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## Contact information

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**Qualification:** Doctor of Philosophy in Mathematics, University of Auckland (March 2018)

**Positions held:** (September 2022 - ) Assistant Professor, Drexel University

(September 2021 - August 2022) Postdoc, University of Copenhagen

(August 2018 - Aug 2021) Visiting Assistant Professor, Texas A&M University

(November 2017 - August 2018) Postdoctoral Fellow, Ben-Gurion University of the Negev

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## Education

2014 - 2017: Doctor of Philosophy in Mathematics, Faculty of Science, University of Auckland. Thesis: *Noncommutative rational functions and their finite dimensional representations*, supervisor: Igor Klep.

2012 - 2014: Master in Mathematics (2nd cycle master's study program Mathematics), Faculty of Mathematics and Physics, University of Ljubljana. GPA: 10/10, thesis: *Homological properties of truncated quiver algebras*, supervisor: Matjaž Omladič.

2009 - 2012: Bachelor in Mathematics (1st cycle academic study program Mathematics), Faculty of Mathematics and Physics, University of Ljubljana. GPA: 10/10, thesis: *Hochschild cohomology of an algebra related to an oriented cycle*, supervisor: Matjaž Omladič.

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## Grants and scholarships

2024: US Junior Oberwolfach Fellow grant, Mathematisches Forschungsinstitut Oberwolfach.

October 2023 - September 2027: BSF grant 2022235 "Local and algebraic phenomena in noncommutative function theory", United States - Israel Binational Science Foundation (with Eli Shamovich).

June 2020 - August 2021, January 2023 - May 2024: NSF grant DMS-1954709 "Noncommutative Rational Functions in Free Analysis", National Science Foundation (sole principal investigator).

2020: US Junior Oberwolfach Fellow grant, Mathematisches Forschungsinstitut Oberwolfach.  
2019: Early career travel award, Society for Industrial and Applied Mathematics.  
2019: Travel support, Fields Institute for Research in Mathematical Sciences.  
2014 - 2017: University of Auckland Doctoral Scholarship.  
2017: Student travel grant, American Mathematical Society.  
2017: Oberwolfach Leibniz Graduate Student grant, Mathematisches Forschungsinstitut Oberwolfach.  
2016: Student travel grant, New Zealand Mathematical Society.  
2015, 2016: Performance-based research fund allocation for travel expenses, Tertiary Education Commission of New Zealand.  
2009 - 2014: Zois Scholarship, Slovene Human Resources Development and Scholarship Fund.

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## Published papers

28. I. Klep, V. Magron, J. Volčič, J. Wang: *State polynomials: positivity, optimization and nonlinear Bell inequalities*, Math. Prog. (2023) DOI: 10.1007/s10107-023-02024-5
27. H. Derksen, I. Klep, V. Makam, J. Volčič: *Ranks of matrix pencils and orbit equivalence*, Adv. Math. 415 (2023) 108888
26. I. Klep, C. Scheiderer, J. Volčič: *Globally trace-positive noncommutative polynomials and the unbounded tracial moment problem*, Math. Ann. 387 (2022) 1403–1433
25. F. Huber, I. Klep, V. Magron, J. Volčič: *Dimension-free entanglement detection in multipartite Werner states*, Commun. Math. Phys. 396 (2022) 1051–1070
24. K. Aguilar, Á. Chávez, S. R. Garcia, J. Volčič: *Norms on complex matrices induced by complete homogeneous symmetric polynomials*, Bull. Lond. Math. Soc. 54 (2022) 2078–2100
23. J. W. Helton, I. Klep, J. Volčič: *Factorization of noncommutative polynomials and Nullstellensätze for the free algebra*, Int. Math. Res. Not. 1 (2022) 343–372
22. I. Klep, V. Magron, J. Volčič: *Optimization over trace polynomials*, Ann. Henri Poincaré 23 (2022) 67–100
21. I. Klep, J. E. Pascoe, J. Volčič: *Positive univariate trace polynomials*, J. Algebra 579 (2021) 303–317
20. J. W. Helton, I. Klep, S. McCullough, J. Volčič: *Noncommutative polynomials describing convex sets*, Found. Comput. Math. 21 (2021) 575–611
19. J. Volčič: *Hilbert's 17th problem in free skew fields*, Forum Math. Sigma 9 (2020) E61
18. H. Dym, J. W. Helton, I. Klep, S. McCullough, J. Volčič: *Plurisubharmonic noncommutative rational functions*, J. Math. Anal. Appl. 492 (2020) 124421, 23 pp

17. I. Klep, V. Vinnikov, J. Volčič: *Multipartite rational functions*, Doc. Math. 25 (2020) 1285–1313
16. I. Klep, J. E. Pascoe, G. Podlogar, J. Volčič: *Noncommutative rational functions invariant under the action of a finite solvable group*, J. Math. Anal. Appl. 490 (2020) 124341, 17 pp
15. J. Volčič: *Free Bertini's theorem and applications*, Proc. Amer. Math. Soc. 148 (2020) 3661–3671
14. I. Klep, V. Vinnikov, J. Volčič: *Local theory of free noncommutative functions: germs, meromorphic functions and Hermite interpolation*, Trans. Amer. Math. Soc. 373 (2020) 5587–5625
13. I. Klep, J. Volčič: *A note on group representations, determinantal hypersurfaces and their quantizations*, in Operator Theory, Functional Analysis and Applications, 393–402, Oper. Theory Adv. Appl. 282, Birkhäuser/Springer, Cham, 2020
12. J. W. Helton, I. Klep, S. McCullough, J. Volčič: *Bianalytic free maps between spectrahedra and spectraballs*, J. Funct. Anal. 278 (2020) 108472, 61 pp
11. J. Volčič: *Stable noncommutative polynomials and their determinantal representations*, SIAM J. Appl. Algebra Geometry 3 (2019) 152–171
10. J. W. Helton, I. Klep, J. Volčič: *Geometry of free loci and factorization of noncommutative polynomials*, Adv. Math. 331 (2018) 589–626
9. I. Klep, Š. Špenko, J. Volčič: *Positive trace polynomials and the universal Procesi-Schacher conjecture*, Proc. London Math. Soc. 117 (2018) 1101–1134
8. J. Volčič: *Matrix coefficient realization theory of noncommutative rational functions*, J. Algebra 499 (2018) 397–437
7. M. Brešar, C. Hanselka, I. Klep, J. Volčič: *Skolem-Noether algebras*, J. Algebra 498 (2018) 294–314
6. I. Klep, J. Povh, J. Volčič: *Minimizer extraction in polynomial optimization is robust*, SIAM J. Optim. 28 (2018) 3177–3207
5. I. Klep, J. Volčič: *Free loci of matrix pencils and domains of noncommutative rational functions*, Comment. Math. Helv. 92 (2017) 105–130
4. I. Klep, J. E. Pascoe, J. Volčič: *Regular and positive noncommutative rational functions*, J. London Math. Soc. 95 (2017) 613–632
3. J. Volčič: *On domains of noncommutative rational functions*, Linear Algebra Appl. 516 (2017) 69–81
2. I. Klep, V. Vinnikov, J. Volčič: *Null- and Positivstellensätze for rationally resolvable ideals*, Linear Algebra Appl. 527 (2017) 260–293
1. J. Volčič: *Cyclic homology of truncated quiver algebras*, J. Pure Appl. Algebra 219 (2015) 33–46

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## Submitted papers

3. R. Chen, J. Volčič, L. Mančinska: *All projective measurements can be self-tested*, ArXiv: 2302.00974
2. I. Klep, V. Magron, J. Volčič: *Sums of squares certificates for polynomial moment inequalities*, arXiv: 2306.05761
1. J. Volčič: *Constant-sized self-tests for maximally entangled states and single projective measurements*, arXiv: 2306.13498

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## Reports

3. J. Volčič: *State polynomials: positivity and applications*, in Real algebraic geometry with a view toward Koopman operator methods, Oberwolfach Rep. 14 (2023) 771–774
2. J. Volčič: *Free real algebraic geometry, with a focus on convexity*, in Real algebraic geometry with a view toward hyperbolic programming and free probability, Oberwolfach Rep. 12 (2020) 687–689
1. J. Volčič: *Real free loci of linear matrix pencils*, in Real algebraic geometry with a view toward moment problems and optimization, Oberwolfach Rep. 14 (2017) 844–846

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## Awards

2019: Excellent in Science program recognition for the most prominent annual achievements, with a presentation for the general audience, Slovenian Research Agency (for paper #9).

2018: Hatherton Award for best paper in physical sciences, earth sciences or mathematics and information sciences by a New Zealand University PhD, Royal Society Te Apārangi (for paper #8).

2018: Dean of Graduate Studies List in recognition of excellence achieved with PhD thesis, University of Auckland.

2014: Solemn Plaque for Exceptional Study Achievements, University of Ljubljana.

2013, 2012: Second Prize and Third Prize at International Mathematics Competition for University Students organised, University College London.

2012: Prešeren Award for outstanding bachelor's thesis, Faculty of Mathematics and Physics, University of Ljubljana.

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## Invited conference talks and session organizations

*Aug 2024*: Mathematical Theory of Networks and Systems, University of Cambridge, United Kingdom.

*Aug 2024*: International Workshop on Operator Theory and Applications, University of Kent, United Kingdom.

*Apr 2024*: Non-commutative Function Theory and Free Probability, Mathematisches Forschungsinstitut Oberwolfach, Germany.

*January 2024*: Joint Mathematics Meetings, San Francisco, California.

*Nov 2023*: Combinatorics in Algebraic Structures: Invariant Theory and its Applications(online).

*Aug 2023*: International Workshop on Operator Theory and Applications, University of Helsinki, Finland.

*Jul 2023*: Rings and Factorizations, University of Graz, Austria (*plenary talk*).

*Jun 2023*: Conference of the International Linear Algebra Society, Polytechnic University of Madrid, Spain.

*May 2023*: Joint Spectra and related Topics in Complex Dynamics and Representation Theory, Banff International Research Station, Canada.

*Mar 2023*: Real Algebraic Geometry with a View toward Koopman Operator Methods, Mathematisches Forschungsinstitut Oberwolfach, Germany.

*Sep 2022*: Mathematical Theory of Networks and Systems, University of Bayreuth, Germany.

*Sep 2022*: International Workshop on Operator Theory and Applications, Jagiellonian University, Poland.

*Jun 2022*: Algebraic and Combinatorial Perspectives in the Mathematical Sciences (online).

*Aug 2021*: International Workshop on Operator Theory and Applications, Lancaster University, United Kingdom (*semi-plenary talk*).

*Aug 2021*: International Workshop on Operator Theory and Applications, Chapman University, California.

*Jun 2021*: 8th European Congress of Mathematics, Portorož, Slovenia.

*Jun 2021*: Noncommutative inequalities, American Institute of Mathematics (online).

*Mar 2021*: 37th Southeastern Analysis Meeting (online; *semi-plenary talk*).

*Jan 2021*: Joint Mathematics Meetings (online).

*Jun 2020*: The Online Operator Theory and Related Topics.

*Mar 2020*: Real Algebraic Geometry with a View Toward Hyperbolic Programming and Free Probability, Mathematisches Forschungsinstitut Oberwolfach, Germany.

*January 2020*: Joint Mathematics Meetings, Denver, Colorado.

*Nov 2019*: AMS Southeastern Sectional Meeting, University of Florida, Florida.

*Oct 2019:* Noncommutative Analysis, Computational Complexity, and Quantum Information, Harvard University, Massachusetts.

*Jul 2019:* International Workshop on Operator Theory and Applications, University of Lisbon, Portugal.

*Jul 2019:* SIAM Conference on Applied Algebraic Geometry, University of Bern, Switzerland.

*Jun 2019:* Focus Program on Applications of Noncommutative Functions, Fields Institute, Canada.

*Apr 2019:* Multivariable Spectral Theory and Representation Theory, Banff International Research Station, Canada.

*Jul 2018:* International Workshop on Operator Theory and Applications, East China Normal University, China.

*Jul 2018:* Mathematical Theory of Networks and Systems, The Hong Kong University of Science and Technology, Hong Kong.

*Jan 2018:* Joint Mathematics Meetings, San Diego, California.

*Jun 2017:* Multivariable Operator Theory, Technion, Israel.

*Mar 2017:* Real Algebraic Geometry With a View Toward Moment Problems and Optimization, Mathematisches Forschungsinstitut Oberwolfach, Germany.

*Jul 2016:* International Workshop on Operator Theory and Applications, Washington University in St. Louis, Missouri.

*Jul 2016:* Conference of the International Linear Algebra Society, Catholic University of Leuven, Belgium.

*Dec 2015:* New Zealand Mathematical Society Colloquium, University of Canterbury, New Zealand.

*Jun 2015:* Noncommutative rings and their applications, University of Artois, France.

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### **Seminar and colloquium talks**

*Feb 2024:* Algebra seminar, Georgia Institute of Technology, Georgia.

*Nov 2023:* Analysis seminar, University at Albany, New York.

*Oct 2023:* Analysis seminar, Drexel University, Pennsylvania.

*May 2023:* Analysis seminar, Drexel University, Pennsylvania.

*Jan 2023:* Mathematics of quantum theory seminar, University of Copenhagen, Denmark.

*Sep 2022:* Analysis seminar, Drexel University, Pennsylvania.

*Mar 2022:* Mathematics colloquium, University of Haifa, Israel.

*Feb 2022:* Functional analysis seminar, University of California San Diego, California.

*Sep 2021*: Mathematics of quantum theory seminar, University of Copenhagen, Denmark.

*Apr 2021*: Department of mathematics colloquium, University of Texas at San Antonio, Texas.

*Apr 2021*: Operator theory talks for early researchers (online).

*Mar 2021*: Algebra and functional analysis seminar, University of Ljubljana, Slovenia.

*Mar 2021*: Operator algebras and quantum information seminar (online).

*Feb 2021*: Algebra and combinatorics seminar, Texas A&M University, Texas.

*Oct 2020*: Geometry, algebra, singularities and combinatorics seminar, Northeastern University, Massachusetts.

*Oct 2020*: Department of mathematics colloquium, University of Florida, Florida.

*Nov 2019*: Algebra and combinatorics seminar, Texas A&M University, Texas.

*Oct 2019*: Linear analysis seminar, Texas A&M University, Texas.

*Jun 2019*: Algebra and functional analysis seminar, University of Ljubljana, Slovenia.

*May 2019*: Algebra and combinatorics seminar, University of Auckland, New Zealand.

*Apr 2019*: Geometry seminar, Texas A&M University, Texas.

*Sep 2018*: Algebra and combinatorics seminar, Texas A&M University, Texas.

*Sep 2018*: Noncommutative functions seminar, Texas A&M University, Texas.

*May 2018*: Algebraic geometry & number theory seminar, Ben-Gurion University of the Negev, Israel.

*Apr 2018*: Algebra and combinatorics seminar, Texas A&M University, Texas.

*Feb 2018*: Cohn's theory of universal skew fields of fractions (three 90' lectures), Ben-Gurion University of the Negev, Israel.

*Jan 2018*: Functional analysis seminar, University of California San Diego, California.

*Jan 2018*: Operator algebras & operator theory seminar, Ben-Gurion University of the Negev, Israel.

*Oct 2017*: Algebra and functional analysis seminar, University of Ljubljana, Slovenia.

*Mar 2017*: Free probability seminar, Saarland University, Germany.

*Feb 2017*: Structure theory seminar, Graz University of Technology, Austria.

*Jun 2016*: Algebra seminar, University of Ljubljana, Slovenia.

*May 2016*: Algebra and geometry seminar, University of Auckland, New Zealand.

*Mar 2016*: Algebra and geometry seminar, University of Auckland, New Zealand.

*Sep 2015*: Algebra and combinatorics seminar, University of Auckland, New Zealand.

*Jul 2015*: Structure theory seminar, Graz University of Technology, Austria.

*Jun 2015*: Algebra seminar, University of Ljubljana, Slovenia.

*Jun 2015*: Free probability seminar, Saarland University, Germany.

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## Teaching experience and training

*2024*: Instructor, 2nd/3rd linear algebra course (30 students), Drexel University.

*2023*: Instructor, graduate matrix analysis course (15 students), Drexel University.

Instructor, 1st/2nd year linear algebra course (30 students), Drexel University.

*2022*: Instructor, 1st/2nd year linear algebra course (30 students), Drexel University.

Instructor, 3rd year differential equations course (30 students), Drexel University.

*2021*: Introduction to University Pedagogy (*training*), intensive 77h course, University of Copenhagen.

*2021*: Lecturer, 1st year discrete mathematics course (100 students), University of Copenhagen.

*2021*: Instructor, 4th year advanced linear algebra course (40 students), Texas A&M University.

*2020*: Instructor, 1st year Honors calculus course (100 students), Texas A&M University.

Instructor, 4th year complex analysis course (30 students), Texas A&M University.

*2019*: Instructor, 3rd year linear algebra course (three times 45 students), Texas A&M University.

*2018*: Instructor, 1st year calculus course (100 students), Texas A&M University.

*2017*: Teaching assistant, postgraduate algebraic geometry course (20 students), University of Auckland.

*2015, 2016*: Teaching assistant, 3rd year real/complex calculus course (30 students), University of Auckland.

*2015, 2016*: Tutor and marker, 1st and 2nd year courses, University of Auckland.

*2014, 2015*: Course notes preparation for a 2nd year linear algebra course and a third year real/complex calculus course, University of Auckland.

*2013*: Tutor, 2nd year linear algebra course, University of Ljubljana.

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## Academic service

Faculty council committee 2023-2024, College of Arts and Sciences, Drexel University.

Graduate program committee 2023-2024, Department of Mathematics, Drexel University.

Graduate applications committee 2022-2023, Department of Mathematics, Drexel University.

Diversity, equity and inclusion committee 2022-2023, Department of Mathematics, Drexel University.

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## Research service

Co-organizer:

Session “Symmetries, Positivity and Representations” at the International Workshop on Operator Theory and Applications, Helsinki 2023.

Session “Noncommutative real algebraic geometry and function theory” at the International Workshop on Operator Theory and Applications, Kraków 2022.

Summer school “The mathematics of quantum entanglement via nonlocal games” at the University of Copenhagen, 2022.

Workshop “Noncommutative inequalities” at the American Institute of Mathematics, 2021.

Session “Free algebraic geometry and free analysis” at the International Workshop on Operator Theory and Applications, Lancaster 2021.

Panelist for reviewing proposals of research grants for FY22, Division of Mathematical Sciences, National Science Foundation.

Reviewer for AMS Mathematical Reviews and Zentralblatt MATH.

Referee for peer-reviewed international mathematical journals, such as Transactions of the American Mathematical Society, Proceedings of the London Mathematical Society, Journal of Algebra, Journal of Functional Analysis, Journal of Pure and Applied Algebra, SIAM Journal on Applied Algebra and Geometry, Communications in Algebra, International Journal of Algebra and Computation, Communications in Mathematical Physics, Quantum Information Processing, Annales Henri Poincaré, Ars Mathematica Contemporanea, Journal of Mathematical Analysis and Applications, Bulletin of the London Mathematical Society.

A Mathematica package for realizations of noncommutative rational functions,  
<https://github.com/NCAalgebra/UserNCNotebooks/tree/master/2017>

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## Teaching service

Moderator of a graduate student writing group at Texas A&M University in Spring 2020.

Supervisor and marker for the Auckland Mathematical Olympiad in 2015 and 2016, and for the Texas A&M High School Mathematics Contest in 2019 and 2020. Activity organizer for the TAMU Math Circle in Fall 2019 (education enrichment and outreach project for local high school students).

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## Computer skills and languages

Mathematica, Matlab, Macaulay2, Gap, Singular, Python, LaTeX, HTML.

English (fluent), Slovene (native), French (intermediate), Danish (beginner).