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British citizen, Hong Kong permanent resident

Research Interests

Algebraic structures on combinatorial objects (e.g. symmetric functions, combinatorial Hopf algebras/monoids, dual graded graphs, Solomon's descent algebra), and their interaction with Markov chains.

Employment

- 2016 - present Assistant Professor, Hong Kong Baptist University, Hong Kong
- 2014 - 2016 CRM-ISM postdoctoral fellow, Laboratoire de Combinatoire et d'Informatique Mathématique (LaCIM), Université du Québec à Montréal (UQAM), Canada
- 2015 Course Lecturer (part time), McGill University, Montreal, Canada

Education

- 2014 PhD in Mathematics, Stanford University, USA (*Advisor: Persi Diaconis; dissertation title: Hopf Algebras and Markov Chains*)
- 2009 Certificate of Advanced Study in Mathematics ('Part III') with distinction, Trinity Hall, University of Cambridge, UK
- 2008 BA in Mathematics with first class honours, Trinity Hall, University of Cambridge, UK

Awards

- 2019 Faculty/School/Academy Performance Award in Early Career Teaching

Research Grants

- 2018-2020 RGC-ECS: *Markov Chains driven by Permuted and Hyperoctahedral Descent Operators on Combinatorial Hopf Algebras.*

Publications

- 7 [Lumpings of Algebraic Markov Chains arise from Subquotients](#), J. Theoret. Probab., 32 (2019), no. 4, 1804–1844.
- 6 (with M. Josuat-Vergès) [Subalgebras of Solomon's Descent Algebra based on Alternating Runs](#), J. Combin. Theory Ser. A, 158 (2018), 36–65.
- 5 [Card-Shuffling via Convolutions of Projections on Combinatorial Hopf Algebras](#), 27th Annual International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2015), 49–60, Discrete Math. Theor. Comput. Sci. Proc., Assoc. Discrete Math. Theor. Comput. Sci., Nancy, 2015.
- 4 (with P. Diaconis, A. Ram) [Hopf Algebras and Markov Chains: Two Examples and a Theory](#), J. Algebraic Combin., 39 (2014), no. 3, 527–585.

- 3 [A Hopf-power Markov chain on Compositions](#), 25th Annual International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2013), 499-510, Discrete Math. Theor. Comput. Sci. Proc., AS, Assoc. Discrete Math. Theor. Comput. Sci., Nancy, 2013.
- 2 (with 27 others) [Supercharacters, Symmetric Functions in Noncommuting variables, and related Hopf Algebras](#), Adv. Math. 229 (2012), no. 4, 2310–2337.
- 1 (with 27 others) [Supercharacters, symmetric functions in noncommuting variables \(extended abstract\) and related Hopf Algebras](#), 23rd Annual International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2011), 3-14, Discrete Math. Theor. Comput. Sci. Proc., AO, Assoc. Discrete Math. Theor. Comput. Sci., Nancy, 2011.

Preprints

[Markov Chains from Descent Operators on Combinatorial Hopf Algebras](#)

arxiv.org/abs/1609.04312

[Hopf Algebras and Markov Chains](#) (thesis) arxiv.org/abs/1412.8221

Presentations

Invited Talks

- 03/2018 *Lumpings of Algebraic Markov Chains arise from Subquotients*, Hong Kong Probability Seminar
- A Uniform Analysis of Combinatorial Markov Chains using Hopf Algebras*,
 10/2016 Department of Stat. Seminar, Chinese University of Hong Kong
 01/2016 Department of Math. Colloquium, Hong Kong Baptist University
 01/2016 Numerical Methods and Applied Analysis Seminar, University of Hong Kong
- 10/2015 *A Hopf-Algebraic Lift of the Down-Up Markov Chain on Partitions to Permutations*, Special Session on Hopf Algebraic Combinatorics, AMS Sectional Meeting, Chicago, USA.
- Card Shuffling and Convolutions of Projections on graded Hopf Algebras*,
 01/2015 Applied Algebra Seminar, York University
 09/2014 Combinatorics Seminar, LaCIM
- 12/2014 *Card Shuffling, Tree-Pruning and Convolutions of Projections on graded Hopf Algebras*, CRM-ISM Probability Seminar
- Card Shuffling and other Hopf-Power Markov Chains*,
 06/2014 Combinatorics Seminar, LaCIM
 01/2014 Combinatorics Seminar, University of Michigan
 08/2013 Algebra/Geometry/Topology Seminar, University of Melbourne
 03/2013 Algebra and Combinatorics Seminar, Loyola University Chicago
- 02/2014 *Markov Chains from Combinatorial Hopf Algebras*, Probability Seminar, Cornell University
- ### Other Research Presentations
- 06/2019 *Deformations of Comonoids-in-Species, Coalgebras, Hopf Algebras and their Quasisymmetric Invariants (8-minute flash talk on work-in-progress)*, New Directions in Algebraic Combinatorics, San Diego, USA.
- 05/2018 *Markov Chains and Descent Subalgebras*, HKBU-NCKU Joint Workshop on Mathematical Sciences, National Cheng Kung University, Taiwan.
- 07/2015 [Card-Shuffling via Convolutions of Projections on Combinatorial Hopf Algebras](#), 27th International Conference on Formal Power Series and Algebraic Combinatorics, Daejeon, South Korea.

- 03/2015 *Card Shuffling and Markov Chains on Combinatorial Hopf Algebras*, Probability Seminar, University of Ottawa
- 01/2015 *Card Shuffling and Convolutions of Projections on graded Hopf Algebras*, Combinatorial Algebra meets Algebraic Combinatorics, Kingston, Canada.
- 07/2013 *A Hopf-power Markov chain on Compositions (poster)*, 25th International Conference on Formal Power Series and Algebraic Combinatorics, Paris, France.
- 04/2012 *Ribbon Characters, Garsia-Reutenauer idempotents and a Biased Amazing Matrix??*, Student Probability and Related Fields Seminar, Stanford University
- 05/2011 *Kolmogorov's Rock-Breaking and Related Walks on Species*, Student Probability and Related Fields Seminar, Stanford University

Expository Presentations

- 03/2014 *What is a Combinatorial Hopf Algebra?* Graduate Student Colloquium, Stanford University
- 05/2011 *Card Games and Crystals*, Graduate Student Colloquium, Stanford University
- 04/2010 *The Art Gallery Problem*, Stanford University Mathematics Organisation
- Hopf Algebras and Representation Theory*
- 10/2009 Graduate Student Colloquium, Stanford University
- 03/2009 Part III seminar, University of Cambridge

Teaching

at Hong Kong Baptist University:

- 2016 - present Math 2207, Linear Algebra
- 2019 Math 3407, Advanced Linear Algebra
- 2017 Math 2205, Multivariate Calculus

Course Lecturer at McGill University:

- 2015 Math 141, Integral Calculus

Guest Lecturer at Université du Québec à Montréal (3 lectures):

- 2015 Mat 995B, Research Seminar on Combinatorics: Descent Algebras

Teaching Assistant at Stanford University (leading recitations):

- 2013 Math 41A, Accelerated Differential Calculus
- 2010 - 2013 Math 51, Linear Algebra and Multivariable Calculus

Course Assistant at Stanford University (office hours, grading):

- 2012 Math 19, Differential Calculus
- 2012 Math 110, Applied Number Theory and Field Theory
- 2011 Math 210B, Graduate Algebra
- 2010 Math 113, Linear Algebra and Matrix Theory
- 2009 Math 120, Introduction to Abstract Algebra

Administrative Teaching Assistant at Stanford University:

- 2014 Math 51, Linear Algebra and Multivariable Calculus (200 students)

Teaching Assistant at Stanford University Mathematics Camp:

- 2009 - 2010 Program I, Abstract Algebra and Number Theory

Teaching Assistant at Enrichment Program for Young Mathematical Talents, Chinese University of Hong Kong:

- 2007 Non-Euclidean Geometry

Student Supervision

Undergraduate research honours projects, Hong Kong Baptist University:

2018-2019	<i>Cocycles on Graphs</i>
2017-2018	<i>A Remove-and-Reattach Markov Chain on Planar Binary Trees</i>
2017-2018	<i>A Vertex Deletion Markov Chain on Graphs</i>
2017-2018	<i>A Vertex Deletion Markov Chain on Ordered Trees</i>
2017-2018	<i>The Catalan Hopf Algebra</i>

Undergraduate expository honours projects, Hong Kong Baptist University:

2018-2019	<i>Sim and Ramsey Theory</i>
2016-2017	<i>Around Sylow's Theorems</i>
2016-2017	<i>Partition Bijections</i>

Summer undergraduate research fellowship, Hong Kong Baptist University:

2018	<i>Comonoids on finite vector spaces</i>
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Conference and Workshop Participation

07/2019	Symposium on Emerging Innovations and Evaluation of Technology Enhanced Active Learning Pedagogies in Tertiary Education, Hong Kong
06/2018	Mini Symposium on Technology Enhanced Active Learning in Tertiary STEM Education, Hong Kong Polytechnic University, Hong Kong
05/2018	SIAM Conference on Applied Linear Algebra, Hong Kong
08/2017	3rd International Congress in Algebras and Combinatorics, Hong Kong
12/2016	Joint UM-HKBU Workshop on Mathematics and Statistics, Macau
06/2016	4th Institute of Mathematical Statistics Asia Pacific Rim Meeting, Hong Kong
12/2015	Canadian Mathematical Society Winter Meeting, Montreal, Canada
08/2015	BIRS workshop on Positivity in Algebraic Combinatorics, Banff, Canada
06/2015	SageDays65, Chicago, USA
04/2015	SageDays67, Montreal, Canada
2011 - 2014	Bay Area Discrete Mathematics Days, USA
02/2014	Lie Groups, Lie Algebras and Their Representations, Stanford, USA
01/2013	Algebraic Groups and Representation Theory - a Conference in Memory of Tonny A. Springer, Hong Kong
07/2012	24th International Conference on Formal Power Series and Algebraic Combinatorics, Nagoya, Japan

Service

Academic

2014 - present	Journal referee, J. Alg. Combi.; J. Combin. Theory Ser. A; Ann. Comb.; Random Structures Algorithms.
2018	Program committee member, 28th International Conference on Formal Power Series and Algebraic Combinatorics

Departmental

2018 - present	HKBU coordinator, Simon Marais Mathematics Competition
2017 - present	Interviewer, year 3 direct entry to HKBU Math Department
2017 - 2019	Library coordinator, HKBU Math Department
2017 - present	Science faculty representative, Advisory Committee for Language Enhancement Program (HKBU)
2018	Interviewer, year 1 entry to HKBU Science Faculty
2011 - 2013	Co-organiser, Stanford Women in Math
2010 - 2011	Co-organiser, Stanford Graduate Student Colloquium