

Dr. Peter Mayr

Department of Mathematics, CU Boulder

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Degrees

2013 Habilitation	Mathematics (venia docendi), JKU Johannes Kepler University Linz, Austria
2004 PhD	Mathematics (Doktor der technischen Wissenschaften), JKU Linz, Austria
1999 MSc	Mathematics (Dipl.-Ingenieur), JKU Linz, Austria

Employment at academic institutions

2015 – present	Assistant professor, CU Boulder, Colorado
2012 – 2015	Research associate, JKU Linz, Austria
2009 – 2012	Research associate, Centro de Álgebra da Universidade de Lisboa, Lisbon, Portugal
2007 – 2009	Assistant professor, JKU Linz, Austria
2006 – 2007	Erwin Schrödinger fellow, CU Boulder, Colorado
2004 – 2006	Assistant professor, JKU Linz, Austria
2003 – 2004	Research assistant, JKU Linz, Austria
2002 – 2003	Visiting researcher, UW Madison, Wisconsin

Current research interests

- Universal algebra and logic: clones of operations and relations, equational theories, classification and structure of finite algebras, duality
- Computer algebra: algorithms, structure and complexity issues for computational problems on general algebras, constraint satisfaction problems
- Classical algebra: group actions, permutation groups, semigroups

Grants and awards

1. Simons collaboration grant (pending): Subdirect products in algebra, PI.
2. NSF grant (pending): Algebraic approach to promise constraint satisfaction, PI.
3. NSF grant no. DMS-1728937, conference proposal: BLAST 2017, 2018, 2019, co-PI.
4. NSF collaborative research grant: Algebra and algorithms, structure and complexity theory (2015–2018), co-PI.
5. FWF (Austrian Science Fund) project: Computations in direct products (2012 – 2015), 350.000 Euro, PI.
6. Marie Curie Fellowship for W. Bentz (University of Lisbon, Portugal, 2011 – 2014): As the host at University of Lisbon, I wrote the application jointly with Bentz.

January 20, 2019

7. Erwin Schrödinger Grant of the FWF (Austrian Science Fund): Clones on groups (2006 – 2007), 34.000 Euro, PI.
8. FWF (Austrian Science Fund) project: Planar near-rings – theory and applications (2002–2005), co-PI.
9. Award of the Austrian Math. Society (Studienpreis der ÖMG): Best Austrian Master’s thesis in Mathematics in 1999.

Refereed publications

Papers are in reverse chronological order, authors in alphabetical order.

1. A. Bulatov, P. Mayr and Á. Szendrei. *The subpower membership problem for finite algebras with cube terms.* (49 pages), to appear in Logical Methods in Computer Science. <https://arxiv.org/abs/1803.08019>
2. K. Kearnes, P. Mayr, and N. Ruškuc. *Solvable quotients of subdirect products of perfect groups are nilpotent.* Bulletin London Math. Soc., 50(6), 1016–1026, 2018.
3. P. Mayr and N. Ruškuc. *Finiteness properties of direct products of algebraic structures.* J. Algebra, 494 (2018), 167–187.
4. A. Bulatov, M. Kozik, P. Mayr, and M. Steindl. *The subpower membership problem for semigroups.* International Journal of Algebra and Computation (IJAC), 26(7), 14351451, 2016.
5. H. Chen and P. Mayr. *Quantified Constraint Satisfaction on monoids.* 25th EACSL Annual Conference on Computer Science Logic (CSL 2016). Jean-Marc Talbot and Laurent Regnier (Eds.), LIPICS Vol. 62.
6. E. Aichinger and P. Mayr. *Finitely generated equational classes.* Journal Pure and Applied Algebra, 220, 2816–2827, 2016.
7. E. Aichinger and P. Mayr. *Independence of algebras with edge term.* International Journal of Algebra and Computation (IJAC), 25(7), 1145–1157, 2015.
8. E. Aichinger, P. Mayr and R. McKenzie. *On the number of finite algebraic structures.* Journal European Math. Society (JEMS), 16(8), 1673–1686, 2014.
9. W. Bentz and P. Mayr. *Supernilpotence prevents dualizability.* Journal Australian Math. Society, 96, 1–24, 2014.
10. P. Mayr. *On finitely related semigroups.* Semigroup Forum, 86(3), 613–633, 2013.
11. P. Mayr. *The subpower membership problem for Mal’cev algebras.* International Journal of Algebra and Computation (IJAC), 22(7), 1250075 (23 pages), 2012.
12. G. Horváth, P. Mayr, and A. Pongrácz. *Characterizing translations on groups by cosets of their subgroups.* Comm. Algebra, 40, 3141–3168, 2012.
13. E. Aichinger, P. Mayr, J. D. P. Meldrum, G. L. Peterson and S. D. Scott. *Units of compatible nearrings.* Monatsh. Math., 164(2), 119–132, 2011.
14. P. Mayr. *Mal’cev algebras with supernilpotent centralizers.* Algebra Universalis, 65(2), 193–211, 2011.
15. K. Kaarli and P. Mayr. *Polynomial functions on subdirect products.* Monatsh. Math., 159(4), 341–359, 2010.

16. E. Jabara and P. Mayr. *Frobenius complements of exponent dividing $2^m * 9$* . Forum Math., 21(2), 217–220, 2009.
17. P. Mayr. *Polynomial functions on squarefree groups*. International Journal of Algebra and Computation (IJAC), 18(4), 759–777, 2008.
18. G. Landsmann, P. Mayr and J. Schicho. *A topological property of polynomial functions on $GL(2, \mathbb{R})$* . Aequationes Math., 73(1-2), 71–77, 2007.
19. E. Aichinger and P. Mayr. *Polynomial clones on groups of order pq* . Acta Math. Hungar., 114(3), 267–285, 2007.
20. P. Mayr. *The polynomial functions on Frobenius complements*. Acta Sci. Math. (Szeged), 72(1-2), 37–50, 2006.
21. P. Mayr. *Sharply 2-transitive groups with point stabilizer of exponent 3 or 6*. Proc. Amer. Math. Soc., 134(1), 9–13, 2006.
22. T. Boykett and P. Mayr. *Fixed-point-free automorphism groups from rings*. Southeast Asian Bull. Math., 29(2), 253–257, 2005.
23. T. Boykett and P. Mayr. *Difference methods and Ferrero pairs*. In Kiechle, Hubert (ed.) et al., *Nearrings and nearfields*. Proceedings of the conference on nearrings and nearfields, Hamburg, Germany, July 27-August 3, 2003. Dordrecht: Springer, 177–187, 2005.
24. E. Aichinger and P. Mayr. *Polynomial functions and endomorphism near-rings on certain linear groups*. Comm. Algebra, 31(11), 5627–5651, 2003.
25. P. Mayr and F. Morini. *Nearrings whose set of N -subgroups is linearly ordered*. Results Math., 42(3-4), 339–348, 2002.
26. F. Binder and P. Mayr. *Algorithms for finite near-rings and their N -groups*. J. Symbolic Comput., 32(1-2), 23–38, 2001.
27. E. Aichinger, F. Binder, J. Ecker, P. Mayr and C. Nöbauer. *Algorithms for near-rings of non-linear transformations*. Proceedings of the ISSAC 2000, 23–29, St. Andrews, Scotland, ACM, 2000.

Software

28. E. Aichinger, F. Binder, J. Ecker, P. Mayr and C. Nöbauer. *SONATA (GAP package for computation with nearrings), version 2.9.1 (2018)*. <https://gap-packages.github.io/sonata/>

Submitted

29. P. Mayr and N. Ruškuc. *Generating subdirect products*. (26 pages), submitted 2018. <https://arxiv.org/abs/1802.09325>
30. P. Mayr and N. Ruškuc. *Presentations for subrings and subalgebras of finite co-rank*. (20 pages), submitted 2018. <https://arxiv.org/abs/1709.04435>

Talks

Invited plenary talks at conferences are highlighted.

1. *Complexity for transformation semigroups*. International Conference on Semigroups 2018, Lisbon, Portugal, July 2018.
2. *Subdirect products of perfect groups*. Linz Algebra Research Day – LARD 2018, Linz, Austria, June 2018.
3. *Computing with transformation semigroups*. Technical University Vienna Algebra Seminar, Vienna, Austria, June 2018.
4. *Universal algebra for groups*. Workshop Algebra and Algorithms, Honolulu, Hawaii, May 2018.
5. *Presentations for subrings of finite co-rank*. AAA 95 – Workshop on General Algebra, Bratislava, Slovakia, February 2018.
6. *Reidemeister-Schreier for rings*. Rocky Mountain Algebraic Combinatorics Seminar, CSU Fort Collins, Colorado, September 2017.
7. ***Computing in direct products of algebras*. BLAST 2017, Nashville, Tennessee, August 2017.**
8. *The complexity of quantified constraint satisfaction on monoids*. Workshop: Symmetry in finite and infinite structures, Lisbon, Portugal, July 2017.
9. ***A few algebras, subpowers and relations*. Symmetry in finite models (Conference to celebrate the 70th anniversary of Peter J. Cameron), Lisbon, Portugal, July 2017.**
10. *The complexity of quantified constraint satisfaction on monoids*. AAA 94 – Workshop on General Algebra, Novi Sad, Serbia, June 2017.
11. *Reidemeister-Schreier for rings*. Linz Algebra Research Day – LARD 2017, Linz, Austria, June 2017.
12. *Quantified constraint satisfaction in monoids*. 2017 AMS Sectional Meeting, Charleston, South Carolina, March 2017.
13. ***Zauberwürfel, Sudoku und Algebra*. AAA 93 – Workshop on General Algebra, Open Session, Bern, Switzerland, February 2017.**
14. *Subpower membership in residually small varieties with cube term* AAA 93 – Workshop on General Algebra, Bern, Switzerland, February 2017.
15. *Finite generation and presentation for subdirect products of loops*. 2016 AMS Sectional Meeting, Denver, Colorado, October 2016.
16. *Finitely generated congruence modular varieties*. Front Range Logic Saturdays, Golden, Colorado, September 2016.
17. *Finiteness conditions for subdirect products*. AAA 92 – Workshop on General Algebra, Prague, Czech Republic, May 2016.
18. *Computational problems for direct products of algebras*. 2015 International Meeting of AMS/EMS/SPM, Porto, Portugal, June 2015.
19. ***Computations in direct powers*. AAA 90 – Workshop on General Algebra, Novi Sad, Serbia, June 2015.**

20. *Deciding supernilpotence*. BLAST 2015, Las Cruces, New Mexico, January 2015.
21. *Direct products and finite presentations*. Linz Algebra Research Day – LARD 2014, Linz, Austria, October 2014.
22. ***Finitely generated varieties with edge term*. Algebras and Clones fest, Prague, Czech Republic, June 2014.**
23. *Finite generation and direct products*. AAA 88 – Workshop on General Algebra, Warsaw, Poland, June 2014.
24. *Computing in direct powers*. Workshop “Algebra and its applications”, Mokko, Estonia, April 2014.
25. *Generating direct powers*. Linz Algebra Research Day – LARD 2013 (Christmas edition), Linz, Austria, December 2013.
26. *Finitely related algebras*. Habilitation Colloquium, JKU Linz, Austria, October 2013.
27. *Finiteness properties of direct products*. 2013 AMS Southeastern Sectional Meeting, Louisville, Kentucky, October 2013.
28. *The degree of operations on groups*. Kangro-100 Methods of Analysis and Algebra, Tartu, Estonia, September 2013.
29. *Supernilpotence prevents dualizability*. BLAST 2013, Orange, California, August 2013.
30. *Functions on p -groups are like homomorphisms*. Linz Algebra Research Day – LARD 2013, Linz, Austria, June 2013.
31. *Supernilpotence prevents dualizability*. NSAC 2013, Novi Sad, Serbia, June 2013.
32. *The degree of operations on groups*. CU Boulder, Colorado, April 2013.
33. *Termoperationen und Relationen auf algebraischen Strukturen*. Johannes Kepler Symposium, JKU Linz, Austria, March 2013.
34. *Operations on p -groups are basically homomorphisms*. AAA 85 – Workshop on General Algebra, Luxemburg, February 2013.
35. *Kurze Darstellungen von Unterhalbgebren direkter Produkte und ihre Anwendungen*. TU Dresden, Germany, January 2013.
36. *Computation in direct powers*. Pure Math Colloquium, University of St Andrews, UK, December 2012.
37. *Finitely related semigroups*. Workshop on Semigroups, Lisbon, Portugal, May 2012.
38. ***Almost all semigroups are finitely related*. AAA 83 – Workshop on General Algebra, Novi Sad, Serbia, March 2012.**
39. *Checking membership in direct powers*. Groups and Semigroups: Interactions and Computations, Lisbon, Portugal, July 2011.
40. *On the subpower membership problem for Malcev algebras*. 2011 AMS Spring Central Sectional Meeting, Iowa City, Iowa, March 2011.
41. *Recognizing partial term functions*. AAA 81 – Workshop on General Algebra, Salzburg, Austria, February 2011.

42. *On the number of finite algebras.* Seminario de Algebra, University of Coimbra, Portugal, December 2010.
43. *Term functions and subalgebras.* Workshop on Algebra, Lisbon, Portugal, July 2010.
44. ***Algebras with few subpowers are finitely related.*** International Conference on Algebras and Lattices, Prague, Czech Republic, June 2010.
45. *Subpower membership and interpolation.* Workshop on Algebra, Complexity and CSP, Lisbon, Portugal, June 2010.
46. *On finitely related clones.* 2010 AMS Spring Central Sectional Meeting, St Paul, Minnesota, April 2010.
47. *Some finitely related clones.* AAA 79 – Workshop on General Algebra, Olomouc, Czech Republic, February 2010.
48. *Nearrings of polynomial functions on expanded groups.* 21st International Conference on Near-rings and Near-fields, Vorau, Austria, July 2009.
49. *Describing polynomial functions implicitly.* Linz Algebra Research Day – LARD 2009, Linz, Austria, June 2009.
50. *Polynomial functions and higher commutators.* AAA 78 – Workshop on General Algebra, Bern, Switzerland, June 2009.
51. *Are Mal'cev clones finitely related?* Charles University Prague, Czech Republic, May 2009.
52. *Affine complete G -sets.* 2009 AMS Spring Central Sectional Meeting, Urbana, Illinois, March 2009.
53. *Functions that are compatible with group actions.* Southern Regional Algebra Conference 2009, Mobile, Alabama, March 2009.
54. *Are polynomial clones of Mal'cev algebras finitely related?* Eötvös Lorand University Budapest, Hungary, December 2008.
55. *Affine complete G -sets.* Eötvös Lorand University Budapest, Hungary, December 2008.
56. *Polynomial functions on subdirect products.* AAA 76 – Workshop on General Algebra, Linz, Austria, May 2008.
57. *Frobenius complements of exponent $2^m \cdot 9$ are finite.* 2008 Joint Mathematics Meetings, San Diego, California, January 2008.
58. *Polynomial clones on squarefree groups and certain Mal'cev algebras.* AAA75 – Workshop on General Algebra, Darmstadt, Germany, November 2007.
59. *Polynomial clones on squarefree groups.* International Conference on Order, Algebra, and Logic, Nashville, Tennessee, July 2007.
60. *Functions on algebras.* Buffalo State College, New York, March 2007.
61. *Sharply 2-transitive permutation groups.* University of Tartu, Estonia, May 2006.
62. *Clones on expanded groups.* University of Tartu, Estonia, May 2006.
63. *On polynomial functions on squarefree expanded groups.* AAA 71 – Workshop on General Algebra, Bedlewo, Poland, February 2006.
64. *Construction and analysis of near-rings.* Sage Days 2006, San Diego, California, February 2006.

65. *Sharply 2-transitive permutation groups with point stabilizer of finite exponent.* Groups St Andrews 2005, UK, August 2005.
66. *Varieties of nearrings satisfying $x^n = x$.* NSAC 05, Novi Sad, Serbia, July 2005.
67. *Clones containing the polynomial functions on groups of order pq .* Conference on Universal Algebra and Lattice Theory, Szeged, Hungary, July 2005.
68. *A topological property of polynomials on some general linear groups.* AAA 70 – Workshop on General Algebra, Vienna, Austria, May 2005.
69. *Polynomial functions on classical groups and Frobenius groups.* AAA 68 – Workshop on General Algebra, Dresden, Germany, June 2004.
70. *Endomorphism near-rings on classical groups.* University of Tainan, Taiwan, September 2003.
71. *Polynomial functions on groups.* University of Taipei, Taiwan, September 2003.
72. *Polynomial functions on linear groups.* 18th International Conference on Nearrings and Nearfields, Hamburg, Germany, July 2003.
73. *Sharply 2-transitive groups.* UW Madison, Wisconsin, April 2003.
74. *Polynomial functions on linear groups.* UW Madison, Wisconsin, October 2002.
75. *On Frobenius groups.* 17th International Conference on Nearrings and Near-fields, Harrisonburg, Virginia, July 2001.
76. *SONATA Workshop 2001.* 17th International Conference on Nearrings and Nearfields, Harrisonburg, Virginia, July 2001.
77. *Fixed-point-free representations of finite groups.* AAA 62 – Workshop on General Algebra, Linz, Austria, June 2001.
78. *On weakly divisible near-rings.* Universita Degli Studi Brescia, Italy, February 2001.
79. *On finite fixed-point-free automorphism groups.* 16th International Conference on Nearrings and Nearfields, Edinburgh, UK, July 1999.
80. *Fixed-point-free automorphisms.* AAA 58 – Workshop on General Algebra, Vienna, Austria, June 1999.
81. *Ferrero pairs and their construction in SONATA.* Universita Cattolica del Sacro Cuore Brescia, Italy, May 1999.
82. *On some properties of linear codes from finite planar near-rings.* 15th International Conference on Nearrings and Nearfields, Stellenbosch, South Africa, July 1997.

Teaching

Courses developed

Computability Theory, Math 6010 (CU Boulder, Fall 2015)
Algorithmic Abstract Algebra (JKU Linz, Fall 2013)
Representation Theory of Finite Groups (JKU Linz, Fall 2002)

Independent studies at CU Boulder

Computability Theory with T. Jack, A. Sparks, Fall 2016
Semigroup Theory with J. DuBeau, T. Jack, M. Pullins, M. Wheeler, Spring 2018

CU Boulder

Math 2001 – Introduction to Discrete Mathematics	Fall 2015, Fall 2016, Spring 2018
Math 2135 – Linear Algebra for Math Majors	Fall 2018
Math 3130 – Introduction to Linear Algebra	Spring 2016
Math 3140 – Abstract Algebra 1	Fall 2016
Math 6010 – Computability Theory	Fall 2015
Math 6140 – Modern Algebra 2	Spring 2017, Spring 2018

JKU Linz, Austria

Algebra for Computer Science Majors	Fall 2007, Fall 2008
Algebra for Computer Science Majors (TA)	Fall 2000, Fall 2001
Algebra Seminar	Spring 2005, Fall 2005, Spring 2006, Fall 2007, Fall 2008
Algorithmic Abstract Algebra	Fall 2013
Discrete Mathematics	Spring 2008
Introduction to Algebra (TA)	Spring 1999, Spring 2009, Spring 2014
Linear Algebra (TA)	Spring 1999, Fall 1999, Spring 2000, Fall 2000, Spring 2001, Fall 2001, Fall 2004, Spring 2005, Fall 2012, Spring 2013, Fall 2014
Representation Theory of Finite Groups	Spring 2002, Spring 2004, Spring 2006

University of Lisbon, Portugal

Coding Theory (TA) Spring 2011

University of Applied Sciences Upper Austria, Austria

Calculus (TA)	Spring 2005
Coding Theory and Cryptography (TA)	Fall 2004, Fall 2005, Fall 2007
Discrete Mathematics (TA)	Fall 2005, Fall 2007, Fall 2008
Linear Algebra (TA)	Fall 1999, Spring 2000, Fall 2000, Spring 2001, Fall 2001, Spring 2002, Fall 2005, Fall 2007
Probability Theory and Statistics (TA)	Fall 2000, Fall 2001

Mentoring and advising

Postdoctoral fellows

- W. DeMeo, since August 2017, CU Boulder.
- M. Steindl, January-December 2016, CU Boulder.

PhD students

- T. Jack, (comprehensive exam, 2016) CU Boulder.
- A. Sparks, (comprehensive exam, 2017) CU Boulder.
- M. Steindl. Computations in direct products. PhD, JKU Linz, Austria, 2015.
- O. Koshik. Categorical equivalence of algebras. PhD, University of Tartu, Estonia, 2015, supervised jointly with K. Kaarli.

Master's students

- S. Zweckinger. Computing in direct powers of expanded groups. MSc, JKU Linz, Austria, 2013.
- F. Renetseder-Saxinger. Computer-assisted analysis of polynomial completeness for groups and rings. MSc, JKU Linz, Austria, 2013, supervised jointly with E. Aichinger.
- B. Mayrhauser. A survey of results on Černý's conjecture on finite automata. MSc, JKU Linz, Austria, 2009, supervised jointly with E. Aichinger.

Undergraduate students

- S. Kreinecker. Equations for semigroups. Bachelor's thesis, JKU Linz, Austria, 2014.

Editorial work, reviewing and refereeing

- Editor for Algebra Universalis
- Reviewer for MathSciNet and Zentralblatt
- Referee for:

Algebra Universalis	American Math. Monthly
Annals of Combinatorics	Bulletin London Math. Soc.
Communications in Algebra	Discrete Math. Theor. Comput. Sci.
Internat. J. Algebra Comput.	J. Aust. Math. Soc.
J. Comput. System Sci.	J. Europ. Math. Soc.
Math. Pannonica	Proceedings London Math. Soc.
Quaest. Math.	Rep. Math. Logic
Results Math.	Rocky Mountain J. Math.
Semigroup Forum	Theoretical Computer Science
- Reviewing grant applications for:
 - Chilean National Science and Technology Commission (CONICYT - Chile)
 - Natural Sciences and Engineering Research Council of Canada (NSERC)

Membership in professional organizations

American Mathematical Society, Austrian Mathematical Society

Conference organization

1. Algebra and Algorithms 2016 – Structure and Complexity Theory Workshop, Boulder, Colorado, May 2016, co-organizer.
2. LARD 2014 – Linz Algebra Research Day, Linz, Austria, October 2014, principal organizer.
3. AAA 87 – Workshop on General Algebra, Linz, Austria, February 2014, co-organizer.
4. LARD 2013 – Linz Algebra Research Day, Linz, Austria, June 2013, principal organizer.
5. Workshop on Universal Algebra, Complexity and CSP, Lisbon, Portugal, June 2010, co-organizer.
6. LARD 2009 – Linz Algebra Research Day, Linz, Austria, June 2009, principal organizer.
7. AAA 76 – Workshop on General Algebra, Linz, Austria, May 2008, co-organizer.
8. LARD 2008 – Linz Algebra Research Day, Linz, Austria, 2008, co-organizer.

Outreach

- CU Boulder Math Club: *Rubik's cube versus Sudoku*, talk, CU Boulder, Colorado, November 2016.
- Consulting on mathematical content for the production of the play “Incendies” by Wajdi Mouawad at Landestheater Linz, Austria, November 2014.
- Kepler Salon: *Puzzles and Math*, public lecture, Linz, Austria, October 2014.
- 5 day Workshop Applied Mathematics: Coding Theory for gifted high school students, Zell an der Pram, Austria, February 2005.

Service at the Math Department, CU Boulder

- Chair of website committee, Fall 2018.
- Member of teaching quality framework, Fall 2018.
- Co-organizer of the Kempner colloquium, Spring 2016 – Spring 2018.
- Co-organizer of the graduate algebra seminar, Fall 2015 – present.
- Member of graduate committee, Fall 2016 – Spring 2017.
- Member of undergraduate committee, Fall 2015 – Spring 2016.