

- CONTACT** School of Mathematics Phone: 07531103398
The University of Manchester martin.lotz@manchester.ac.uk
Alan Turing Building www.maths.manchester.ac.uk/~mlotz
Oxford Road www.math36061.org
Manchester M139PL
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, MOS (Mathematical Optimization Society)
- POSITIONS** **The University of Manchester**
Lecturer in Numerical Analysis since October 2012.
- 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.
- Other employment includes**
Scientific Consultant at Vincorex AG, Zürich (2010-2012). 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 mathematics of information and on foundations of computational mathematics. My current focus is on applications of probabilistic and geometric methods to dimensionality reduction, compressive sensing and data inference, large scale optimization, and topological data analysis. Among my results in these fields is a complete explanation of the phase transition phenomenon in convex optimization and compressive sensing, which gives insight into the possibilities and limitations of convex regularization as a tool for large-scale data acquisition. A new, interdisciplinary research project uses machine learning and Bayesian data analysis to disentangle mutation patterns in cancer genomes. Previous and ongoing research interests also include computational geometry and topology, integral geometry, and computational complexity. Due to the varied nature of my work, my contributions have been published in mathematics and mathematically oriented computer science journals; examples include the Annals of Probability, Journal of the ACM and Foundations of Computational Mathematics.

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.

PUBLICATIONS

1. *Persistent homology for low-complexity models*.
Preprint, 2017.
2. *Effective condition number bounds for convex regularization*.
Preprint, 2017.
(with D. Amelunxen and J. Walvin)
3. *Intrinsic volumes of polyhedral cones: a combinatorial perspective*.
To appear in *Discrete and Computational Geometry*, 2017.
(with D. Amelunxen)
4. *Average-case complexity without the black swan*.
Journal of Complexity, published online, 2016.
(with D. Amelunxen)
5. *Gordon’s Inequality and Condition Numbers in Convex Optimization*.
Preprint, 2015. To be split into two papers on the suggestion of the editor.
(with D. Amelunxen)
6. *On the Volume of Tubular Neighbourhoods of Real Algebraic Varieties*.
Proceedings of the AMS 143.5, pp. 1875-1889, 2015.
7. *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)
8. *Adversarial Smoothed Analysis*.
Journal of Complexity 26, pp. 255-262, 2010.
(with F. Cucker and R. Hauser)
9. *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)
10. *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)
11. *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)
12. *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)
13. *Smoothed analysis of complex conic condition numbers*.
Journal de Mathématiques Pures et Appliquées 86, pp. 293-309, 2006.
(with P. Bürgisser and F. Cucker)

14. *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)
15. *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)
16. *Lower bounds on the bounded coefficient complexity of bilinear maps.*
Journal of the ACM 51 (3), pp. 464-482, 2004.
(with P. Bürgisser)
17. *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)
18. *Lower bounds on the bounded coefficient complexity of bilinear maps.*
Proceedings 43rd FOCS, pp. 658-668, November 16-19, 2002, Vancouver.
(with P. Bürgisser)

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.

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.

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.

RECENT SEMINAR AND COLLOQUIUM TALKS	Colloquium and seminar talks at Cardiff (2017), Sheffield (2017), Hong Kong University (2016), RWTH Aachen (2015), Paris-Sud (2014), TU Berlin (2014), Tokyo University (2013), Oxford (2013).
GRANTS AND FUNDING	<p>In preparation: Multidisciplinary Project Award by EPSRC and Cancer Research UK on novel data analysis methods in melanoma research (with Amaya Viros, CRUK), for 4 years, to be submitted in September 2017.</p> <p>In preparation: EPSRC Standard Grant “Integral Geometry for Dimensionality Reduction”.</p> <p>Awarded an Nvidia GPU grant (around £3,000), May 2016.</p> <p>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), £7,945.00.</p> <p>Awarded MAPLE platform grant funding for hosting a postdoctoral visitor (May-June 2014).</p> <p>Awarded a Leverhulme Early Career Fellowship for two years at the University of Edinburgh.</p> <p>Awarded a Seggie Brown Fellowship at the University of Edinburgh.</p> <p>Awarded a DFG (German Research Foundation) Research Fellowship for 20 months in Oxford and Hong Kong.</p>
VISITS	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	<p>Dennis Amelunxen (Postdoc, August 2013-July 2014)</p> <p>Fatemeh Nosrat (PhD student, starting 2017)</p> <p>Amit Arfan (PhD student, 2017-present)</p> <p>Stephen Elsworth (PhD student, 2016-present)</p> <p>Jake Walvin (PhD student, 2013-2017)</p> <p>Elliot Brendel (Visiting student from ENSTA ParisTech, May-August 2016)</p> <p>Joannés Chambon (Visiting student from ENSTA ParisTech, May-August 2017)</p> <p>Supervision of many third year, MMath and MSc. projects in Manchester, Edinburgh and Oxford, on topics such as matrix completion, tensor computations, compressive sensing, multi-period portfolio optimization and financial volatility.</p>
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

The University of Manchester (since 2012)

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

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

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

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)

KNOWLEDGE AND
TECHNOLOGY
TRANSFER

Represented the School of Mathematics during scoping visits to BBC and Auto-trader UK.

Preparing a KTP project with Arctic Shores on games based psychometric testing.

Co-supervision of PhD student with Sabisu.

Participated in two Maths & Industry Workshops in Manchester.

Supervised MSc projects in Edinburgh with Vincorex AG (Zürich).

OTHER

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

Experience with statistical methods and with large-scale financial data management and analysis through work with Vincorex.

REFERENCES

Available on request.