

CV Peter Benner December 15, 2024

Affiliations

Primary:

Department “Computational Methods in Systems and Control Theory”
Max Planck Institute for Dynamics of Complex Technical Systems
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Secondary :

Institut für Analysis und Numerik (IAN)
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Otto von Guericke University Magdeburg
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Education

- 2001 Habilitation (*venia legendi*) in Mathematics, University of Bremen (Germany)
- 1997 Dr. rer. nat. (Ph.D.) in Mathematics, Technische Universität Chemnitz-Zwickau (Germany)
- 1993 *Diplom* in Mathematics with minor in Economics, RWTH Aachen (Germany)

Career

- 2025-2026 & 2021-2022 Managing Director of the Max Planck Institute for Dynamics of Complex Technical Systems (MPI DCTS), Magdeburg
- 2021-2026 Member of the Board of the Mathematical Research Data Initiative (MaRDI)
- since 2021 Member of the Board of Directors of the Research Center “Dynamic Systems: Systems Engineering” at Otto von Guericke University Magdeburg
- 2020-2025 Member of the Project Management Board of NFDI4Cat – Digital Catalysis
- 2017-2023 Chair of Max Planck network “BiGmax: MaxNet on Big-Data-Driven Materials Science”
- since 2017 Member of the Management Board of the DFG Research Training Group 2297 “Mathematical Complexity Reduction”, Magdeburg
- 2013-2014 Managing Director of the MPI DCTS, Magdeburg
- since 2011 *Honorary professor* (Adjunct Professor), Otto von Guericke University Magdeburg
- since 2010 Member of the Management Board of the International Max Planck Research School “ProEng - Advanced Methods in Process and Systems Engineering”, Magdeburg
- since 2010 Director and Scientific Member of the MPI DCTS, Magdeburg
- 2010-2023 Head of research group “Mathematics in Industry and Technology”, TU Chemnitz
- 2003-2010 Full Professor for Mathematics in Industry and Technology, TU Chemnitz
- 2002-2003 Lecturer at the Institute for Mathematics, TU Berlin
- 2001-2002 Visiting Associate Professor, TU Hamburg-Harburg
- 1997-2001 Assistant Professor at the Center for Industrial Mathematics, University of Bremen
- 1994-1996 Research Assistant, Department of Mathematics, TU Chemnitz-Zwickau
- 1993 Graduate Teaching Assistant, Department of Mathematics, University of Kansas
- 1991-1993 Software developer, Hille Engineering GmbH, Aachen

Honors and Services to the Community

- 2024-2028 Spokesperson of DFG¹ Review Board 3.31 “Mathematics”
- since 2023 Editor-in-Chief, *Computational Science and Engineering* (SpringerNature)
- since 2023 Member of the Board of Trustees of the Center for Industrial Mathematics (ZeTeM) at the University of Bremen

¹ German Science Foundation

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| since 2023 | Member of the Advisory Board of the Energy Innovation Center (EIZ) at BTU Cottbus-Senftenberg |
| 2021–2026 | Member of the Board of Trustees of the Fraunhofer Institute for Industrial Mathematics (ITWM), Kaiserslautern |
| 2020–2028 | Elected member of the DFG Review Board 3.31 “Mathematics” |
| since 2020 | Member of the editorial board of <i>Calcolo</i> |
| since 2019 | Member of the editorial board of <i>Mathematical Control and Related Fields</i> |
| 2019–2022 | Member of the editorial board of <i>Numerical Algorithms</i> |
| since 2019 | Member of SIAM ² Book Committee and editorial board of book series <i>SIAM Spotlights</i> (chair since 07/2022) |
| 2019–2021 | Member of the SIAM Council (2021 Member of its Executive Committee) |
| 2017–2019 | Member of the SIAM Fellow Selection Committee |
| since 2018 | Member Selection Committee of the Max Planck Society <i>Lise Meitner Excellence Program</i> |
| 2018, 2023 | J. Tinsley Oden Faculty Fellow at University of Texas in Austin |
| since 2017 | SIAM Fellow (Class of 2017) |
| since 2017 | Member of the editorial board of <i>Electronic Transactions on Numerical Analysis</i> |
| since 2016 | Member of the editorial board of <i>Advances in Computational Mathematics</i> |
| since 2015 | Member of the editorial board of <i>ScienceOpen</i> |
| 2015, 2016 | Distinguished Professor at Shanghai University |
| 2014–2017 | Member of the selection committee for the SIAM W. T. and Idalia Reid Prize |
| since 2013 | GAMM ³ delegate, International Council for Industrial and Applied Mathematics (ICIAM) |
| 2013–2019 | Member of the Max Planck Research Group Leader Selection Committee |
| 2012–2020 | Member of the council of the European Mathematical Society (EMS) |
| 2011–2016 | Member of the GAMM Managing Board |
| 2010 | Guest Professorship Université du Littoral Côte d’Opale, Calais (France) |
| 2009–2013 | Chair of the GAMM Activity Group <i>Applied and Numerical Linear Algebra</i> |
| 2008–2015 | Member of the editorial board of <i>Numerical Linear Algebra with Applications</i> |
| 2005–2019 | Associate Editor of <i>SIAM Journal on Matrix Analysis and Applications</i> |
| 2003–2008 | Member of the editorial board of the SIAM book series <i>Fundamentals of Algorithms</i> |
| 1996 | DAAD Visiting Fellow University of Kansas in Lawrence and University of California at Davis |
| 1994 | Scholarship of the Ministry of Science and Arts of the federal state Saxony |
| 1993 | Springorum-Denkünze of RWTH Aachen for excellent diploma thesis |

Organization of Conferences and Workshops (selected activities)

- Chair of Organization Committee: *GAMM Annual Meeting*, Magdeburg, March 18–22, 2024
- Member of the Executive Committee of *Model Reduction and Surrogate Modeling (MORE)*, Berlin (2022), San Diego (2024), Milano (2026) – merger of the MODRED and MoRePaS workshop series
- Member of the Steering Committee of the *Matrix Equations and Tensor Techniques (METT)* workshops, METT XI will be held in Leuven, Belgium, January 7–9, 2026.
- Member of the Steering Committee of the *Model Reduction of Complex Dynamical Systems (MODRED)* workshops, 2010 (Berlin), Magdeburg (2013), Odense (2017), Graz (2019).
- Member of the Executive and Scientific Committees of the *Model Reduction of Parametrized Systems (MoRePaS)* workshops, Günzburg (2012), Trieste (2015), Nantes (2018).
- Member of the Scientific Advisory and Programme Committee of the *European Conference on Computational Optimization (EUCCO)* since 2012, EUCCO 2025 will be held in Klagenfurt.
- Scientific Committee member for the *European Conference on Numerical Mathematics and Advanced Applications (ENUMATH)* 2013–2023
- Scientific Committee member of the 2012 *SIAM Conference on Applied Linear Algebra*, Valencia
- Co-chair, 17th Conference of the International Linear Algebra Society (ILAS), 2011, Braunschweig

² SIAM – Society for Industrial and Applied Mathematics

³ GAMM – *Gesellschaft für Angewandte Mathematik und Mechanik* (Association for Applied Mathematics and Mechanics)

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Research Interests

- Scientific Machine Learning
- Numerical Linear and Multilinear Algebra, with a particular interest in linear and nonlinear eigenvalue problems, preconditioning of linear systems with block structure, matrix equations, low-rank tensor approximation and calculus
- Model Order Reduction and Reduced-order Modeling
- Numerical Methods in Systems and Control Theory
- Optimal and Feedback Control of Partial Differential Equations
- High-performance and Power-aware Computing
- Mathematical Software

Application areas include Computational Nanoelectronics/Circuit Simulation, Computational Electromagnetics, Micro-Electro-Mechanical Systems (MEMS), Computational Fluid Dynamics, Process Engineering, Machine Tool Design, Energy Networks, and Computational Physics/Chemistry.

Publications

More than 700, including 13 edited books, 3 research monographs, 311 articles in journals with peer review, more than 100 book chapters, and more than 200 articles in conference proceedings (mostly with peer review), a full list is available at

<https://www.mpi-magdeburg.mpg.de/csc/publications/benner>

Citation Indices

h-index: 63 (Google scholar, 19799 citations), 38 (Scopus, 7891 citations), 34 (WoS, 6306 citations)

10 Selected Papers (chronological order)

- Kirandeep Kour, Sergey Dolgov, Martin Stoll, and Peter Benner, *Efficient Structure-preserving Support Tensor Train Machine*. Journal of Machine Learning Research **24**, No. 4 (2023), 1-22.
- Mohammad S. Khorrami, Jaber R. Mianroodi, Nima H. Siboni, Pawan Goyal, Bob Svendsen, Peter Benner, and Dierk Raabe, *An Artificial Neural Network for Surrogate Modeling of Stress Fields in Viscoplastic Polycrystalline Materials*. npj Computational Materials **9**, Issue 1 (2023), Art. 37.
- Peter Benner and Pawan K. Goyal, *Discovery of Nonlinear Dynamical Systems using a Runge-Kutta Inspired Dictionary-based Sparse Regression Approach*. Proceedings of the Royal Society A **478**, Issue 2262 (2022), Art. 20210883.
- Peter Benner, Serkan Gugercin, Karen Willcox, *A Survey of Projection-Based Model Reduction Methods for Parametric Dynamical Systems*. SIAM Review **57**, No. 4 (2015), 483–531.
- Peter Benner, Tobias Breiten, *Two-Sided Projection Methods for Nonlinear Model Order Reduction*. SIAM Journal on Scientific Computing, **37**, No. 2 (2015), B239–B260.
- Peter Benner, Tobias Damm, *Lyapunov Equations, Energy Functionals, and Model Order Reduction of Bilinear and Stochastic Systems*. SIAM Journal on Control and Optimization **49**, No. 2 (2011), 686–711.
- Peter Benner, Jing-Rebecca Li, Thilo Penzl, *Numerical Solution of Large Lyapunov Equations, Riccati Equations, and Linear-Quadratic Control Problems*. Numerical Linear Algebra with Applications **15**, No. 9 (2008), 755–777.
- Peter Benner, Enrique S. Quintana-Ortí, *Solving Stable Generalized Lyapunov Equations with the Matrix Sign Function*. Numerical Algorithms **20**, No. 1 (1999), 75–100.
- Peter Benner, Volker Mehrmann, Hongguo Xu, *A Numerically Stable, Structure Preserving Method for Computing the Eigenvalues of Real Hamiltonian or Symplectic Pencils*. Numerische Mathematik **78**, No. 3 (1998), 329–358.
- Peter Benner, Heike Faßbender, *An Implicitly Restarted Symplectic Lanczos Method for the Hamiltonian Eigenvalue Problem*. Linear Algebra and its Applications **263** (1997), 75–111.

Teaching

- Courses taught at University of Kansas, University of Bremen, TU Hamburg-Harburg, TU Berlin, TU Chemnitz, Otto von Guericke University Magdeburg, Shanghai University, including
 - Linear Algebra I + II (for mathematicians)

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- Numerical Analysis (introductory courses for mathematicians, computer scientists, engineers)
- Numerical Methods for Ordinary / Partial Differential Equations
- Numerical Linear Algebra / Advanced Numerical Linear Algebra
- Geometric Integration Methods
- Model Order Reduction
- Mathematical Systems and Control Theory
- Optimal Control
- Engineering Mathematics I – III
- Lecturer at various summer schools, including
 - Gene Golub SIAM Summer School 2013 “Matrix Functions and Matrix Equation”, Fudan University, Shanghai, China
 - LMS-EP SRC Durham Symposium 2017 “Model Order Reduction”
 - ICERM special semester “Model and dimension reduction in uncertain and dynamic systems” 2020

Supervision

- 21 Diplom/Master theses
- 33 Ph.D. theses, 8 on-going; 25 external reviews
- 1 Habilitation (Martin Stoll, 2016); 2 external reviews; 1 in review
- 44 PostDocs

Selected Key Projects

- 2021-2026 MaRDI: *Mathematical Research Data Initiative*, a consortium within the National Research Data Initiative (NFDI), 640,000€ (of 10M€ in total) **[co-applicant]**
- 2020-2025 NFDI4Cat: *NFDI for Catalysis-Related Sciences*, a consortium within the NFDI, 405,000€ (of 10.1M€ in total) **[co-applicant]**
- 2017-2023 BiGmax: MaxNet on “Big-Data-Driven Materials Science” (Max Planck Society, 6 M€ in total) **[chair]**
- 2017-2026 DFG Research Training Group 2297 “Mathematical Complexity Reduction” (9.2 M€ in total)
- 2016-2021 MathEnergy: *Mathematical Key Technologies for Energy Networks*, funded by BMWi (German Ministry for Economics and Energy), 600,000€ (of 6 M€ in total)
- 2014-2018 EU-MORNET: *European Model Reduction Network*, funded by COST (European Co-operation in Science and Technology), 500,000€ for networking activities **[co-chair]**
- 2013-2016 nanoCOPS: *Nanoelectronic Coupled Problems Solutions*, funded by EU FP7 (STREP), 348,000€ (of 3.5 M€ in total)
- 2011-2023 Sub-project A6 “Model Order Reduction” within DFG Collaborative Research Center TR96, “Thermo-Energetic Design of Machine Tools”, funded by DFG, ca. 920,000€
- 2010-2014 MoreSim4Nano: *Model Reduction for fast Simulation of new Semiconductor Structures within Nanotechnology and Microsystems Technology*, funded by BMBF (German Ministry of Research and Education), 155,000€ (of 930,000€ in total) **[network coordinator]**
- 2007-2010 SyreNe: *System Reduction for Nanoscale IC Design*, funded by BMBF, ca. 150,000€ (of 911,000€ in total) **[network coordinator]**
- 2006-2013 *Optimal Control-Based Feedback Stabilization in Multi-Field Flow Problems*, funded by DFG, Priority Program 1253, “Optimization with PDEs”, ca. 220,000€