Filip Bělík

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filipbelik | fbelik

PhD Candidate
Department of Mathematics and Scientific Computing and Imaging Institute
University of Utah, Salt Lake City, USA

Education

- **University of Utah** — *August 2022 - Present*
  Mathematics PhD — Salt Lake City, UT, USA
  - Studying applied/computational mathematics
  - Co-advised by Dr. Akil Narayan and Dr. Christel Hohenegger
  - Intended graduation in May 2027
  - President of University's Student SIAM chapter
  - Chair of Mathematics Graduate Student Recruitment Committee
  - GPA: 4.00

  Coursework:
  - MATH 5080 Statistical Inference I
  - MATH 6010 Linear Models
  - MATH 6410 Ordinary Differential Equations
  - MATH 6420 Partial Differential Equations
  - MATH 6610 Analysis of Numerical Methods I
  - MATH 6620 Analysis of Numerical Methods II
  - MATH 6630 Numerical Method for Partial Differential Equations
  - MATH 6710 Applied Linear Operators and Spectral Methods
  - MATH 6720 Applied Complex Variables and Asymptotic Methods
  - MATH 6740 Bifurcation Theory
  - MATH 6750 Fluid Dynamics
  - MATH 6880 Mathematics of Data Science
  - MATH 7875 Advanced Optimization

- **Gustavus Adolphus College** — *September 2018 - May 2022*
  BA Honors Mathematics & BA Computer Science — St. Peter, MN, USA
  - Student host for Nobel Conference 2021, Big Data
  - Mathematics, Computer Science, and Statistics (MCS) Department Assistant, 2021
  - President of Club Tennis
  - Co-President of Coding Club
  - MCS Club; Running Club
  - Cumulative GPA: 3.989
  - Major GPA: 4.00

  Coursework:
  - MCS-150 Discrete Mathematics
  - MCS-177 Computer Science I (Python)
  - MCS-178 Computer Science II (Java/Kotlin/Assembly)
  - MCS-220 Introduction to Analysis
  - MCS-221 Linear Algebra
  - MCS-222 Multivariable Calculus
  - MCS-256 Discrete Calculus
  - MCS-265 Theory of Computation
  - MCS-270 Android Development
  - MCS-284 Computer Organization (C)
  - MCS-313/314 Modern Algebra I and II
  - MCS-321 Theory of Complex Variables
  - MCS-331 Real Analysis
  - MCS-353 Continuous Dynamical Systems
  - MCS-355 Scientific Computing
  - MCS-357 Discrete Dynamical Systems
  - MCS-375 Algorithms
  - MCS-377 Networking

- **East Ridge High School** — *September 2015 - May 2022*
  Secondary Education — Woodbury, MN, USA

- Varsity Tennis
- Mathematics Club
- Weighted GPA: 4.123
- Unweighted GPA: 3.814

Work Experience

- **University of Utah Mathematics Department** *August 2022 - Present*
  Graduate Research and Teaching Assistant Salt Lake City, UT, USA
  - Instructor of record for MATH 1310 Calculus I for engineers
  - Research funding under Dr. Narayan, Dr. Christel Hohenegger, and a University of Utah funding incentive seed grant
  - Lab TA for MATH 4600 Mathematics in Medicine

- **Gustavus Mathematics and Computer Science Department** *February 2019 - May 2022*
  TA & Tutor & Grader St. Peter, MN, USA
  - Computer Science I Teacher's Assistant, Grader, and Tutor (Python)
  - Computer Science II Teacher's Assistant and Tutoring (Kotlin and Java)
  - Discrete Mathematics Grader
  - Online volunteer tutoring during COVID semester

- **Allianz Life** *May 2021 - August 2021*
  Hedging Intern Golden Valley, MN, USA
  - Learned about quantitative finance; specifically in hedging
  - Software development through programming in C# and SQL
  - Implemented procedure for automating the labeling of incoming market data
  - Developed application for visualization of 3D data and interpolation/approximation of data
  - Presented final projects to corresponding teams

- **Her Next Play** *June 2020 - August 2020*
  CRM Intern Remote
  - Research and evaluation of different contact resource management (CRM) options
  - Presentation of key information to executives
  - Implementation and instruction of new CRM software
  - Learned about incredible mission of Her Next Play while expanding network

Research

- **Model Order Reduction and Numerical Methods for Conservation Laws** *May 2023 - December 2023*
  with Dr. Akil Narayan
  - Study and implementation of finite difference, finite volume, discontinuous Galerkin methods for conservation laws
  - Understand wide application and shortcomings of linear ROMs for transport-dominated equations
  - Study of parametric model order reduction methods for linear stationary and nonstationary parametric problems
  - Implementation of balanced truncation and RB method for linear time-invariant dynamical systems
  - Implementation of proper orthogonal decomposition, strong greedy, and weak greedy methods for stationary parametric problems
  - Goal of expanding to nonlinear and transport dominated problems
  - Development of open-source software package ModelOrderReductionToolkit.jl

- **Blood Flow Modeling for Conductivity and Uncertainty Quantification** *June 2022 - Present*
  with Dr. Christel Hohenegger
  - Analytical modeling of arterial blood flow and wall displacement
  - Use of electrical theory on ellipsiods and Maxwell-Fricke theory to compute an averaged bulk conductivity in the artery

- Goal of better understanding relationship between blood pressure and blood-driven electrical properties at the wrist
- Work to understand impacts of various parameters and nondimensional constants through local and (Sobol-based) global sensitivity analyses
- Modeling propagation of pressure waves through an arterial tree along with required boundary conditions to cause peaking seen in wrist blood pressures
- Collaboration with Henry Crandall and Dr. Benjamin Sanchez (University of Utah Electrical Engineering) and Tyler Schuessler and Dr. Braxton Osting (University of Utah Mathematics)

• **Carathéodory-Steinitz Pruning** *May 2023 - Present*

with Dr. Akil Narayan and Dr. Jesse Chan (Rice University)

- Implementation of various QR-based methods for pruning procedure
- Testing of various methods for numerical quadrature and model order reduction applications
- Development of open-source Julia package CaratheodoryPruning.jl
- Discussion of complexity of various algorithms

• **Uncertainty Quantification for Markov Decision Processes in Ecological Settings** *May 2023 - Present*

with John Turnage, Dr. Akil Narayan and Dr. Jody Reimer

- Study of use of decision-based models for ecological processes
- Working to understand impacts of uncertainty of such models
- Development of methods for uncertainty quantification for such models

• **Modeling Closed Vortices as Self-Avoiding Polygons** *August 2021 - May 2022*

with Dr. Pavel Bělík (Augsburg University) and Dr. Thomas LoFaro (Gustavus Adolphus College)

- Undergraduate mathematics honors project
- Extend on former work by modeling closed-loop vortices, such as dolphin bubble rings or smoke rings, as self-avoiding polygons in the cubic lattice
- Implemented sets of transformations for use in Metropolis Markov Chain Monte-Carlo methods
- Discovered interesting and nonintuitive pattern of high-energy configurations

• **Port-and-Sweep Solitaire Army Problem** *May 2020 - September 2020*

with Dr. Jacob Siehler (Gustavus Adolphus College)

- Six-week research project under Stephen Hilding Fund
- Research of algebra associated with Port-and-Sweep Solitaire
- Use of various algebraic and computational techniques to tackle one-dimensional army problem
- Presentation of information to other Gustavus student researchers

• **The Propagation of Health-Related Habits on Twitter** *May 2019 - November 2019*

with Dr. Louis Yu and Jeffery Engelhardt (Gustavus Adolphus College)

- Accepted as one of six first-year Gustavus students for ten-week research project under First-Year Research Experience (FYRE)
- Use of various machine learning models in classification of tweets
- Construction of listener to run over twelve-week period
- Presented and attended research presentations at Midstates Consortium at University of Chicago

Conferences

• **Wasatch SIAM Student Chapters Conference** *April 2025*

Utah State University, Logan UT [🌐]

- Talk: Carathéodory-Steinitz Pruning for Numerical Quadrature

• **MAA North Central Section Meeting** *March 2025*

St. Olaf College, Northfield MN [🌐]

- Talk: Carathéodory-Steinitz Pruning for Numerical Quadrature

- **Model Reduction and Surrogate Modeling** *September 2024*
  Scripps Seaside Forum, La Jolla CA [🌐]
  ◦ Talk: Greedy Frequency Domain Model Reduction for Parametric Systems: New Theory and Algorithms
- **NSF Computational Mathematics PI Meeting** *July 2024*
  University of Washington, Seattle WA [🌐]
  ◦ Poster: Dynamic Bulk Conductivity in Radial Artery
- **Mathematical Opportunities in Digital Twins** *December 2023*
  George Mason University, Arlington VA [🌐]
  ◦ Poster: Dynamic Bulk Conductivity in Radial Artery
- **Midstates Consortium for Math and Science** *November 2019*
  University of Chicago, Chicago IL [🌐]
  ◦ Talk: The Propagation of Health-Related Habits on Twitter

Skills

- **Programming Languages:** Julia, Python, MATLAB, LaTeX, C, C++, Java, C#
- **Other Mathematical/Statistical Tools:** Jupyter, LaTeX, Maple
- **Android App Development:** Kotlin
- **Web Development:** HTML, JavaScript, CSS
- **Computer Operating Systems:** Windows, Linux, Max
- **Competitive Programming:** ICPC, COMAP, Kattis (fbelik), Project Euler (fbelik)

Honors and Awards

- **RTG: Optimization and Inversion Summer Grant** *May 2023*
  University of Utah Mathematics Department [🌐]
- **Fulbright Canada Mitacs Globalink Research Internship** *April 2021*
  Mitacs Globalink [🌐]
- **Hilding Research Fund** *April 2020*
  Gustavus Adolphus College
- **First-Year Research Experience (FYRE)** *April 2019*
  Gustavus Adolphus College [🌐]
- **Math Problem Solving Competition** *2018, 2019*
  Gustavus Adolphus College [🌐]
- **Dean's Scholarship** *Fall 2018*
  Gustavus Adolphus College