Dr. Matthias Voigt

Curriculum Vitae (December 06, 2018)

Personal Data

Date of Birth	04/16/1986
Place of Birth	Erlabrunn, GDR
Nationality	Germany
Marital Status	single, no children

Contact

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Research Interests

Differential-algebraic equations, optimal and robust control, matrix equations and inequalities, matrix perturbation theory, structured eigenvalue problems, numerical linear algebra, model order reduction, data assimilation, mathematical software

Academic Degrees

05/2015	**Dr. rer. nat.**, Otto-von-Guericke-Universität Magdeburg, Germany
07/2010	**Dipl.-Math.**, Technische Universität Chemnitz, Germany

Education

10/2010–05/2015 **Doctoral studies of mathematics**, *Otto-von-Guericke-Universität Magdeburg, Germany*.

- 01/2011–05/2015: Doctoral student of the "International Max Planck Research School for Advanced Methods in Process and Systems Engineering",
- 02/2013–05/2013: Research stay at the Courant Institute of Mathematical Sciences, New York University, New York City, New York, USA,
- Thesis: "On Linear-Quadratic Optimal Control and Robustness of Differential-Algebraic Systems" (promoted by Peter Benner and Paul Van Dooren),
- Final grade: "summa cum laude (excellent)".

10/2004–07/2010 **Diplom studies of mathematics**, *Technische Universität Chemnitz, Germany*.
- Major: numerical mathematics, minor: physics,
- 01/2008–05/2008: Exchange studies at the University of Helsinki, Finland,
- Thesis: "$\mathcal{L}_\infty$-Norm Computation for Descriptor Systems" (promoted by Peter Benner and Vasile Sima),
- Final grade: "very good".

08/1992–07/2004 **Secondary education**, *Gymnasium „Prof. Dr. Max Schneider" Lichtenstein, Germany*.
- 07/2004: Abitur (university entrance diploma),
- Final grade: 1.3 (very good).

Language Skills

Maximum level of competence ever achieved:

German	**native (C2)**	
English	**business fluent (C1)**	*10 years of language courses & working language*
French	**intermediate (B1)**	*4 years of language training at school*
Finnish	**intermediate (B1)**	*1 year of intensive language courses & lived in Finland for 5 months*
Russian	**intermediate (B1)**	*1.5 years of language courses (UNIcert 1) & several visits to Eastern Europe*
Swedish	**good basic knowledge (A2)**	*2 years of language courses*

Professional Experience

since 10/2014 **Postdoctoral research assistant**, *Technische Universität Berlin, Institut für Mathematik, Germany*.
Development of theory and numerical methods within the fields of systems and control, numerical linear algebra, and model reduction

08/2010–08/2014 **Research assistant**, *Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany*.
Development of theory and numerical methods for optimal control of differential-algebraic systems

02/2011–12/2012 **Freelance software engineer**, *SynOptio GmbH, Berlin, Germany*.
Development of the software library SLICOT

10/2010–01/2011 **Graduate teaching assistant**, *Otto-von-Guericke-Universität Magdeburg, Fakultät für Mathematik, Germany*.
Instructor for elementary mathematics classes

04/2007–08/2010 **Student research assistant**, *Technische Universität Chemnitz, Fakultät für Mathematik, Germany*.
Implementation of algorithms for skew-Hamiltonian/Hamiltonian eigenvalue problems in MATLAB and FORTRAN 77 (for the software library SLICOT)

08/2008–10/2008 **Guest student**, *Forschungszentrum Jülich, Institute of Advanced Simulation, Germany*.
Analysis of the influence of the dual floating point unit "Double Hummer" on the performance of specific library routines on the Linux cluster Blue Gene/P

11/2007–12/2007 **Intern**, *Moscow Aviation Institute, Russia*.
Implementation of an algorithm for the computation of the optical depth in stereo images

10/2005–03/2007 **Student teaching assistant**, *Technische Universität Chemnitz, Fakultät für Mathematik, Germany*.
Grader for elementary mathematics classes

Awards and Scholarships

06/2017 Shortlisted for the **Alston S. Householder Award XVI**

06/2017 **Otto Hahn Medal for Young Academics of the Max Planck Society**

11/2015 **Award for the best doctoral dissertation in mathematics** at the Otto-von-Guericke-Universität Magdeburg, Germany

02/2013–05/2013 **DAAD short term scholarship** for a research stay with Michael Overton (Courant Institute of Mathematical Sciences, New York University, New York City, New York, USA)

Publications

Submitted Articles

[1] S. K. Baydoun, M. Voigt, C. Jelich, and S. Marburg. A greedy reduced basis scheme for multi-frequency solution of structural acoustic systems, November 2018. Submitted for publication.

[2] T. Reis and M. Voigt. Linear-quadratic optimal control of differential-algebraic systems: The infinite time horizon problem with zero terminal state. Hamburger Beiträge zur angewandten Mathematik 2018-13, Universität Hamburg, Fachbereich Mathematik, May 2018. Submitted for publication, also available from http://www.math.tu-berlin.de/fileadmin/i26/Bilder_Webseite/AG_ModNumDiff/FG_NumMath/mvoigt/ReiV18a.pdf.

Journal Articles

[3] T. Reis and M. Voigt. Inner-outer factorization for differential-algebraic systems. *Math. Control Signals Systems*, 30(3):15:1–15:19, 2018.

[4] D. Bankmann and M. Voigt. On linear-quadratic optimal control of implicit difference equations. *IMA J. Math. Control Inform.*, 2018.

[5] P. Benner, R. Lowe, and M. Voigt. $\mathcal{L}_\infty$-norm computation for large-scale descriptor systems using structured iterative eigensolvers. *Numer. Algebra Control Optim.*, 8(1):119–133, 2018.

[6] N. Aliyev, P. Benner, E. Mengi, P. Schwerdtner, and M. Voigt. Large-scale computation of $\mathcal{L}_\infty$-norms by a greedy subspace method. *SIAM J. Matrix Anal. Appl.*, 38(4):1496–1516, 2017.

[7] P. Benner, V. Sima, and M. Voigt. Algorithm 961: Fortran 77 subroutines for the solution of skew-Hamiltonian/Hamiltonian eigenproblems. *ACM Trans. Math. Software*, 42(3):24:1–24:26, 2016.

[8] T. Reis and M. Voigt. The Kalman-Yakubovich-Popov inequality for differential-algebraic systems: Existence of nonpositive solutions. *Systems Control Lett.*, 86:1–8, 2015.

[9] T. Reis, O. Rendel, and M. Voigt. The Kalman-Yakubovich-Popov inequality for differential-algebraic systems. *Linear Algebra Appl.*, 485:153–193, 2015.

[10] P. Benner and M. Voigt. A structured pseudospectral method for $\mathcal{H}_\infty$-norm computation of large-scale descriptor systems. *Math. Control Signals Systems*, 26(2):303–338, 2014.

[11] P. Benner and M. Voigt. Spectral characterization and enforcement of negative imaginariness for descriptor systems. *Linear Algebra Appl.*, 439(4):1104–1129, 2013.

[12] P. Benner, V. Sima, and M. Voigt. $\mathcal{L}_\infty$-norm computation for continuous-time descriptor systems using structured matrix pencils. *IEEE Trans. Automat. Control*, 57(1):233–238, 2012.

Book Chapters

[13] D. Kressner and M. Voigt. Distance problems for linear dynamical systems. In P. Benner, M. Bollhöfer, D. Kressner, C. Mehl, and T. Stykel, editors, *Numerical Algebra, Matrix Theory, Differential-Algebraic Equations and Control Theory – Festschrift in Honor of Volker Mehrmann*, chapter 20, pages 559–583. Springer-Verlag, Cham, Switzerland, 2015.

[14] P. Benner, P. Losse, V. Mehrmann, and M. Voigt. Numerical linear algebra methods for linear differential-algebraic equations. In A. Ilchmann and T. Reis, editors, *Surveys in Differential-Algebraic Equations III*, Differ.-Algebr. Equ. Forum, chapter 3, pages 117–175. Springer-Verlag, Cham, Switzerland, 2015.

Refereed Conference Proceedings

[15] P. Schwerdtner and M. Voigt. Computation of the $\mathcal{L}_\infty$-norm using rational interpolation. *IFAC-PapersOnLine*, 51(25):84–89, 2018. Joint 9th IFAC Symposium on Robust Control Design and 2nd IFAC Workshop on Linear Parameter Varying Systems, Florianópolis, Brazil, 2018.

[16] J. Saak and M. Voigt. Model reduction of constrained mechanical systems in M-M.E.S.S. *IFAC-PapersOnLine*, 51(2):661–666, 2018. 9th Vienna International Conference on Mathematical Modelling, Vienna, Austria, 2018.

[17] N. Bajcinca and M. Voigt. Spectral conditions for symmetric positive real and negative imaginary systems. In *Proc. 19th European Control Conference*, pages 809–814, Zürich, Switzerland, 2013.

[18] P. Benner and M. Voigt. Numerical computation of structured complex stability radii of large-scale matrices and pencils. In *Proc. 51th IEEE Conference on Decision and Control*, pages 6560–6565, Maui, Hawaii, USA, 2012.

[19] T. Reis and M. Voigt. Linear-quadratic infinite time horizon optimal control for differential-algebraic equations - a new algebraic criterion. In *Proc. 20th International Symposium on Mathematical Theory of Networks and Systems*, Melbourne, Australia, 2012.

[20] P. Benner, V. Sima, and M. Voigt. Robust and efficient algorithms for $\mathcal{L}_\infty$-norm computation for descriptor systems. *IFAC Proceedings Volumes*, 45(13):195–200, 2012. 7th IFAC Symposium on Robust Control Design, Aalborg, Denmark, 2012.

Miscellaneous Conference Proceedings

[21] S. K. Baydoun, L. Li, M. Voigt, and S. Marburg. A low-rank iteration scheme for multi-frequency acoustic problems. In *Proc. 47th International Congress and Exposition on Noise Control Engineering*, Chicago, Illinois, USA, 2018. Accepted for publication.

[22] N. Aliyev, P. Benner, E. Mengi, P. Schwerdtner, and M. Voigt. A greedy subspace method for computing the $\mathcal{L}_\infty$-norm. *Proc. Appl. Math. Mech.*, 17(1):751–752, 2017.

[23] T. Reis and M. Voigt. Inner-outer factorization via Lur'e equations. *Proc. Appl. Math. Mech.*, 16(1):829–830, 2016.

[24] T. Reis and M. Voigt. The Kalman-Yakubovich-Popov inequality for descriptor systems. *Proc. Appl. Math. Mech.*, 15(1):645–646, 2015.

[25] T. Reis and M. Voigt. Solution of descriptor Lur'e equations via even matrix pencils. *Proc. Appl. Math. Mech.*, 14(1):925–926, 2014.

[26] T. Reis and M. Voigt. The dissipation inequality for differential-algebraic systems. *Proc. Appl. Math. Mech.*, 14(1):11–14, 2014.

[27] P. Benner, R. Lowe, and M. Voigt. Computation of the $\mathcal{H}_\infty$-norm for large-scale systems. In *Oberwolfach Reports*, number 56/2013, pages 3289–3291, Oberwolfach, 2013. Mathematisches Forschungsinstitut Oberwolfach.

[28] M. Voigt. Computation of the complex dissipativity radius. In O. Sawodny and J. Adamy, editors, *Tagungsband des GMA-Fachausschusses 1.30 „Modellbildung, Identifikation und Simulation in der Automatisierungstechnik"*, pages 10–19. Technische Universität Darmstadt, Institut für Automatisierungstechnik und Mechatronik, 2013.

[29] J. Saak, M. M. Uddin, and M. Voigt. Modellreduktion für strukturierte Index-3-Systeme. In O. Sawodny and J. Adamy, editors, *Tagungsband des GMA-Fachausschusses 1.30 „Modellbildung, Identifikation und Simulation in der Automatisierungstechnik"*, pages 180–190. Technische Universität Darmstadt, Institut für Automatisierungstechnik und Mechatronik, 2013.

[30] P. Benner and M. Voigt. $\mathcal{H}_\infty$-norm computation for large and sparse descriptor systems. *Proc. Appl. Math. Mech.*, 12(1):797–800, 2012.

[31] P. Benner and M. Voigt. $\mathcal{L}_\infty$-norm computation for discrete-time descriptor systems. In O. Sawodny and J. Adamy, editors, *Tagungsband des GMA-Fachausschusses 1.30 „Modellbildung, Identifikation und Simulation in der Automatisierungstechnik"*, pages 228–240. Technische Universität Darmstadt, Institut für Automatisierungstechnik und Mechatronik, 2011.

[32] P. Benner and M. Voigt. On the computation of particular eigenvectors of Hamiltonian matrix pencils. *Proc. Appl. Math. Mech.*, 11(1):753–754, 2011.

Manuals

[33] P. Benner, V. Sima, and M. Voigt. *SHHEIG Users' Guide*. ACM, 2016.

Technical Reports

[34] P. Jiang and M. Voigt. MB04BV – A FORTRAN 77 subroutine to compute the eigenvectors associated to the purely imaginary eigenvalues of skew-Hamiltonian/Hamiltonian matrix pencils. SLICOT Working Note 2013-3, NICONET e. V., September 2013. Available from http://slicot.org/objects/software/reports/SLWN2013_3.pdf.

Theses

[35] M. Voigt. *On Linear-Quadratic Optimal Control and Robustness of Differential-Algebraic Systems*. Logos-Verlag, Berlin, 2015. Also as Dissertation, Otto-von-Guericke-Universität Magdeburg, Fakultät für Mathematik, 2015.

[36] M. Voigt. $\mathcal{L}_\infty$-norm computation for descriptor systems. Diplomarbeit, Technische Universität Chemnitz, Fakultät für Mathematik, July 2010. Available from http://nbn-resolving.de/urn:nbn:de:bsz:ch1-201001050.

Talks Given at Conferences and in Seminars

09/21/2018 **Interpolatory Methods for Robust Control of Dynamical Systems**, *Numerical Analysis and Scientific Computing Seminar, Courant Institute of Mathematical Sciences, New York University*, New York City, New York, USA (invited seminar talk).

09/17/2018 **Classical Results and Recent Advances in $\mathcal{H}_\infty$-Control**, *Applied Numerical Analysis Seminar, Virginia Polytechnic Institute and State University*, Blacksburg, Virginia, USA (invited seminar talk).

09/03/2018 **Computation of the $\mathcal{L}_\infty$-Norm Using Rational Interpolation**, *Joint 9th IFAC Symposium on Robust Control Design and 2nd IFAC Workshop on Linear Parameter Varying Systems, Section "$\mathcal{H}_2$ and $\mathcal{H}_\infty$ Control"*, Florianópolis, Brazil.

06/21/2018 **Balanced Truncation Model Reduction for Systems with Nonzero Initial Condition**, *International Workshop on Optimal Control of Dynamical Systems and Applications*, Osijek, Croatia.

04/20/2018 **Balanced Truncation Model Reduction for Systems with Nonzero Initial Condition**, *Workshop of the GAMM Activity Group "Dynamics and Control Theory"*, Berlin, Germany.

03/15/2018 **$\mathcal{H}_\infty$-Control: Classical Results and Recent Advances**, *Mathematical Colloquium Osijek, Josip Juraj Strossmayer University of Osijek*, Osijek, Croatia (invited colloquium talk).

09/14/2017 **Linear-Quadratic Optimal Control, Lur'e Equations, and Structured Matrix Pencils**, *International Conference on Scientific Computation and Differential Equations, Minisymposium "Matrix Equations: Theory, Numerics and Applications"*, Bath, United Kingdom (invited minisymposium talk).

06/22/2017 **Linear-Quadratic Optimal Control of Differential-Algebraic Equations**, *Householder Symposium XX on Numerical Linear Algebra, Section "Optimization"*, Blacksburg, Virgina, USA (invited talk).

03/15/2017 **A Greedy Subspace Method for Computing the $\mathcal{H}_\infty$-Norm**, *Seminar on Optimization and Applications, Josip Juraj Strossmayer University of Osijek*, Osijek, Croatia (invited seminar talk).

03/09/2017 **A Greedy Subspace Method for Computing the $\mathcal{H}_\infty$-Norm**, *88th GAMM Annual Meeting, Section "Applied and Numerical Linear Algebra"*, Weimar, Germany.

09/29/2016 **Linear-Quadratic Control of DAEs with an Application to Flow Control Problems**, *Sino-German Symposium "Modeling, Model Order Reduction, and Optimization of Flows"*, Shanghai, China (invited talk).

07/21/2016 **Inner-Outer Factorization for Differential-Algebraic Equations**, *7th European Congress of Mathematics, Minisymposium "Analysis, Numerics, and Control of Differential-Algebraic Equations"*, Berlin, Germany.

07/01/2016 **Computation of Robustness Measures for Descriptor Systems**, *Symposium of SFB 910 "Computational Methods for Stability and Robust Stability of Dynamical Systems"*, Berlin, Germany (invited talk).

05/03/2016 **Existence of Nonpositive Solutions for the Kalman-Yakubovich-Popov Inequality**, *Workshop "Computational Methods for High-Dimensional Problems"*, Tegernsee, Germany (invited talk).

03/09/2016 **Inner-Outer Factorization for Differential-Algebraic Equations**, *Joint DMV and GAMM Annual Meeting, Section "Dynamics and Control"*, Braunschweig, Germany.

01/13/2016 **Inner-Outer Factorization for Differential-Algebraic Systems**, *Seminar on Optimization and Applications, Josip Juraj Strossmayer University of Osijek*, Osijek, Croatia (invited seminar talk).

12/01/2015 **Inner-Outer Factorization for Differential-Algebraic Systems**, *DAE Day Workshop HU/TU*, Berlin, Germany.

10/01/2015 **Existence of Nonpositive Solutions for the Kalman-Yakubovich-Popov Inequality**, *Workshop of the GAMM Activity Group "Dynamics and Control Theory"*, Duisburg, Germany.

08/11/2015 **The Kalman-Yakubovich-Popov Lemma for Differential-Algebraic Equations**, *8th International Congress on Industrial and Applied Mathematics, Section "Control and Systems Theory"*, Beijing, China.

03/26/2015 **The Kalman-Yakubovich-Popov Inequality for Differential-Algebraic Equations**, *86th GAMM Annual Meeting, Section "Dynamics and Control"*, Lecce, Italy.

10/07/2014 **Linear-Quadratic Optimal Control of Differential-Algebraic Equations**, *Workshop of the DAAD Project "Optimal Damping of Vibrating Systems"*, Osijek, Croatia.

06/26/2014 **Singular Linear-Quadratic Optimal Control of DAEs and Descriptor Lur'e Equations**, *Tegernsee Workshop*, Tegernsee, Germany.

03/13/2014 **Singular Linear-Quadratic Optimal Control of Differential-Algebraic Equations**, *85th GAMM Annual Meeting, Section "Dynamics and Control"*, Erlangen, Germany.

03/03/2014 **Berechnung des komplexen Dissipativitätsradius**, *9th Elgersburg Workshop*, Elgersburg, Germany.

11/21/2013 **Computation of the $\mathcal{H}_\infty$-Norm for Large-Scale Systems**, *Oberwolfach Workshop: Numerical Solution of PDE Eigenvalue Problems*, Oberwolfach, Germany (invited talk).

10/31/2013 **New Approaches to Compute the $\mathcal{H}_\infty$-Norm of Large-Scale Systems**, *Graduate Seminar "Numerical Mathematics", Technische Universität Berlin*, Berlin, Germany (invited seminar talk).

09/18/2013 **Computation of the Complex Dissipativity Radius**, *Workshop of the GMA Activity Group 1.30 "Modeling, Identification and Simulation in Automation Engineering"*, Anif/Salzburg, Austria.

09/10/2013 **Computation of the Complex Dissipativity Radius**, *GAMM Workshop "Applied and Numerical Linear Algebra"*, Wuppertal, Germany.

08/16/2013 **The Singular Linear-Quadratic Optimal Control Problem for Differential-Algebraic Systems**, *2nd Symposium of the German SIAM Student Chapters*, Heidelberg, Germany.

02/13/2013 **The Kalman-Yakubovich-Popov Lemma for Differential-Algebraic Equations with Applications**, *8th Elgersburg Workshop*, Elgersburg, Germany.

12/13/2012 **Numerical Computation of Structured Complex Stability Radii of Large-Scale Matrices and Pencils**, *51st IEEE Conference on Decision and Control, Section "Stability of Linear Systems"*, Maui, Hawaii, USA.

10/09/2012 **Computational Methods Based on Structured Pseudospectra**, *CIRM Workshop "Structured Matrix Computations in Non-Euclidean Geometries: Algorithms and Applications"*, Luminy/Marseille, France (invited talk).

09/19/2012 **$\mathcal{H}_\infty$-Norm Computation for Large-Scale Descriptor Systems**, *Workshop of the GAMM Activity Group "Dynamics and Control Theory"*, Anif/Salzburg, Austria.

09/12/2012 **$\mathcal{H}_\infty$-Norm Computation for Large-Scale Descriptor Systems**, *Seminar on Optimization and Applications, Josip Juraj Strossmayer University of Osijek*, Osijek, Croatia (invited seminar talk).

08/16/2012 **$\mathcal{H}_\infty$-Norm Computation for Large-Scale Descriptor Systems via Optimization over Structured Pseudospectra**, *Compact Course "Optimization with Differential Equations"*, Magdeburg, Germany.

06/20/2012 **Robust and Efficient Algorithms for $\mathcal{L}_\infty$-Norm Computation for Descriptor Systems**, *7th IFAC Symposium on Robust Control Design, Section "Robustness Analysis"*, Aalborg, Denmark.

03/27/2012 **$\mathcal{H}_\infty$-Norm Computation for Large Sparse Descriptor Systems**, *83rd GAMM Annual Meeting, Young Researchers' Minisymposium "Differential-Algebraic Equations: Theory, Numerics and Applications"*, Darmstadt, Germany.

03/09/2012 **Kalman-Yakubovich-Popov Lemma for Differential-Algebraic Equations**, *Workshop of the GAMM Activity Group "Dynamics and Control Theory"*, Stuttgart, Germany.

10/13/2011 **Solution of Computational Problems for Descriptor Systems**, *Summer School "Numerical Linear Algebra for Dynamical and High-Dimensional Problems"*, Trogir, Croatia.

09/23/2011 **$\mathcal{L}_\infty$-Norm Computation for Discrete-Time Descriptor Systems**, *Workshop of the GMA Activity Group 1.30 "Modeling, Identification and Simulation in Automation Engineering"*, Anif/Salzburg, Austria.

09/16/2011 **SLICOT Software for Structured Matrix Pencils**, *General Assembly of NICONET e. V.*, Berlin, Germany.

08/23/2011 **On Negative Imaginary Descriptor Systems**, *17th ILAS Conference, Section "Control"*, Braunschweig, Germany.

04/19/2011 **On the Computation of Particular Eigenvectors of Hamiltonian Matrix Pencils for Passivity Enforcement of Descriptor Systems**, *82nd GAMM Annual Meeting, Section "Applied and Numerical Linear Algebra"*, Graz, Austria.

03/18/2011 **Passivity Enforcement of Descriptor Systems via Structured Perturbation of Hamiltonian Matrix Pencils**, *Workshop of the GAMM Activity Group "Dynamics and Control Theory"*, Linz, Austria.

04/16/2010 **$\mathcal{L}_\infty$-Norm Computation for Descriptor Systems**, *Workshop of the GAMM Activity Group "Dynamics and Control Theory"*, Berlin, Germany.

Posters Presented at Conferences and in Seminars

08/11/2015 **The Linear-Quadratic Optimal Control Problem for Differential-Algebraic Equations**, *8th International Congress on Industrial and Applied Mathematics*, Beijing, China.

05/07/2015 **The Linear-Quadratic Optimal Control Problem Revisited**, *Conference "Numerical Algebra, Matrix Theory, Differential-Algebraic Equations, and Control Theory" in Honor of Volker Mehrmann on the Occasion of his 60th Birthday*, Berlin, Germany.

06/10/2014 **Numerical Methods to Compute the $\mathcal{H}_\infty$-Norm of Large-Scale Descriptor Systems**, *Householder Symposium XIX on Numerical Linear Algebra*, Spa, Belgium (invited poster).

05/07/2012 **Analysis and Numerical Solution of Structured Descriptor System Problems**, *Workshop on Nonlinear Model Order Reduction*, Tegernsee, Germany.

05/07/2012 **Development of the Systems and Control Library SLICOT**, *Workshop on Nonlinear Model Order Reduction*, Tegernsee, Germany.

06/27/2010 **Computation of the Eigenvalues of Skew-Hamiltonian/Hamiltonian Pencils in SLICOT**, *8th International Workshop on Accurate Solution of Eigenvalue Problems*, Berlin, Germany.

Software

I am/was involved in the development of certain software packages:

- `SHHEIG`, a FORTRAN package for the solution of skew-Hamiltonian/Hamiltonian eigenvalue problems, published as Algorithm 961 within the Collected Algorithms of the ACM (CALGO),
- several FORTRAN and Matlab codes for the computation of the $\mathcal{L}_\infty$-/$\mathcal{H}_\infty$-norm for descriptor systems.

For more information see http://www.tu-berlin.de/?178568&L=1.

Third-Party Funded Projects

Submitted Project Proposals

11/2018 **Interpolation-Based Numerical Algorithms in Robust Control**.

- **submitted to:** German Research Foundation (Research Grants – Individual Proposal)
- **requested support:** 1 position E13 TV-L (100%, 36 months), 1 student research assistant (40 hours per month, 36 months), and direct costs

Funded Projects (as (Co-)Principal Investigator)

01/2019–12/2021 **Energy-Based Modeling, Simulation, and Optimization of Power Systems under Uncertainty**.

- **supported by:** German Research Foundation within the framework of the Cluster of Excellence: Berlin Mathematics Research Center MATH+
- **partners:** Volker Mehrmann (TU Berlin, Germany) and Caren Tischendorf (HU Berlin, Germany)
- **support:** 1 shared position E13 TV-L (75%, 36 months, employed with Volker Mehrmann) and direct costs

11/2018–10/2021 **Randomized Techniques for Model Reduction**.

- **supported by:** German Research Foundation within the framework of the Research and Training Group 2433: "Differential Equation- and Data-driven Models in Life Sciences and Fluid Dynamics (DAEDALUS)"
- **partners:** Gitta Kutyniok und Volker Mehrmann (TU Berlin, Germany)
- **support:** 1 shared position E13 TV-L (100%, 36 months, employed with Volker Mehrmann) and direct costs

06/2017–12/2018 **Data Assimilation for Port-Hamiltonian Power Network Models**.

- **supported by:** Einstein Foundation Berlin within the framework of the Einstein Center for Mathematics (ECMath)
- **partners:** Raphael Kruse und Volker Mehrmann (TU Berlin, Germany)
- **support:** 1 shared position E13 TV-L (100%, 19 months, employed with Volker Mehrmann) and direct costs

01/2017–12/2018 **Robustness Optimization of Damped Mechanical Systems**.

- **supported by:** German Academic Exchange Service within the framework of a project-related personal exchange (PPP) with Croatia
- **partner:** Zoran Tomljanović (Josip Juraj Strossmayer University of Osijek, Croatia)
- **support:** travel and guest funds

09/2016–08/2019 **Structure-Preserving Model Reduction for Dissipative Mechanical Systems**.

- **supported by:** German Research Foundation within the framework of the Priority Program 1897: "Calm, Smooth and Smart - Novel Approaches for Influencing Vibrations by Means of Deliberately Introduced Dissipation"
- **partners:** Peter Benner (MPI for Dynamics of Complex Technical Systems, Magdeburg, Germany) und Timo Reis (University of Hamburg, Germany)
- **support:** 1 student research assistant (41 hours per month, 36 months) and direct costs

06/2013–08/2013 **Computation of Norms for Large-Scale Dynamical Systems**.
- **supported by:** German Academic Exchange Service within the framework of the RISE program
- **support:** 1 intern (10 weeks)

05/2012–08/2012 **Structure-Preserving Computation of Particular Eigenvectors of skew-Hamiltonian/Hamiltonian Pencils**.
- **supported by:** German Academic Exchange Service within the framework of the RISE program
- **support:** 1 intern (12 weeks)

Funded Projects (as Contributor/Student Research Assistant)

06/2014–05/2017 **Reduced Order Modeling for Data Assimilation**.
- **supported by:** Einstein Foundation Berlin within the framework of the Einstein Center for Mathematics (ECMath)
- **headed by:** Volker Mehrmann and Christian Schröder (TU Berlin, Germany)

01/2013–12/2014 **Optimal Damping of Vibrating Systems**.
- **supported by:** German Academic Exchange Service within the framework of a project-related personal exchange (PPP) with Croatia
- **headed by:** Peter Benner (MPI for Dynamics of Complex Technical Systems, Magdeburg, Germany) and Ninoslav Truhar (Josip Juraj Strossmayer University of Osijek, Croatia)

06/2006–06/2010 **Numerical Algorithms for Generalized Eigenvalue Problems of Even Structure with Application in Robust Control of Descriptor Systems**.
- **supported by:** German Research Foundation
- **headed by:** Peter Benner (TU Chemnitz, Germany) und Volker Mehrmann (TU Berlin, Germany)

Research Visits (from 3 Days)

09/2018 **Courant Institute of Mathematical Sciences**, New York University, New York City, New York, USA (3 days)

09/2018 **Virginia Polytechnic Institute and State University**, Blacksburg, Virginia, USA (1 week)

03/2018 **Josip Juraj Strossmayer University of Osijek**, Croatia (1 week)

04/2017 **Max Planck Institute for Dynamics of Complex Technical Systems**, Magdeburg, Germany (3 days)

03/2017 **Josip Juraj Strossmayer University of Osijek**, Croatia (1 week)

04/2016 **Koç University**, Istanbul, Turkey (1 week)

01/2016 **Josip Juraj Strossmayer University of Osijek**, Croatia (1 week)

09/2013–10/2013 **Josip Juraj Strossmayer University of Osijek**, Croatia (1 week)

02/2013–05/2013 **Courant Institute of Mathematical Sciences**, New York University, New York City, New York, USA (3.5 months)

09/2012 **Josip Juraj Strossmayer University of Osijek**, Croatia (1 week)

Teaching

Delivered Courses

WS 2018/19 **Numerical Mathematics II for Engineering** (lectures)

Model Reduction (lectures)

Graduate Seminar Numerical Mathematics (coordination)

SS 2018 **Graduate Seminar Numerical Mathematics** (coordination)

WS 2017/18 **Model Reduction** (lectures)
Linear Algebra I for Mathematicians (tutorial classes)
Graduate Seminar Numerical Mathematics (coordination)
Early Bird II (Calculus II for Engineering) (assistance)

SS 2017 **Matrix Equations** (lectures)
Linear Algebra I for Mathematicians (homework supervision)
Graduate Seminar Numerical Mathematics (coordination)

WS 2016/17 **Linear Algebra II for Mathematicians** (assistance together with exercise and tutorial classes)

SS 2016 **Linear Algebra I for Mathematicians** (assistance together with exercise and tutorial classes)

WS 2015/16 **Linear Algebra II for Mathematicians** (assistance together with exercise classes)

WS 2010/11 **Mathematics I – Elementary Course for Engineering Economists** (2 tutorial classes)

Lecture Notes

„Model Reduction“, last updated: WS 2017/18.

„Matrix Equations“, based on a draft of Patrick Kürschner (MPI for Dynamics of Complex Technical Systems, Magdeburg, Germany), last updated: SS 2017.

Supervision of Students

Diplom and Master Students

current **Jennifer Przybilla (TU Berlin, Germany)**.
Working title: "Model Reduction via Parametric Balanced Truncation"

current **Pia Marie Lutum (TU Berlin, Germany)**.
"Numerical Computation of the Real Structured Stability Radius"

04/2018 **Paul Schwerdtner (TU Berlin, Germany, M. Sc. in engineering science)**.
"On Fixed Order $\mathcal{H}_\infty$-Controller Design for Delay Systems"

12/2015 **Daniel Bankmann (TU Berlin, Germany, M. Sc. in technical mathematics)**.
"On Linear-Quadratic Control Theory of Implicit Difference Equations"

Bachelor Students

12/2018 **Heinrich Walter Ellmann (TU Berlin, Germany, B. Sc. in mathematics)**.
"Numerical Solution of the Discrete-Time Linear Quadratic Optimal Control Problem using the Palindromic Laub Trick"

Student Research Assistants

since 06/2018 **Rebekka Salome Beddig (TU Berlin, Germany)**, *supported by the DFG Priority Program 1897*.
Implementation and testing of algorithms for structure-preserving model reduction of mechanical systems

11/2016–04/2018 **Paul Schwerdtner (TU Berlin, Germany)**, *supported by the DFG Priority Program 1897*.
Implementation and testing of algorithms for the efficient computation of the $\mathcal{L}_\infty$-norm

Interns

06/2017–08/2017 **Tiphaine Bonniot de Ruisselet (ENSEEIHT Toulouse, France)**.
Parametric model reduction for damping optimization

06/2013–08/2013 **Ryan Lowe (Queen's University, Ontario, Canada)**, *supported by the DAAD RISE program*.
Computation of the $\mathcal{L}_\infty$-norm for descriptor systems of high dimension

05/2012–08/2012 **Peihong Jiang (University of Rochester, New York, USA)**, *supported by the DAAD RISE program*.
Efficient implementation of an algorithm for the structure-exploiting computation of particular eigenvectors of skew-Hamiltonian/Hamiltonian pencils in FORTRAN 77

05/2012–07/2012 **Maximilian Bremer (University of Texas at Austin, Texas, USA)**.
Fast computation and visualization of structured pseudospectra

Refereeing of Theses (without Supervision Responsibilities)

Bachelor Theses

06/2018 **David Noben (TU Berlin, Germany, B. Sc. in mathematics)**.
"Ein adaptiver Algorithmus zur Regelung von Modell- und Diskretisierungsfehlern mittels sukzessiver linearer Programmierung"

Experience in Academic Self-Administration & Further Activities

since 03/2018 **Member**, *Search committee for Mathematics – Mathematical Image Communication*.

08/2008–07/2010 **Coordinator**, *Correspondence Group for Mathematics*.
Coordinator of an extracurricular offer for promoting mathematically talented and interested school students

05/2006–07/2010 **Member**, *Student Accredidation Pool*.
Reviewer in one accredidation procedure

04/2005–10/2007 **Student representative**.
Involvement in different committees including budget, Bachelor/Master, and study program committee, and one search committee (Numerical Mathematics (Partial Differential Equations))

Refereeing

Book Series Differential-Algebraic Equations Forum

Journals Applied Mathematics and Optimization (2×), Automatica (2×), BIT Numerical Mathematics (2×), Control & Cybernetics, IEEE Transactions on Automatic Control (9×), IMA Journal of Mathematical Control and Information (2×), IMA Journal of Numerical Analysis (3×), ISA Transactions, Linear Algebra and its Applications (4×), Nonlinear Dynamics, SIAM Journal on Control and Optimization (2×), SIAM Journal on Matrix Analysis and Applications (9×), SIAM Journal on Scientific Computing, Systems & Control Letters (14×, **07/2017: outstanding reviewer**)

Conferences American Control Conference, Australian Control Conference, IEEE Conference on Decision and Control, IFAC Symposium on Robust Control Design, International Symposium on Mathematical Theory of Networks and Systems (2×)

Organization of Conferences and Minisymposia

11/2018 **Minisymposium "Eigenvalue Optimization"**, submitted to the 9th International Congress on Industrial and Applied Mathematics in Valencia, Spain (together with Emre Mengi (Koç University, Istanbul, Turkey))

04/2018 **Workshop of the GAMM Activity Group "Dynamics and Control Theory"** in Berlin, Germany (together with Sergio Lucia (TU Berlin, Germany))

07/2016 **Minisymposium "Analysis, Numerics, and Control of Differential-Algebraic Equations"** at the 7th European Congress of Mathematics in Berlin, Germany

08/2015 **Minisymposium "Distance Problems for Dynamical Systems"** at the 8th International Congress on Industrial and Applied Mathematics in Beijing, China

03/2015 **Section S20: "Dynamics and Control"** at the 86th GAMM Annual Meeting in Lecce, Italy (together with Thomas Berger (Universität Hamburg, Germany) and Fabio Ancona (University of Padova, Italy))

09/2013 **Workshop of the GAMM Activity Group "Dynamics and Control Theory"** in Magdeburg, Germany

03/2012 **Young Researchers' Minisymposium MA-2: "Differential-Algebraic Equations: Theory, Numerics and Applications"** at the 83rd GAMM Annual Meeting in Darmstadt, Germany (together with Stephan Trenn (TU Kaiserslautern, Germany))

Membership in Scientific Organizations

since 2012 **NICONET e. V. – The Numerics in Control Network**, association to promote the development and use of numerical methods for systems and control theory in science, engineering, and economics

since 2012 **SIAM – Society for Industrial and Applied Mathematics**, member of the activity groups "Control and Systems Theory", "Dynamical Systems", and "Linear Algebra", 2013–2015: member of the SIAM Student Chapter Magdeburg

since 2011 **GAMM – Gesellschaft für angewandte Mathematik und Mechanik (International Association for Applied Mathematics and Mechanics)**, elected member of the activity group "Dynamics and Control Theory", member of the activity group "Applied and Numerical Linear Algebra"

Personal Interests

Cycling active member of the German cyclists' association (ADFC), yearly long-distance trips through Europe (cycled from Magdeburg to St. Petersburg in 2014)

Board games member of the local board game club