

Florestan Brunck

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RESEARCH INTERESTS

My broad research interests lie at the intersection of **geometry**, **topology** and **learning theory**. Most of my recent work has been focused on understanding **neural networks** using beautiful connections with polyhedral geometry. I also like to think about **tilings**, **triangulations** and other interesting **spatial subdivisions** that naturally arise when trying to solve concrete problems. I am fond of **reconfiguration problems** and **geometrical puzzles**. Generally, I thrive on intuitive and motivated problems that are easily communicated but hard to solve.

EDUCATION

Ph.D. in Computer Science & Mathematics (in progress) <i>University of Copenhagen</i> — Supervisor: Amir Yehudayoff.	2024–Present
Doctoral Studies in Mathematics & Computer Science <i>Institute of Science and Technology Austria (ISTA), Vienna</i> — Advisors: H. Edelsbrunner, M.Kwan, and U.Wagner.	2021–2024
Master of Mathematics <i>McGill University, Montreal</i> — Supervisors: Piotr Przytycki and Christophe Hohlweg.	2019–2021
B.Sc., Joint Honours in Mathematics & Computer Science <i>McGill University, Montreal</i> — Minor in Music Composition; graduated with First-Class Honours.	2016–2019

RESEARCH POSITIONS AND VISITS

Visiting Researcher, Basic Algorithms Research Copenhagen (BARC) <i>University of Copenhagen</i> — Hosted by Mikkel Abrahamsen.	2023–2024
Visiting Student <i>University of Waterloo</i> — Four-month research program and collaboration with Anna Lubiw.	Summer 2021
Research Assistant <i>McGill University</i> — Research assistant to Professor Luc Devroye.	Winter 2019
Undergraduate Mathematics Researcher <i>McGill University, Montreal</i> — Advised by Piotr Przytycki.	Summer 2019
Visiting Student <i>Institute of Mathematics of the Polish Academy of Sciences (IMPAN), Warsaw</i> — Advised by Piotr Przytycki.	Summer 2018
Undergraduate Applied Mathematics Researcher <i>McGill University, Montreal</i> — Advised by Jean-Christophe Nave.	Summer 2017

PUBLICATIONS AND MANUSCRIPTS

Published, Accepted, and Proceedings

1. E. Bakaev, F. Brunck, C. Hertrich, J. Stade, and A. Yehudayoff. *Better Neural Network Expressivity: Subdividing the Simplex*. STOC 2026.
2. M. Abrahamsen, F. Brunck, J. Conradi, B. Kolbe, and A. Nusser. *Computing Non-Obtuse Triangulations with Few Steiner Points*. 2025 CG:SHOP Challenge (SoCG). Challenge winner.
3. F. Brunck and M. Kwan. *Books, Hallways & Social Butterflies: A Note on Sliding Block Puzzles*. The Mathematical Intelligencer.
4. F. Buchin, A. Lubiw, A. de Mesmay, S. Schleimer, and F. Brunck. *Computation and Reconfiguration in Low-Dimensional Topological Spaces*. Dagstuhl Seminar.
5. F. Brunck. *Iterated Medial Triangle Subdivision in Surfaces of Constant Curvature*. Discrete & Computational Geometry.

Submitted Manuscripts

6. F. Brunck, M. Löffler, and R. Silveira. *A Curve with Rotation Number One That Is Not Universal for Beacon Routing*.
7. E. Bakaev, F. Brunck, and A. Yehudayoff. *Approximate Depth of Convex Polytopes*.
8. E. Bakaev, F. Brunck, C. Hertrich, D. Reichman, and A. Yehudayoff. *On the Depth of Monotone ReLU Neural Networks and ICNNs*.
9. F. Brunck. *On the Non-Locality of Edge Insertions*.
10. F. Brunck, H. C. Chang, M. Löffler, T. Ophelders, and L. Schlipf. *Reconfiguring Popular Faces in Curved Nonagrams*.
11. F. Brunck. *Acute Triangulation of Constant-Curvature Polygonal Complexes*.

Works in Progress

12. F. Brunck, J. Stade, and A. Yehudayoff. *Pyramid Schemes: Towards Lower Bounds for Neural Expressivity*.
13. F. Brunck and C. Hohlweg. *A Geometric Algorithm for Computing the Weak-Order Join in Coxeter Groups*.

INVITED TALKS

Better Neural Network Expressivity: Subdividing the Simplex <i>Symposium on the Theory of Computing (STOC)</i>	Summer 2026
Pyramid Schemes: Towards Lower Bounds for Neural Expressivity <i>Workshop on Polyhedral Geometry for Neural Networks, University of Technology Nuremberg</i>	Spring 2026
Planar Simple Curves Are Universal for Beacon Routing <i>Graduate topics in Computer Science Lecture, University of Copenhagen</i>	Fall 2025
On the Non-Locality of Edge Insertion <i>EuroCG</i>	Spring 2025
Spherical Cubes Through Cheeger's Inequality <i>Combinatorics Seminar, University of Copenhagen</i>	Fall 2024
How to Throw a Great Party (and Solve Any Sliding Block Puzzle); A Fast Algorithm for Turning Your Room into a Dojo <i>MIX Seminar, ISTA and Vienna School of Mathematics — Two seminar talks.</i>	January 2024
Acute Triangulation of Constant-Curvature Polygonal Complexes <i>Topology Seminar, University of Wisconsin–Milwaukee</i>	October 2022
Iterated Medial Subdivisions in Spaces of Constant Curvature and Acute Triangulations of Spherical and Hyperbolic Simplicial Complexes <i>Geometric Group Theory Seminar, McGill University</i>	January 2020
Illustrating Mathematics <i>ICERM, Brown University — Short talk in the semester-long Illustrating Mathematics program.</i>	Fall 2019
Aperiodic Tilings & Undecidability; Penrose Tilings <i>McGill Mathematics and Statistics Graduate Student Seminar</i>	Winter 2019
Aperiodic Tilings and Undecidability <i>Seminars in Undergraduate Mathematics in Montreal (SUMM) — Selected for a competitive inter-university conference.</i>	Winter 2019
Non-Obtuse Dissection of Tetrahedra and the Hadwiger Conjecture in Dimension 3 <i>Geometric Group Theory Seminar, McGill University</i>	Fall 2018

PROFESSIONAL SERVICE

Peer Reviewer <i>Discrete & Computational Geometry; Symposium on Discrete Algorithms; The Mathematical Intelligencer; Computing in Geometry and Topology; Symposium on Computational Geometry</i>	Ongoing
Editor-in-Chief, McGill Journal for Undergraduate Mathematics <i>McGill University — Led the journal's revival and oversaw articles and illustrations for its online and print editions.</i>	2017–2018

TEACHING EXPERIENCE

Teaching Assistant, Introduction to Discrete Mathematics and Algorithms <i>University of Copenhagen</i> — Semester-long undergraduate course.	Winter 2025; Winter 2026
Guest Lecturer, Topics in Computer Science <i>Graduate course</i> — Lecture on using topology to solve a natural problem in beacon routing.	Fall 2025
Co-Instructor <i>PhD short course</i> — Two-week course: <i>Proving as a Computational Procedure and the Limits of Computation</i> .	Winter 2022
Teaching Assistant, Theory of Computation (COMP 330) <i>McGill University</i> — Average student evaluation of 4.8/5 in 2018.	Winter 2018; Winter 2021
Teaching Assistant, Algebraic Topology (MATH 576) <i>McGill University</i> — First graduate course in algebraic topology.	Fall 2020
Teaching Assistant, Algorithm Design (COMP 251) <i>McGill University</i> — Second undergraduate course in algorithm design.	Fall 2019
Private Tutor <i>Mathematics, computer science, and music theory</i>	2017–Present
Science Undergraduate Society Peer Tutor <i>McGill University</i> — Tutor for the first course in abstract algebra.	2016

AWARDS AND FUNDING

Winner, CG:SHOP Challenge at SoCG <i>Computing Non-Obtuse Triangulations with Few Steiner Points</i>	2025
Graduate Mobility Award <i>McGill University</i> — Competitive award supporting a research visit at another university.	2021
BLUE Fellowship <i>McGill University</i> — Competitive summer fellowship; project: <i>Teaching Mathematics Through Games and Puzzles</i> .	2020
Science Undergraduate Research Award (SURA) <i>McGill University</i> — Merit-based scholarship supporting sixteen weeks of full-time research with Piotr Przytycki.	2018
James McGill Scholarship <i>McGill University</i> — Entrance scholarship awarded on academic merit.	2014
Bourse au Mérite <i>France</i> — Monthly bursary awarded for outstanding results in the French Baccalauréat.	2011–2013

TECHNICAL SKILLS AND LANGUAGES

Programming	Python, C, OCaml, Java, MATLAB, Assembly
Technical tools	$\text{\LaTeX}$, Bash, HTML/CSS, Rhino & Grasshopper
Languages	English (native), French (native), Spanish (basic)

Last updated: August 2026.