

Prof. Dr. rer.nat. habil. Sebastian Sager

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* 7.3.1975, Westerstede (D), married, 2 daughters



— Education and Positions —

- 10/2023– • **Max Planck Fellow** at MPI Magdeburg
- 4/2017– • **Spokesperson** of DFG research training group 2297
 “Mathematical Complexity Reduction”
- 10/2014– • **Director** of the OVGU Center for Dynamic Systems
- 4/2012– • **Principal Investigator** at the IMPRS ProEng Magdeburg
- 4/2012– • **W3 full professor** at the Faculty of Mathematics, OVGU
- 4/2012 • **Habilitation** at the Ruprecht-Karls-Universität Heidelberg
- 10/2008–3/2012 • **Junior Research Group Leader** at the Interdisciplinary Center
 for Scientific Computing (IWR), Heidelberg
- 2/2008–9/2008 • **Akademischer Rat auf Zeit** at IWR, Heidelberg
- 4/2007–1/2008 • **Postdoc** in the SIMUMAT research team on aerodynamic
 shape optimization, Universidad Autónoma, Madrid (E)
- 10/2006–3/2007 • Akademischer Rat auf Zeit at IWR Heidelberg
- 2/2006–9/2006 • Postdoc at the IWR, Heidelberg
- 2/2002–2/2006 • **PhD thesis** *Numerical methods for mixed-integer optimal control
 problems* (supervisors: H.G. Bock, G. Reinelt; summa cum laude)
- 2/2002–2/2005 • Member of the International DFG research training group 710
- 2/2004–4/2004 • Research stays at U Carlos III de Madrid and U de Valladolid (E)
- 10/1995–12/2001 • Studies at the Universität Heidelberg, **diploma** in mathematics
 with specialization in physics/astronomy (grade: excellent)
- 1/2000–5/2000 • Exchange student at the University of Ho-Chi-Minh-City (VN)
- 9/1997–7/1998 • Exchange student at the Université de Montpellier (F)
- 6/1994 • Abitur at the Gymnasium Westerstede

— Offers, Honors, and Awards —

- 2021 • Offer of **W3 professor position** “Mathematics of Machine Learning” at the
 Julius-Maximilians-Universität Würzburg; not realized
- 2016 • **ERC Proof of Concept Grant** isitFlutter-727417
- 2015 • **ERC Consolidator Grant** MODEST-647573
 “Mathematical Optimization for Clinical Decision Support and Training”
 • **Otto-von-Guericke Research Award**
- 2011 • Offer of **W3 professor position** “Mathematical Optimization” at OVGU Mag-
 deburg; realized
- 2007 • **Klaus Tschira Award** for Achievements in Public Understanding of Science
- 2006 • **Dissertation prize** of the German Operations Research Society

— Teaching —

Lectures

- 2013–, 3× • *Algorithmic Parameter Estimation and Experimental Design* (M)
- 2008 • *Introduction to Numerics* (B)
- 2012–, 3× • *Introduction to Optimization* (B)
- 2021 • *Mathematics for Clinical Decision Support* (M)
- 2018–, 4× • *Mathematical Modeling* (B, for mathematical engineers)
- 2013–, 6× • *Nonlinear Optimization* (B/M)
- 2008–, 8× • *Mixed-integer nonlinear Optimization* (B/M)
- 2006–, 2× • *Numerics 2* (M)
- 2012–, 4× • *Optimal Control / Algorithmic Dynamic Optimization* (M)
- 2018–, 3× • *Optimization Methods for Machine Learning* (M)

Seminars

- 2022 • *Mathematics for Clinical Decision Support* (M)
- 2018–, 4× • *Optimization and Machine Learning* (M)
- 2013–, 2× • *Optimal Control* (M), *Optimal Control Software* (M)
- 2011–, 2× • *Global (and Stochastic) Optimization* (M)
- 2014 • *Chebfun* (M)
- 2009 • *Scientific Software Engineering* (M)
- 2008 • *Artificial Intelligence and Robotics* (B/M)
- 2006 • *Optimal control in economics* (M)

Compact Courses

- 2013, '17 • *Optimization under Uncertainties* (PhD)
- 2014, '17 • *Complexity Reducing Formulations in Optimization* (PhD)
- 2009, '12 • *Optimization with Differential Equations* (PhD)
- 2005, '10 • *Mixed-Integer Nonlinear Programming* (PhD)

— Academic Work —

Academic work

- 2019–, 2× • Guest editor of *Mathematical Programming*
- 2017– • Member *Forschungskommission* at OVGU
- 2016-2019 • Member *Rektoratskommission Gleichstellung* at OVGU
- 2016 • Organizing committee member of the *IFAC FOSBE 2016*
- 2015–, 3× • Organizer of the *Oberwolfach Workshop on MINLP*
- 2013-2017 • Editor and Guest-Editor of *Optimal Control and Applications*
- 2013 • Co-organizer of the *CWMINLP13 workshop* in Paris
- 2012 • Scientific committee member of the *Global Optimization Workshop*
 - Guest editor of *Computational Science*
- 2012– • Main organizer of public outreach activity “Magdeburger Mathenacht”
- 2012-2021 • Series editor of the *Differential-Algebraic Equations Forum*, Springer
- 2011 • Organizer of the ANLO11 workshop *Nonlinear Optimization*
 - Organizer of the OCE11 workshop *Optimal Control & Economics*
- 2010 • Organizer of the SOCCER 2010 conference on *Commodities*
 - Organizer of SCCS 2010: *Scientific Computing for the Cognitive Sciences*
- 2009 • Organizer: *German-American Frontiers of Engineering Symposium 2009*
- 2008 • Co-organizer of OPTEX2008 workshop on *Industrial Modeling*
- 2007 • Co-chair *Czech–French–German Conference on Optimization 2007*

— Third Party Funding —

- Total sum: ca. **13.0 MEuro** Own contribution: ca. **5.3 MEuro**
- 2021-2024 • **DFG SPP 2331**: *mlP2X* with A. Kienle and A. Seidel-Morgenstern
- 2016-2022 • **DFG SPP 1962**: *Non-smooth Methods for Complementarity Formulations of Switched Advection-Diffusion Processes* with C. Kirches
- 2019-2021 • **Excellency–Synergy** Program of Saxony-Anhalt
- 2018-2021 • BMBF Project *P2Chem* with P. Benner, M. Stoll, K. Sundmacher
- 2017-2026 • **DFG RTG 2297** *Mathematical Complexity Reduction* (spokesperson), with 12 / 9 PIs (first/second funding period) from OVGU and MPI
- 2017-2020 • Project *OTTI* with Volkswagen, with R. Findeisen
- 2016-2018 • **ERC Proof of Concept Grant** isitFlutter-727417
- 2016 • **High Performance** Program of Saxony-Anhalt
- 2015-2020 • **ERC Consolidator Grant** MODEST-647573
- 2014-2017 • Project *Revenue Management* with Air Berlin
- 2013-2016 • BMBF Project “GOSSIP” with H.G. Bock, C. Kirches, E. Kostina
- 2013-2016 • Klaus-Tschira-Foundation: *Cardiac arrhythmia*, with E. Scholz
- 2010–2013 • EU project EMBOCON with ETH, ICL, Leuven, Bucharest, industry
- 2009-2012 • Project *Revenue Management* with Lufthansa
- 2009-2012 • **DFG SPP 1253** *Optimization with Partial Differential Equations*, with H.G. Bock, S. Engell
- 2009-2012 • 4 DFG Graduate School stipends (HD internal)

— Supervision —

15 Ongoing PhD theses (as first advisor)

- 2022- • Feldmann, S.: *The Spread Dimension*
- 2019- • Gebhard, A.: *Modeling and Control of Chemotherapy for Acute Lymphoblastic Leukemia*
- 2016- • Hahn, M.: *Mixed-integer PDE constrained optimization*
- 2020- • Haritonova, V.: *Inverse Optimal Control and Inverse Reinforcement Learning*
- 2023- • Klein, T.: *Mathematical Foundations of Neural Networks and Applications in Neuroscience*
- 2017- • Le, D.D.: *Optimal Urban Traffic*
- 2017- • Lilienthal, P.: *Personalized Mathematical Modeling of Haematopoiesis*
- 2020- • Martensen, J.: *Deep Learning for Novel Power2Chem Processes*
- 2015- • Matke, C.: *Modeling & Optimization of Battery Storage in the Power Grids*
- 2022- • Plate, C.: *Machine Learning for the Design and Control of Power2X Processes*
- 2021- • Reimann, A.: *Machine Learning Models for Acute Leukemia*
- 2020- • Shaydurova, D.: *Complexity Reducing Approximations of Polynomial Optimization Problems*
- 2015- • Tetschke, M.: *Global Optimal Control for Clinical Treatment*
- 2014- • Weber, T.: *Source Detection in Graphs*
- 2023- • Wittmann, R.: *Direct Optimal Control Methods in Chemical Engineering*

6 Ongoing PhD theses (as second advisor)

- 2023- • Föge, N.: *Trustworthy Complexity Reduction by Random Forests*
- 2021- • Kapustsin, U.: *Structure and Physics preserving Neural Networks*
- 2018- • Minakowska, M.: *Machine Learning enhanced Modeling and Simulation of Thrombosis*
- 2018- • Monem, S.: *Model Order Reduction and Mixed-Integer Nonlinear Optimization*

— Supervision (continued) —

- 2020- • Pfefferkorn, M.: *Machine Learning Supported Model Predictive Control with Guarantees*
- 2023- • Stoffregen, N.: *Data Segmentation for Non-stationary Time Series*

11 Completed PhD theses (as first advisor)

- 2021 • Uebbing, J.: *Power-to-Methane Process Synthesis via Mixed Integer Nonlinear Programming*
- 2021 • Zeile, C.: *Combinatorial Integral Approximation Decompositions for Mixed-integer Optimal Control*
- 2020 • Jost, F.: *Model-based Optimal Treatment Schedules for Acute Leukemia*
- 2018 • Kehrle, F.: *Inverse Simulation of Atrial Tachycardia*
- 2017 • Rauch, J.: *The Airline Pricing Problem*
- 2016 • Sorgatz, S.: *Optimization of Vehicular Traffic at Traffic-Light Intersections*
- 2015 • Engelhart, M.: *Optimization-based Training of Human Decision Making*
- 2015 • Diedam, H.: *Global Optimal Control using Direct Multiple Shooting*
- 2014 • Frasch, J.: *Parallel Algorithms for Optimization of Dynamic Systems in Real Time*
- 2014 • Huschto, T.: *Numerical Methods for Random Parameter Optimal Control and the Optimal Control of Stochastic Differential Equations*
- 2013 • Jung, M.: *Relaxations and Approximations for Mixed-integer Optimal Control*

4 Completed PhD theses (as second advisor)

- 2021 • Peters, B.: *Polynomial Optimization on Polytopes*
- 2021 • Himmel, A.: *Optimization-based Operation Strategy and Storage Design for Coupled Processes*
- 2013 • Kellner, S.: *Modeling of Demand for Commodities and a Case Study of the Petrochemical Market*
- 2013 • Kramer, L.: *Modeling and Reduction of a Multi-Commodity Supply-Demand Trade Network*

— Publications —

2 Patents

- 2016 • Scholz, E., Sager, S., Katus, H., *A system and computer program product for automatically distinguishing atrial flutter from atrial fibrillation*, EP2757940B1, 13.4.2016, <https://www.google.com/patents/EP2757940B1>
- 2010 • Gehring, O., Kauffmann, F., Bock, H.G., Kirches, C., Sager, S., Schlöder, J.P., *Verfahren zum Steuern des Betriebs eines Fahrzeugs*, DE102009030784A1, 4.2.2010, <http://www.google.com/patents/DE102009030784A1>

3 Theses

- 2011 • Sager, S., *On the Integration of Optimization Approaches for Mixed-Integer Nonlinear Optimal Control*, habilitation thesis, Ruprecht-Karls-Universität Heidelberg, 2011, <https://mathopt.de/PUBLICATIONS/Sager2011d.pdf>
- 2005 • Sager, S., *Numerical methods for mixed-integer optimal control problems*, PhD thesis, Ruprecht-Karls-Universität Heidelberg, published in Der Andere Verlag, Tönning, Lübeck, Marburg, ISBN 3-89959-416-9, available at <https://mathopt.de/PUBLICATIONS/Sager2005.pdf>

— Publications (continued) —

- 2001 • Sager, S., *Lange Schritte im Dualen Simplex-Algorithmus*, diploma thesis, Ruprecht-Karls-Universität Heidelberg, available at <https://mathopt.de/PUBLICATIONS/Sager2001.pdf>

66 Journal Publications (plus 3 submitted ones)

- Subm • Plate, C., Sager, S., Stoll, M., Tetschke, M., *Second-order Partial Outer Convexification for Switched Dynamical Systems*, Optimization Online, submitted to **IEEE Transactions on Automatic Control**
- Sager, S., Tetschke, M., Zeile, C., *A numerical study of transformed mixed-integer optimal control problems*, Optimization Online, 2020/03/7698, submitted to **Mathematical Programming Computation**
- Weber, T., Kaibel, V., Sager, S., *Source Detection on Graphs*, Optimization Online, 2022/07/9002, submitted to **Optimization and Engineering**
- 2023 • Bürger, A., Zeile, C., Altmann-Dieses, A., Sager, S., Diehl, M., *A Gauss-Newton-based Decomposition Algorithm for Nonlinear Mixed-Integer Optimal Control Problems*, **Automatica**, Vol. 152, pp. 110967
- Gebhard, A., Lilienthal, P., Metzler, M., Rauh, M., Sager, S., Schmiegelow, K., Toksvang, L.N., Zierk, J., *Pharmacokinetic-Pharmacodynamic Modeling of Maintenance Therapy for Childhood Acute Lymphoblastic Leukemia*, **Scientific Reports**, Vol. 13 (1), pp. 11749
- Hahn, M., Leyffer, S., Sager, S., *Binary Optimal Control by Trust-Region Steepest Descent*, **Mathematical Programming**, Vol. 197 (1), pp. 147–190
- Manns, P., Hahn, M., Kirches, C., Leyffer, S., Sager, S., *On Convergence of Binary Trust-Region Steepest Descent*, **Journal of Nonsmooth Analysis and Optimization**, Vol. 4, pp. 10164
- Reimann, A., Schalk, E., Mougiakakos, D., Weber, D., Döhner, H., Récher, C., Dumas, P.-Y., Ditzhaus, M., Fischer, T., Sager, S., *AML Consolidation Therapy: Timing Matters*, **Journal of Cancer Research and Clinical Oncology**, Vol. 149 (15), pp. 13811–13821
- S. Sager, *Digital Twins in Oncology*, **Journal of Cancer Research and Clinical Oncology**, Vol. 149 (9), pp. 5475–5477, DOI 10.1007/s00432-023-04633-1
- 2022 • Le, D.D., Merkert, M., Sorgatz, S., Hahn, M., Sager, S., *Autonomous traffic at intersections: an optimization-based analysis of possible time, energy, and CO₂ savings*, **Networks**, Vol. 79 (3), pp. 338–363
- Thünen, A., Leyffer, S., Sager, S., *State Elimination for Mixed-Integer Optimal Control of Partial Differential Equations by Semigroup Theory*, **Optimal Control, Applications and Methods**, Vol. 43 (3), pp. 867–883
- Zeile, C., Weber, T., Sager, S., *Combinatorial Integral Approximation Decompositions for Mixed-Integer Optimal Control*, **Algorithms**, Vol. 15 (4), pp. 121
- 2021 • Maggi, A., Garmatter, D., Sager, S., Stoll, M., Sundmacher, K., *Power-to-Syngas: a PARAREAL optimal control approach*, **Frontiers in Energy Research**, Vol. 9, DOI 10.3389/fenrg.2021.720489
- Minakowska, M., Richter, T., Sager, S., *A finite element / neural network framework for modeling suspensions of non-spherical particles – Concepts and medical applications*, **Vietnam Journal of Mathematics**, Vol. 49, pp. 207–235

— Publications (continued) —

- Robuschi, N., Zeile, C., Sager, S., Braghini, F., Cheli, F., *Multiphase Mixed-Integer Nonlinear Optimal Control of Hybrid Electric Vehicles*, **Automatica**, Vol. 123, pp. 109325
- Sager, S., Bernhardt, F., Kehrle, F., Merkert, M., Potschka, A., Meder, B., Katus, H., Scholz, E., *Expert-Enhanced Machine Learning for Cardiac Arrhythmia Classification*, **PLoS One**, 16.12: e0261571
- Sager, S., Zeile, C., *On Mixed-Integer Optimal Control with Constrained Total Variation of the Integer Control*, **Computational Optimization and Applications**, Vol. 78.2, pp. 575–623
- Schweidtmann, A.M., Esche, E., Fischer, A., Kloft, M., Repke, J., Sager, S., Mitsos, A., *Machine Learning in Chemical Engineering: A Perspective*, **Chemie Ingenieur Technik**, Vol. 93 (12), pp. 2029–2039, DOI 10.1002/cite.202100083
- Uebbing, J., Biegler, L.T., Rihko-Struckmann, L., Sager, S., Sundmacher, K., *Optimization of Pressure Swing Adsorption via a Trust-Region Filter Algorithm and Equilibrium Theory*, **Computers & Chemical Engineering**, Vol. 151, pp. 107340
- Zeile, C., Rauwolf, T., Schmeisser, A., Mizerski, J.K., Braun-Dullaeus, R.C., Sager, S., *An Intra-Cycle Optimal Control Framework for Ventricular Assist Devices based on Atrioventricular Plane Displacement Modeling*, **Annals of Biomedical Engineering**, Vol. 49(12), pp. 3508–3523
- Zeile, C., Robuschi, N., Sager, S., *Mixed-Integer Optimal Control under Minimum Dwell Time Constraints*, Optimization Online, 2019/09/7366, **Mathematical Programming B**, Vol. 188 (2), pp. 653–694, DOI 10.1007/s10107-020-01533-x
- 2020 • Himmel, A., Sager, S., Sundmacher, K., *Time-minimal setpoint transition for nonlinear SISO systems under different constraints*, **Automatica**, Vol. 114, pp. 108806
- Jost, F., Schalk, E., Weber, D., Döhner, H., Fischer, T., Sager, S., *Model-based optimal AML consolidation treatment*, **IEEE Transactions on Biomedical Engineering**, Vol. 67 (12), pp. 3296–3306
- Jost, F., Zierk, J., Le, T.T.T., Raupach, T., Rauh, M., Suttorp, M., Stanulla, M., Metzler, M., Sager, S., *Model-based simulation of maintenance therapy of childhood acute lymphoblastic leukemia*, **Frontiers in Physiology**, Vol. 11, pp. 217
- Lilienthal, P., Tetschke, M., Schalk, E., Fischer, T., Sager, S., *Optimized and Personalized Phlebotomy Schedules for Patients suffering from Polycythemia Vera*, **Frontiers in Physiology**, Vol. 11, pp. 328
- Rihko-Struckmann, L., Uebbing, J., Sager, S., Sundmacher, K., *CO₂ Methanation Process Synthesis by Superstructure Optimization*, **Journal of CO₂ Utilization**, Vol. 40, pp. 101228
- Scholz, E., Hartlage, C., Bernhardt, F., Weber, T., Salatzki, J., André, F., Lugenbiel, P., Riffel, J., Katus, H., Sager, S., *Spatial relationship between ablation sites within the pulmonary trunk and the left coronaries: Systematic risk assessment based on automated three-dimensional distance measurements*, **Heart Rhythm O2**, Vol. 1.1, pp. 14–20

— Publications (continued) —

- 2019
- A. Bürger, C. Zeile, A. Altmann-Dieses, S. Sager, M. Diehl, *Design, Implementation and Simulation of an MPC Algorithm for Switched Nonlinear Systems under Combinatorial Constraints*, **Journal of Process Control**, Vol. 81, pp. 15–30
 - T. Huschto, M. Podolskij, Sager, S., *The asymptotic error of chaos expansion approximations for stochastic differential equations*, **Modern Stochastics: Theory and Applications**, Vol. 6 (2), pp. 145–165
 - Jost, F., Schalk, E., Rinke, K., Fischer, T., Sager, S., *Mathematical Models for the Influence of Cytarabine on White Blood Cell Dynamics in Acute Myeloid Leukemia*, **PLOS One**, Vol. 14 (7), DOI 10.1371/journal.pone.0204540
 - Weber, T., Sager, S., Gleixner, A., *Solving Quadratic Programs to High Precision using Scaled Iterative Refinement*, **Mathematical Programming Computation**, Vol. 11 (3), pp. 421–455
- 2018
- Diedam, H., Sager, S., *Global optimal control with the direct multiple shooting method*, **Optimal Control Applications and Methods**, Vol. 39 (2), pp. 449–470, DOI 10.1002/oca.2324
 - Jung, M.N., Kirches, C., Sager, S., Sass, S., *Computational Approaches for Mixed-Integer Optimal Control Problems with Indicator Constraints*, **Vietnam Journal of Mathematics**, Vol. 46, pp. 1023–1051, DOI 10.1007/s10013-018-0313-z
 - Le, T.T.T., Jost, F., Raupach, T., Zierk, J., Rauh, M., Suttorp, M., Stanulla, M., Metzler, M., Sager, S., *A mathematical model of white blood cell dynamics during maintenance therapy of childhood acute lymphoblastic leukemia*, **Mathematical Medicine and Biology**, DOI 10.1093/imammb/dqy017
 - Le, T.T.T., Jost, F., Sager, S., *Optimal Control of Vibration-Based Micro Energy Harvesters*, **Journal of Optimization Theory and Applications**, Vol. 179 (3), pp. 1025–1042
 - Tetschke, M., Lilienthal, P., Pottgießer, T., Fischer, T., Schalk, E., Sager, S., *Mathematical modeling of RBC count dynamics after blood loss*, **Processes**, Vol. 6 (9), 157, DOI 10.3390/pr6090157
- 2017
- Engelhart, M., Funke, J., Sager, S. *A Web-based Feedback Study on Optimization-based Training and Analysis of Human Decision Making*, **Journal of Dynamic Decision Making**, Vol. 3 (1)
 - Jost, F., Sager, S., Le Thi, T.T., *A Feedback Optimal Control Algorithm with Optimal Measurement Time Points*, **Processes**, Vol. 5 (1), 10
 - Weber, T., Katus, H.A., Sager, S., Scholz E.P., *Novel Algorithm for Accelerated Electroanatomic Mapping and Prediction of Earliest Activation of Focal Cardiac Arrhythmias using Mathematical Optimization*, **Heart Rhythm**, Vol 14 (6), pp. 875–882
- 2016
- Janka, D., Kirches, C., Sager, S., Wächter, A., *An SR1/BFGS SQP algorithm for nonconvex nonlinear programs with block-diagonal Hessian matrix*, **Mathematical Programming Computation**, Vol. 8 (4), pp. 435–459
- 2015
- Frasch, J. V., Sager, S., Diehl, M., *A parallel quadratic programming method for dynamic optimization problems*, **Mathematical Programming Computation**, Vol. 7 (3), pp. 289–329
 - Jung, M.N., Reinelt, S., Sager, S., *The Lagrangian Relaxation for the Combinatorial Integral Approximation Problem*, **Optimization Methods and Software**, Vol. 30 (1), pp. 54–80

— Publications (continued) —

- Sager, S., Claeys, M., Messine, F., *Efficient upper and lower bounds for global mixed-integer optimal control*, **Journal of Global Optimization**, Vol. 61 (4), pp. 721–743
- 2014 • Duran, B.J., Jung, M.N., Ocampo-Martinez, C., Sager, S., Cambrano, G., *Minimization of Sewage Network Overflow*, **Water Resources Management**, Vol. 28 (1), pp. 41–63
- Huschto, T., Sager, S., *Pricing conspicuous consumption products in recession periods with uncertain strength*, **European Journal of Decision Processes**, Vol. 2 (1–2), pp. 3–30
- Huschto, T., Sager, S., *Solving Stochastic Optimal Control Problems by a Wiener Chaos Approach*, **Vietnam Journal of Mathematics**, Vol. 42(1), pp. 83–113
- Scholz, E.P., Kehrle, F., Vossel, S., Hess, A., Zitron, E., Katus, H.A., Sager, S., *Discriminating atrial flutter from atrial fibrillation using a multilevel model of atrioventricular conduction*, **Heart Rhythm**, Vol. 11(5), pp. 877–884
- 2013 • Engelhart, M., Funke, J., Sager, S., *A Decomposition Approach for a New Test-Scenario in Complex Problem Solving*, **Journal of Computational Science**, Vol. 4(4), pp. 245–254
- Hante, F., Sager, S., *Relaxation Methods for Mixed-Integer Optimal Control of Partial Differential Equations*, **Computational Optimization and Applications**, Vol. 55(1), pp. 197–225
- Kirches, C., Potschka, A., Bock, H.G., Sager, S., *A Parametric Active Set Method for QPs with Vanishing Constraints Arising in a Robot Motion Planning Problem*, **Pacific Journal of Optimization**, Vol. 9(2), pp. 275–299
- Sager, S., *Sampling Decisions in Optimum Experimental Design in the Light of Pontryagin’s Maximum Principle*, **SIAM Journal on Control and Optimization**, Vol. 51(4), pp. 3181–3207
- 2012 • Sager, S., Bock, H.G., Diehl, M., *The Integer approximation error in mixed-integer optimal control*, **Mathematical Programming A**, Vol. 133(1-2), pp. 1–23
- 2011 • Engelhart, M., Lebiedz, D., Sager, S., *Optimal control for cancer chemotherapy ODE models: Potential of optimal schedules and choice of objective function*, **Mathematical Biosciences**, Vol. 229(1), pp. 123–134
- Huschto, T., Feichtinger, G., Kort, P., Hartl, R.F., Sager, S., Seidl, A., *Numerical solution of a conspicuous consumption model with constant control delay*, **Automatica**, Vol. 47(9), 1868–1877
- Kirches, C., Bock, H.G., Schlöder, J.P., Sager, S., *Block structured quadratic programming for the direct multiple shooting method for optimal control*, **Optimization Methods and Software**, Vol. 26(2), 239–257
- Kirches, C., Bock, H.G., Schlöder, J.P., Sager, S., *A factorization with update procedures for a KKT matrix arising in direct optimal control*, **Mathematical Programming Computation**, Vol 3(4), pp. 319–348
- Sager, S., Barth, C., Diedam, H., Engelhart, M., Funke, J., *Optimization as an analysis tool for human complex problem solving*, **SIAM Journal on Optimization**, Vol. 21(3), pp. 936–959
- Sager, S., Jung, M.N., Kirches, C., *Combinatorial integral approximation*, **Mathematical Methods for Operations Research**, Vol. 73(3), pp. 363–380

— Publications (continued) —

- 2010 • Logist, F., Sager, S., Kirches, C., Van Impe, J.F., *Efficient multiple objective optimal control of dynamic systems with integer controls*, **Journal of Process Control**, Vol. 20(7), 810–822
- Kirches, C., Sager, S., Bock, H.G., Schlöder, J.P., *Time-optimal control of automobile test drives with gear shifts*, **Optimal Control Applications and Methods**, Vol. 31(2), 137–153
- 2009 • Sager, S., Reinelt, G., Bock, H.G., *Direct methods with maximal lower bound for mixed-integer optimal control problems*, **Mathematical Programming**, Vol. 118(1), pp. 109–149
- Sager, S., *Reformulations and algorithms for the optimization of switching decisions in nonlinear optimal control*, **Journal of Process Control**, Vol. 19, pp. 1238–1247
- 2008 • Brandt-Pollmann, U., Winkler, R., Sager, S., Moslener, U., Schlöder, J.P., *Numerical solution of optimal control problems with constant control delays*, **Computational Economics**, Vol. 31(2), pp. 181–206
- Shaik, O.S., Sager, S., Slaby, O., Lebiedz, D., *Phase tracking and restoration of circadian rhythms by model-based optimal control*, **IET Systems Biology**, Vol. 2, pp. 16–23
- 2007 • Slaby, O., Sager, S., Shaik, O.S., Kummer, U., Lebiedz, D., *Optimal control of self-organized dynamics in cellular signal transduction*, **Mathematical and Computer Modelling of Dynamical Systems**, Vol. 13, pp. 487–502
- Sager, S., Brandt-Pollmann, U., Diehl, M., Lebiedz, D., Bock, H.G., *Exploiting system homogeneities in large scale optimal control problems for speedup of multiple shooting based SQP methods*, **Computers & Chemical Engineering**, Vol. 31, pp. 1181–1186
- 2006 • König, R., Schramm, G., Oswald, M., Seitz, H., Sager, S., Zapatka, M., Reinelt, G., Eils, R., *Discovering functional gene expression patterns in the metabolic network of *Escherichia coli* with wavelet transforms*, **BMC Bioinformatics**, 7:119
- 2005 • Lebiedz, D., Sager, S., Bock, H.G., Lebiedz, P., *Annihilation of limit-cycle oscillations by identification of critical perturbing stimuli via mixed-integer optimal control*, **Physical Review Letters**, 95, 108303
- Brandt-Pollmann, U., Lebiedz, D., Diehl, M., Sager, S., Schlöder, J.P., *Real-time nonlinear feedback control of pattern formation in (bio)chemical reaction-diffusion processes: A model study*, **Chaos**, 15, 033901, selected for online-publication in **Virtual Journal of Biological Physics Research**, July 15, 2005

15 Book Contributions (plus 1 submitted one)

- Subm • Borger, C., Kahle, T., Kretschmer, A., Sager, S., Schulze, J., *Liftings of Polynomial Systems Decreasing the Mixed Volume*, submitted to **European Math Soc. Volume “Varieties, Polyhedra Computation”**, <https://arxiv.org/abs/2105.10714>
- 2022 • Hahn, M., Kirches, C., Manns, P., Sager, S., Zeile, C., *Decomposition and approximation for PDE-constrained mixed-integer optimal control*, SPP1962 special issue Non-Smooth and Complementarity-Based Distributed Parameter Systems, Birkhäuser, pp. 283–306

— Publications (continued) —

- 2021 • Bethge, J., Findeisen, R., Le, D.D., Merkert, M., Rewald H., Sager, S., Savchenko, A., Sorgatz, S., *Mathematical Optimization and Machine Learning for Efficient Urban Traffic*, special volume “Mathematical Success Stories”
- Garmatter, D., Maggi, A., Wenzel, M., Monem, S., Hahn, M., Stoll, M., Sager, S., Benner, P., Sundmacher, K., *Power-to-Chemicals: A Superstructure Problem for Sustainable Syngas Production*, Mathematical Modeling, Simulation and Optimization for Power Engineering and Management, Springer, Cham, pp. 145–168
- 2017 • Himmel, A., Sager, S., Sundmacher, K., *Set point tracking of a biogas plant coupled to a methanation reactor*, Computer Aided Chemical Engineering, Vol. 40, pp. 1645–1650, <https://doi.org/10.1016/B978-0-444-63965-3.50276-2>
- Matke, C., Bienstock, D., Munoz, G., Yang, G., Kleinhans, D., Sager, S., *Robust optimization of power network operation: storage devices and the role of forecast errors in renewable energies*, Studies in Computational Intelligence, Complex Networks & Their Applications V, Springer, ISBN 978-3-319-50900-6, pp. 809–820
- Matke, C., Medjroubi, W., Kleinhans, D., Sager, S., *Structure Analysis of the German Transmission Network Using the Open Source Model SciGRID*, Trends in Mathematics, Advances in Energy System Optimization, Springer, ISBN 978-3-319-51795-7, pp. 177–188
- 2014 • Zanon, M., Frasch, J.V., Vukov, M., Sager, S., Diehl, M., *Model Predictive Control of Autonomous Vehicles*, Eds. Waschl, H., Kolmanovsky, I. Steinbuch, M., del Re, L., Optimization and Optimal Control in Automotive Systems, Springer, ISBN 978-3-319-05370-7, pp. 41–57
- 2013 • Jung, M.N., Kirches, C., Sager, S., *On perspective functions and vanishing constraints in mixed-integer nonlinear optimal control*, Eds. Jünger, M., Reinelt, G., Facets of Combinatorial Optimization, Springer, ISBN 978-3-642-38188-1, pp. 387–417
- 2012 • Bock, H.G., Potschka, A., Sager, S., Schlöder, J.P., *On the connection between forward and optimization problem in one-shot one-step methods*, in G. Leugering, S. Engell, A. Griewank, M. Hinze, R. Rannacher, V. Schulz, M. Ulbrich, and S. Ulbrich, editors, Constrained Optimization and Optimal Control for Partial Differential Equations, volume 160 of International Series of Numerical Mathematics, Springer, pp. 37–49
- Gerds, M., Sager, S., *Mixed-Integer DAE Optimal Control Problems: Necessary conditions and bounds*, Eds. Biegler, L., Campbell, S., Mehrmann, V., Control and Optimization with Differential-Algebraic Constraints, SIAM, ISBN 978-1-611972-24-5, pp. 189–212
- Sager, S., *A benchmark library of mixed-integer optimal control problems*, Springer, Eds. Lee, J., Leyffer, S., Mixed Integer Nonlinear Programming, The IMA Volumes in Mathematics and its Applications, Vol. 154, ISBN 978-1-4614-1926-6, pp. 631–670
- 2010 • Grüne, L., Sager, S., Allgöwer, F., Bock, H.G., Diehl, M., *Predictive planning and systematic action – on the control of technical processes*, Springer, Eds. Grötschel, M., Lucas, K., Mehrmann, V., Production Factor Mathematics, ISBN 978-3-6421-1247-8, pp. 9–38

— Publications (continued) —

- Kirches, C., Wirsching, L., Sager, S., Bock, H.G., *Efficient numerics for nonlinear model predictive control*, Springer, Eds. Diehl, M., Glineur, F., Jarlebring, E., Michiels, W., Recent Advances in Optimization and its Applications in Engineering, ISBN 978-3-6421-2597-3, pp. 339–359
- 2009 • Sager, S., Bock, H.G., Diehl, M., Reinelt, G., Schlöder, J.P., *Numerical methods for optimal control with binary control functions applied to a Lotka-Volterra type fishing problem*, Springer, Eds. Seeger, A., Recent Advances in Optimization, ISBN 978-3-5402-8257-0, pp. 269–289
- 2008 • Grüne, L., Sager, S., Allgöwer, F., Bock, H.G., Diehl, M., *Vorausschauend planen, gezielt handeln – über die Regelung und Steuerung technischer Prozesse*, acatech, Eds. Grötschel, M., Lucas, K., Mehrmann, V., Produktionsfaktor Mathematik, ISBN 978-3-8167-7642-0, pp. 27–62

20 Peer-Reviewed Proceedings Publications

- 2023 • Ghezzi, A., Simpson, L., Bürger, A., Zeile, C., Sager, S., Diehl, M., *A Voronoi-Based Mixed-Integer Gauss-Newton Algorithm for MINLP Arising in Optimal Control*, **ECC2023**
- Martensen, C.J., Plate, C., Keßler, T., Kunde, C., Kaps, L., Kienle, A., Seidel-Morgenstern, A., Sager, S., *Towards Machine Learning of Power-2-Methanol Processes*, **ESCAPE2023**
- 2020 • Bürger, A., Zeile, C., Hahn, M., Altmann-Dieses, A., Sager, S., Diehl, M., *pycombina: An Open-Source Tool for Solving Combinatorial Approximation Problems arising in Mixed-Integer Optimal Control*, **IFAC-PapersOnLine**, Vol. 53 (2), pp. 6502–6508
- 2018 • Bürger, A., Zeile, C., Altmann-Dieses, A., Sager, S., Diehl, M., *An Algorithm for Mixed-Integer Optimal Control of Solar Thermal Climate Systems with MPC-capable runtime*, **ECC 2018**
- 2017 • Zeile, C., Rauwolf, T., Schmeisser, A., Weber, T., Sager, S., *The Influence of Right Ventricular Afterload in Cardiac Resynchronization Therapy: A CircAdapt Study*, **Computing in Cardiology 2017**
- 2016 • Jost, F., Rinke, K., Fischer, T., Schalk, E., Sager, S., *Patient specific sampling decisions by optimum experimental designs for Leukopenia*, **IFAC-PapersOnLine**, Vol. 49 (26), pp. 344–349
- Rinke, K., Jost, F., Findeisen, R., Fischer, T., Bartsch, R., Schalk, E., Sager, S., *Parameter estimation for leukocyte dynamics after chemotherapy*, **IFAC-PapersOnLine**, Vol. 49 (26), pp. 44–49
- Thuy T. T. Le, Binh D. Truong, Cuong P. Le, Sebastian Sager, *On the power optimization of the vibration-based energy harvesters under swept input acceleration*, **IEEE SENSORS**, Orlando, FL
- Zeile, C., Scholz, E., Sager, S., *A Simplified 2D Heart Model of the Wolff-Parkinson-White Syndrome*, **IFAC-PapersOnLine**, Vol. 49 (26), pp. 26–31
- 2013 • Frasch, J.V., Gray, A.J., Zanon, M., Ferreau, H.J., Sager, S., Borrelli, F., Diehl, M., *An Auto-generated Nonlinear MPC Algorithm for Real-Time Obstacle Avoidance of Ground Vehicles*, **ECC 2013**
- Huschto, T., Sager, S., *Stochastic Optimal Control in the Perspective of the Wiener Chaos*, **ECC 2013**
- Kirches, C., Bock, H.G., Schlöder, J.P., Sager, S., *Mixed-integer NMPC for predictive cruise control of heavy-duty trucks*, **ECC 2013**

— Publications (continued) —

- 2012 • Frasch, J.V., Wirsching, L., Sager, S., Bock, H.G., *Mixed-Level Iteration Schemes for Nonlinear Model Predictive Control*, Proceedings of the **4th IFAC NMPC Conference**, Eds. Lazar, M., Allgöwer, F.
- Kirches, C., Bock, H.G., Schlöder, J.P., Sager, S., *Complementary Condensing for the Direct Multiple Shooting Method, Modeling, Simulation, and Optimization of Complex Processes*, **HPSC 2009**, Springer, pp. 195–206
- 2011 • Kehrle, F., Frasch J.V., Kirches, C., Sager, S., *Optimal control of Formula 1 race cars in a VDrift based virtual environment*, **IFAC World Congress 2011**, Paper ThB21.2, Milano
- 2010 • Sager, S., Barth, C., Diedam, H., Engelhart, M., Funke, J., *Optimization to measure performance in the Tailorshop test scenario — structured MINLPs and beyond*, Proceedings **EWMINLP10**, pp. 261–269, CIRM, Marseille
- 2008 • S. Sager, C. Kirches, H.G. Bock, *Fast solution of periodic optimal control problems in automobile test-driving with gear shifts*, **IEEE CDC08 Proceedings**, ISBN: 978-1-4244-3124-3
- 2007 • Sager, S., Diehl, M., Singh, G., Küpper, A., Engell, S., *Determining SMB superstructures by mixed-integer optimal control*, Proceedings OR 2006, Eds. K.-H. Waldmann, U.M. Stocker, Springer, pp. 37–44
- 2006 • Lebiedz, D., Sager, S., Shaik, O.S., Slaby, O., *Optimal control of self-organized dynamics in cellular signal transduction*, Proceedings of the 5th Vienna Symposium of Mathematical Modeling, Vienna, Argesim Rep. 30
- 2005 • Körkel, S., Qu, H., Rücker, G., Sager, S., *Derivative Based vs. Derivative Free Optimization Methods for Nonlinear Optimum Experimental Design*, Proceedings of HPCA2004 Conference, pp. 339–345, Springer, Shanghai

5 Popular Science Publications

- 2018 • Sager, S., *Optimization and Clinical Decision Support*, **Optima**, 104, pp. 1–8
- Sager, S., *Optimierung und Klinische Entscheidungsunterstützung*, **Mitteilungen der Deutschen Mathematiker-Vereinigung**, 26, pp. 101–111
- 2011 • Frasch, J., Janka, D., Kircheis, R., Sager, S., *Das Rucksackproblem der Bundesligamanager*, **OR News**, 43, pp. 6–9
- 2007 • Sager, S., *Von diskreten Mathematikern und Wanderungen im Gebirge*, **Bild der Wissenschaft plus**, Vol. 11, pp. 12–15, available at http://www.klaus-tschira-preis.info/download/2007/BDW_KTP_2007.pdf
- 2006 • Sager, S., *Numerische Methoden für Probleme der gemischt-ganzzahligen Optimalen Steuerung*, **OR News**, 28, pp. 30–31

— Publications (continued) —

Reviewing Activities

- Advances in Computational Mathematics, Applied Mathematics and Optimization, Automatica, CDC, Computational and Mathematical Methods in Medicine, Computational Optimization and Applications, Computer Methods and Programs in Biomedicine, Computers and Chemical Engineering, Discrete Optimization, Environmental Modelling and Software, European Journal of Operational Research, IEEE TAC, IFAC, Industrial & Engineering Chemistry Research, INFORMS Journal on Computing, Int J. of Biomathematics, Journal of Biological Systems, Journal of Global Optimization, Journal of Process Control, MMOR, Mathematical Programming, Open Applied Mathematics Journal, OCAM, Optimization, Optimization and Engineering, Scientific Reports, SICON
- Alexander von Humboldt Foundation
- Deutsche Forschungsgemeinschaft
- Dutch National Science Foundation
- Klaus Tschira Foundation