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Zeeman Building         <http://homepages.warwick.ac.uk/staff/Martin.Lotz/>  
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United Kingdom
- EDUCATION**        **University of Paderborn**, Germany  
Ph.D. (Dr. rer. nat.) in Mathematics, summa cum laude, 2005.  
Advisor: Prof. Peter Bürgisser.  
Dissertation: *On Numerical Invariants in Algebraic Complexity Theory*.
- ETH Zürich (Swiss Federal Institute of Technology)**  
Diploma in Mathematics (Dipl. Math. ETH), 2001.  
Advisor: Prof. János Makowsky.  
Thesis: *On the algebraic complexity of some families of coloured Tutte polynomials*.
- Attended primary and secondary schools in Argentina, Mexico, and Germany.
- PROFESSIONAL MEMBERSHIPS**    Member of the AMS, DMV, SIAM  
Fellow of the Higher Education Academy (UK)
- POSITIONS**         **University of Warwick**  
Associate Professor since September 2018
- The University of Manchester**  
Lecturer in Numerical Analysis October 2012 - August 2018
- The University of Edinburgh**  
Research Fellow, October 2010-September 2012, supported by the Leverhulme Trust and a Seggie Brown Fellowship.
- University of Oxford**  
Research Fellow, July 2008-September 2010, supported by DFG Grant LO 1580/1-1 by the German Research Foundation.
- Previous employment includes**  
Scientific Consultant at Vincorex AG, Zürich.  
Research Fellow at City University of Hong Kong (2005-2008). Teaching assistant at Uni Paderborn and ETH Zürich, consulting work in IT security.
- RESEARCH INTERESTS**    My research interests are in the foundations of computational mathematics and the mathematics of information. My current work is on geometric and probabilistic methods in dimensionality reduction, compressive sensing, optimization theory, and topological data analysis. Among my results in these fields is a complete explanation of the phase transition phenomenon in compressive sensing, which gives insight into the possibilities and limitations of convex regularization. Other research interests include integral geometry, computational geometry and topology, and computational complexity. Due to the varied nature of my work, my contributions have been published in mathematics and computer science journals; examples include the Annals of Probability, Mathematics of Computation, Journal of the ACM and Foundations of Computational Mathematics. Besides my academic research, I gained industry experience as part of a start-up company in Zürich.

## AWARDS

Inaugural best paper award of the journal *Information and Inference* (2015), for the paper “Living on the edge: phase transitions in convex problems with random data”.

Prize of the faculty of Electrical Engineering, Computer Science, and Mathematics of the University of Paderborn for best doctoral dissertation of the year.

## WORK IN PREPARATION

1. *Sharp Phase Transitions in Euclidean Integral Geometry*.  
Preprint (available upon request), with J. A. Tropp.
2. *Randomized cutting plane methods*.  
In preparation, with A. Eftekhari.

## PUBLICATIONS

1. *Dimensionality reduction for  $k$ -distance applied to persistent homology*.  
Proceedings of the 36th Symposium on Computational Geometry, 2020 (to appear).  
(with S. Arya, J.-D. Boissonnat and K. Dutta).
2. *Molecular subtype, biological sex and age shape melanoma tumour evolution*.  
British Journal of Dermatology, 2020 (to appear).  
(with T. Budden, S. Furney and A. Virós).
3. *Wilkinson’s Bus: weak condition numbers, with an application to singular polynomial eigenvalue problems*.  
Foundations of Computational Mathematics, 2020 (published online).  
(with V. Noferini).
4. *Concentration of the Intrinsic Volumes of a Convex Body*.  
Geometric Aspects of Functional Analysis – Israel Seminar (GAFA) 2017-2019  
Lecture Notes in Mathematics 2266, 2020.  
(with M. B. McCoy, I. Nourdin, G. Peccati, J. A. Tropp)
5. *Effective condition number bounds for convex regularization*.  
IEEE Transactions on Information Theory 66.4: 2501-2516, 2020.  
(with D. Amelunxen and J. Walvin)
6. *Persistent homology for low-complexity models*.  
Proceedings of the Royal Society A, 475.2230, 2019.
7. *On the Error in Phase Transition Computations for Compressed Sensing*.  
IEEE Transactions on Information Theory 65.10: 6620-6632, 2019.  
(with S. Daei, F. Haddadi, A. Amini)
8. *Intrinsic volumes of polyhedral cones: a combinatorial perspective*.  
Discrete & Computational Geometry 58.2: 371-409, 2017.  
(with D. Amelunxen)
9. *Average-case complexity without the black swan*.  
Journal of Complexity 41: 82-101, 2017.  
(with D. Amelunxen)
10. *Gordon’s Inequality and Condition Numbers in Convex Optimization*.  
Preprint, 2015.  
(with D. Amelunxen)
11. *On the Volume of Tubular Neighbourhoods of Real Algebraic Varieties*.  
Proceedings of the AMS 143.5, pp. 1875-1889, 2015.

12. *Living on the edge: phase transitions in convex problems with random data.*  
Information and Inference 3(3), pp. 224-294, 2014.  
(with D. Amelunxen, M. McCoy and J. Tropp)
13. *Adversarial Smoothed Analysis.*  
Journal of Complexity 26, pp. 255-262, 2010.  
(with F. Cucker and R. Hauser)
14. *Coverage Processes on Spheres and Condition Numbers of Linear Programming.*  
Annals of Probability 38(2), pp. 570-604, 2010.  
(with P. Bürgisser and F. Cucker)
15. *The probability that a slightly perturbed numerical analysis problem is difficult.*  
Mathematics of Computation 77, pp. 1559-1583, 2008.  
(with P. Bürgisser and F. Cucker)
16. *The Complexity of Computing the Hilbert Polynomial of Smooth Equidimensional Complex Projective Varieties.*  
Foundations of Computational Mathematics 7 (1), pp. 51-86, 2007.  
(with P. Bürgisser)
17. *General formulas for the smoothed analysis of condition numbers.*  
Comptes rendus de l'Académie des sciences Paris, Ser. I 343, pp. 145-150, 2006  
(with P. Bürgisser and F. Cucker)
18. *Smoothed analysis of complex conic condition numbers.*  
Journal de Mathématiques Pures et Appliquées 86, pp. 293-309, 2006.  
(with P. Bürgisser and F. Cucker)
19. *Counting Complexity Classes for Numeric Computations. III: Complex Projective Sets.*  
Foundations of Computational Mathematics 5 (4), pp. 351-387, 2005.  
(with P. Bürgisser und F. Cucker)
20. *The Complexity of Computing the Euler Characteristic of Complex Varieties.*  
Comptes rendus de l'Académie des sciences Paris, Ser. I 339, pp. 370-376, 2004.  
(with P. Bürgisser und F. Cucker)
21. *Lower bounds on the bounded coefficient complexity of bilinear maps.*  
Journal of the ACM 51 (3), pp. 464-482, 2004.  
(with P. Bürgisser)
22. *On the algebraic complexity of some families of coloured Tutte polynomials.*  
Advances in Applied Mathematics 32 (1-2), pp. 327-349, 2004.  
(with J. Makowsky)
23. *Lower bounds on the bounded coefficient complexity of bilinear maps.*  
Proceedings 43rd FOCS, pp. 658-668, November 16-19, 2002, Vancouver.  
(with P. Bürgisser)

SOFTWARE

Conivol: An R package for the (bivariate) chi-bar-squared distribution and conic intrinsic volumes.

<https://github.com/damelunx/conivol>.

(with D. Amelunxen)

CoGAGA: GPU Accelerated Greedy Algorithms for Cosparsely Signal Recovery.

(with E. Brendel)

- THESIS *On Numerical Invariants in Algebraic Complexity Theory.*  
Ph.D. Thesis at Department of Mathematics, University of Paderborn, July 2005.  
Supervised by Prof. P. Bürgisser.
- On the algebraic complexity of some families of coloured Tutte polynomials.*  
Diploma Thesis at Department of Mathematics, ETH Zürich, April 2001.  
Supervised by Prof. R. Stärk and Prof. J. Makowsky.
- RECENT SEMINAR AND COLLOQUIUM TALKS Colloquium and invited seminar talks at Oxford (2018 and 2013), Cambridge (2017), Alan Turing Institute London (2017), Cardiff (2017), Sheffield (2017), Hong Kong University (2016), RWTH Aachen (2015), Paris-Sud (2014), TU Berlin (2014, 2019), Tokyo University (2013).
- SELECTED INVITED CONFERENCE TALKS Invited speaker at all six Foundations of Computational Mathematics conferences between 2002 and 2017, in workshops on Complexity Theory, Computational Algebraic Geometry, and Optimization.
- Wilkinson's Bus: weak condition numbers, with an application to singular polynomial eigenvalue problems*  
SIAM Algebraic Geometry, Berne, 2019.
- Average-case analysis without the black swan*  
Discretization in Geometry and Dynamics, Döllnsee-Schorfheide, 2018.
- Effective condition number bounds in convex regularization*  
Algebra meets numerics: condition and complexity, TU Berlin, 2017.
- Average-case analysis without the black swan*  
Low complexity Models in Signal Processing, Hausdorff Research Institute, Bonn, 2016.
- A blind spot in the probabilistic analysis of algorithms*  
Alan Turing Institute workshop on Information-theoretic Foundations and Algorithms, London, 2015.
- Integral Geometry and Sparse Approximation*  
Applied Harmonic Analysis and Sparse Approximation, Oberwolfach, 2015.
- Conic integral geometry and applications*  
Complexity of Symbolic and Numerical Problems, Schloss Dagstuhl, 2015.
- Conic Intrinsic Volumes: Theory and Applications*  
SIAM Annual Conference, Chicago, 2014.
- On the Geometry of Phase Transitions.*  
Newton Institute programme on Polynomial Optimization, Cambridge University, July 2013.
- A Geometric Theory of Phase Transitions in Convex Optimization.*  
SIAM Annual Meeting, San Diego, June 2013.
- Conditioning of the Convex Feasibility Problem and Sparse Recovery.*  
21st International Symposium on Mathematical Programming, Berlin, August 2012.

GRANTS AND FUNDING

Awarded an Nvidia Academic Hardware Grant, May 2016.

Awarded MAPLE platform grant funding for organising the workshop “Compressive Sensing and Sparsity: Theory and Applications in Tomography” at the University of Manchester, November 2015 (with Oliver Dorn), £7945.00.

Awarded MAPLE platform grant funding for hosting a postdoctoral visitor (May-June 2014).

Awarded a Leverhulme Early Career Fellowship for two years at the University of Edinburgh.

Awarded a Seggie Brown Fellowship at the University of Edinburgh.

Awarded a DFG (German Research Foundation) Research Fellowship for 20 months in Oxford and Hong Kong.

#### VISITS

Invited participant at a special programme “Approximation, sampling and compression in data science” at the Newton Institute, Cambridge, January-July 2019.

Externally funded research visits of at least one week to Hong Kong (2011, 2014, 2015, 2016), RWTH Aachen (July 2015), TU Berlin (May 2014), and Caltech (June 2013).

#### STUDENTS AND POSTDOCS

James Taylor (LMS funded URSS summer research project)  
Log-concave sequences in algebraic combinatorics and integral geometry.

Jake Walvin (PhD student, 2013-2018)  
Phase transitions for general convex regularization.

Dennis Amelunxen (Postdoc, August 2013-July 2014)

Stephen Elsworth (co-supervised PhD student, 2016-2019, with Sabisu)  
Analysis and clustering of industrial time series.

Amit Arfan (co-supervised PhD student, 2017-present)  
Reinforcement learning and Markov processes.

Elliot Brendel (Visiting student from ENSTA ParisTech, May-August 2016)  
Randomized linear algebra.

Joannés Chambon (Visiting student from ENSTA ParisTech, May-August 2017)  
GPU accelerated algorithms for cosparsity signal recovery.

Supervision of many third year, MMath and MSc. projects in Warwick, Manchester, Edinburgh and Oxford, on topics such as matrix completion, tensor computations, compressive sensing, multi-period portfolio optimization and financial volatility.

#### ORGANISATION

Sessions at International Conference on Continuous Optimization, Tokyo (2016)

Workshop on Compressive Sensing in Tomography, Manchester (November 2015)

Session at Stochastic Processes and Applications, Oxford (July 2015)

Complexity Questions in Optimization in Edinburgh (April 2011)

#### TEACHING

**University of Warwick**

Designed, developed and delivered the new third year course **Mathematics of Machine Learning** (Term 1, 2019).

Contents: statistical learning theory, optimization, deep learning.

Course page: <http://homepages.warwick.ac.uk/staff/Martin.Lotz/courses/learning/>

A textbook based on the lecture notes (~ 150 pages) is in preparation.

Teaching **Introduction to Topology** (Term 1 2018 and 2019)

Course page: <http://homepages.warwick.ac.uk/staff/Martin.Lotz/courses/topology/>

### **The University of Manchester (2012-2018)**

Designed, developed and delivered a new third year course Convex Optimization with a view towards applications in machine learning. The lecture notes are presented as Jupyter notebooks combining theory and Python code.

Course page: [www.math36061.org](http://www.math36061.org)

Teaching the course Numerical Analysis I and the MSc level course Scientific Computing, an introduction to C++ programming based on various projects.

Various tutorial, lab and supervision classes.

### **The University of Edinburgh (2010-2012)**

Teaching the course Differential Equations and Modeling, supervision of three MSc students in the Operations Research programme.

### **Other**

Helped out with teaching and supervision in Oxford, Paderborn and ETH Zürich.

## SERVICE

External Examiner at the University of Birmingham (since 2019)

Secretary to the Second Year Exam board (since 2019)

In charge of academic aspects of departmental computing (since 2018)

Year 4 Tutor (2017-2018)

Programme director for the Computer Science with Mathematics joint honours programme (since 2015)

Internal and external PhD examiner on various occasions.

Organiser of yearly student information events for the Numerical Analysis pathway.

Academic advisor to 39 students, ranging from year one to postgraduate.

Regular involvement in admissions interviews.

Regular refereeing activity (among others, for Foundations of Computational Mathematics, Annals of Statistics, Information and Inference, SIAM Journal on Optimization, Mathematical Programming).

Reviewed research funding proposals for research councils in Portugal, Ireland, Hong Kong and Poland.

## KNOWLEDGE AND TECHNOLOGY TRANSFER

Represented the School of Mathematics at Manchester during scoping visits to BBC and Autotrader UK.

Co-supervision of PhD student with Sabisu.

Participated in Maths & Industry Workshops in Manchester.

PERSONAL

Nationality: British and German

Languages: German (native), Spanish (native), English (fluent)

OTHER

Experience in software development (C++, Python), with scientific computing tools (R, MATLAB, Julia, Sage, among others) and GPU Computing (CUDA)