

# Steffen W. R. Werner

*Curriculum Vitae as of July 11, 2021*



Born September 6, 1992 in Stendal, Germany

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## Contact

Address Max Planck Institute for Dynamics of Complex Technical Systems  
Sandtorstr. 1

39106 Magdeburg, Germany

Phone +49 (0)391 6110 484

Email [werner@mpi-magdeburg.mpg.de](mailto:werner@mpi-magdeburg.mpg.de)

URL <https://ninsteve.github.io/>

ORCID 0000-0003-1667-4862

Google Scholar <https://scholar.google.de/citations?user=F2v1uKAAAAAJ&hl=en>

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## Education

since 10/2016 **Doctoral Studies, Mathematics**, *Otto von Guericke University*, Magdeburg, Germany.

- 10/2016–09/2019: Project research in the Priority Program 1897 “Calm, Smooth and Smart – Novel Approaches for Influencing Vibrations by Means of Deliberately Introduced Dissipation”.
- since 04/2017: Associated researcher in the Research Training Group 2297 “MathCoRe”, Magdeburg.

10/2014–09/2016 **Master of Science, Mathematics**, *Otto von Guericke University*, Magdeburg, Germany, very good with distinction.

Thesis: *Hankel-Norm Approximation of Descriptor Systems* [27]

10/2011–09/2014 **Bachelor of Science, Mathematics**, *Otto von Guericke University*, Magdeburg, Germany, very good with distinction.

Thesis: *Numerische Berechnung der Eigenwerte großer Hamiltonisch-positiver Matrizen* [28]

07/2011 **Abitur (university entrance diploma)**, *Diesterweg-Gymnasium*, Tangermünde-Havelberg, Germany.

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## Professional Experience

- since 10/2016 **Doctoral researcher**, *Computational Methods in Systems and Control Theory*, Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany.
- 05/2016–09/2016, 10/2014–01/2016 **Student employee**, *Computational Methods in Systems and Control Theory*, Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany.
- Development and maintenance of MATLAB toolboxes and codes
- 01/2016–04/2016 **Industrial intern**, *proALPHA Business Solutions GmbH*, Weilerbach, Germany.
- Analysis of modern version control systems
  - Application programming
- 10/2013–09/2014 **Student employee**, *Otto von Guericke University*, Magdeburg, Germany.
- Tutor for mathematical courses
  - Tutor for the consultation of the Department of Mathematics

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## Research Interests

model order reduction, mathematical software, differential-algebraic equations, mechanical systems, matrix equations, numerical linear algebra, scientific computing

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## Publications

### Submitted

- [1] P. Benner, J. Heiland, and S. W. R. Werner. Robust output-feedback stabilization for incompressible flows using low-dimensional  $\mathcal{H}_\infty$ -controllers. e-print 2103.01608, arXiv, 2021. math.OC. URL: <https://arxiv.org/abs/2103.01608>.
- [2] R. S. Beddig, P. Benner, I. Dorschky, T. Reis, P. Schwerdtner, M. Voigt, and S. W. R. Werner. Structure-preserving model reduction for dissipative mechanical systems. e-print 2010.06331, arXiv, 2020. math.OC. URL: <https://arxiv.org/abs/2010.06331>.
- [3] P. Benner and S. W. R. Werner. MORLAB – the Model Order Reduction LABoratory. e-print 2002.12682, arXiv, 2020. cs.MS. URL: <https://arxiv.org/abs/2002.12682>.

### Journal Articles

- [4] P. Benner, S. Gugercin, and S. W. R. Werner. Structure-preserving interpolation for model reduction of parametric bilinear systems. *Automatica J. IFAC*, 132:109799, 2021. doi:10.1016/j.automatica.2021.109799.
- [5] P. Benner, S. Gugercin, and S. W. R. Werner. Structure-preserving interpolation of bilinear control systems. *Adv. Comput. Math.*, 47(3):43, 2021. doi:10.1007/s10444-021-09863-w.
- [6] P. Benner and S. W. R. Werner. Frequency- and time-limited balanced truncation for large-scale second-order systems. *Linear Algebra Appl.*, 623:68–103, 2021. Special

issue in honor of P. Van Dooren, Edited by F. Dopico, D. Kressner, N. Mastronardi, V. Mehrmann, and R. Vandebril. doi:10.1016/j.laa.2020.06.024.

- [7] P. Benner and S. W. R. Werner. Hankel-norm approximation of large-scale descriptor systems. *Adv. Comput. Math.*, 46(3):40, 2020. doi:10.1007/s10444-020-09750-w.
- [8] J. Saak, D. Siebelts, and S. W. R. Werner. A comparison of second-order model order reduction methods for an artificial fishtail. *at-Automatisierungstechnik*, 67(8):648–667, 2019. doi:10.1515/auto-2019-0027.

### Conference Proceedings

- [9] P. Benner and S. W. R. Werner. MORLAB – A model order reduction framework in MATLAB and Octave. In A. M. Bigatti, J. Carette, J. H. Davenport, M. Joswig, and T. de Wolff, editors, *Mathematical Software – ICMS 2020*, volume 12097 of *Lecture Notes in Comput. Sci.*, pages 432–441. Springer International Publishing, Cham, 2020. doi:10.1007/978-3-030-52200-1\_43.
- [10] P. Benner and S. W. R. Werner. Frequenz- und zeitbeschränktes balanciertes Abschneiden für Systeme zweiter Ordnung. In T. Meurer and F. Woittennek, editors, *Tagungsband GMA-FA 1.30 'Modellbildung, Identifikation und Simulation in der Automatisierungstechnik' und GMA-FA 1.40 'Systemtheorie und Regelungstechnik', Workshops in Anif, Salzburg, 23.-27.09.2019*, pages 460–474, 2019. URL: <http://www.control.tf.uni-kiel.de/files/gma/2019/Tagungsband2019.pdf>.
- [11] P. Benner and S. W. R. Werner. MORLAB – Model Order Reduction LABoratory. In T. Meurer and F. Woittennek, editors, *Tagungsband GMA-FA 1.30 'Modellbildung, Identifikation und Simulation in der Automatisierungstechnik' und GMA-FA 1.40 'Systemtheorie und Regelungstechnik', Workshops in Anif, Salzburg, 23.-27.09.2019*, pages 337–342, 2019. URL: <http://www.control.tf.uni-kiel.de/files/gma/2019/Tagungsband2019.pdf>.
- [12] R. S. Beddig, P. Benner, I. Dorschky, T. Reis, P. Schwerdtner, M. Voigt, and S. W. R. Werner. Model reduction for second-order dynamical systems revisited. *Proc. Appl. Math. Mech.*, 19(1):e201900224, 2019. doi:10.1002/pamm.201900224.
- [13] P. Benner, J. Heiland, and S. W. R. Werner. Robust controller versus numerical model uncertainties for stabilization of Navier-Stokes equations. *IFAC-PapersOnLine*, 52(2):25–29, 2019. 3rd IFAC/IEEE CSS Workshop on Control of Systems Governed by Partial Differential Equation CPDE 2019. doi:10.1016/j.ifacol.2019.08.005.
- [14] P. Benner and S. W. R. Werner. Balancing related model reduction with the MORLAB toolbox. *Proc. Appl. Math. Mech.*, 18(1):e201800083, 2018. doi:10.1002/pamm.201800083.
- [15] P. Benner and S. W. R. Werner. Model reduction of descriptor systems with the MORLAB toolbox. *IFAC-PapersOnLine 9th Vienna International Conference on Mathematical Modelling MATHMOD 2018, Vienna, Austria, 21–23 February 2018*, 51(2):547–552, 2018. doi:10.1016/j.ifacol.2018.03.092.

- [16] P. Benner and S. W. R. Werner. MORLAB – Modellreduktion in MATLAB. In T. Meurer and F. Woittennek, editors, *Tagungsband GMA-FA 1.30 'Modellierung, Identifikation und Simulation in der Automatisierungstechnik' und GMA-FA 1.40 'Theoretische Verfahren der Regelungstechnik', Workshop in Anif, Salzburg, 18.-22.09.2017*, pages 508–517, 2017. URL: <http://www.control.tf.uni-kiel.de/files/gma/2017/Tagungsband2017.pdf>.
- [17] P. Benner and S. W. R. Werner. On the transformation formulas of the Hankel-norm approximation. *Proc. Appl. Math. Mech.*, 17(1):823–824, 2017. doi:10.1002/pamm.201710379.

### Software

- [18] P. Benner and S. W. R. Werner. SOLBT – Limited balanced truncation for large-scale sparse second-order systems (version 3.0), April 2021. doi:10.5281/zenodo.4600763.
- [19] P. Benner and S. W. R. Werner. SOMDDPA – Second-Order Modally-Damped Dominant Pole Algorithm (version 2.0), April 2021. doi:10.5281/zenodo.3997649.
- [20] P. Benner and S. W. R. Werner. SOMDDPA – Second-Order Modally-Damped Dominant Pole Algorithm (version 1.1), 2020. doi:10.5281/zenodo.3332706.
- [21] P. Benner and S. W. R. Werner. Limited balanced truncation for large-scale sparse second-order systems (version 2.0), 2020. doi:10.5281/zenodo.3331592.
- [22] P. Benner and S. W. R. Werner. MORLAB – Model Order Reduction LABORatory (version 5.0), 2019. see also: <http://www.mpi-magdeburg.mpg.de/projects/morlab>. doi:10.5281/zenodo.3332716.
- [23] P. Benner and S. W. R. Werner. Limited balanced truncation for large-scale sparse second-order systems (version 1.0), 2019. doi:10.5281/zenodo.2553926.
- [24] P. Benner and S. W. R. Werner. SOMDDPA – Second-Order Modally Damped Dominant Pole Algorithm (version 1.0), 2019. doi:10.5281/zenodo.2553902.
- [25] P. Benner and S. W. R. Werner. MORLAB – Model Order Reduction LABORatory (version 4.0), 2018. see also: <http://www.mpi-magdeburg.mpg.de/projects/morlab>. doi:10.5281/zenodo.1574083.
- [26] P. Benner and S. W. R. Werner. MORLAB-3.0 – model order reduction laboratory, 2017. see also: <http://www.mpi-magdeburg.mpg.de/projects/morlab>. doi:10.5281/zenodo.842659.

### Theses

- [27] S. Werner. Hankel-norm approximation of descriptor systems. Master's thesis, Otto-von-Guericke-Universität, Magdeburg, Germany, 2016. doi:10.25673/4507.
- [28] S. Werner. Numerische Berechnung der Eigenwerte großer Hamiltonisch-positiver Matrizen. Bachelor's thesis, Otto-von-Guericke-Universität, Magdeburg, Germany, 2014.

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## Contributions to Other Projects

I made contributions to the content of the following software projects:

- J. Saak, M. Köhler, and P. Benner. M-M.E.S.S.-2.1 – The Matrix Equations Sparse Solvers Library, April 2021. see also: <https://www.mpi-magdeburg.mpg.de/projects/mess>. doi:10.5281/zenodo.4719688.
- J. Saak, M. Köhler, and P. Benner. M-M.E.S.S.-2.0.1 – The Matrix Equations Sparse Solvers Library, February 2020. see also: <https://www.mpi-magdeburg.mpg.de/projects/mess>. doi:10.5281/zenodo.3606345.
- J. Saak, M. Köhler, and P. Benner. M-M.E.S.S.-2.0 – The Matrix Equations Sparse Solvers Library, August 2019. see also: <https://www.mpi-magdeburg.mpg.de/projects/mess>. doi:10.5281/zenodo.3368844.
- J. Saak, M. Köhler, and P. Benner. M-M.E.S.S.-1.0.1 – The Matrix Equations Sparse Solvers Library, April 2016. see also: <https://www.mpi-magdeburg.mpg.de/projects/mess>. doi:10.5281/zenodo.50575.

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## Presentations

- 24/06/2021 **Structure-Preserving Interpolation for Bilinear Systems**, *8th European Congress of Mathematics (8ECM)*, Portorož, Slovenia, (invited minisymposium talk, online conference).
- 16/03/2021 **Structure-Preserving Model Reduction for Bilinear Systems**, *91st GAMM Annual Meeting, Section “Dynamics and Control” (GAMM 2020@21)*, Kassel, Germany, (online conference).
- 11/01/2021 **Model Reduction of Parametric Bilinear Mechanical Systems**, *14th World Congress in Computational Mechanics and ECCOMAS Congress (WCCM-ECCOMAS 2020)*, Paris, France, (online conference).
- 16/07/2020 **MORLAB – A Model Order Reduction Framework in MATLAB & Octave**, *International Congress on Mathematical Software (ICMS 2020)*, Braunschweig, Germany, (online conference).
- 20/05/2020 **Structure-Preserving Interpolation for Bilinear Control Systems**, *Weekly Fellow Seminar Series of “MathCoRe”*, Magdeburg, Germany, (online seminar).
- 25/09/2019 **Frequenz- und zeitbeschränktes balanciertes Abschneiden für Systeme zweiter Ordnung**, *Meeting of the GMA Fachausschuss 1.30 “Modellbildung, Identifikation und Simulation in der Automatisierungstechnik” and GMA Fachausschuss 1.40 “Systemtheorie und Regelungstechnik”*, Anif, Austria.
- 25/09/2019 **MORLAB – Model Order Reduction LABoratory**, *Meeting of the GMA Fachausschuss 1.30 “Modellbildung, Identifikation und Simulation in der Automatisierungstechnik” and GMA Fachausschuss 1.40 “Systemtheorie und Regelungstechnik”*, Anif, Austria, (interactive software session).
- 10/09/2019 **Limited Model Reduction for an Artificial Fishtail**, *Meeting of the European SIAM and GAMM Student Chapters (MESIGA 2019)*, Aachen, Germany.
- 30/08/2019 **Frequency- and Time-Limited Balanced Truncation for Second-Order Systems**, *4th Workshop on Model Reduction of Complex Dynamical Systems (MODRED 2019)*, Graz, Austria.

- 26/06/2019 **How to Reduce the Model of an Artificial Fishtail**, *Weekly Fellow Seminar Series of "MathCoRe"*, Magdeburg, Germany.
- 20/05/2019 **Robust Controller versus Numerical Model Uncertainties for Stabilization of Navier-Stokes Equations**, *3rd IFAC/IEEE CSS Workshop on Control of Systems Governed by Partial Differential Equations CPDE and XI Workshop Control of Distributed Parameter Systems, CDPS 2019*, Oaxaca, Mexico, (invited session talk).
- 28/02/2019 **H-Infinity Balanced Truncation for Feedback Control of Flow Problems**, *SIAM Conference on Computational Science and Engineering (CSE19)*, Spokane, Washington, USA, (invited minisymposium talk).
- 22/02/2019 **H-Infinity Balanced Truncation for Feedback Control of Flow Problems**, *Applied Numerical Analysis Seminar, Virginia Polytechnic Institute and State University*, Blacksburg, Virginia, USA, (invited seminar talk).
- 21/09/2018 **MORLAB – A Model Reduction Framework in MATLAB & Octave**, *Meeting of the European SIAM and GAMM Student Chapters (MESIGA 2018)*, Berlin, Germany.
- 16/05/2018 **Model Reduction of Linear Dynamical Systems with the MORLAB Toolbox**, *Weekly Fellow Seminar Series of "MathCoRe"*, Magdeburg, Germany.
- 20/04/2018 **MORLAB – A Framework for Model Reduction in MATLAB & OCTAVE**, *GAMM-Fachausschuss Dynamik und Regelungstheorie*, Berlin, Germany.
- 21/03/2018 **Balancing Related Model Reduction with the MORLAB Toolbox**, *89th GAMM Annual Meeting, Section "Dynamics and Control"*, Munich, Germany.
- 22/02/2018 **Model Reduction of Descriptor Systems with the MORLAB Toolbox**, *9th Vienna International Conference on Mathematical Modeling (MATHMOD 2018)*, Vienna, Austria.
- 22/09/2017 **MORLAB – Modellreduktion in MATLAB**, *Meeting of the GMA Fachausschuss 1.30 "Modellbildung, Identifikation und Simulation in der Automatisierungstechnik" and GMA Fachausschuss 1.40 "Systemtheorie und Regelungstechnik"*, Anif, Austria.
- 17/05/2017 **Model Reduction for Linear Systems**, *Weekly Fellow Seminar Series of "Math-CoRe"*, Magdeburg, Germany.
- 09/03/2017 **Hankel-Norm Approximation of Descriptor Systems**, *88th GAMM Annual Meeting, Section "Dynamics and Control"*, Weimar, Germany.
- 12/01/2017 **Hankel-Norm Approximation of Descriptor Systems**, *3rd Workshop on Model Reduction of Complex Dynamical Systems (MODRED 2017)*, Odense, Denmark.

## Posters

- 07/11/2019 **Solving Matrix Equations with the MORLAB Toolbox**, *METT VIII – 8th Workshop on Matrix Equations and Tensor Techniques*, Magdeburg, Germany.
- 28/08/2019 **MORLAB – Model Order Reduction LABORatory**, *4th Workshop on Model Reduction of Complex Dynamical Systems (MODRED 2019)*, Graz, Austria.

- 27/02/2019 **MORLAB – Model Order Reduction LABORatory**, *SIAM Conference on Computational Science and Engineering (CSE19)*, Spokane, Washington, USA, (invited poster).
- 12/04/2018 **Computing the Hankel-Norm Approximation of Large-Scale Descriptor Systems**, *Model Reduction of Parametrized Systems IV (MoRePaS 2018)*, Nantes, France.
- 01/06/2017 **Hankel-Norm Approximation of Descriptor Systems**, *Gene Golub SIAM Summer School: Data Sparse Approximations and Algorithms*, Berlin, Germany.

### Conference/Workshop Participation without Contribution

- 20/06/2018–  
22/06/2018 **International Workshop on Optimal Control of Dynamical Systems and Applications**, *Osijek, Croatia*.
- 26/02/2018–  
01/03/2018 **12th Elgersburg Workshop**, *Elgersburg, Germany*.
- 06/09/2017–  
08/09/2017 **2nd MOR PhD Students Workshop**, *Munich, Germany*.

### Research Stays

- 02/2019–04/2019 **Virginia Polytechnic Institute and State University**, *Blacksburg, Virginia, USA*, local supervisors: Prof. Serkan Gugercin, Prof. Christopher Beattie.  
(3 months)

### Teaching

- 11/2019 **Introduction to MATLAB**, *Lecturer (self-directed)*, Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany, (one week compact course).
- Winter term  
2017/2018 **Funktionentheorie**, *Co-lecturer together with Jan Heiland*, Otto von Guericke University, Magdeburg, Germany.
- Summer term  
2014 **Consultation hour for the Department of Mathematics**, *Tutor*, Otto von Guericke University, Magdeburg, Germany.
- Summer term  
2014 **Stochastik für Ingenieure**, *Exercise tutor*, Otto von Guericke University, Magdeburg, Germany.
- Winter term  
2013/2014 **Explorative Datenanalyse**, *Exercise tutor*, Otto von Guericke University, Magdeburg, Germany.



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## Supervised Students

### Bachelor students

13/06/2019 **Robert Jendersie**, *"Model Order Reduction of Linear Discrete-Time Systems"*,  
Co-Advisor: Christian Lessig, Otto von Guericke University, Magdeburg, Germany.

### Interns

11/2018–03/2019 **Robert Jendersie**, *Implementations in the MORLAB toolbox and other MATLAB related coding tasks.*

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## Awards

03/2020 **Best Paper Award Automatisierungstechnik**, for the contribution *"A comparison of second-order model order reduction methods for an artificial fishtail"*, at -  
Automatisierungstechnik, De Gruyter, Austria.

06/2019 **SIAM Student Chapter Certificate of Recognition**, Society for Industrial and  
Applied Mathematics (SIAM), Philadelphia, USA.

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## Language Skills

German Mother tongue

English Advanced

French Elementary

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## Programming Skills

Expert MATLAB, LaTeX

Advanced C, Progress

Intermediate Java, Python

Basic BASIC, C++, CSS, Delphi, Haskell, HTML, Javascript, Maple, Pascal, PHP, Prolog,  
Shell

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## Additional Qualification

21/10/2020–  
23/10/2020 **Good Scientific Practice**, Course held by Helga Nolte (CoachInScience), Magde-  
burg, Germany.

○ Course content: scientific practice, data management, scientific misconduct

23/09/2020–  
25/09/2020 **Leadership Skills**, Course held by Sabine Lerch (Soft Skills for Science), Magdeburg,  
Germany.

○ Course content: leadership models, critical feedback, mediation

10/12/2019–  
11/12/2019 **Presentation Skills**, Course held by the National Institute for Science Communi-  
cation, Karlsruhe, Germany.

○ Course content: body language, presentation structures, art of persuasion



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## Further Activities

since 10/2016 **Student Chapter of SIAM Magdeburg, Germany.**

- 04/2017–09/2018, 10/2019–09/2020: IT Officer
- 10/2018–09/2019: President