

# Alex McDonough | Curriculum Vitae

University of Oregon – Department of Mathematics – Eugene, OR

✉ alexmcd@uoregon.edu • 🌐 alexmcdonough.com

## Appointments

---

- **University of Oregon** **Eugene, OR**  
*Postdoctoral Scholar* 2024 –
- **University of California Davis** **Davis, CA**  
*Krener Assistant Professor* 2021 – 2024

## Education

---

- **Brown University** **Providence, RI**  
*PhD in Pure Mathematics* 2016 – 2021
- **University of Chicago** **Chicago, IL**  
*BS with Honors in Mathematics, BA in Statistics* 2012 – 2016

## Research

---

### Published Articles.....

- **Fragmenting any Parallelepiped into a Signed Tiling** 2024  
*with Joseph Doolittle*  
*Discrete & Computational Geometry*, 1-34
- **Rotor-Routing Induces the Only Consistent Sandpile Torsor Structure on Plane Graphs** 2023  
*with Ankan Ganguly*  
*Forum of Mathematics, Sigma*, vol. 11, e78
- **Sampling Planar Tanglegrams and Pairs of Disjoint Triangulations** 2023  
*with Alex E. Black, Kevin Liu, Garrett Nelson, Michael Wigal, Mei Yin, and Youngho Yoo*  
*Advances in Applied Mathematics*, vol. 149
- **Matching Complexes of Trees and Applications of the Matching Tree Algorithm** 2022  
*with Helen Jenne, Marija Jelić Milutinović, and Julianne Vega*  
*Annals of Combinatorics*, vol. 26, pg. 1041-1075.
- **A Family of Sandpile Multijections** 2021  
*Algebraic Combinatorics*, vol. 4, no. 5

- **Higher-Dimensional Sandpile Groups and Matrix-Tree Multijections** 2021  
PhD Thesis, Brown University
- **Determining Genus from Sandpile Torsor Algorithms** 2021  
*Discrete Mathematics & Theoretical Computer Science*, vol. 23, no. 1
- Published Conference Proceedings.....
- **Fragmenting any Parallelepiped into a Signed Tiling** 2024  
*with Joseph Doolittle*  
Séminaire Lotharingien de Combinatoire. Presented at FPSAC 2024 (poster).
- **A Consistent Sandpile Torsor Algorithm for Regular Matroids** 2024  
*With Changxin Ding, Lilla Tóthmérész, and Chi Ho Yuen*  
Séminaire Lotharingien de Combinatoire. Presented at FPSAC 2024 (poster).
- **Rotor-Routing Induces the Only Consistent Sandpile Torsor Structure on Plane Graphs** 2022  
*with Ankan Ganguly*  
Séminaire Lotharingien de Combinatoire, Number 86B.73, Presented at FPSAC 2022 (talk).
- **Torsors from toggling independent sets** 2022  
*with Colin Defant, Michael Joseph, and Matthew Macauley*  
Séminaire Lotharingien de Combinatoire, Number 86B.85, Presented at FPSAC 2022 (poster).
- **A Combinatorial Mapping for the Higher-Dimensional Matrix-Tree Theorem** 2021  
Séminaire Lotharingien de Combinatoire, Number 85B.62, Presented at FPSAC 2021 (talk).
- **Dynamical Algebraic Combinatorics, ACA, and Toggling Independent Sets** 2021  
*with Laurent David, Colin Defant, Michael Joseph, and Matthew Macauley*  
OASlcs, Volume 90, Presented at AUTOMATA 2021 (talk).
- **Genus From Sandpile Torsor Algorithm** 2018  
Séminaire Lotharingien de Combinatoire, Number 80B.82, Presented at FPSAC 2018 (poster).
- Preprints.....
- **A Consistent Sandpile Torsor Algorithm for Regular Matroids** 2024  
*With Changxin Ding, Lilla Tóthmérész, and Chi Ho Yuen*  
arXiv:2407.03999
- **A Canonical Group-Like Structure on the Spanning Trees of a Plane Graph** 2024  
Not on arXiv due to journal restrictions. Email me for a copy.
- **Torsors and Tilings from Toric Toggling** 2023  
*with Colin Defant, Michael Joseph, and Matthew Macauley*  
arXiv:2305.07627

- **Realizable Standard Young Tableaux**  
with Igor Araujo, Alex E. Black, Amanda Burcroff, Yibo Gao, and Robert A. Kreuger 2023  
arXiv:2302.09194
- **Combinatorial and Asymptotic Aspects of the Neighborhood Grid Data Structure**  
with Martin Skrodzki and Ulrich Reitebuch 2023  
arXiv:1710.03435

## Presentations

---

### Talks.....

- **“What is the Sandpile Torsor?”** Davis, CA  
UC Davis ADM Seminar May 2024
- **“A Canonical Group-Like Structure on Spanning Trees”** El Paso, TX  
UTEP Colloquium April 2024
- **“Integer Cokernels and Fragmented Tilings”** Arcata, CA  
Cal Poly Humboldt Math Colloquium October 2023
- **“Fragmenting any Parallelepiped into a Signed Tiling”** Virtual  
International Conference on Enumerative Combinatorics and Applications September 2023
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** Eindhoven, Netherlands  
Combinatorial Optimization Research Group at TU/e December 2022
- **“Signed Determinantal Tilings of  $R^n$ ”** Budapest, Hungary  
MTA-ELTE Momentum Matroid Optimization Research Group December 2022
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** London, England  
Queen Mary University CSG December 2022
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** Amherst, MA  
UMass Amherst Discrete Math Seminar November 2022
- **“Chip-Firing and Sandpile Torsor Algorithms”** Santa Clara, CA  
Santa Clara University Colloquium November 2022
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** Virtual  
UNV Discrete Math Seminar September 2022
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** Berkeley, California  
Berkeley Combinatorics Seminar August 2022
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** Bangalore, India  
Formal Power Series and Algebraic Combinatorics (FPSAC) July 2022
- **“...The Only Consistent Sandpile Torsor Algorithm Structure”** Bogotá, Colombia  
Encuentro Colombiano de Combinatoria (ECCO) June 2022

- **"...The Only Consistent Sandpile Torsor Algorithm Structure"** **Davis, CA**  
*Davis CACAO Seminar* *May 2022*
- **"A Family of Multijections"** **Virtual**  
*Waterloo Combinatorics Seminar* *March 2022*
- **"A Family of Multijections"** **Virtual**  
*Formal Power Series and Algebraic Combinatorics (FPSAC)* *January 2022*
- **"A Family of Multijections"** **Virtual**  
*Brandeis Combinatorics Seminar* *November 2021*
- **"A Family of Multijections"** **Virtual**  
*AMS Sectional Meeting* *October 2021*
- **"A Family of Multijections"** **Davis, CA**  
*UC Davis Algebra and Discrete Math Seminar* *October 2021*
- **"Dynamical Algebraic Combinatorics and ACAs"** **Marseille, France**  
*AUTOMATA 2021* *July 2021*
- **"Higher-Dimensional Sandpile Groups and Matrix-Tree Multijections"** **Virtual**  
*University of Kentucky Algebra Seminar* *May 2021*
- **"Higher-Dimensional Sandpile Groups and Matrix-Tree Multijections"** **Virtual**  
*Discrete Math Days* *April 2021*
- **"Higher-Dimensional Sandpile Groups and Matrix-Tree Multijections"** **Virtual**  
*PhD Defense* *March 2021*
- **"Oriented Arithmetic Matroids and Integer Matrices"** **Virtual**  
*ICERM Grad/Postdoc Seminar* *March 2021*
- **"Getting a Math PhD after UChicago"** **Virtual**  
*UChicago Math Club* *February 2021*
- **"The Higher-Dimensional Matrix-Tree Theorem"** **Virtual**  
*Washington Combinatorics Seminar* *January 2021*
- **"The Higher-Dimensional Matrix-Tree Theorem"** **Virtual**  
*Dartmouth Combinatorics Seminar* *January 2021*
- **"The Higher-Dimensional Matrix-Tree Theorem"** **Virtual**  
*Minnesota Graduate Combinatorics and Algebra Seminar* *December 2020*
- **"The Higher-Dimensional Matrix-Tree Theorem"** **Virtual**  
*Berkeley Combinatorics Seminar* *November 2020*
- **"The Higher-Dimensional Matrix-Tree Theorem"** **Virtual**  
*York Applied Algebra Seminar* *October 2020*

- **“The Higher-Dimensional Matrix-Tree Theorem”** **Virtual**  
*Texas State Discrete Math Seminar* *October 2020*
- **“The Higher-Dimensional Matrix-Tree Theorem”** **Virtual**  
*Brown Graduate Seminar* *October 2020*
- **“The Higher-Dimensional Matrix-Tree Theorem”** **Virtual**  
*Georgia Tech Algebra Seminar* *September 2020*
- **“The Higher-Dimensional Matrix-Tree Theorem”** **Virtual**  
*AMS Sectional Meeting* *September 2020*
- **“The Higher-Dimensional Matrix-Tree Theorem”** **Virtual**  
*Junior Mathematician Research Archive* *September 2020*
- **“Chip-firing on Cell Complexes and Matroids”** **Virtual**  
*Graduate Online Combinatorics Colloquium* *May 2020*
- **“Discrete Morse Theory and the Matching Tree Algorithm”** **Providence, RI**  
*Brown Graduate Student Seminar* *October 2019*
- **“What is Chip-Firing?”** **Providence, RI**  
*Brown DUG Seminar* *October 2019*
- **“Chip-Firing on Cell Complexes and Matroids”** **Burlington, VT**  
*Summer Combo* *July 2019*
- **“What is Chip-Firing”** **Providence, RI**  
*Brown Math Slam* *April 2019*
- **“What is a Coxeter Group?”** **Providence, RI**  
*Brown Graduate Student Seminar* *April 2019*
- **“Chip Firing on Simplicial Complexes and Matroids”** **Binghamton, NY**  
*Binghamton Combinatorics Seminar* *April 2019*
- **“Chip Firing on Simplicial Complexes and Matroids”** **Lawrence, KS**  
*KU Combinatorics Seminar* *April 2019*
- **“Chip Firing on Simplicial Complexes and Matroids”** **Hartford, CT**  
*AMS Sectional Meeting* *April 2019*
- **“Chip Firing on Simplicial Complexes and Matroids”** **New York City, NY**  
*NY Combinatorics Seminar* *March 2019*
- **“Chip Firing on Simplicial Complexes and Matroids”** **Providence RI**  
*Brown Discrete Math Seminar* *March 2019*
- **“An Introduction to Matroids”** **Providence, RI**  
*Brown Graduate Student Seminar* *December 2018*

- **“The Sandpile Group and Spanning Trees of a Graph”** **Dublin, Ireland**  
*Trinity College Dublin Maths Society* *March 2018*
- **“A Potpourri of Fun Combinatorics Problems”** **Providence, RI**  
*Brown Graduate Student Seminar* *March 2018*
- **“Sandpiles and Rotor Routing”** **Providence, RI**  
*Brown Graduate Student Seminar* *February 2017*
- **“The Sandpile Group and Spanning Trees”** **Providence, RI**  
*Brown Graduate Student Seminar* *November 2016*

## Posters.....

- **Fragmenting any Parallelepiped into a Signed Tiling** **Virtual**  
*with Joseph Doolittle* *June, 2023*  
AICoVE Conference
- **Torsors from Toggling Independent Sets** **Bangalore, India**  
*with Colin Defant, Michael Joseph, and Matthew Macauley* *July, 2022*  
FPSAC Conference
- **Chip-Firing on Cell Complexes and Matroids** **Amherst, MA**  
*Discrete Math Day* *April 2019*
- **Genus From a Sandpile Torsor** **Kingston, RI**  
*Discrete Math Day* *September 2018*
- **Genus From a Sandpile Torsor** **Hanover, NH**  
*FPSAC Conference* *July 2018*

## Upcoming Posters.....

- **Fragmenting any Parallelepiped into a Signed Tiling** **Bochum, Germany**  
*with Joseph Doolittle* *July 2024*  
FPSAC Conference
- **A Consistent Sandpile Torsor Algorithm for Regular Matroids** **Bochum, Germany**  
*with Changxin Ding, Lilla Tóthmérés, and Chi Ho Yuen* *July 2024*  
FPSAC Conference

## Teaching

---

### Instructor.....

- **Calculus 1 (Math 251)** **Eugene, OR**  
*Give Lectures, Choose the Curriculum, and Grade Exams (2 Sections)* *Winter 2024*
- **Calculus 1 (Math 21A)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum* *Winter 2024*

- **Abstract Algebra 2 (Math 150B)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum* *Winter 2024*
- **Calculus 1 (Math 21A)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum* *Fall 2023*
- **Advanced Problem Solving (Math 189)(Capstone)** **Davis, CA**  
*Guide Students through Group Writing Projects* *Spring 2023*
- **Algebraic Combinatorics (Math 146)(Capstone)** **Davis, CA**  
*Give Lectures and Design the Curriculum* *Spring 2023*
- **Calculus 2 (Math 21B)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum (2 Sections)* *Winter 2022*
- **Matroids Reading Course** **Davis, CA**  
*A Guided Reading Course for 2 Graduate Students* *Fall 2022*
- **Stochastic Processes (Math 135B)(Capstone)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum* *Spring 2022*
- **Probability (Math 135A)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum* *Spring 2022*
- **Probability (Math 135A)** **Davis, CA**  
*Gave Lectures and Chose the Curriculum (2 Sections)* *Fall 2021*
- **Calculus III (Math 180)** **Providence, RI**  
*Gave lectures and graded exams* *Fall 2019*
- **Probability and its Applications** **Providence, RI**  
*Part of the Summer Pre-College Program. Taught and designed the curriculum* *Summer 2019*
- **Calculus II (Math 100)** **Providence, RI**  
*Gave lectures and graded exams* *Spring 2019*
- **Calculus I (Math 90)** **Providence, RI**  
*Gave lectures and graded exams* *Fall 2018*
- Teaching Assistant.....**
- **Chip-Firing Mini Course** **Bogotá, Colombia**  
*Facilitated 4 Problem Sessions* *Summer 2022*
- **Calculus III (Math 180)** **Providence, RI**  
*Ran weekly Mandatory Recitations and Graded Exams (partly virtually)* *Spring 2020*
- **Spy Training 101** **Providence, RI**  
*Part of the Stem I Program. Taught Cryptography to Middle School Students* *Summer 2018*

- **Million Dollar Math** **Providence, RI**  
*Part of the Stem II Program. Taught Research Math to High School Students* *Summer 2018*
- **Calculus II (Math 100)** **Providence, RI**  
*Ran weekly Mandatory Recitations and Graded Exams* *Spring 2018*
- **Calculus I (Math 90)** **Providence, RI**  
*Ran weekly Mandatory Recitations and Graded Exams* *Fall 2017*
- **Spy Training 101** **Providence, RI**  
*Part of the Stem I Program. Taught Cryptography to Middle School Students* *Summer 2017*

Training.....

- **Sheridan Center Certificate 1** **Providence, RI**  
*Biweekly Workshops and Online Assignments* *Fall 2017*
- **Effective Performance Workshop** **Providence, RI**  
*Workshops hosted by The Graduate School and Trinity Repertory Theater* *Spring 2017*

Graduate Students Mentored through a Reading Course.....

- **Jeshu Dastidar** **Davis, CA**  
*Matroids* *Fall 2022*
- **Lisa Johnston** **Davis, CA**  
*Matroids* *Fall 2022*

Undergraduate Students Mentored Through the Spelman-Morehouse Directed Reading Program.....

- **Aden Mobley** **Virtual**  
*Chip-Firing and Graph Theory* *Fall 2024*

Undergraduate Students Mentored Through the Directed Reading Program at UC Davis....

- **Timothy Blanton** **Davis, CA**  
*Chip-Firing* *Fall 2022*

Undergraduate Students Mentored Through “Brown Undergraduate Mathematics Projects”

- **Alexander Brown** **Virtual**  
*Random Walks* *Summer 2020*
- **Eddie Li** **Virtual**  
*Random Walks* *Summer 2020*



## Undergraduate Students Mentored Through the Directed Reading Program at Brown.....

- **Jeremy Wang** **Providence, RI**  
*Fall 2020*  
*Representation Theory*
- **Dominick Joo** **Providence, RI**  
*Fall 2020*  
*Representation Theory*
- **Jerry Chu** **Providence, RI**  
*Fall 2019*  
*Advanced Topics in Chip-Firing*
- **Josiah Lim** **Providence, RI**  
*Fall 2019*  
*Chip-Firing Linear Algebra*
- **Keith Richie** **Providence, RI**  
*Spring 2019*  
*Coxeter Groups*
- **Nathaniel Zaldivar** **Providence, RI**  
*Fall 2018*  
*Matroids*
- **Emmanuel Peters** **Providence, RI**  
*Spring 2018*  
*Chip-Firing and the Sandpile Group*
- **Kenneth Berglund** **Providence, RI**  
*Spring 2018*  
*Spectral Graph Theory*
- **Shivam Nadimpalli** **Providence, RI**  
*Fall 2017*  
*Geometric Combinatorics*

## Additional Teaching Experience.....

- **Math Circle Leader (BVP Middle School)** **Cumberland, RI**  
*Fall 2019*  
*Guided Middle School Students Through Math Exercises*
- **Math Resource Center Tutor** **Providence, RI**  
*Fall 2017-Spring 2018*  
*Helped Undergraduate Students with Math Homework*
- **Guest Speaker (Muraco Elementary School)** **Winchester, MA**  
*Winter 2017*  
*Designed and Presented Five Enrichment Lessons for Fourth Grade Students*

## Awards

---

- **Math Outstanding Teaching Prize** **Providence, RI**  
*2020-2021*  
*Voted by the Faculty of the Brown Math Department*

## Professional Activities

---

- **Algebra and Discrete Math Seminar Organizing Committee** **Davis, CA**  
*Fall 2022 & Fall 2023*  
*A weekly hybrid seminar for discrete math*

- Visiting Fellows in Precalculus** **Virtual**  
 ○ *Gave feedback for an AP precalculus exam* *Summer 2023*
- FPSAC Conference Organizing Committee** **Davis, CA**  
 ○ *Helped plan a large international conference* *Summer 2022-Summer 2023*
- Graduate Research Workshop in Combinatorics Postdoc** **Denver, CO**  
 ○ *As a Postdoc participant, I had some mentoring duties* *Summer 2022*
- Graduate Online Combinatorics Colloquium Founder and Organizer** **Virtual**  
 ○ *Ran a weekly online seminar geared towards graduate students* *Spring 2020-Spring 2021*
- Math Resource Center Coordinator** **Providence, RI**  
 ○ *Ran a tutoring center to help undergrads with math questions* *Fall 2018-Spring 2021*
- Grad Student Seminar Organizer** **Providence, RI**  
 ○ *Ran a weekly seminar featuring Brown's math grad students* *Fall 2018-Spring 2020*
- Horizons Seminar Organizing Committee** **Providence, RI**  
 ○ *A seminar promoting the work of under-represented mathematicians* *Fall 2017- Spring 2019*
- Professional Peer Review**  
 ○ *I have reviewed several paper submissions for a variety of math journals*