *Erlangen, Germany*
Talk: “Optimalsteuerung und Machine Learning”
- Dec 2023 Oberseminar Numerical Optimization, *Konstanz, Germany (virtual)*
Talk: “Adaptive Deep Neural Network Architectures: Time variable framework and regularization”
- Sep 2023 European Conference on Computational Optimization (EUCCO), *Heidelberg, Germany*
Talk: “Physics-Informed Neural Networks for Optimal Control Problems”
- Aug 2023 International Congress on Industrial and Applied Mathematics (ICIAM), *Tokyo, Japan*
Talk: “Adaptive time stepping in DNNs and time regularization”

- Jun 2023 Research Seminar on Mathematical Optimization, *WIAS, Berlin, Germany (virtual)*
Talk: “Deep Learning with variable time stepping”
- May 2023 GAMM 93rd Annual Meeting, *Dresden, Germany*
Talk: “Deep Learning from an optimal control point of view with adaptive time stepping”
- Apr 2023 Numerical Analysis and PDE Seminar, *University of Delaware, Newark, DE, U.S.A. (virtual)*
Talk: “An Optimal Time Variable Learning Framework for DNNs”
- Apr 2023 East Coast Optimization Meeting, *Fairfax, VA, U.S.A. (virtual)*
Talk: “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”
- Mar 2023 SPP1962 Young Researchers’ Workshop on Deep Learning, *Essen, Germany*
Talk: “Deep Learning with variable time stepping”
- Mar 2023 Special Interest Group in Optimization (SIGOPT) International Conference on Optimization, *Cottbus, Germany*
Talk: “Variational Discretization of Optimal Control Problems with Measures”
- Feb 2023 Heidelberg Seminar on Optimal Control, *Haus im Ennstal, Austria*
Talk: “Inexact Second Order Optimization using Randomized Sketching”
- Jan 2023 Lothar-Collatz-Seminar, *Hamburg, Germany*
Talk: “Deep Learning with variable time stepping”
- Dec 2022 Oberseminar Applied Mathematics, *Bayreuth, Germany*
Talk: “Learning the time step size in Deep Neural Networks”
- Nov 2022 Seminar Optimization, *Koblenz, Germany*
Talk: “Learning the time step size in Deep Neural Networks”
- Nov 2022 Oberseminar Applied Mathematics, *Freiburg, Germany*
Talk: “Learning the time step size in Deep Neural Networks”
- Sep 2022 Chemnitz Finite Element Symposium, *Herrsching am Ammersee, Germany*
Talk: “An Optimal Time Variable Learning Framework for Deep Neural Networks”
- Jul 2022 International Conference on Continuous Optimization (ICCOPT), *Bethlehem, PA, U.S.A.*
Talk: “Sketching for Nonsmooth PDE Constrained Optimization Problems”
- Jul 2022 Accurate Reduced Order Models for Industrial Applications at Virginia Tech (ARIA@VT), *Blacksburg, VA, U.S.A.*
Talk: “Sketching for Nonsmooth PDE Constrained Optimization Problems”
- Apr 2022 The Spring Finite Element Circus, *Gainesville, FL, U.S.A. (virtual)*
Talk: “An Optimal Time Variable Learning Framework for DNNs”
- Mar 2022 East Coast Optimization Meeting, *Fairfax, VA, U.S.A.*
Talk: “An Optimal Time Variable Learning Framework for DNNs”
- Nov 2021 The Fall Finite Element Circus, *State College, PA, U.S.A.*
Talk: “Sketching in dynamic constrained optimization”

- Sep 2021 44th SIAM Southeastern Atlantic Section Conference, *Auburn, AL, U.S.A.*
(*virtual*)
Talks: “Variational discretization for optimal control with BV functions based on the mixed formulation”, and “Sparse discretization of optimal control problems with PDEs”
- Aug 2021 IFIP TC 7 Conference on System Modeling and Optimization, *Quito, Ecuador*
(*virtual*)
Talk: “Variational discretization applied to sparse control problems with BV functions”
- Mar 2021 GAMM 91st Annual Meeting, *Kassel, Germany* (*virtual*)
Talk: “Variational discretization approach applied to an optimal control problem with bounded measure controls”
- Jan 2020 Lothar-Collatz-Seminar, *Hamburg, Germany*
Talk: “Variational discretization approach applied to an optimal control problem with bounded measure controls”
- Oct 2019 Workshop: New trends in PDE constrained optimization, *Linz, Austria*
Talk: “Variational discretization of PDE constrained optimal control problems with measure controls”
- Jul 2019 International Congress on Industrial and Applied Mathematics (ICIAM), *Valencia, Spain*
Talk and Poster: “Sparse discretization in PDE constrained optimization with measure controls”
- Feb 2019 GAMM 90th Annual Meeting, *Vienna, Austria*
Talk: “Sparse discretization of sparse control problems”
Poster: “Studentchapter Hamburg”
- Sep 2018 Model Order Reduction Summer School, *Hamburg, Germany*
Talk: “Introduction to optimal control”
- Jul 2018 IFIP TC 7 Conference on System Modeling and Optimization, *Essen, Germany*
Talk: “Maximal discrete sparsity in parabolic optimal control with measures”
- Mar 2018 Young Researchers Meeting and CSE Workshop, *Plön, Germany*
Talk: “Time-sparse discretization for parabolic optimal control with measures”
- Feb 2018 Winter School Modern Methods in Nonsmooth Optimization, *Würzburg, Germany*
Poster: “Time-sparse discretization for parabolic optimal control with measures”

Mentoring and Supervision

PhD Students

- Jan 2023 – Leonie Kreis, *Multilevel Architectures in Deep Learning*, Heidelberg University, Germany
present
Co-Supervision with Prof. Dr. Roland Herzog
- Mar 2022 – Mohammed Alshehri, *Randomized Sketching for Dynamic Optimization and*
Aug 2022 *Inexact Adaptive Semismooth Newton methods*, George Mason University, VA, U.S.A.
Mentoring, Student of Prof. Dr. Harbir Antil

Master's Theses

- ongoing Fengyun Yu, *Optimization Methods using Operator Learning and Applications in Optimal Control*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog
- ongoing Laurin Ernst, *Generative Models for Probability Density Estimation with Applications in Bayesian Inference*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog
- 2024 Hannah Rickmann, *Global Convergence Theory for Non-Smooth Newton Methods Applied to Quadratic Programs*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog
- 2024 Nico Haaf, *Optimal Control with Functions of Bounded Variation in Mixed Formulation*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog and Prof. Dr. Michael Hinze
- 2023 Isabel Gernand, *Prediction of Optimal Trajectories by Neural Networks*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog
- 2023 Johannes Wagner, *Physics-Informed Neural Networks for Optimal Control Problems*, University of Technology Chemnitz, Germany
Co-Supervision with Prof. Dr. Roland Herzog

Bachelor's Theses

- ongoing Simone Hechler, *Invex Optimization Problems*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog
- 2023 Karina Kniel, *Parametric Linear Optimization using Neural Networks*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog
- 2023 Nico Haaf, *Optimal Control with Measures*, Heidelberg University, Germany
Co-Supervision with Prof. Dr. Roland Herzog and Dr. Georg Müller

Teaching

Lectures

- 2024 Nonlinear Optimization, *Heidelberg University*, Germany
- Mar 2024 Fundamentals of Optimization – heiAIMS Summer School Pre Course, *African Institute for Mathematical Science (AIMS)*, Cape Town, South Africa
- 2023/24 Fundamentals of Optimization, *Heidelberg University*, Germany
- Mar 2023 Neural Network Architectures, *SPP1962 Young Researchers' Workshop on Deep Learning*, Essen, Germany

Seminars

- 2023 Mathematical Machine Learning - Selected Famous Papers, *Heidelberg University*, Germany
- 2022/23 Mathematical Machine Learning - Neural Network Architectures, *Heidelberg University*, Germany

- 2022/23 Advanced Topics of Numerics, *Heidelberg University*, Germany
2022 Research Interaction and Training - PDE and Data Control, *George Mason University*, U.S.A.

Organization of Exercise Classes

- 2021 Optimization I, *University of Koblenz-Landau*, Germany
2020/21 Optimization II, *University of Koblenz-Landau*, Germany
2020 Optimization I, *University of Koblenz-Landau*, Germany
2019/20 Optimization II, *University of Koblenz-Landau*, Germany
2019 Optimization I, *University of Koblenz-Landau*, Germany

Exercise Classes

- 2023 Nonlinear Optimization, *Heidelberg University*, Germany
2020/21 Applied Differential Equations, *University of Koblenz-Landau*, Germany
2018/19 Numerics, *University of Hamburg*, Germany
2018 Optimization, *University of Hamburg*, Germany
2017/18 Differential Equations I, *Technical University of Hamburg*, Germany
2017 Optimization, *University of Hamburg*, Germany
2016/17 Numerics, *University of Hamburg*, Germany
2016 Linear Algebra II, *University of Hamburg*, Germany
2015/16 Linear Algebra I, *University of Hamburg*, Germany
2015 Optimization, *University of Hamburg*, Germany
2014/15 Numerics, *University of Hamburg*, Germany

Further Teaching

- Feb 2017 “Girls go math”, *University of Hamburg*, Germany
Oct 2016 Preparation Course Mathematics for Students of Bachelor Mathematics, *University of Hamburg*, Germany
Oct 2015 Preparation Course Mathematics for Students of Bachelor Business Administration, *University of Hamburg*, Germany

Organizational Activities

- Sep 2025 European Conference on Numerical Mathematics and Advanced Applications (ENUMATH), Heidelberg, Germany
Support Team Member
Apr 2025 Young Academics Meet Mentors (YAMM) Lunch, *GAMM 95th Annual Meeting*, Poznań, Poland
Organization Team
Aug 2024 Minisymposium “Optimal Control and Machine Learning”, *IFIP TC7 System Modeling and Optimization*, Hamburg, Germany
with Roland Herzog

- Jul 2024 *EMYA Activities, European Congress of Mathematics (ECM)*, Seville, Spain
 Organization Team
 - EMYA Ice Breaking Session
 - EMYA Lightning Talks
 - Sustainability Panel & Group Discussion
- Mar 2024 Section 16 - Optimization, *GAMM 94th Annual Meeting*, Magdeburg, Germany
 with Christian Kahle
- Sep 2023 *European Conference on Computational Optimization (EUCCO)*, Heidelberg, Germany
 Organization Team
- Aug 2023 Minisymposium “Machine Learning and Differential Equations”, *International Congress on Industrial and Applied Mathematics (ICIAM)*, Tokyo, Japan
 with Roland Maier
- Jul 2022 Minisymposium “Recent Advances in Hierarchical and PDE Constrained Optimization”, *International Conference on Continuous Optimization (ICCOPT)*, Bethlehem, PA, U.S.A.
 with Harbir Antil and Uday V. Shanbhag
- Mar 2022 *East Coast Optimization Meeting*, Fairfax, VA, U.S.A.
 Support Team Member
- 2020 – 2021 *CMAI Colloquium*, Fairfax, VA, U.S.A.
 Support Team Member
- Sep 2018 *Model Order Reduction Summer School*, Hamburg, Germany
 Organization Team

Professional Responsibilities

- 2024 Formulation of the By-Laws of GAMM Juniors
- 2023 – present Treasurer, EMYA
- 2023 Formulation of the By-Laws of EMYA
- 2018 – 2019 Finance Officer, GAMM Chapter Hamburg
- 2018 Co-Founder, GAMM Chapter Hamburg
- 2017 – 2019 Finance Officer, SIAM Chapter Hamburg

Membership in Professional Societies

- EMS (European Mathematical Society)
- GAMM (International Association of Applied Mathematics and Mechanics)
- GAMM Activity Group on Optimization with PDE Constraints
- 2017 – 2020 SIAM (Society for Industrial and Applied Mathematics)
- 2017 – 2020 Student Chapter Hamburg

Editorial Activities

Aug 2023 – Editorial Board Member Examples & Counterexamples (EXCO)
present

Manuscripts Refereed for Journals

- Advances in Computational Mathematics (ACOM)
- Electronic Transactions on Numerical Analysis (ETNA)
- Journal of Inverse and Ill-Posed Problems (JIIP)
- Proceedings in Applied Mathematics and Mechanics (PAMM)

Skills

Languages English (fluent), French (good), Spanish (basics)
Programming MATLAB, Python

References

- Prof. Dr. Michael Hinze, *University of Koblenz*, Germany
email: hinze@uni-koblenz.de
- Prof. Dr. Harbir Antil, *George Mason University*, U.S.A.
email: hantil@gmu.edu
- Prof. Dr. Roland Herzog, *Heidelberg University*, Germany
email: roland.herzog@iwr.uni-heidelberg.de

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