

# Curriculum Vitae

## Dipl.-Ing. Dr.rer.nat. Markus Bachmayr

### PERSONAL

Born on March 25, 1983 in Linz, Austria.  
Nationality: Austria.

### EDUCATION

*Doctorate at RWTH Aachen, May 2008 – Oct 2012,*  
thesis title: “*Adaptive low-rank wavelet methods and applications to two-electron Schrödinger equations*”  
(advisors: Prof. Dr. W. Dahmen, Prof. K. Veroy-Grepl, Ph.D.).

Stipend at Graduate School AICES, May 2008 – Aug 2011,  
employed at IGPM, RWTH Aachen, from Sept 2011,  
graduation summa cum laude, Oct 2012.

*Master’s programme Industrial Mathematics, Nov 2004 – Feb 2007,*  
Johannes Kepler Universität Linz, Austria, graduation with distinction,  
thesis title: “*Iterative total variation methods for nonlinear inverse problems*” (advisor: Prof. Dr. M. Burger).

*Bachelor’s programme Technical Mathematics, Oct 2001 – Nov 2004,*  
Johannes Kepler Universität Linz, Austria, graduation with distinction.

*Khevenhüller Gymnasium Linz, 1993 – 2001,*  
Grammar school, emphasis modern languages, final exam (Matura) passed with distinction.

### EMPLOYMENT

*Wissenschaftlicher Mitarbeiter* (scientific employee), since Oct 2013,  
Institut für Mathematik, Technische Universität Berlin.

*Wissenschaftlicher Mitarbeiter, Sept 2011 – Sept 2013,*  
Institut für Geometrie und Praktische Mathematik, RWTH Aachen.

*Zivildienst* (Civilian alternative to compulsory military service), Jul 2007 – Mar 2008,  
Caritas Oberösterreich Auslandshilfe (foreign aid department of Caritas Upper Austria)

*Software developer, Jul 2001 – Sept 2005 (part-time), Mar–May 2007 (full-time),*  
Salzburger Banken Software, Linz.

### HONORS

*Erwin Wenzl Prize 2007, Category University, awarded for Master’s thesis.*

*Leistungsstipendien* (merit scholarships) of the faculty of technical and natural sciences, Johannes Kepler Universität Linz, academic years 2001/02 and 2003/04.

### FURTHER ACTIVITIES

*Research in Industrial Projects for Students 2006, Jun 25 – Aug 26, 2006,*  
Institute for Pure and Applied Mathematics, University of California Los Angeles,  
Project: “*Simulation of many colliding deformable solids for set dressing and arrangement*”  
(collaboration with Pixar Animation Studios).

*European Student Workshop on Mathematical Modelling in Industry, Sept 1–11, 2005*  
Universitat Autònoma de Barcelona,  
Project: “*Simulation and characterization of two-phase reservoirs*”.

Institute speaker of Institut für Geometrie und Praktische Mathematik, Sept 2012 – Aug 2013.

Student representative of Graduate School AICES, Mar–Sept 2010

### TALKS

#### Invited Talks

Workshop *Discrepancy, Numerical Integration and Hyperbolic Cross Approximation*, Hausdorff Center for Mathematics, Universität Bonn, Sept 23–27, 2013, “*Approximation of high-dimensional rank one tensors*”.

Minisymposium *Low-Rank Tensor Techniques*, ENUMATH 2013, EPF Lausanne, Aug 26–30 2013, “*Adaptive methods based on tensor representations of coefficient sequences*”.

Workshop *Multiscale and High-Dimensional Problems*, Mathematisches Forschungsinstitut Oberwolfach, Jul 28 – Aug 3, 2013, “*Adaptive near-optimal rank tensor approximation for high-dimensional operator equations*”.

Minisymposium *Low Rank Tensor Based Numerical Methods*, MAFELAP 2013, Brunel University London, Jun 11–14, 2013, “*Adaptive methods based on tensor representations of coefficient sequences and their complexity analysis*”.

Workshop on Sparse Grids and Applications, Hausdorff Research Institute for Mathematics, Bonn, May 16–20, 2011, “*Solving the electronic Schrödinger equation in wavelet coordinates: the two-electron case*”

9. Leipzig-Berlin Numerikseminar, TU Berlin, Dec 10, 2010, “*Approximation of correlated electronic wavefunctions by wavelet and low-rank tensor methods*”.

Workshop *Wavelets and Multiscale Methods*, Mathematisches Forschungsinstitut Oberwolfach, Aug 1–7, 2010, “*Hyperbolic wavelet discretization of the electronic Schrödinger equation: explicit correlation and separable approximation of potentials*”.

Oberseminar Angewandte Mathematik, WWU Münster, Jan 13, 2009, “*Bregman iterative methods for total variation regularization of nonlinear inverse problems*”.

### **Contributed Talks**

29<sup>th</sup> GAMM-Seminar Leipzig on Numerical Methods for Uncertainty Quantification, Leipzig, Jan 21–23, 2013, “*Adaptive low-rank methods and their complexity analysis*”.

27<sup>th</sup> GAMM-Seminar Leipzig on Approximation of Multiparametric functions, Leipzig, Jan 10–12, 2011, “*Approximation of electron interaction cusps by wavelets and structured tensor decompositions*”.

8<sup>th</sup> International Conference of Numerical Analysis and Applied Mathematics (ICNAAM 2010), Rhodos, Sept 19–25, 2010, “*An explicitly correlated wavelet method for the electronic Schrödinger equation*”.

### **Poster**

Signal Processing with Adaptive Sparse Structured Representations (SPARS) 2013, EPF Lausanne, Jul 8–11, 2013, “*Adaptive low-rank methods and their complexity analysis*”.

## **TEACHING**

Tutorials “*Numerische Analysis II*”, summer term 2013  
lecture by W. Dahmen, IGPM, RWTH Aachen.

Tutorials “*Numerische Analysis I*”, winter term 2012/13  
lecture by W. Dahmen, IGPM, RWTH Aachen.

Tutorials “*Numerische Mathematik für Maschinenbauer*”, summer term 2012  
lecture by W. Dahmen, IGPM, RWTH Aachen.

Tutorials “*Adaptive Lösungskonzepte*”, winter term 2011/12  
lecture by W. Dahmen, IGPM, RWTH Aachen.

Group supervisor for “*Softwareentwicklungspraktikum CES*” (practical course in software development for computational engineering science), winter term 2009/10,  
course by U. Naumann, LuFG Informatik 12, RWTH Aachen.

Tutorials “*Partielle Differentialgleichungen I*”, summer term 2008  
lecture by A. Wagner, Institute for Mathematics, RWTH Aachen.

Tutorials “*Mathematische Grundlagen I CES*” (Mathematical Basics I for Computational Engineering Science), winter term 2008/09  
lecture by D. Bothe and J. Schöberl, Institute for Mathematics in CES, RWTH Aachen.

## PUBLICATIONS

### Submitted for publication

- [1] M. Bachmayr, W. Dahmen, *Adaptive near-optimal rank tensor approximation for high-dimensional operator equations*, arXiv:1304.7796 [math.NA], 2013, submitted to Foundations of Computational Mathematics.
- [2] M. Bachmayr, H. Chen, R. Schneider, *Numerical analysis of Gaussian approximations in quantum chemistry*, DFG SPP 1324 Preprint 128, 2012, submitted to Numerische Mathematik.

### Refereed journal articles

- [3] M. Bachmayr, W. Dahmen, R. DeVore, L. Grasedyck, *Approximation of high-dimensional rank one tensors*, to appear in Constructive Approximation.
- [4] M. Bachmayr, *Integration of products of Gaussians and wavelets with applications to electronic structure calculations*, SIAM J. Numer. Anal., 51(5), pp. 2491–2513, 2013.
- [5] M. Bachmayr, *Hyperbolic wavelet discretization of the two-electron Schrödinger equation in an explicitly correlated formulation*, M2AN 46(6), pp. 1337–1362, 2012.
- [6] M. Bachmayr und M. Burger, *Iterative total variation schemes for nonlinear inverse problems*, Inverse Problems 25, 105004, 2009.

### Further publications

- [7] M. Bachmayr, *Adaptive near-optimal rank tensor approximation for high-dimensional operator equations*, in Oberwolfach Report 39/2013, Mathematisches Forschungsinstitut Oberwolfach.
- [8] M. Bachmayr, *Hyperbolic wavelet discretization of the electronic Schrödinger equation: Explicit correlation and separable approximation of potentials*, in Oberwolfach Report 33/2010, Mathematisches Forschungsinstitut Oberwolfach.
- [9] M. Bachmayr, *An explicitly correlated wavelet method for the electronic Schrödinger equation*, AIP Conf. Proc. 1281, pp. 933–936, International Conference of Numerical Analysis and Applied Mathematics 2010.
- [10] M. Bachmayr, P. Carrió, Th. End, H. Millar, J. Ward, *Simulation and characterization of two-phase reservoirs*, Proceedings of the European Student Workshop on Mathematical Modelling in Industry 2005, Universitat Autònoma de Barcelona, Instructors: M. Kindelan und M. Moscoso.

November 7, 2013