

Raymond Hemmecke

– Curriculum Vitae –

CONTACT INFORMATION

Zentrum Mathematik, M9
Technische Universität München
85747 Garching
Germany

Phone: +49-89-289 16864
Fax: +49-89-289 16859
E-mail: hemmecke@ma.tum.de
WWW: <http://www-m9.ma.tum.de>

PERSONAL DATA

Born on July 16, 1972, in Kölleda, Germany
Nationality: German

EDUCATION

Otto-von-Guericke-University Magdeburg, Germany

Habilitation degree in mathematics (Dr. rer. nat. habil.), December, 2006

- “Representations of lattice point sets: theory, algorithms, applications”
- Advisor: Robert Weismantel

Mercator-University Duisburg, Germany

Ph.D. degree in mathematics (Dr. rer. nat.), September, 2001

- “On the decomposition of test sets: building blocks, connection sets, and algorithms”
- Advisor: Rüdiger Schultz

University of Leipzig, Germany

Diploma degree (Dipl. Math.), Mathematics, December, 1997

- “Untersuchung verschiedener Dekompositionsverfahren für polynomiale Gleichungssysteme”
- Advisor: Hans-Gert Gräbe

EMPLOYMENTS

Professor (W2)

TU Munich, Germany
Zentrum Mathematik

11/2009 –

Guest Professor (W2)

TU Munich, Germany
Zentrum Mathematik

10/2009 – 11/2009

Guest Professor (W2)

TU Darmstadt, Germany
Department of Mathematics

10/2008 – 09/2009

Scientific Assistant (C1)

Otto-von-Guericke-University Magdeburg, Germany
Department of Mathematics

02/2004 – 09/2008

Visiting Research Assistant Professor (VRAP)

University of California, Davis, CA, USA
Department of Mathematics

07/2001 – 12/2003

Scientific Employee

Mercator-University Duisburg, Germany
Department of Mathematics

10/1998 – 06/2001

Scientific Employee

University of Leipzig, Germany
Department of Mathematics

10/1998 – 06/2001

AWARDS

- **2011 Abraham Mechrez Prize for Best Student Paper** (awarded to L. Romanchuk by the OR Society of Israel) for
R. Hemmecke, S. Onn, and L. Romanchuk. N-fold integer programming in cubic time. To appear in *Mathematical Programming*, e-print, arXiv:1101.3267, 2011.
- **2nd prize winning paper at the “UTIA Best 2010 Paper competition”**, UTIA Prag, for
R. Hemmecke, S. Lindner, and M. Studený. Learning restricted Bayesian network structures. *International Journal of Approximate Reasoning* 51 (2010), 573–586.

GRANTS

- eXIST Start-Up Grant **2013**
“Magazino–simple storage”
- Banff International Research Station (BIRS) Focused Research Group **2010**
“Nonlinear Discrete Optimization”
with Jesus De Loera (UC Davis), Matthias Köppe (UC Davis), Jon Lee (IBM), Shmuel Onn (Technion Haifa), Robert Weismantel (ETH Zrich)
- Faculty Research Grant, UC Davis **2003**
“Algebraic and geometric techniques for the automatic computation of counting formulas”
with Jesus De Loera (UC Davis)

FIVE SELECTED
PUBLICATIONS

- J. A. De Loera, R. Hemmecke, M. Köppe, R. Weismantel. Integer polynomial optimization in fixed dimension. *Mathematics of Operations Research* **31** (2006), 147–153.
- R. Hemmecke, J. Morton, A. Shiu, B. Sturmfels, O. Wienand. Convex rank tests and semi-graphoids: three counterexamples. *Combinatorics, Probability and Computing* **17** (2008), 239–257.
- J. A. De Loera, R. Hemmecke, S. Onn, R. Weismantel. N-fold integer programming. *Discrete Optimization* **5** (2008), 231–241.
- R. Hemmecke, P. Malkin. Computing generating sets of lattice ideals and Markov bases of lattices. *Journal of Symbolic Computation* **44** (2009), 1463–1476.
- R. Hemmecke, S. Onn, R. Weismantel. A polynomial oracle-time algorithm for convex integer minimization problems. *Mathematical Programming* **126** (2011), 97–117.

SOFTWARE
DEVELOPMENT

- **4ti2** <http://www.4ti2.de>
Software-Package for algebraic, geometric and combinatorial problems in linear spaces (jointly with M. Köppe, P. Malkin und M. Walter)
- **LattE** <http://www.math.ucdavis.edu/~latte>
Software-Package to count lattice points in rational polyhedra and to compute Hilbert series (jointly with J. A. De Loera, D. Haws, P. Huggins, M. Köppe, J. Tauzer and R. Yoshida)

SELECTED INVITED
TALKS

- Mixed Integer Programming Workshop Series, MIP 2009, Berkeley **(06/2009)**
“Optimality Certificates, N-fold IPs and Nash Equilibria”
- (Pre)Doc Course “Integer Points in Polyhedra”, Berlin **(05–06/2007)**
Course “Representations of lattice point sets”
- Workshop “Software for Algebraic Geometry”, IMA, Minneapolis **(10/2006)**
“4ti2–Computation of Hilbert bases, Graver bases, toric Gröbner bases and more”
- Conference “Theoretical Effectivity and Practical Effectivity of Gröbner Bases”, Tokyo **(08/2005)**
“Effective computation of Gröbner bases and Markov bases of toric ideals”
- Workshop “Randomness, Geometry, and Counting”, Berlin **(12/2004)**
“Test sets in integer programming: recent developments”

Fifth Biannual Bay Area Discrete Math Day, Berkeley (10/2002)
 “Hilbert bases”

ORGANIZATION OF WORKSHOPS

Organizer of two-days workshop at TU Munich 2012
 “Combinatorial Optimization, Statistics, and Applications”, <http://www.cosa-workshop.de>

Organizer of two-days workshop at TU Munich 2011
 “Combinatorial Optimization, Statistics, and Applications”, <http://www.cosa-workshop.de>

Organizer of one-day workshop at TU Darmstadt 2009
 “Model Selection Day”, <http://www.model-selection-day.de>

Organizer of one-day workshop at Otto-von-Guericke University Magdeburg 2008
 “Model Selection Day”, <http://www.model-selection-day.de>

PROFESSIONAL ACTIVITIES

Reviewer for International Scientific Journals
 Journal of Symbolic Computation, Discrete Mathematics, Discrete Optimization, Journal of Discrete Applied Mathematics, Mathematical Programming, SIAM Journal on Optimization, Mathematical Methods of Operations Research, Operations Research Letters, Mathematical Research Letters, European Journal of Operational Research, Annals of Combinatorics, Australasian Journal of Combinatorics, Journal of Multivariate Analysis, Journal on Linear Algebra and its Applications, Ann. Inst. Statist. Math., International Journal of Approximate Reasoning, Information Processing Letters, European Journal of Forest Research

Reviewer for
 Czech Science Foundation (GA CR)

REFERENCES

- Jesús A. De Loera (University of California, Davis, USA)
 deloera@math.ucdavis.edu
 +1-530-754 7029
- Bernd Sturmfels (University of California, Berkeley, USA)
 bernd@math.berkeley.edu
 +1-510-642 4687
- Robert Weismantel (ETH Zurich)
 robert.weismantel@ifor.math.ethz.ch
 +41-44-632 4815

PUBLICATIONS

2001-2003

1. R. Hemmecke and K. Schiele. Migration Effects at Driven Pendula. *ZAMM (Applied Mathematics and Mechanics)* **81** (2001), Potsdam, Germany, 291–303.
2. R. Hemmecke and R. Schultz. Decomposition Methods for two-stage Stochastic Integer Programs. In: *Online Optimization of Large Scale Systems*, M. Grötschel, S.O. Krumke, J. Rambau (eds.), Springer, 2001, 601–622.
3. R. Hemmecke. On the computation of Hilbert bases of cones. In: *Mathematical Software, ICMS 2002*, A. M. Cohen, X.-S. Gao, N. Takayama (eds.), World Scientific, 2002, 307–317.
4. R. Hemmecke and R. Schultz. Decomposition of Test Sets in Stochastic Integer Programming. *Mathematical Programming* **94** (2003), 323–341.
5. R. Hemmecke. On the Positive Sum Property and the Computation of Graver test sets. *Mathematical Programming* **96** (2003), 247–269.

6. R. Hemmecke, R. Schultz, and D. L. Woodruff. Interdicting Stochastic Networks. In: “Network Interdiction and Stochastic Integer Programming, D. L. Woodruff (ed.), Kluwer, 2003, 69–84.
7. M. Ahmed, J. A. DeLoera, and R. Hemmecke. Polyhedral Cones of Magic Cubes and Squares. In: “*Discrete and Computational Geometry - The Goodman-Pollack Festschrift*”, S. Basu et al. (eds.), Springer, Berlin, 2003.

2004-2006

8. J. A. DeLoera, D. Haws, R. Hemmecke, P. Huggins, B. Sturmfels, and R. Yoshida. Short Rational Functions for Toric Algebra and Applications. *Journal of Symbolic Computation* **38** (2004), 959–973.
9. J. A. DeLoera, R. Hemmecke, J. Tauzer, and R. Yoshida. Effective Lattice Point Counting in Rational Convex Polytopes. *Journal of Symbolic Computation* **38** (2004), 1273–1302.
10. J. A. DeLoera, D. Haws, R. Hemmecke, P. Huggins, and R. Yoshida. Three Kinds of Integer Programming Algorithms based on Barvinok’s Rational Functions. In: *Integer Programming and Combinatorial Optimization: 10th International IPCO Conference*, D. Bienstock and G. Nemhauser (eds.), Springer, 2004, 244–255.
11. H. Held, R. Hemmecke, and D. L. Woodruff. A Decomposition Algorithm Applied to Planning the Interdiction of Stochastic Networks. *Naval Research Logistics* **52** (2005), 321–328.
12. J. A. DeLoera, D. Haws, R. Hemmecke, P. Huggins, and R. Yoshida. A Computational Study of Integer Programming Algorithms based on Barvinok’s Rational Functions. *Journal of Discrete Optimization* **2** (2005), 135–144.
13. J. A. DeLoera, R. Hemmecke, M. Köppe, and R. Weismantel. Integer Polynomial Optimization in Fixed Dimension. *Mathematics of Operations Research* **31** (2006), 147–153.
14. J. A. DeLoera, R. Hemmecke, M. Köppe, and R. Weismantel. FPTAS for mixed-integer polynomial optimization with a fixed number of variables. In: *Proceedings of the 17th Annual ACM-SIAM Symposium on Discrete Algorithms*, Miami, FL, 743–748.

2007-2009

15. R. Hemmecke and R. Weismantel. Representation of sets of lattice points. *SIAM Journal on Optimization* **18** (2007), 133–137.
16. M. Aschenbrenner and R. Hemmecke. Finiteness theorems in stochastic integer programming. *Foundations of Computational Mathematics* **7** (2007), 183–227.
17. R. Hemmecke, J. Morton, A. Shiu, B. Sturmfels, and O. Wienand. Convex Rank Tests and Semi-graphoids: Three Counterexamples. *Combinatorics, Probability and Computing* **17** (2008), 239–257.
18. J. A. DeLoera, R. Hemmecke, M. Köppe, and R. Weismantel. FPTAS for optimizing polynomials over the mixed-integer points of polytopes in fixed dimension. *Mathematical Programming* **115** (2008), 273–290.
19. J. A. DeLoera, R. Hemmecke, S. Onn, and R. Weismantel. N-fold integer programming. *Discrete Optimization* **5** (2008), 231–241.
20. J. A. DeLoera, R. Hemmecke, M. Köppe. Pareto Optima of Multicriteria Integer Linear Programs. *INFORMS Journal on Computing* **21** (2009), 39–48.
21. R. Hemmecke and K. A. Nairn. On the Gröbner complexity of matrices. *Journal of Pure and Applied Algebra* **213** (2009), 1558–1563.
22. J. De Loera, R. Hemmecke, S. Onn, U. G. Rothblum, and R. Weismantel. Convex integer maximization via Graver bases. *Journal of Pure and Applied Algebra* **213** (2009), 1569–1577.

23. R. Hemmecke, A. Takemura, and R. Yoshida. Computing holes in semi-groups and its application to transportation problems. *Contributions to Discrete Mathematics* **4** (2009), 81–91.
24. R. Hemmecke and P. Malkin. Computing generating sets of lattice ideals and Markov bases of lattices. *Journal of Symbolic Computation* **44** (2009), 1463–1476.
25. R. Hemmecke, M. Köppe, J. Lee, and R. Weismantel. Nonlinear integer programming. Invited book chapter in: *50 Years of Integer Programming 1958–2008: The Early Years and State-of-the-Art Surveys*, M. Jünger, T. Liebling, D. Naddef, G. Nemhauser, W. Pulleyblank, G. Reinelt, G. Rinaldi, and L. Wolsey (eds.), Springer-Verlag, 2009, ISBN 3540682740.

2010-2012

26. R. Hemmecke, M. Studený and J. Vomlel. A geometric view on learning Bayesian network structures. *International Journal of Approximate Reasoning* **51** (2010), 573–586.
27. U.-U. Haus and R. Hemmecke. Unraveling the initial phase of the permanganate/oxalic acid reaction. *Journal of Mathematical Chemistry* **48** (2010), 305–312.
28. R. Hemmecke, M. Köppe, and R. Weismantel. A polynomial-time algorithm for optimizing over N -fold 4-block decomposable integer programs. In: *Integer Programming and Combinatorial Optimization*, Lecture Notes in Computer Science **6080** (2010), 219–229.
29. R. Hemmecke, S. Lindner, and M. Studený. Characteristic imset: a simple algebraic representative of a Bayesian network structure. In Proceedings of PGM 2010 (P. Myllymäki, T. Roos, T. Jaakkola eds.), HIIT Publications 2010, available online at www.helsinki.fi/pgm2010/proceedings.html
30. R. Bouckaert, R. Hemmecke, S. Lindner, and M. Studený. Efficient algorithms for conditional independence inference. *Journal of Machine Learning Research* **11** (2010), 3453–3479.
31. R. Hemmecke, S. Onn, and R. Weismantel. A polynomial oracle-time algorithm for convex integer minimization problems. *Mathematical Programming* **126** (2011), 97–117.
32. R. Hemmecke, S. Onn, and R. Weismantel. N -fold integer programming and nonlinear multi-transshipment. *Optimization Letters* **5** (2011), 13–25.
33. W. Bruns, R. Hemmecke, B. Ichim, M. Köppe, and Ch. Söger. Challenging computations of Hilbert bases of cones associated with algebraic statistics. *Experimental Mathematics* **20** (2011), 25–33.
34. E. Eisenschmidt, R. Hemmecke, and M. Köppe. Computation of atomic fibers of \mathbb{Z} -linear maps. *Contributions to Discrete Mathematics* **6** (2011), 36–69.
35. U.-U. Haus, R. Hemmecke, and S. Pokutta. Computing biochemical cluster networks. *Journal of Mathematical Chemistry* **49** (2011), 2441–2456.
36. D. Haws, R. Hemmecke, S. Lindner, and M. Studený. Polyhedral approach to statistical learning graphical models. In *Proceedings of the Second CRESTSBM International Conference, ‘Harmony of Gröbner Bases and the Modern Industrial Society*, 2011.
37. R. Hemmecke, S. Kosub, E. W. Mayr, Hanjo Täubig, and J. Weihmann. Inequalities for the Number of Walks in Trees and General Graphs and a Generalization of a Theorem of Erdős and Simonovits. In: *Proceedings of the 9th Meeting on Analytic Algorithmics and Combinatorics (ANALCO’12) (16. Januar 2012, Kyoto, Japan)*, 26–39, SIAM, 2012.
38. T. Bogart, R. Hemmecke, and S. Petrović. Equality of Graver and Universal Gröbner bases of colored partition identities. *Experimental Mathematics* **21** (2012), 395–401.
39. J. A. De Loera, R. Hemmecke, and M. Köppe. Foundations of Discrete Optimization: In transition from linear to non-linear models and methods. DMV Jahresbericht Band 114 (2012), Heft 4, 189–207.

40. R. Hemmecke, S. Onn, and L. Romanchuk. N -fold integer programming in cubic time. *Mathematical Programming* **137** (2013), 325–341.
41. R. Hemmecke, M. Köppe, and R. Weismantel. Graver basis and proximity techniques for block-structured separable convex integer minimization problems. To appear in *Mathematical Programming*.

Monographs

1. R. Hemmecke. Untersuchung verschiedener Dekompositionsverfahren für polynomiale Gleichungssysteme. Diplomarbeit, Universität Leipzig, 1997.
2. R. Hemmecke. On the Decomposition of Test Sets: Building Blocks, Connection Sets, and Algorithms. Dissertation, Universität Duisburg, 2001.
3. R. Hemmecke. Representations of lattice point sets: Theory, Algorithms, Applications. Habilitationsschrift, Otto-von-Guericke-Universität Magdeburg, 2006.
4. J. A. De Loera, R. Hemmecke, M. Köppe. *Algebraic and Geometric Ideas in the Theory of Discrete Optimization*. MOS-SIAM Series on Optimization, 2013.