

Geoffrey Cruttwell

Department of Mathematics and Computer Science
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Academic Positions

- **Mount Allison University** Sackville, NB
Associate Professor 2017 – present
- **Dalhousie University** Halifax, NS
Adjunct Professor 2013 – present
- **Mount Allison University** Sackville, NB
Assistant Professor 2012 – 2017
- **University of Ottawa** Ottawa, ON
Postdoctoral Fellow 2011
– Supervisor: Richard Blute
- **University of Calgary** Calgary, AB
Postdoctoral Fellow 2009–2011
– Supervisor: Robin Cockett

Education

- **Dalhousie University** Halifax, NS
PhD (Mathematics) 2005 - 2009
– Thesis: “Normed Spaces and the Change of Base for Enriched Categories”
– Supervisor: Richard Wood
- **Dalhousie University** Halifax, NS
MSc (Mathematics) 2004 - 2005
– Thesis: “A Study of CCD Lattices in a Functor Category”
– Supervisor: Richard Wood
- **University of Waterloo** Waterloo, ON
Bachelor of Mathematics 1999 - 2004
– Graduated on Dean’s Honour List
– Minored in Philosophy

Awards, Grants & Honours

NSERC Discovery Grant (\$17,000/year) 2019–2028
Mount Allison Paul Pare Excellence Award 2023
NSERC Discovery Grant (\$15,000/year) 2013–2019
Mount Allison Student’s Union Excellence in Teaching Award 2013

PIMS Calgary Postdoctoral Fellowship (\$40,000/year)	2009–2011
NSERC Doctoral Scholarship (\$21,000/year)	2005–2008
NSERC Master’s Scholarship (\$17,000/year)	2004
University of Waterloo Research Award (\$8,000)	2004
NSERC Summer Research Award (\$8,000)	2003, 2002
University of Waterloo Descartes Scholarship (\$8,000)	1999

Publications (available at www.reluctantm.com/gcruttw/)

Peer-Reviewed Research Articles

23. **Factorization systems for restriction categories** (with R. Cockett, J. Gallagher, and D. Pronk), *Theory and Applications of Categories*, **42** (7), pg. 145–171, 2024.
22. **Reverse tangent categories** (with JS Lemay), in *32nd EACSL Annual Conference on Computer Science Logic (CSL 2024) Proceedings*, **38**, pg. 1–21, 2024.
21. **Differential bundles in Commutative Algebra and Algebraic Geometry** (with JS Lemay), *Theory and Applications of Categories*, **39** (36), pg. 1077–1120, 2023.
20. **Monoidal reverse differential categories** (with J. Gallagher, JS Lemay, and D. Pronk), *Mathematical Structures in Computer Science*, Vol. 32, Issue 10, 1313–1363, 2022.
19. **Double fibrations** (with M. Lambert, D. Pronk, and M. Szyld), *Theory and Applications of Categories*, **38** (35), pg. 1326–1394, 2022.
18. **Categorical Foundations of Gradient-Based Learning** (with B. Gavranovic, N. Ghani, P. Wilson, F. Zanasi), in *Proceedings of ESOP 2022*, 2022.
17. **Latent fibrations: fibrations for categories of partial maps** (with R. Cockett, J. Gallagher, and D. Pronk), *Theory and Applications of Categories*, **36** (16), pg. 423–491, 2021.
16. **Differential equations in a tangent category I** (with R. Cockett and JS Lemay), *Applied Categorical Structures*, issue 5, 2021.
15. **Integral and differential structure on the free C^∞ -ring modality** (with R. Lucyshyn-Wright and JS Lemay), published in *Cahiers de topologie et geometrie differentielle categoriques*, Volume LXII(2), pg. 116–176, 2021.
14. **Categorical semantics of a simple differential programming language** (with Jonathan Gallagher and Dorette Pronk), published in *Applied Category Theory 2020*, EPTCS 333 pg. 289–310, 2021.
13. **Reverse derivative categories** (with R. Cockett, J. Gallagher, JS Lemay, B. MacAdam, G. Plotkin, D. Pronk), in *28th EACSL Annual Conference on Computer Science Logic*, 18:1–16, 2020.
12. **Affine geometric spaces in tangent categories** (with R. Blute and R. Lucyshyn-Wright), *Theory and Applications of Categories*, **34** (15), pg. 405–437, 2019.
11. **A simplicial foundation for differential and sector forms in tangent categories** (with R. Lucyshyn-Wright), *Journal of Homotopy and Related Structures*, pg. 1–59, 2018.

10. **Differential bundles and fibrations for tangent categories** (with R. Cockett), *Cahiers de Topologie et Géométrie Différentielle Catégoriques*, **59** (1), pg. 10–92, 2018.
9. **Connections in tangent categories** (with R. Cockett), *Theory and Applications of Categories*, **32** (26), pg. 835–888, 2017.
8. **Cartesian differential categories revisited**, *Mathematical structures in computer science*, Vol. 27 (1), pg. 70–91, 2017 (first appeared online in 2015).
7. **The Jacobi identity for tangent categories** (with R. Cockett), *Cahiers de Topologie et Géométrie Différentielle Catégoriques*, Vol. LVI (4) pg. 301–316, 2015.
6. **Differential structure, tangent structure, and SDG** (with R. Cockett), *Applied Categorical Structures*, Vol. 22, pg. 331–417, 2014.
5. **Forms and exterior differentiation in Cartesian differential categories**, *Theory and Applications of Categories*, Vol. 28, pg. 981–1001, 2013.
4. **Differential Restriction Categories** (with R. Cockett and J. Gallagher), *Theory and Applications of Categories*, Vol. 25, pg 537–613, 2011.
3. **A Unified Framework for Generalized Multicategories** (with M. Shulman), *Theory and Applications of Categories*, Vol. 24, pg 580–655, 2010.
2. **CCD in Presheaf Categories**, (with F. Marmolejo, R. Wood), *Theory and Applications of Categories*, Vol. 18, pg 157–171, 2007.
1. **Dimensions of Fractals in the Large** (with M.R. Allen, K. Hare, J.O. Ronning), *Chaos, Solitons and Fractals*, Vol. 31, Issue 1, pg 5–13, 2007.

Book Chapters

1. **Assignment structure in upper-year mathematics courses** in *Mount A Teaches* (L. Wasylkiw and J. Tomes, eds.), pages 181–188, Friesen Press, 2016.

Student supervision

Postdoctoral fellows:

- September 2021 – April 2022: **Michael Lambert**: research on double categories.
- April 2021 – March 2022: **Jean-Simon Lemay**: research on cotangent categories and algebraic geometry.
- March 2020 – June 2022: **Martin Sztyld**: research on double fibrations (co-supervised with Dorette Pronk).
- March 2019 – August 2021: **Jonathan Gallagher**: research on tangent categories and orbifolds (co-supervised with Dorette Pronk).
- September 2015 – June 2017: **Rory Lucyshyn-Wright**: research on tangent categories and differential forms (co-supervised with Robert Rosebrugh).

PhD students:

- September 2020 – August 2024: **Marcello Lafranchi**; research on applications of tangent categories to physics and non-commutative geometry (at Dalhousie University, co-supervised with Dorette Pronk).
- January 2014 – August 2018: **Evangelia Aleiferi**; research on Cartesian Bicategories and Double categories (at Dalhousie University, co-supervised with Richard Wood).

Undergraduate students:

- May 2024 – August 2024: **Tanner Altenkirk**, research on categories of combinatorial games.
- May 2023 – April 2024: **Eli Vandenburg**, research on examples and theory of connections in algebraic geometry.
- May 2020 – August 2020: **Isaac Lee and Chaoyi Liang**, research on building computational tools to investigate finite categories.
- May 2018 – August 2018: **Shane Grogan**, research on links between category theory and psychology.
- May 2017 – April 2018: **Jonathan Bradet-Legrís and Hayley Reid**, research on differential categories and the forward difference operator.
- May 2014 – August 2014: **Rejean LeBlanc**, research on enumerating finite categories.
- May 2013 – August 2013: **Martin Sers**, research on generalizing constructions of the real numbers.

Invited conference and workshop talks (for all talks, see www.reluctantm.com/gcruttw/)

- “**Algebraic geometry via category theory**”, Foundational Methods in Computer Science 2024, June 2024.
- “**Algebraic geometry and tangent categories**”, ALT Coimbra Seminar, September 2022.
- “**Learning and derivatives, categorically**”, Cognitive Science 2022, workshop on Category Theory for Cognitive Science, July 2022.
- “**Algebraic geometry: a different path up the mountain**”, Foundational Methods in Computer Science 2022, June 2022.
- “**Categorical differential structures and their role in abstract machine learning**”, Topos Institute colloquium, July 2021.
- “**Towards cotangent categories**”, Mathematical congress of the Americas, Special session on Categories and Topology, July 2021.
- “**Tangent categories tutorial I: Multivariable Calculus**”, Foundational Methods in Computer Science 2019, Kananaskis, AB, May 2019.
- “**The usefulness of double categories**”, Foundational Methods in Computer Science 2016, Vancouver, BC, June 2016.

- **“Counting finite categories”**, American Mathematical Society fall meeting (Special session on New directions in category theory), Dalhousie University, October 2014.
- **“Differential categories and differential algebra”**, Association for Symbolic Logic annual meeting (Differential categories and differential lambda-calculi session), University of Waterloo, May 2013.
- **“Combining differential categories and manifolds”**, Foundational Methods in Computer Science 2011, Kananaskis, AB, June 2011.
- **“A unified framework for generalized multicategories”**, Canadian Mathematical Society summer meeting (Tensor Categories Session), Fredericton, June 2010.
- **“A unified framework for generalized multicategories”**, International Category Theory Conference 2009, Cape Town (South Africa), June 2009.

Professional and Service Activities

- **Managing Editor:** Theory and Applications of Categories journal, 2020–present.
- **Committee member:** NSERC Mathematics and Statistics Evaluation group, July 1 2024–June 30, 2027.
- **Scientific program committee member:** Applied Category Theory 2021, Applied Category Theory 2022, Applied Category Theory 2023, Applied Category Theory 2024.
- **Conference organizer:**
 - 30th workshop on Foundational Methods in Computer Science, June 2023.
 - Math/CS Science Atlantic conference, October 2022.
 - BIRS Workshop on Tangent categories and their applications, June 2021.
 - 26th workshop on Foundational Methods in Computer Science, May 2018.
 - 21st workshop on Foundational Methods in Computer Science, June 2013.
- **Department head:** Mathematics and Computer Science Department, Mount Allison University, 2022–2025.
- **Acting department head:** Mathematics and Computer Science Department, Mount Allison University, 2018–2019.
- **Faculty council secretary:** Mount Allison University, July 2020–June 2022.
- **Mount Allison University Committee member:**
 - Provost search committee, May–June 2024.
 - Joint research administration review committee, September 2020–May 2021.
 - Academic appeals committee, July 2019–June 2021.
 - Academic senate member, 2018–2019.
 - Planning Committee, 2015–2019.
 - Budget Advisory Committee, 2018–2019.
 - Faculty Council executive, 2015–2017.

- Research and Creative activities committee, 2013–2015.
- Re-admission Appeals committee, 2014–2015.
- MAFA Donations committee, 2014–2015.
- **Co-treasurer and board member:** Mount Allison University club, 2014 and 2015.
- **Referee and reviewer.** Refereed publications submitted to *Theory and Applications of Categories*, *Mathematical structures in Computer Science*, *Theoretical Computer Science*, *Journal of Mathematical Economics*, *Journal of Homotopy and Related Structures*, *Logic in Computer Science (LICS)* and reviewed papers for *Mathematical Reviews*.