Matthew Burke

+14036049368 | matthew.burke@cantab.net | **https://mwpb.uk**

Education

Macquarie University, Sydney
Doctor of Philosophy in Mathematics 2011-2015

Christ's College, University of Cambridge
Part III Mathematics (MMATH) 2010-2011
Bachelor's Degree in Mathematics (BA) 2007-2010

Work Experience

University of Calgary   Sep 2018 - Present
Sessional instructor   & Sep 2017 - Dec 2017

- Lectured 4 classes of around 230 students for the MATH211 and MATH249 courses.

- Used Jupyter notebooks for interactive visualisations and showing intermediate steps.

University of Calgary   Sep 2017 - Present
Postdoctoral scholar

- Initiated a cross-discipline collaboration between the departments of mathematics and computer science with my supervisors. Published in a respected peer-reviewed journal.

- Provided mentoring support for two PhD students.

- Examiner for a PhD student's candidacy examination.

- Reviewed papers for two mathematics journals. Organised the University of Calgary Peripatetic Seminar and chaired a session of the Alberta Mathematics Dialogue 2018.

MathSpire Ltd.   Nov 2016 - Aug 2017
Chief technology officer

- Developed a functional reactive cross-platform mobile and desktop application to teach A-level mathematics using interactive graphs, videos and integrated testing.

- Created a web front-end and API for teachers to track student progress.

- Showcased application at the BETT eduction technology conference.

Debate Chamber Ltd.   Jul 2016 - Aug 2016
Summer school tutor

- Guided classes of around 14 A-level students through university level material using a combination of presentations, exercises and group work.

MathSpire Ltd.   Jun 2016 - Nov 2016
Software developer and content creator

- Created a database of mathematics videos, tests and interactive graphics.

Masaryk University, Brno   Oct 2015 - Nov 2015
Visiting postdoctoral researcher

- Plenary speaker at the multi-disciplinary Eduard Cech Institute Workshop.

- Collaborated with researchers in algebra, geometry and theoretical physics.

Macquarie University, Sydney   Jan 2013 - Jun 2014
Tutor

- Demonstrated solutions on the whiteboard for three undergraduate mathematics courses.

Macquarie University Numeracy Centre   Jan 2012 - Dec 2013
Tutor

- Guided and motivated first year students at the drop-in centre.

Blue Tutors   Jun 2010
GCSE Tutor

Selected Projects

- **Kaggle Box Office Predictions:** (<https://github.com/mwpb/kaggle-projects>)
  Competition to predict the revenue of films. Uses IPython in Google Colab.

- **Cryptopals Challenges:** (<https://github.com/mwpb/matasano-go>)
  Solutions written in Go. Work in progress: currently first three sets completed.

- **ChessLogBook** (<https://mwpb.uk/ChessLogBook>)
  MacOS app written using Qt to play games on `freechess.org` and annotate them offline.

- **Colimits in Coq:** (<https://github.com/mwpb/postulated-colimits-in-coq>)
  Computer verification of a key result in category theory using the Coq proof assistant.

Professional Development and Prizes

2018   Mitacs online workshop: Managing Project Timelines
2016   University of Michigan on Coursera: Using Python to Access Web Data
2016   University of Michigan on Coursera: Using Databases with Python
2008   Christ's College Whelan Prize for First Class Examination Performance

Skills

Over 1 year experience: F#, .NET, WebSharper & Xamarin Frameworks, Git, LaTeX.

Some experience: C#, JavaScript, HTML, CSS, Python, Jupyter Notebook, Coq.

Publications

- Involution algebroids: a generalisation of Lie algebroids for tangent categories, *In preparation.* Available at <https://mwpb.uk/static/pdfs/involution-algebroids.pdf>.

- A Synthetic Version of Lie's Second Theorem, *Applied Categorical Structures*, 2018.02.06. Available at <https://doi.org/10.1007/s10485-018-9518-2>.

- Connected Lie Groupoids are Internally Connected and Integral Complete in Synthetic Differential Geometry, *Symmetry, Integrability and Geometry: Methods and Applications*, 2016.06.29. Available at <http://www.emis.de/journals/SIGMA/2017/007/>.

Selected Conference Presentations

- Canadian Mathematical Society, Summer Meeting, *The Calculus of Infinity Functors and Tangent Categories*, University of New Brunswick, 2018.06.04.

- 26th Foundational Methods in Computer Science Workshop, *Tangent Bundles of Groupoids, Pre-groupoids and Torsoids*, Mount Allison University, 2018.06.02.

- Seminaire de geometrie et physique mathematique, *Multi-object Lie theory using synthetic differential geometry*, Universite Paris Diderot, Paris 7, 2015.12.04.

- Category Theory Seminar, *A Synthetic Version of Lie's Second Theorem*, University of Cambridge, 2015.11.17.

- Plenary Speaker at Eduard Cech Institute Workshop, *Synthetic Lie Theory*, Trest, Czech Republic, 2015.10.10.

- Category Theory 2014, *Synthetic Lie Theory*, University of Cambridge, 2014.07.04.