

PERSONAL STATEMENT

I am not, in a strict sense, a mathematician, nor can I claim to be an engineer or a physicist — yet I am all of these three. My expertise lies in numerical analysis and partial differential equations, but my work draws from the fields of functional analysis, numerical linear algebra, approximation theory, optimization, geometry, and high-performance scientific computing. As I finish my PhD, I seek to grow in a new technical area and transition into data-driven engineering and machine learning. While this is a new direction, I bring with me mathematical maturity, scientific software engineering experience, and a proven ability to learn quickly. I am passionate about finding rigorous and effective mathematical solutions for challenging problems, and am excited by the opportunity to build powerful computational tools with a direct real-world impact.

EDUCATION

Ph.D. University of Toronto Institute of Aerospace Studies. Sept. 2020 – Present
(Direct transfer from M.A.Sc. in Sept. 2020)

Supervisor: Prof. David Zingg

- Developing robust and mathematically rigorous high-order structure-preserving numerical methods to solve partial differential equations for fluid dynamics.
- Expected defence date is November 2026.

H.B.Sc. University of Toronto. Graduation date: Nov. 2019
Physics Specialist, Mathematics Minor GPA: 3.84 / 4.00

- Dean's List Scholar, 2015 to 2019
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PUBLICATIONS

Bercik, A., Craig Penner, D.A. & Zingg, D.W. Stable Volume Dissipation for High-Order Finite-Difference and Spectral-Element Methods with the Summation-by-Parts Property. *J Sci Comput* **107**, 28 (2026). DOI: [10.1007/s10915-026-03213-y](https://doi.org/10.1007/s10915-026-03213-y)

Bercik, A. & Zingg, D.W. On the Practical Impact of Local Linear Instabilities in Entropy-Stable Schemes. *arXiv preprint* (2026). DOI: [10.48550/arXiv.2605.02081](https://doi.org/10.48550/arXiv.2605.02081)

...and a few more to be submitted in fall 2026!

INVITED TALKS

Volume Dissipation for Finite-Difference and Spectral-Element Summation-By-Parts Methods. *University of Cologne* (December 2025) [\[link to abstract\]](#)

Provable Numerical Stability Without the Variational Crimes: An Introduction to Summation-By-Parts Methods for PDEs. *McMaster University* (November 2025) [\[link to abstract\]](#)

Nonlinearly Stable High-Order Summation-by-Parts Methods: From Curvilinear Grids to Volume Dissipation. *Ansys* (September 2025)

An overview of Summation By Parts Methods for CFD: how to make your CFD discretizations more attractive to both engineers and mathematicians. *University of Toronto* (February 2023)

CONFERENCE PRESENTATIONS

Bercik, A. & Zingg, D.W. On the Practical Impact of Local Linear Instabilities in Entropy-Stable Summation-By-Parts Schemes. 17th World Congress on Computational Mechanics (WCCM-ECCOMAS) Munich, Germany (July 2026). [\[link to abstract\]](#)

Bercik, A. & Zingg, D.W. Stable Volume Dissipation for High-Order Finite-Difference and Spectral-Element Methods with the Summation-by-Parts Property. 15th International Conference on Spectral and High Order Methods (ICOSAHOM) Montréal, Canada (July 2025). [\[link to program\]](#)

Bercik, A., Craig Penner, D.A. & Zingg, D.W. Summation by Parts Discretizations on Curvilinear Grids. The Annual Meeting of the Canadian Society of Applied and Industrial Mathematics (CAIMS) Kingston, Canada (June 2024).

Bercik, A., Craig Penner, D.A. & Zingg, D.W. Extension of Optimized Grid Metrics to Non-Polynomial Curvilinear Coordinate Transformations for Summation-by-Parts Discretizations. *2023 Society for Industrial and Applied Mathematics Conference on Computational Science and Engineering* (SIAM CSE) Amsterdam, The Netherlands (February 2023). [\[link to abstract\]](#)

NOTABLE AWARDS

Ontario Graduate Scholarship (OGS)	2021-2022, 2024-2025, 2025-2026
NSERC Canada Graduate Scholarship (CGS M)	2020-2021

TECHNICAL SKILLS

Python (NumPy, SciPy, Numba, Matplotlib, SymPy, scikit-learn, Jupyter, etc.)
Fortran, Julia, C++, Bash, Git, Linux/Unix, Slurm, compilers, profiling, unit testing

TEACHING EXPERIENCE

Instructor – Vector Calculus & Fluid Mechanics (AER210) Sept. 2023 – Jan. 2024
Dept. of Engineering, University of Toronto, Toronto, ON

- Delivered 7 hours of weekly lectures to 241 students in the Engineering Science program, and coordinated with 10 TAs to deliver weekly tutorials.
- Developed a curriculum, 2 laboratory assignments, 2 problem sets, 2 midterms, a final exam, supplemental lecture notes, and weekly practical demonstration sessions.
- Exceeded department and division averages across all course evaluation metrics.
- Managed all course administration, including Quercus and Piazza platforms.

Teaching Assistant (various roles) 2018 – 2022
Engineering & Society (ESC203), *Dept. of Engineering, University of Toronto*
Calculus I & II (ESC194 & ESC195), *Dept. of Engineering, University of Toronto*
Calculus 1[A] (MAT135), *Dept. of Mathematics, University of Toronto*

EXTRACURRICULAR ACTIVITIES

Pledge4Future (pledge4future.org) 2022 – 2024

- Student-led project to develop a free web app to visualize and reduce CO₂ emissions.
- Developed the methodology, including CO₂ calculators & Life cycle assessments.

YouTube Channel & Podcast [youtube.com/c/BeyondtheBigBang] Feb. 2021 – Oct. 2021

- Along with 3 Physics PhD colleagues, created educational and entertaining content to promote science and teach advanced physics topics. Amassed 140,000+ views.
- Example videos: (a) [weak solutions to a PDE & applications to fluid dynamics](#)
(b) [numerical methods for ODEs](#)

Alumni Speaker at Bay Area Science and Engineering Fair (BASEF) Mar. 2026

Juror at Canadian Young Physicists' Tournament (CaYPT) 2019 – 2025

Aerospace Student's Association 2019 – 2022
Co-President (2020-2021), Social Coordinator (2019-2020)

Organization of Latin American Students 2016 – 2019
President (2018-2019), Vice-President (2017-2018), Events Coordinator (2016-2017)

Intramural Sports Coordinator, University of Toronto 2016 – 2019

- Awarded the 'T' Award for "outstanding contribution to the Intramural Program at the University of Toronto".

Semi-Professional Soccer 2017 – 2022
Canadian Soccer League & League1 Ontario

LANGUAGES

Fluent in English & Spanish; Proficient in Portuguese & French; Intermediate in Czech