Curriculum vitæ

Alex Fink

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Research interests The meeting of combinatorics with algebra and geometry, in particular matroids and tropical mathematics.

Positions held

2013–	Academic post in the School of Mathematical Sciences, Queen Mary University of London. Senior Lecturer, 2016–present; Lecturer, 2013–2016.
2010–2013	Research Associate (Postdoc), mentored by Seth Sullivant, North Carolina State University

Education

2006–2010	PhD, mathematics, advised by Bernd Sturmfels and Federico Ardila, University of California, Berkeley
2002–2006	BSc Honours, pure mathematics, and BSc Honours, computer science, University of Calgary

Grants, academic awards

2016	Support to attend the Combinatorial Algebraic Geometry theme semester, Fields Institute.
2015–2017	EPSRC First Grant *Algebra and geometry of matroids*, EP/M01245X/1.
2012	Postdoctoral Fellowship in the Commutative Algebra theme semester, Mathematical Sciences Research Institute.
2006–2009	Berkeley Fellowship (UC Berkeley)
2007–2008	NSERC Julie Payette PGS M Research Scholarship

Publications

Articles in preparation

1. with Dori Bejleri and Diane Maclagan, *The tropical Hilbert scheme.*
2. with Madhusudan Manjunath, *The Eagon complex of the toppling ring.*
3. with Jeff Giansiracusa and Noah Giansiracusa, *Tropical linear ideals.*

Preprints, articles submitted

4. with Clément Dupont and Luca Moci, *Universal Tutte characters via combinatorial coalgebras*, arXiv:1711.09028.
5. with Luca Moci, *Polytopes and parameter spaces for matroids over valuation rings*, arXiv:1707.01026.
6. with Karola Mészáros and Avery St. Dizier, *Schubert polynomials as integer point transforms of generalized permutahedra*, arXiv:1706.04935.
7. with Amanda Cameron, *A lattice point counting generalisation of the Tutte polynomial*, extended abstract accepted to FPSAC 2016, arXiv:1604.00962. Full version forthcoming.
8. with Andrew Berget, *Matrix orbit closures*, arXiv:1306.1810.

Accepted and published articles

9. with David Speyer and Alexander Woo, *A Gröbner basis for the graph of the reciprocal plane*, to appear in Journal of Commutative Algebra. arXiv:1703.05967.
10. with Jenna Rajchgot and Seth Sullivant, *Matrix Schubert varieties and Gaussian conditional independence models*, Journal of Algebraic Combinatorics **44** no. 4 (2016), 1009–1046. arXiv:1510.04124.
11. with Richard K Guy, *The outercoarseness of the n-cube*, Contributions to Discrete Math. **12** no. 2 (2017), #582.
12. with Andrew Berget, *Equivariant Chow classes of matrix orbit closures*, Transformation Groups **22** no. 3 (2016). doi:10.1007/s00031-016-9406-5. arXiv:1507.05054.
13. with Felipe Rincon, *Stiefel tropical linear spaces*, Journal of Combinatorial Theory, Series A **135** (2015), 291–331. arXiv:1305.6329.
14. with Luca Moci, *Matroids over a ring*, J. Eur. Math. Soc. **18** issue 4 (2016), 681–731. arXiv:1209.6571.
15. with Aviezri Fraenkel and Carlos Santos, *Lim is not slim*, International Journal of Game Theory **43** issue 2 (2014), 269–281.
16. with David Speyer, *K-classes of matroids and equivariant localization*, Duke Math. J. **161** no. 14 (2012), 2699–2723. arXiv:1004.2403.
17. with Richard Nowakowski and Aaron Siegel and David Wolfe, *Toppling conjectures*, Games of No Chance 4, MSRI Publications volume 63 (2015), 65–76.
18. *Chow polytopes and tropical cycles*, Beiträge zur Algebra und Geometrie **54** no. 1 (2013), 13–40. arXiv:1001.4784.
19. *Lattice games without rational strategies*, Journal of Combinatorial Theory, Series A **119** (2012), pp. 450–459. doi:10.1016/j.jcta.2011.10.005.
20. *The binomial ideal of the intersection axiom for conditional probabilities*, J. of Algebraic Combinatorics **33** issue 3 (2011), 455–463. doi:10.1007/s10801-010-0253-5.
21. with Benjamin Iriarte Giraldo, *Bijections between noncrossing and nonnesting partitions for classical reflection groups*, Portugal. Math. **67** fasc. 3 (2010), 369–401. Extended abstract in Discrete Mathematics and Theoretical Computer Science.
22. with Harm Derksen, *Valuative invariants for polymatroids*, Advances in Math. **225** no. 4 (2010), 1840–1892. doi:10.1016/j.aim.2010.04.016. Extended abstract in Discrete Mathematics and Theoretical Computer Science.
23. with Federico Ardila and Felipe Rincón, *Valuations for matroid polytope subdivisions*, Canadian Journal of Mathematics **62** (2010), 1228–1245. doi:10.4153/CJM-2010-064-9, arXiv:0710.4424v2.
24. with Richard Guy and Mark Krusemeyer, *Partitions with parts appearing at most thrice*, Contributions to Discrete Math. **3** (2008), #79.
25. with Richard Guy, *The number-pad game*, Coll. Math. J. **38** (2007), 260–264.
26. *A generalization of an IMO problem*, Integers, Electronic Journal of Combinatorial Number Theory **6** (2006), #A17.
27. with Bill Sands, *Rationals whose sum equals the reciprocal of their product*, Crux Math. **30** (2004), 292–295.

Conference publications

28. with Jörg Denzinger and John Aycock, *Extracting NPC behavior from Computer Games using Computer Vision and Machine Learning Techniques*, IEEE Symposium on Computational Intelligence and Games, 2007, 24–31.

Expository writing

29. *Matroid subdivisions, with a computational appendix.* Written for my teaching in Jack Edmonds' courses on Polyhedral Combinatorics and Exponential Polytime in summer 2015.
30. with Richard Guy, *Rick's Tricky Six Puzzle: S_5 sits specially in S_6*, Math. Magazine **82** no. 2 (April, 2009).
31. *If two were three, what would Hex be?*, 2008, Gathering for Gardner 8.
32. with Derek Kisman and Richard Guy, *Patulous pegboard polygons*, 2006, Gathering for Gardner 7.

Conferences and sessions at meetings organized

2015	Meeting of the LMS working group in tropical mathematics.
2011–2013	Four instances of the Triangle Lectures in Combinatorics, North Carolina State. Joint organizer with subsets of Patricia Hersh, Carla Savage, Sarah Mason, Ed Allen.
2012	Session of introductory talks for the postdocs attending for the fall 2012 MSRI programmes.
2011	*Algebraic and geometric aspects of matroids*, special session #1A at the Fall 2011 Southeastern Sectional Meeting of the AMS, Wake Forest University. Joint organizer with Hoda Bidkhori and Seth Sullivant.

Programme committee memberships

2015–2017	Co-chair of programme committee, Formal Power Series and Algebraic Combinatorics 2017.
2015	Formal Power Series and Algebraic Combinatorics 2015, Daejeon, South Korea.

Seminars run

2014–2016	with Matt Fayers, Algebra seminar and London Algebra Colloquium, QMUL.
2014	with Behrang Noohi, Quantum algebras seminar, QMUL.
2011–2013	with Bojko Bakalov, Combinatorics / algebra seminar, NCSU.
2009	with Franziska Schroeder, Graduate student tropical geometry seminar, MSRI.
2006–2007	with William Slofstra, Many Cheerful Facts, Berkeley.

Editorial roles

2014–	Editorial board, Theoretical Computer Science, series A.

Group

Postdocs hired

2015–2016	Madhusudan Manjunath

PhD students supervised (as first supervisor)

2014–2017	Amanda Cameron
2015–	Ben P. Smith
2017–	Scott Kemp

Courses taught At Queen Mary:

- Introduction to Algebra.

  Proofs and logic. Irrationality of $\sqrt{2}$. Division algorithm. Induction. Complex numbers: Basic algebraic operations (fields). Argand diagram. Euler's notation. Extracting roots from complex numbers. Statement of Fundamental Theorem of Algebra. Other number systems: Pseudo-complex numbers, hyper-complex numbers, quaternions. Sets and Relations. Finite directed graphs. Partitions. Equivalence relations. Relationship between surjections and equivalence relations. Congruence modulo m. Modular arithmetic. Operations. Rings. Skewfields. Matrices. Groups. Groups of units. Subgroups, cyclic groups, Lagrange's Theorem. Permutations, symmetric group, sign.

- Enumerative Combinatorics, at the London Taught Course Centre.

At North Carolina State University:

- Applied Differential Equations I.

  Differential equations and systems of differential equations. Methods for solving ordinary differential equations including Laplace transforms, phase plane analysis, and numerical methods. Matrix techniques for systems of linear ordinary differential equations.

- Calculus III.

  Third of three semesters in a calculus sequence for science and engineering majors. Vectors, vector algebra, and vector functions. Functions of several variables, partial derivatives, gradients, directional derivatives, maxima and mimima. Multiple integration. Line and surface integrals, Green's Theorem, Divergence Theorems, Stokes' Theorem, and applications. Use of computational tools.

- Calculus for Life and Management Sciences B.

  Differential equations — population growth, flow processes, finance and investment models, systems; functions of several variables — partial derivatives, optimization, least squares, multiple integrals; Lagrange multiplier method — chain rule, gradient; Taylor polynomials and series; numerical methods.

Other mentoring activities

2013–	Advisor for maths undergraduates, QMUL.
2012, 2011, 2007	Training at the Canadian IMO summer training camp, Banff.
2006–2007	Coaching contestants in the ACM International Collegiate Programming Competition, Calgary.
2003–2006	Informal tutoring with the Society of Calgary Undergrad Mathematics, Calgary.
2002–2006	Volunteer at the math enrichment program and International Math. Olympiad training program, Calgary.

Administration All of the below are in the School of Mathematical Sciences at QMUL.

2017–	Director of Undergraduate Admissions.
2015–2017	Postgraduate Admissions Tutor.
2014–2015	Communications Coordinator.
2013–2014	Programme Director for BSc and MSci programmes in mathematics and pure mathematics.
2013–2014	Member of Teaching and Learning Committee.