Curriculum Vitae: Ethan Ebbighausen

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Education

- **University of California Berkeley- Berkeley, CA**

  August 2024 - May 2029 Graduate Student, Ph.D program in Mathematics

- **University of North Carolina at Chapel Hill- Chapel Hill, NC**

  August 2020 –May 2024; Mathematics Major, Statistics Major; **GPA: 4.0** Graduated with Highest Honots

- **North Carolina State University- Raleigh, NC**

  June 2019- May 2020; Non-degree program; Mathematics Interest; GPA: 4.33 (Highest Possible; 4.0 on non-A+ scale)

Research Experience

- **Interests and Current Work**

  I'm currently looking into generalizations of the Furstenberg set problem to build me familiarity with geometric measure theory. In particular, I'm interested in what can be obtained in higher dimensions in Euclidean spaces, and what can be said about non-Euclidean spaces. I'm also interested in Falconer's distance problem and orthogonal projection theory.

  Undergraduate:

- **REU: Sensitivity Analysis of Optimal Control Problems**

  Mentors: Alen Alexanderian, Joseph Hart

  June 2023-January 2024

  This project focuses on update systems for mid-flight parameter changes in the problem of computing the optimal trajectory for a space shuttle to re-enter the atmosphere, and implementing such updates as well as optimal control in MATLAB.The project began under NSF grant DMS-2051010, as well as the National Security Agency Grant No. H98230-23-1-0009 for the DRUMS REU at NC State University.

  Topics: Derivative-Based Sensitivity Analysis (Local and Global), Nonlinear Optimization, Ordinary Differential Equations, Partial Differential Equations, Quasi Monte Carlo methods, MatLab coding, Adjoint method, Sensitivity Equations,

- **Investigations on the Collatz Conjecture**

  Mentor: Idris Assani (assani@email.unc.edu)

  September 2021- May 2024

  This long-term project focuses on the applications of Ergodic Theory to the famous Collatz conjecture specifically in building measures with specific properties relative to the Collatz map. This work has resulted in one paper in review and one preprint so far.

  Topics: Ergodic Theory, Dynamical Systems, Krylov-Bogoliobov, Measure Theory, Combinatorics, Number Theory, Functional Analysis, Hopf Decomposition, Compactifications

- **Polymath Jr. –Variable $A_{p(\cdot)}$ Weights**

  Mentor: Michael Penrod (mjpenrod@crimson.ua.edu)

  June-August 2022

  This project focused on developing analogues for properties of Muckenhoupt Weights for variable exponents, working with variable $L^{p(\cdot)}$ spaces.

  Topics: Harmonic Analysis, Functional Analysis, L^p spaces, Variable $L^{p(\cdot)}$ spaces, Muckenhoupt Weights

Papers

- **Syracuse Maps as Non-Singular Power-Bounded Transformations and Their Inverse Maps**

  January, 2023; Preprint DOI: https://doi.org/10.48550/arXiv.2208.11801

  Submitted to Colloquia Mathematica, In revision

  Jointly Written with I. Assani and A. Hande.

- **On the Convergence of the Density of Terras' Set**

  September, 2023; Preprint DOI: https://doi.org/10.48550/arXiv.2310.08749

  Jointly written with I.Assani

Teaching Experience and Outreach

- **UC Berkeley Graduate Student Instructor**

  I have previously taught discussions for Math 1A (Calculus I) and Math 54 (Linear Algebra and Differential Equations)

- **Tutoring**

  Three Semesters of peer-tutoring for assorted math classes in the UNC Math Help Center: 3 hours per week (Fall 2022, Spring 2023, Fall 2023).

- **Grading**

  One Semester, Grading for STOR 515 (Dynamic Decision Analytics) Under W.Lassiter

Presentations

- NCSU Undergraduate Research Symposium

  Approximate Solutions for Perturbed Optimal Control Problems, August 2023

- Research Talk at UNC-CH Ergodic Theory Seminar

  Measure-Based Equivalent statements of Bounding Collatz Trajectories, October 2023

- Presentation at the Joint Mathematics Meetings, January 2023

  Approximate Solutions for Perturbed Optimal Control Problems

Affiliations and Honors

- Outstanding Graduate Student Instructor Award (2024)
- Alfred T. Brauer Prize (2024)
- Recipient of the Honors Carolina Excellence Fund (2023)

Skills

- **Computer Languages**: R (1 year: 2 data analytics courses), Python (1 year), MATLAB (1 Year: REU and Stoachastic Processes), LaTeX (4 years)
- **Tools:** Fusion 360, Adobe Illustrator, Microsoft Office, Visual Studio, Git
- **Other:** Leadership (Eagle Scout); Teamwork (Customer Service Jobs, Team Sports, Model UN, Research Group); Active listening, Presentation, Effective communication (Speech and Debate, Model UN, Math department presentations); Customer Service (2 years, job history at Target and Harris Teeter)