John Machacek

CONTACT INFORMATION

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RESEARCH INTERESTS

My interests lie in combinatorics, both in purely combinatorial problems as well as connections with other areas such as algebra, geometry, computer science, and physics.

EMPLOYMENT

York University
York Science Fellow, July 2018 – present

EDUCATION

Michigan State University
Ph.D. in Mathematics, May 2018

- Dissertation Title: On Some Aspects of Cluster Algebras and Combinatorial Hopf Algebras
- Advisor: Michael Shapiro

University of Minnesota - Twin Cities
B.S. in Mathematics, December 2011
B.S. in Computer Science, December 2011

PREPRINTS

Boundary measurement and sign variation in real projective space, arXiv:1909.04640 [math.CO].

New Invariants for Permutations, Orders and Graphs (with J.-C. Aval and N. Bergeron), arXiv:1908.04841 [math.CO].

Building maximal green sequences via component preserving mutations (with E. Bucher, E. Runburg, A. Yeck, and E. Zewde), arXiv:1902.02262 [math.CO].

Combinatorial interpretations of Lucas analogues of binomial coefficients and Catalan numbers (with C. Bennett, J. Carrillo, and B. Sagan), arXiv:1809.09036 [math.CO].

Reddening sequences for Banff quivers and the class $\mathcal{P}$ (with E. Bucher), arXiv:1807.03359 [math.AC].

JOURNAL PUBLICATIONS

Strong factorization and the braid arrangement fan, **Tohoku Math. J. (2)** (to appear).

Upper cluster algebras and choice of ground ring (with E. Bucher and M. Shapiro), **Sci. China Math.** 62 (2019), no. 7, 1257–1266.

Hypergraphic polytopes: combinatorial properties and antipode (with C. Benedetti and N. Bergeron), **J. Comb.** 10 (2019), no. 3, 515 – 544.

Partial words with a unique position starting a power, **Inform. Process. Lett.** 145 (2019), 44–47.

Egyptian Fractions and Prime Power Divisors, **J. Integer Seq.**, 21 (2018), Article 18.3.7.

Boundary Measurement Matrices for Directed Networks on Surfaces, **Adv. in Appl. Math.**, 93 (2018), 69–92.

Log-Canonical Coordinates for Poisson Brackets and Rational Changes of Coordinates (with N. Ovenhouse), **J. Geom. Phys.** 121 (2017), 288–296.

Plurigraph Coloring and Scheduling Problems, **Electron. J. Combin.** 24 (2017), no. 4, Paper 2.2.

Deleting Powers in Words, **J. Autom. Lang. Comb.** 21 (2016), no. 4, 339–349.

Combinatorial Hopf Algebras of Simplicial Complexes (with C. Benedetti and J. Hallam), **SIAM J. Discrete Math.** 30 (2016), no. 3, 1737–1757.

Squares in Partial Words (with F. Blanchet-Sadri, Y. Jiao, J.D. Quigley and X. Zhang), **Theoret. Comput. Sci.** 530 (2014), 42–57.

An interior point method for solving semidefinite programs using cutting planes and weighted analytic centers (with S. Jibrin), **J. Appl. Math.** 2012, Art. ID 946893.

Conference Proceedings

Hypergraphic polytopes: combinatorial properties and antipode (with C. Benedetti and N. Bergeron), Proceedings of FPSAC 2018, **Sém. Lothar. Combin.**, 80B (2018), Art. 70.

Scheduling Problems and Generalized Graph Coloring, Proceedings of FPSAC 2016, 791-802, **Discrete Math. Theor. Comput. Sci. Proc.**, 2016.

Combinatorial Hopf Algebras of Simplicial Complexes (with C. Benedetti and J. Hallam), Proceedings of FPSAC 2015, 949-959, **Discrete Math. Theor. Comput. Sci. Proc.**, 2015.

Squares in Binary Partial Words (with F. Blanchet-Sadri, Y. Jiao), Developments in language theory, 404-415, **Lecture Notes in Comput. Sci.**, 7410, Springer, Heidelberg, 2012.

Talks

Boundary measurement and sign variation in real projective space, Algebraic Combinatorics Seminar, University of Waterloo, October 2019.

Mutation combinatorics and upper cluster algebras, Geometry and Representation Theory Seminar, Queen's University, October 2019.

Symmetric function and polynomial invariants via Hopf algebras, Garsiafest: Future Directions in Algebraic Combinatorics Conference in Honor of Adriano Garsia's 90th Birthday, The Scripps Seaside Forum, San Diego, USA, June 2019.

Sign variation and boundary measurement in projective space, Seminar in Cluster Algebras, Michigan State University, April, 2019.

Reddening sequences for Banff quivers and the class $\mathcal{P}$, AMS Fall Central Sectional Meeting (Special Session on Cluster Algebra, Poisson Geometry, and Related Topics), University of Michigan, October 2018.

Plurigraph coloring and scheduling problems, 58th Midwestern Graph Theory Confer-

ence (MIGHTY LVIII), Grand Valley State University, October 2017.

Log-Canonical Coordinates for Poisson Brackets and Rational Changes of Coordinates, "Gone Fishing" Poisson Geometry Conference, University of Notre Dame, May 2017

The Chromatic Symmetric Function: Hypergraphs and Beyond, Graduate Student Combinatorics Conference, University of Kansas, April 2017

The Chromatic Symmetric Function, Hypertrees, and Generalized Graphs, Applied Algebra Seminar, York University, January 2017

Log-Canonical Poisson Brackets, Combinatorial Algebra meets Algebraic Combinatorics (CAAC), Université du Québec à Montréal, January 2017

The Boundary Measurement Matrix, Algebra and Combinatorics Seminar, Central Michigan University, September 2016

Boundary Measurement Minors for Graphs on Surfaces, Applied Algebra Seminar, York University, January 2016

Colorings and a Hopf Algebra of Simplicial Complexes, Graduate Student Combinatorics Conference, University of Kentucky, March 2015

Teaching Experience

York Science Fellow at York University

- **Lecturer** for Discrete Mathematics for Computer Science and Linear Algebra I.

Graduate Teaching Assistant at Michigan State University

- **Instructor and lecturer** for a variety of courses including college algebra, survey of calculus, calculus I, multivariable calculus, and differential equations.
- **Recitation leader** for survey of calculus and calculus II.
- **Classroom assistant** for Michigan State's introduction to proofs course "Transitions" where primary role was to help facilitate student group work.

Leadership and Service

Organization

- Co-organizer of the "Algebraic Combinatorics Seminar" at the Fields Institute (Fall 2018 – present).
- Co-organizer of the "Applied Algebra Seminar" at York University (Fall 2018 – present).
- Founder and organizer of the "Algebraic Quantum Groups Learning Seminar" at Michigan State University (Fall 2017).

Math Learning Center (MLC) at Michigan State University

- **Lead TA** in MLC where supervised Michigan State's mathematics tutoring center and lead exam reviews sessions for various courses and the precalculus and calculus level.

Center for Instructional Mentoring (CIM) at Michigan State University

- **Lead TA** for MTH 124 (survey of calculus) where observed and mentored first year teaching assistants in order to help new instructors adjust to teaching at the college level and improve there teaching practices.

Lyman Briggs College at Michigan State University

- **Mentor** for undergraduate learning assistants running recitations in mathematics

courses for Lyman Briggs College.

Referee

- ❑ Electron. J. Combin. J. Combin. Theory Ser. A, J. Integer Seq, Proc. Amer. Math. Soc.

Reviewer

- ❑ Math Reviews

Awards

2017 TA Award for Excellence in Teaching
Michigan State University, Department of Mathematics

Dissertation Completion Fellowship
The Graduate School, Michigan State University

Other activity

- Poster presentation on *Hypergraphic polytopes: combinatorial properties and antipodes* at FPSAC 2018 in Hanover, New Hampshire, USA.
- Poster presentation on *Building maximal green sequences via component preserving mutations* at ALGECOM-16 in Ann Arbor, Michigan, USA.
- Poster presentation on *Scheduling problems and generalized graph coloring* at FPSAC 2016 in Vancouver, British Columbia, Canada.
- Attended the *Nordic Summer School in Algebra and Geometry* June 1–5, 2015 at University of Gothenburg's Sven Lovén Centre in Tjärnö, Sweden.