

## 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)

Faculty of Mathematics

Otto von Guericke University Magdeburg

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39106 Magdeburg (Germany)

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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

2021-2022 Managing Director of the Max Planck Institute for Dynamics of Complex Technical Systems (MPI DCTS), Magdeburg

since 2021 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

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

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

since 2023 Member of the Advisory Board of the Energy Innovation Center (EIZ) at BTU Cottbus-Senftenberg

**CV** Peter Benner

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 331 “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 <sup>1</sup> 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 of the 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 <sup>2</sup> delegate, International Council for Industrial and Applied Mathematics (ICIAM)
since 2013	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 Fellowship for research visits to University of Kansas in Lawrence and University of California at Davis
1994	Scholarship of the Saxonian Ministry of Science and Arts
1993	Springorum-Denkmünze 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 and Scientific Committees of *Model Reduction and Surrogate Modeling (MORE)*, Berlin (2022), San Diego (2024) – merger of the MODRED and MoRePaS workshop series
- Member of the Steering Committee of the *Matrix Equations and Tensor Techniques (METT)* workshops, METT X was held in Aachen, September 13–15, 2023.
- 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)* since 2013
- Scientific Committee member of the 2012 *SIAM Conference on Applied Linear Algebra*, Valencia
- Co-chair, 17<sup>th</sup> Conference of the International Linear Algebra Society (ILAS), 2011, Braunschweig

<sup>1</sup> SIAM – Society for Industrial and Applied Mathematics

<sup>2</sup> GAMM – *Gesellschaft für Angewandte Mathematik und Mechanik* (Association for Applied Mathematics and Mechanics)

## 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 600, including 13 edited books, 3 research monographs, 290 articles in journals with peer review, more than 100 book chapters, and more than 180 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:** 60 (Google scholar, 17923 citations), 37 (Scopus, 6962 citations), 33 (WoS, 5623 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, Art. 37 (2023).
- Peter Benner, Venera Khoromskaia, Boris N. Khoromskij, *Range-Separated Tensor Format for Many-Particle Modeling*. SIAM Journal on Scientific Computing **40**, No. 2 (2017), A1034–A1062.
- 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)
  - Numerical Analysis (introductory courses for mathematicians, computer scientists, engineers)

**CV** Peter Benner

- 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-EPSRC Durham Symposium 2017 “Model Order Reduction”
  - ICERM special semester “Model and dimension reduction in uncertain and dynamic systems” 2020

**Supervision**

- 21 Diplom/Master theses
- 31 Ph.D. theses, 8 on-going; 22 external reviews
- 1 Habilitation (Martin Stoll, 2016); 2 external reviews
- 41 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<sup>3</sup> 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€

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<sup>3</sup> German Science Foundation