Curriculum Vitae
Matthias Heinkenschloss

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Personal Data

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Educational Record

September 1991	Doctoral degree "Dr. rer. nat." summa cum laude, University of Trier, Fed. Rep. of Germany.
1988 – 1991	Study for doctoral degree at the University of Trier.
September 1988	Diploma in Mathematics (Minor Economics) at the University of Trier.
1983 – 1988	Study of Mathematics (Minor Economics) at the University of Trier.

Professional Record

January 2017 – Present	Noah G. Harding Chair and Professor, Department of Computational and Applied Mathematics, Rice University
July 2009 – June 2015	Department Chair, Department of Computational and Applied Mathematics, Rice University
July 2005 – Dec. 2016	Professor, Department of Computational and Applied Mathematics, Rice University
July 1996 – June 2005	Associate Professor, Department of Computational and Applied Mathematics, Rice University.
August 1993 – July 1996	Assistant Professor, Department of Mathematics, Virginia Polytechnic Institute and State University.
October 1992 – August 1993	Assistant Professor, University of Trier, Fed. Rep. of Germany.
October 1988 – September 1992	Assistant, University of Trier.

Research

Research Interests

Numerical solution of large scale optimization problems, numerical solution of optimal control problems, numerical solution of parameter identification problems, optimization–level domain decomposition methods, preconditioning of KKT systems, error estimation for optimal control problems, model reduction, application of optimization in science and engineering.

Research Funding

Current and past research is/hasbeen funded by the AirForce Office of Scientific Research, Department of Energy, Draper Laboratory, John and Ann Doerr Fund for Computational Biomedicine through the Ken Kennedy Institute at Rice University, ExxonMobil, the National Science Foundation, Sandia National Laboratories, Texas ATP.

Professional Service

Editorial Activities

July 2013 – Present   Member of the Editorial Board, *EMS Series in Industrial and Applied Mathematics*.

February 2008 – Present   Member of the Editorial Board, *Numerical Linear Algebra with Applications*.

January 2000 – July 2013   Associate Editor, *Mathematical Programming, Series A*.

July 1998 – Dec. 2010   Associate Editor *Systems & Control Letters*.

July 1999 – June 2003   and July 2007 – July 2009   Member of the Editorial Board of the MPS/SIAM book series.

July 1998 – June 2002   Associate Editor of the SIAM book series *Frontiers of Applied Mathematics*.

January 2000 – Dec. 2005   Associate Editor, *SIAM Journal on Control and Optimization*.

January 2000 – May 2006   Associate Editor, *SIAM Review 'Problems and Techniques' Section*.

April 2001 – March 2003   Guest Editor, *Systems & Control Letters* Special Issue on *Optimization and Control of Distributed Systems* dedicated to J. L. Lions. *Systems & Control Letters*, Volume 48, Issues 3-4, March 2003.

Conferences Co–Organized (Selected)

- Member of the Organizing Commitee, *SIAM Conference on Uncertainty Quantification (SIAM UQ18)*, Garden Grove, CA, April 16-19, 2018.

- with Bart van Bloemen Waanders, Omar Ghattas, Luis Tenorio, and Karen Willcox. *Large-Scale Inverse Problems and Quantification of Uncertainty: Big Data Meets Big Models*, Santa Fe, NM, May 22-24, 2013.

- with V. Schulz. Oberwolfach Workshop on *Numerical Methods for PDE Constrained Optimization with Uncertain Data*, Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany. Jan. 27–Feb 2, 2013.

- with A. El Bakry. Conference on *Model Management and Reduced Order Model Approaches for Simulation Driven Optimization*, Rice University, October 11&12, 2010

Membership in Professional Societies

Mathematical Programming Society,
SIAM (Society for Industrial and Applied Mathematics).

Selected Publications

For a full publication list see http://www.caam.rice.edu/∼heinken. Abstracts and, in most cases, links to electronic copies of the full paper are also available at http://www.caam.rice.edu/∼heinken.

1. H. ANTIL, S. HARDESTY, and M. HEINKENSCHLOSS, *Shape Optimization of Shell Structure Acoustics*, *SIAM J. Control and Optimization*, 2017, Vol. 55, No. 3, pp. 1347–1376, DOI: 10.1137/16M1070633.

2. P. BENNER, M. HEINKENSCHLOSS, J. SAAK, and H. K. WEICHELT, *Inexact low-rank Newton-ADI method for large-scale algebraic Riccati equations*, *Applied Numerical Mathematics*, 2016, Vol. 108, pp. 125-142, DOI: 10.1016/j.apnum.2016.05.006.

3. D. P. KOURI, M. HEINKENSCHLOSS, D. RIDZAL, and B. G. VAN BLOEMEN WAANDERS, *Inexact Objective Function Evaluations in a Trust-Region Algorithm for PDE-Constrained Optimization under Uncertainty*, *SIAM J. Scientific Computing*, 2014, Vol. 36, No. 6, pp. A3011-A3029, DOI: 10.1137/140955665.

4. M. HEINKENSCHLOSS and D. RIDZAL, *A Matrix-Free Trust-Region SQP Method for Equality Constrained Optimization*, *SIAM J. Optimization*, 2014, Vol. 24, No. 3, pp. 1507-1541, DOI: 10.1137/130921738

5. D. P. KOURI, M. HEINKENSCHLOSS, D. RIDZAL, and B. G. VAN BLOEMEN WAANDERS, *A Trust-Region Algorithm with Adaptive Stochastic Collocation for PDE Optimization under Uncertainty*, *SIAM J. Scientific Computing*, 2013, Vol. 35, No. 4, pp. A1847-A1879, DOI: 10.1137/120892362.

6. M. BAMBACH, M. HEINKENSCHLOSS, and M. HERTY, *A Method for Model Identification and Parameter Estimation*, *Inverse Problems*, 2013, Vol. 29, No. 2, pages 025009, DOI: 10.1088/0266-5611/29/2/025009.

7. D. LEYKEKHMAN and M. HEINKENSCHLOSS, *Local Error Analysis of Discontinuous Galerkin Methods for Advection-Dominated Elliptic Linear-Quadratic Optimal Control Problems*, *SIAM J. Numerical Analysis*, 2012, Vol. 50, No. 4, pp. 2012-2038, DOI: 10.1137/110826953.

8. H. ANTIL, M. HEINKENSCHLOSS and R. H. W. HOPPE, Reduced Order Modeling Based Shape Optimization of Surface Acoustic Wave Driven Microfluidic Biochips. *Mathematics and Computers in Simulation*, 2012, Vol. 82, No. 10, pp. 1986 - 2003, DOI: 10.1016/j.matcom.2010.10.027.

9. H. ANTIL, M. HEINKENSCHLOSS and R. H. W. HOPPE, Domain Decomposition and Balanced Truncation Model Reduction for Shape Optimization of the Stokes System. Optimization Methods and Software, 2011, Vol. 26, No. 4-5, pp. 643-669, DOI: 10.1080/10556781003767904

10. M. HEINKENSCHLOSS, T. REIS and A. C. ANTOULAS, On Balanced Truncation for Inhomogeneously Initialized Systems. Automatica, 2011, Vol. 47, No. 3, pp. 559–564, DOI: 10.1016/j.automatica.2010.12.002.

11. H. ANTIL, M. HEINKENSCHLOSS, R. H. W. HOPPE, and D.C. SORENSEN, Domain decomposition and model reduction for the numerical solution of PDE constrained optimization problems with localized optimization variables. Computing and Visualization in Science, 2010, Vol. 13, No. 6, pp. 249-264, DOI: 10.1007/s00791-010-0142-4.

12. M. HEINKENSCHLOSS and D. LEYKEKHMAN, Local Error Estimates for SUPG Solutions of Advection-Dominated Elliptic Linear-Quadratic Optimal Control Problems. SIAM Journal on Numerical Analysis, Vol. 47, No. 6, 2010, pp. 4607–4638

13. M. HEINKENSCHLOSS, D. C. SORENSEN and K. SUN, *Balanced Truncation Model Reduction for a Class of Descriptor Systems with Application to the Oseen Equations*. SIAM Journal on Scientific Computing, Vol. 30, 2008, pp. 1038–1063.

14. L. BIEGLER, O. GHATTAS, M. HEINKENSCHLOSS, D. KEYES, and B. VAN BLOEMEN WAANDERS (eds.), *Real-Time Optimization*. Computational Science and Engineering Vol. 3, SIAM, Philadelphia, 2007.

15. M. HEINKENSCHLOSS and M. HERTY, *A Spatial Domain Decomposition Method for Parabolic Optimal Control Problems*, Journal of Computational and Applied Mathematics, Vol. 201, 2007, pp. 88-111.

16. R. BARTLETT, M. HEINKENSCHLOSS, D. RIDZAL, and B. VAN BLOEMEN WAANDERS, *Domain Decomposition Methods for Advection Dominated Linear–Quadratic Elliptic Optimal Control Problems*, Comp. Meth. Appl. Mech. Engng., Vol. 195, 2006, pp. 6428–6447.

17. M. HEINKENSCHLOSS and H. NGUYEN, *Neumann-Neumann Domain Decomposition Preconditioners for Linear Quadratic Elliptic Optimal Control Problems*, SIAM Journal on Scientific Computing, Vol. 28, 2006, pp. 1001–1028 (electronic).

18. F. ABRAHAM, M. BEHR, and M. HEINKENSCHLOSS, *Shape Optimization in Instationary Blood Flow*. Computer Methods in Biomechanics and Biomedical Engineering, Vol. 8, 2005, pp. 201–212.

19. F. ABRAHAM, M. BEHR, and M. HEINKENSCHLOSS, *Shape Optimization in Stationary Blood Flow: A Numerical Study of Non-Newtonian Effects*, Computer Methods in Biomechanics and Biomedical Engineering, Vol. 8, 2005, pp. 127–137.

20. M. HEINKENSCHLOSS, *Time–Domain Decomposition Iterative Methods for the Solution of Distributed Linear Quadratic Optimal Control Problems*, Journal of Computational and Applied Mathematics, Vol. 173, 2005, pp. 169–198.

21. F. ABRAHAM, M. BEHR, and M. HEINKENSCHLOSS, *The Effect of Stabilization in Finite Element Methods for the Optimal Boundary Control of the Oseen Equations*, *Finite Elements in Analysis and Design*, Vol. 41, 2004, pp. 229-251.

22. L. BIEGLER, O. GHATTAS, M. HEINKENSCHLOSS, and B. VAN BLOEMEN WAANDERS (eds.), *Large-Scale PDE-Constrained Optimization*. Lecture Notes in Computational Science and Engineering, Vol. 30, Springer-Verlag, Berlin, Heidelberg, New York, 2003.

23. S. S. COLLIS, K. GHAYOUR, and M. HEINKENSCHLOSS, *Optimal Transpiration Boundary Control for Aeroacoustics*, AIAA Journal, Vol. 41, 2003, pp. 1257–1270.

24. S. S. COLLIS, K. GHAYOUR, M. HEINKENSCHLOSS M. ULBRICH, and S. ULBRICH, *Optimal Control of Unsteady Compressible Viscous Flows*, International Journal for Numerical Methods in Fluids, Vol. 40, 2002, pp. 1401–1429

25. S. S. COLLIS, K. GHAYOUR and M. HEINKENSCHLOSS, *Optimal Control of Aeroacoustic Noise Generated by Cylinder Vortex Interaction*, International Journal of Aeroacoustics, Vol. 1, 2002, pp. 97–114.

26. M. HEINKENSCHLOSS and L. N. VICENTE, *Analysis of Inexact Trust-Region SQP Algorithms*, SIAM J. Optimization, Vol. 12, 2001, pp. 283-302.

Graduate Students Directed

- Peter Geldermans (August 2016 – present; with Prof. A Gillman).

- Timur Takhtaganov (Ph.D. May 2017). *Efficient Estimation of Coherent Risk Measures for Risk-Averse Optimization Problems Governed by Partial Differential Equations with Random Inputs*.

- Caleb Magruder (Ph.D. May 2017). *Projection-Based Model Reduction in the Context of Optimization with Implicit PDE Constraints*.

- Xiaodi Deng (Ph.D. May 2017) *A Parallel-In-Time Gradient-Type Method for Optimal Control Problems*.

- Jedidiah W. Gohlke (M.A. December 2013). Thesis title: *Reduced Order Modeling for Optimization of Large Scale Dynamical Systems*.

- Drew Kouri (Ph.D. May 2012). *An Approach for the Adaptive Solution of Optimization Problems Governed by Partial Differential Equations with Uncertain Coefficients*.

- Millie Mays (MA. May 2012). *Discrete Search Optimization for Real-Time Path Planning in Satellites*.

- Sean Hardesty (Ph.D. May 2010): *Optimization of Shell Structure Acoustics*.

- Klaus Wiegand (M.A. May 2010): *A Numerical Study of an Adjoint Based Method for Reservoir Optimization*.

- Eelco Nederkoorn (M.A. May 2010): *Adaptive finite element methods for linear-quadratic convection dominated elliptic optimal control problems*.

- Jonah Reeger (M.A., May 2009): *A Comparison of Transcription Techniques for the Optimal Control of the International Space Station*.

- Kai Sun (Ph.D. May 2008) (Directed jointly with D. C. Sorensen): *Model Order Reduction and Domain Decomposition for Large-Scale Dynamical Systems*.

- Denis Ridzal (Ph.D. May 2006): *Trust-Region SQP Methods with Inexact Linear System Solves for Large-Scale Optimization*.

- Particia Howard (MA, August 2006): *Multigrid Methods for Elliptic Optimal Control Problems*.

- Agata Comas (Ph.D. December 2005): *Time-Domain Decomposition Preconditioners for the Solution of Discretized Parabolic Optimal Control Problems*.

- Hoang Nguyen (Ph.D. August 2004): *Domain Decomposition Methods for Linear-Quadratic Elliptic Optimal Control Problems*.

- Zhen Wang (Ph.D. December 2003): *A Generalized Trust Region SQP Algorithm for Equality Constrained Optimization*.

- Jesse Pietz (M.A., May 2003): *Pseudospectral Collocation Methods for the Direct Transcription of Optimal Control Problems*.

- Astrid Battermann (MA Department of Mathematics Virginia Tech, July 1996): *Preconditioner for Karush–Kuhn–Tucker Systems Arising in Optimal Control*.