Steffen W. R. Werner

Curriculum Vitae as of July 22, 2021

Born September 6, 1992 in Stendal, Germany

Contact

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

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.

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

Research Interests

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

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.

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.

Presentations

20/07/2021 **Robust Output-Feedback Stabilization for Incompressible Flows using Low-Dimensional H-Infinity Controllers**, *SIAM Conference on Control and Its Applications (CT21)*, Spokane, Washington, USA, (invited minisymposium talk, online conference).

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 "MathCoRe"*, 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.

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*.

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.

Language Skills

German	Mother tongue
English	Advanced
French	Elementary

Programming Skills

Expert	MATLAB, LaTeX
Advanced	C, Progress
Intermediate	Java, Python
Basic	BASIC, C++, CSS, Delphi, Haskell, HTML, Javascript, Maple, Pascal, PHP, Prolog, Shell

Additional Qualification

21/10/2020–23/10/2020 **Good Scientific Practice**, *Course held by Helga Nolte (CoachInScience)*, Magdeburg, 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 Communication*, Karlsruhe, Germany.
- Course content: body language, presentation structures, art of persuasion

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