MAX RUTH

Graduate Student ◇ Center for Applied Mathematics ◇ Cornell University
(720) - 454 - 5488 ◇ mer335@cornell.edu

EDUCATION

Cornell University *August 2018 - present*

- Pursuing Ph.D. in Applied Mathematics (Advisor: David Bindel)
- M.S in Applied Mathematics
- Minor in Theoretical and Applied Mechanics
- GPA: 4.0

University of Colorado Boulder *August 2014 - August 2018*

- M.S. in Applied Mathematics (Advisor: Mark Hoefer)
- B.S. in Applied Mathematics
- B.S. in Engineering Physics
- Summa cum Laude
- GPA: 3.97

RESEARCH INTERESTS

- Scientific Computing
- Hamiltonian Dynamics
- Plasma Physics
- Solid Mechanics (Piezoelectric Materials)
- Numerical Linear Algebra
- High-performance Computing
- Nonlinear Waves
- Extrapolation Methods

HONORS AND AWARDS

- NSF Graduate Research Fellow *Fall 2018 - Spring 2023*
- Outstanding Graduate for Research Award (CU Boulder) *Spring 2018*
- ARCS Fellow *Fall 2017–Fall 2018*
- Igor and Elfriede Gamow Scholarship *Fall 2014–Fall 2018*

PUBLICATIONS

1. (Submitted) R. Gaur, S. Buller, M. E. Ruth, M. Landreman, I. G. Abel, and W. D. Dorland, *An adjoint-based method for optimizing MHD equilibria against the infinite-n, ideal ballooning mode*, Feb. 2023. arXiv:2302.07673 [physics]
2. T. Shi, M. Ruth, and A. Townsend, *Parallel Algorithms for Computing the Tensor-Train Decomposition*, SIAM Journal on Scientific Computing, 45 (2023), pp. C101–C130
3. M. Oprea, M. Ruth, D. Kassabova, and W. Clark, *Optimal Control of Nonholonomic Systems via Magnetic Fields*, IEEE Control Systems Letters, 7 (2023), pp. 793–798. Conference Name: IEEE Control Systems Letters
4. M. E. Ruth, *The role of topology in magnetic solitary wave dynamics*, Master's thesis, University of Colorado Boulder, Department of Applied Mathematics, Boulder CO, 2018
5. M. E. Ruth, E. Iacocca, P. G. Kevrekidis, and M. A. Hoefer, *Transverse instabilities of stripe domains in magnetic thin films with perpendicular magnetic anisotropy*, Physical Review B, 97 (2018), p. 104428

PRESENTATIONS

- Vector RRE for Classifying Chaos in Symplectic Maps. ICERM Workshop on Acceleration and Extrapolation Methods. Providence, RI. (July 2023)
- Finding Invariant Circles from a Single Trajectory. Simons Collaboration on Hiddne Symmetries and Fusion Energy. Online. (July 2023)
- Level Set Learning for Poincaré Plots of Symplectic Maps. Presentation. SIAM Conference on Applications of Dynamical Systems (DS23). Portland, OR. (May 2023) *Minisymposium*
- Optimal Control of Nonholonomic Systems via Magnetic Fields. Presentation. American Control Converence (ACC). San Diego, CA. (June 2023)
- Level Set Learning for Poincaré Plots of Symplectic Maps. Presentation. SIAM Conference on Computational Science and Engineering (CSE23). Amsterdam, The Netherlands. (March 2023) *Minisymposium*
- Sequence Acceleration for Classifying Chaos. Presentation. Cornell University Applied Dynamics Seminar. Ithaca, NY. (October 2022)
- Improving COBRA-VMEC for Determining Ballooning Instability via Eigenvalue Optimization. Presentation. Simons Collaboration on Hidden Symmetries and Fusion Energy Greifswald Retreat. Greifwald, Germany. (July 2022)
- Symplectic Map Approximation and Invariant Circle Continuation. Presentation. Simsopt Developers Meeting. Online (June 2022)
- Geometrically Nonlinear Modes in Piezoeelectric Materials. Presentation. Cornell University PhD Candidacy Exam. Ithaca, NY. (December 2021)
- Instabilities of topological and non-topological bion stripes. Poster. 62nd Annual Conference on Magnetism and Magnetic Materials, Pittsburgh, PA. (November 2017)
- Instabilities of topological and non-topological bion stripes. Poster. Front Range Advanced Magnetics Symposium, Denver, CO. (August 2017)
- Instabilities of topological and non-topological bion stripes. Poster. Oxford Magnonics, Oxford, England. (August 2017)
- Perimeter dynamics of a two-dimensional, circular soliton in a magnetic system. Oral presentation. Front Range Applied Mathematics Student Conference, Denver, CO. (January 2017)
- Droplet solitons in magnetic films of finite thickness. Poster. Front Range Advanced Magnetics Symposium, Laramie, WY. (August 2016)

SERVICE

Local Activity

- Ithaca High Schooler Math Seminar Instructor *Fall 2020-Spring 2021*
- JILA Physics Frontier Center PISEC Volunteer *Spring 2018*

Review Activity

- IEEE Control Systems Society (2022)

TEACHING

- MATH 3610: Mathematical Modeling *Fall 2023*
- MATH 2930: Differential Equations for Engineers (TA) *Spring 2022*
- MATH 4250: Numerical Analysis and Differential Equations (TA) *Fall 2021*
- PHYS 1020: The Physics of Everyday Life (LA) *Spring 2017*

SOFTWARE

`Parallel_TT_Sketching`

- Fully parallelized MPI-based tensor-train decomposition algorithms, implemented in C

- https://github.com/SidShi/Parallel_TT_sketching

StellaratorOptimizationMetrics.jl

- Ballooning stability calculations for stellarators, implemented in Julia
- https://gitlab.com/wistell/StellaratorOptimizationMetrics.jl

PROFESSIONAL SOCIETIES

- Member, SIAM (Society for Industrial and Applied Mathematics)
- Member, AMS (American Mathematical Society)