

# Mike Cummings

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## Education

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<b>University of Waterloo</b> PhD Combinatorics and Optimization	Waterloo, ON Sep. 2024–
<b>McMaster University</b> MSc Mathematics (Thesis) — <i>in progress</i> Supervisor: Jenna Rajchgot	Hamilton, ON 2022–2024 (expected)
<b>McMaster University</b> BSc Honours Mathematics and Statistics, <i>summa cum laude</i>	Hamilton, ON 2018–2022

## Papers

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### Published

6. The GeometricDecomposability package for Macaulay2  
with Adam Van Tuyl  
Journal of Software for Algebra and Geometry **14**(1): 41–50, 2024
5. Gröbner geometry for regular nilpotent Hessenberg Schubert cells  
with Sergio Da Silva, Megumi Harada, and Jenna Rajchgot  
Journal of Pure and Applied Algebra **228**(7), 2024
4. Geometric vertex decomposition and liaison for toric ideals of graphs  
with Sergio Da Silva, Jenna Rajchgot, and Adam Van Tuyl  
Algebraic Combinatorics **6**(4): 695–997, 2023

## Software

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3. GeometricDecomposability, a *Macaulay2* package to check whether ideals are geometrically vertex decomposable  
with Adam Van Tuyl

## Theses

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2. (*submitted*) Gröbner Geometry for Hessenberg Varieties  
Master's thesis, McMaster University, *expected: 2024*  
Supervisor: Jenna Rajchgot

1. Geometric Vertex Decomposition and Hessenberg Patch Ideals  
Undergraduate thesis, McMaster University, 2022  
Supervisors: Sergio Da Silva, Megumi Harada, Jenna Rajchgot

## Teaching

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### Instructor

Summer 2024   Applications of Linear Algebra, Math 2LA3   Enrolment: TBD

### Tutorials

Winter 2024	Theory of Linear Algebra, Math 2R03	Two sections
Fall 2023	Abstract Algebra, Math 3GR3	One section
Winter 2023	Theory of Linear Algebra, Math 2R03	Two sections
Fall 2022	Calculus for Math and Stats I, Math 1X03	Three sections (of seven)
Winter 2022	Calculus for Math and Stats II, Math 1XX3	Two sections (of seven)
Spring 2021	Introduction to Mathematical Scientific Computation, Math 1MP3	Two sections
Spring 2020	Introduction to Mathematical Scientific Computation, Math 1MP3	Two sections

### Math Help Centre

Fall 2021	Calculus for Math and Stats I, Math 1X03
Spring 2021	Matlab for Linear Algebra I, Math 1B03 and Math 1ZC3
Winter 2021	Engineering Mathematics II-B (Linear Algebra I), Math 1ZC3
Fall 2020	Calculus for Math and Stats I, Math 1X03

## Talks

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The <sup>∨</sup> denotes a virtual talk.

### Research

Geometric vertex decomposition: introduction and connections

- February 2024, Graduate Student Seminar in Number Theory and Algebraic Geometry at Simon Fraser University, BC, CAN<sup>∨</sup>

Gröbner geometry for regular nilpotent Hessenberg Schubert cells

- January 2024, Combinatorial Algebra meets Algebraic Combinatorics at LaCIM à l'Université du Québec à Montréal, QC, CAN
- December 2023, Commutative Algebra session at the CMS 2023 Winter Meeting in Montréal, QC, CAN
- March 2023, Algebra & Algebraic Geometry Seminar at McMaster University, ON, CAN

Degenerations of toric ideals of graphs

- May 2023, Open problem session at the SLMATH/CMND Summer School on Commutative Algebra and its Interactions with Algebraic Geometry at University of Notre Dame, IN, USA

An introduction to Hessenberg varieties

- August 2022, Mathematics & Statistics Undergraduate Summer Research Seminar at McMaster University, ON, CAN

Geometric vertex decomposition

- May 2022, Mathematics & Statistics Undergraduate Summer Research Seminar at McMaster University, ON, CAN

## Poster

Gröbner geometry for regular nilpotent Hessenberg Schubert cells

- June 2023, CMS 2023 Summer Meeting in Ottawa, ON, CAN
- May 2023, SLMATH/CMND Summer School on Commutative Algebra and its Interactions with Algebraic Geometry at University of Notre Dame, IN, USA

## Expository

TBD

- April 2024, Student Math Colloquium at Niagara University, NY, USA

Graph colouring, symmetric functions, and open problems

- November 2023, Casual Math Seminar at McMaster University, ON, CAN

Play with your food: Brussel sprouts and other games on graphs

- April 2023, Casual Math Seminar at McMaster University, ON, CAN

## Conferences Attended

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Conferences with future dates are tentative. The <sup>†</sup> indicates that funding was received to attend and the <sup>∨</sup> denotes a virtual conference.

2024 Jun. AlCoVE: an Algebraic Combinatorics Virtual Expedition at University of Waterloo, ON, CAN<sup>∨</sup>

May Why are we teaching mathematics today?, FYMSiC<sup>∨</sup>

Jan. Combinatorial Algebra meets Algebraic Combinatorics at LaCIM à l'Université du Montréal à Québec, QC, CAN<sup>†</sup>

2023 Dec. 2023 CMS Winter Meeting in Montréal, QC, CAN<sup>†</sup>

Nov. Route 81 Conference on Commutative Algebra and Algebraic Geometry at Syracuse University, NY, USA

Jun. AlCoVE: an Algebraic Combinatorics Virtual Expedition at University of Waterloo, ON, CAN<sup>∨</sup>

2023 CMS Summer Meeting at University of Ottawa, ON, CAN<sup>†</sup>

May MSRI/SLMath CMND Summer School: Commutative Algebra and its Interactions with Algebraic Geometry at University of Notre Dame, IN, USA<sup>†</sup>

8<sup>th</sup> Lake Michigan Workshop on Combinatorics and Graph Theory at University of Notre Dame, IN, USA<sup>†</sup>

Teaching: The Backstage of Our Courses, FYMSiC<sup>∇</sup>

Jan. Combinatorial Algebra meets Algebraic Combinatorics at University of Waterloo, ON, CAN<sup>†</sup>

2022 Dec. 2022 CMS Winter Meeting in Toronto, ON, CAN

Jun. ISM Discovery School: Geometry and Combinatorics of Hessenberg Varieties at Université du Québec à Montréal, QC, CAN<sup>†</sup>

## Scholarships and Awards

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All values Canadian dollars.

2024 McMaster Graduate Student Association Travel Assistance Grant, \$500

2023–24 Ontario Graduate Scholarship, \$10,000

Bernhard Banashewski Ontario Graduate Scholarship, \$5,000

Milos Novotny Fellowship, \$4,000

2022–23 NSERC CGS-M, \$17,500

Milos Novotny Fellowship, \$2,500

2022 NSERC USRA, supervisor: Adam Van Tuyl, \$8,400

2019–22 Dean's Honour List

2021 NSERC USRA, supervisors: Sergio Da Silva, Jenna Rajchgot, Adam Van Tuyl, \$8,120

2018 McMaster Entrance Award, \$1,000

## Organization

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2023– McMaster Casual Math Seminar

co-organizer with Alexi Block Gorman (Winter 2023), Justin Gebel (Fall 2023–), Dicle Mutlu, and Adele Padgett

2022 McMaster Math & Stats Undergraduate Summer Research Seminar

co-organizer with Hainan Xu

## Professional Membership

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2022– Canadian Mathematical Society

American Mathematical Society

*Last updated: March 27, 2024.*