Margaret H. Regan www.margaretregan.com
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Positions

- **William W. Elliott Assistant Research Professor** Duke University
  Department of Mathematics *Aug. 2020 - present*
- **Nonlinear Algebra Group** Max Planck Institute for Mathematics in the Sciences, Leipzig
  Visiting Researcher *Aug. 2019 - Sept. 2019*
- **Computer Vision Cluster** ICERM at Brown University
  Visiting Researcher *Feb. 2019*
- **Semester Program on Nonlinear Algebra** ICERM at Brown University
  Visiting Researcher *Sept. 2018 - Dec. 2018*

Education

- **University of Notre Dame** Notre Dame, IN
  Ph.D. in Applied and Computational Mathematics and Statistics *Aug. 2020*
  - Advisor: Jonathan Hauenstein
  - Thesis title: Parameterized Polynomial Systems and their Applications

  M.S. in Applied and Computational Mathematics and Statistics *May 2017*
  - GPA: 3.86/4.00
- **Swarthmore College** Swarthmore, PA
  B.A. Mathematics and Physics (with Honors) *June 2014*
  - GPA: 3.44/4.00.

Publications

- Wenrui Hao, Jonathan D. Hauenstein, **Margaret H. Regan**, and Tingting Tang, "A numerical method for solving elliptic equations on real closed algebraic curves and surfaces." *In preparation.*
- Edgar A. Bernal, Jonathan D. Hauenstein, Dhagash Mehta, **Margaret H. Regan**, and Tingting Tang, "Machine learning the discriminant locus." *Submitted.*
- Jonathan D. Hauenstein and **Margaret H. Regan**, "Evaluating and differentiating a polynomial using a pseudo-witness set." *LNCS*, 12097, 61–69, 2020. DOI: 10.7274/r0-0mc0-gt33
- Ricardo Fabbri, Timothy Duff, Hongyi Fan, **Margaret H. Regan**, David da Costa de Pinho, Elias Tsigaridas, Charles W. Wampler, Jonathan D. Hauenstein, Peter Giblin, Benjamin Kimia, Anton Leykin, and Tomas Pajdla, "TRPLP - Trifocal relative pose from lines at points." *2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 12070–12080, 2020, DOI: 10.1109/CVPR42600.2020.01209..
- Jonathan D. Hauenstein and **Margaret H. Regan**, "Real monodromy action." *Applied Mathematics and Computation*, 373, 124983, 2020. DOI: 10.1016/j.amc.2019.124983
- Danielle A. Brake, Jonathan D. Hauenstein, and **Margaret H. Regan**, "polyTop: Software for computing topology of smooth real surfaces." *LNCS*, 10931, 397–404, 2018. DOI: 10.7274/R0PV6HF4
- Jonathan D. Hauenstein and **Margaret H. Regan**, "Adaptive strategies for solving parameterized systems using homotopy continuation." *Applied Mathematics and Computation*, 332, 19–34, 2018. DOI: 10.7274/R0C53HXK
- Peter J. Collings, Joshua N. Goldstein, Elizabeth J. Hamilton, Benjamin R. Mercado, Kenneth J. Nieser, **Margaret H. Regan**, "The nature of the assembly process in chromonic liquid crystals." *Liquid Crystals Reviews* 3(1), 1–27, 2015. DOI: 10.1080/21680396.2015.1025305
- Elizabeth A. Mills, **Margaret H. Regan**, Vesna Stanic, and Peter J. Collings, "Large Assembly Formation via a Two-Step Process in a Chromonic Liquid Crystal." *The Journal of Physical Chemistry B* 116(45), 13506–13515, 2012. DOI: 10.1021/jp306135w

Awards

- Outstanding Graduate Student Teacher Award ($100) from ND Learning || Kaneb Center for Teaching Excellence and The Graduate School at the University of Notre Dame (April 2020)
- SIAM Student Travel Award ($850) for SIAM Conference on Applied Algebraic Geometry (July 2019)

- Graduate Student Professional Development Award ($500) from ACMS Department at the University of Notre Dame for SIAM Conference on Applied Algebraic Geometry (July 2019)
- NSF Travel Support for MEGA/MEGAR Conference (June 2019)
- SIAM Outstanding Efforts and Achievements Award – University of Notre Dame SIAM Student Chapter (May 2019)
- AMS Travel Award ($250) for AMS Sectional Meeting (Nov. 2018)
- SIAM Student Travel Award ($650) for SIAM Annual Meeting (July 2018)
- Graduate Student Professional Development Award ($500) from ACMS Department at the University of Notre Dame for SIAM Annual Meeting (July 2018)
- SIAM Student Travel Award ($650) for SIAM Conference on Applied Algebraic Geometry (Aug. 2017)
- Arthur J. Schmitt Leadership Fellowship in Science and Engineering (2016 - present)
- National Science Foundation Graduate Research Fellowship Honorable Mention 2016
- Bobby Berman '05 Memorial Prize ($1000) - Awarded by the Department of Physics and Astronomy at Swarthmore College (June 2014)

Invited Presentations

- *Using machine learning to determine the real discriminant locus*, Jan. 2021, (Virtual) Workshop on Algebraic Geometry and Machine Learning, Tsinghua Sanya International Mathematics Forum (TSIMF).
- *Machine Learning the Discriminant Locus*, Jan. 2021, (Virtual) AMS Special Session on Numerical Methods for Solving Polynomial Systems, Joint Mathematics Meeting (JMM).
- *Machine Learning the Discriminant Locus*, Oct. 2020, (Virtual) SIAM TX-LA Sectional Meeting, Texas A&M University, College Station, TX.
- *Using homotopy continuation to solve parametrized polynomial systems in applications*, Sept. 2020, (Virtual) Graduate-Faculty Seminar, Duke University, Durham, NC.
- *Real monodromy action*, Sept. 2020, (Virtual) ICERM Workshop on Monodromy and Galois groups in enumerative geometry and applications, ICERM at Brown University, Providence, RI.
- *Evaluating and differentiating a polynomial using a pseudo-witness set*, July 2020, (Virtual) ICMS Conference, Technische Universität Braunschweig, Braunschweig, Germany.
- *Machine Learning the Discriminant Locus*, May 2020, AMS Spring Western Sectional Meeting, California State University, Fresno, CA. (*Cancelled due to COVID-19.*)
- *Applications of Numerical Algebraic Geometry in Computer Vision*, Nov. 2019, SIAM TX-LA Sectional Meeting, Southern Methodist University, Dallas, TX.
- *Applications of Parameterized Polynomial Systems*, Nov. 2019, Geometry Seminar, Texas A&M University, College Station, TX.
- *Using homotopy continuation to solve parameterized polynomial systems*, Oct. 2019, Undergraduate Lunch Talk, Mount Holyoke College, South Hadley, MA.
- *Applications of Parameterized Polynomial Systems*, Oct. 2019, ACMS Applied Math Seminar, University of Notre Dame, Notre Dame, IN.
- *Structure of Real Algebraic Varieties via Monodromy and Topology*, Sept. 2019, Seminar on Nonlinear Algebra, Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany.
- *Image Reconstruction using Numerical Algebraic Geometry*, Aug. 2019, IMPACT Seminar, Czech Institute of Robotics, Informatics and Cybernetics, Prague, Czech Republic.
- *Structure of Real Algebraic Varieties via Monodromy and Topology*, Aug. 2019, Applied Algebra and Analysis Seminar, Technische Universität Braunschweig, Braunschweig, Germany.
- *Numerical computation of monodromy action over* $\mathbb{R}$, March 2019, SIAM Conference on Applied Algebraic Geometry, University of Bern, Bern, Switzerland.

- *Real monodromy action*, March 2019, AMS Southeastern Sectional Meeting, Auburn University, Auburn, AL.
- *Numerically solving elliptic PDEs on real algebraic curves and surfaces*, Nov. 2018, AMS Northeastern Sectional Meeting, University of Arkansas, Fayetteville, AR.
- *polyTop: Software for computing topology of smooth real surfaces*, July 2018, SIAM Annual Meeting, Portland, OR.
- *polyTop: Software for computing topology of smooth real surfaces*, July 2018, ICMS Conference, University of Notre Dame, Notre Dame, IN.
- *Homotopies for Overdetermined Systems with Applications in Computer Vision*, Aug. 2017, SIAM Conference on Applied Algebraic Geometry, Georgia Institute of Technology, Atlanta, GA.
- *Homotopies for Overdetermined Systems with Applications in Computer Vision*, May 2017, Graduate COS-JAM, University of Notre Dame, Notre Dame, IN.

Poster Presentations

- *Real monodromy action*, Aug. 2020, (Virtual) Workshop on Symmetry, Randomness, and Computations in Real Algebraic Geometry, ICERM at Brown University, Providence, RI.
- *Real monodromy action*, April 2020, Meeting on Applied Algebraic Geometry, Georgia Institute of Technology, Atlanta, GA. (*Cancelled due to COVID-19.*)
- *Real monodromy action*, June 2019, MEGA and MEGAR Conference, Universidad Complutense de Madrid, Madrid, Spain.
- *Solving elliptic PDEs on real algebraic curves and surfaces*, April 2019, Meeting on Applied Algebraic Geometry, Georgia Institute of Technology, Atlanta, GA.
- *Solving elliptic PDEs on real algebraic curves and surfaces*, Nov. 2018, Nonlinear Algebra and Applications, ICERM at Brown University, Providence, RI.
- *Applications of Homotopies for Overdetermined Systems*, Sept. 2018, Core Computational Methods, ICERM at Brown University, Providence, RI.
- *polyTop: Software for computing topology of smooth real surfaces*, June 2018, TCU CBMS Conference: Applications of Polynomial Systems, TCU, Fort Worth, TX. (Also contributed to a software demonstration.)
- *polyTop: Software for computing topology of smooth real surfaces*, April 2018, Meeting on Applied Algebraic Geometry, Georgia Institute of Technology, Atlanta, GA.
- *Applications of Homotopies for Overdetermined Systems*, June 2017, Polynomials, Kinematics, and Robotics Conference, University of Notre Dame, Notre Dame, IN. Awarded second place prize.
- *Study and Analysis of Pinacyanol Acetate, a Chromonic Liquid Crystal*, Oct. 2012, Sigma Xi Poster Presentation, Swarthmore College, Swarthmore, PA.

Research Experience

- **Multiparameter Persistent Homology Research** — Duke University, Durham, NC
  Elliott Assistant Research Professor — *Aug. 2020 - present*
  - Work on projects involving the computation of real multiparameter persistent homology for applications in biology, e.g., the evolution of the topology of fruit fly wings.
- **Numerical Algebraic Geometry Research** — University of Notre Dame, Notre Dame, IN
  Research Assistant — *May 2016 - present*
  - Work on multiple projects in the field of numerical algebraic geometry dealing specifically with homotopy theory and numerical methods applied to topics in computer vision, engineering, and more.
- **Mean First Passage Time Research** — University of Notre Dame, Notre Dame, IN
  Research Assistant — *June 2015 - Dec. 2015*
  - Worked both analytically and numerically to solve a narrow escape problem to determine the statistical behavior of particles that follow a random walk in cell environments that are both heterogeneous and dynamic.
- **Liquid Crystal Research** — Swarthmore College, Swarthmore, PA
  Research Assistant — *May 2012 - Aug. 2012 and Sept. 2013 - Aug. 2014*
  - Designed computer programs based on molecular assembly theory.

- Experimentation and analysis of the phase diagram, absorption spectra, and kinetics of Pinacyanol Acetate.
- Investigated the pitch and twist properties of certain compounds with liquid crystalline properties in Cano wedge cells, among others.

- **Number Theory Research** — Swarthmore College, Swarthmore, PA
  Research Assistant — *May 2013 - Aug. 2013*
  - Created algorithms in Python based on the theory of finding the number of consecutive quadratic residues or nonresidues modulo a prime number. Collected data from these algorithms using a super computer.
  - Split and reformatted files of prime numbers using Unix to use for the computing.
- **Galaxy-Galaxy Collisions** — Swarthmore College, Swarthmore, PA
  Research Assistant — *Jan. - May 2011 and Jan. 2012 - May 2012*
  - Conducted simultations of galaxy collisions using MatLab, specifically looking at the Milky Way and Andromeda galaxies.
  - Analyzed the previous research of another Swarthmore student and new research in order to correct our models of the collisions and create better simulations.

Professional Experience

- **Cambridge Associates, LLC** — Boston, MA
  Quantitative Research Associate — *Aug. 2014 - Jan. 2015*
  - Designed models in Excel and complete coding in MATLAB for different investment strategies and situations.
  - Helped fix models and counsel investment associates on inputs and exhibits of the models.

Teaching Experience

- **Department of Mathematics** — Duke University
  Instructor on Record — *Aug. 2020 - present*
  - MATH 371 - Combinatorics (Fall 2020)
  - MATH 221/721 - Linear Algebra and its Applications (Spring 2021)
- **Applied and Computational Mathematics and Statistics Department** — University of Notre Dame
  Instructor on Record — *Jan. 2019 - May 2019*
  - Teaching ACMS 20620 - Applied Linear Algebra to undergraduate students at the University of Notre Dame.
- **Westville Education Initiative** — Holy Cross College
  Adjunct Professor — *May 2017 - Aug. 2017*
  - Taught Math 113 - College Algebra to inmates at the Westville Correctional Facility working to complete their Associates Degree with Holy Cross College through the Westville Education Initiative.
- **Department of Mathematics** — University of New Hampshire
  Teaching Assistant — *Jan. 2015 - May 2015*
  - Held bi-weekly recitations for students and assisted them in understanding the concepts and problems better, while also grading assignments/exams and clarifying mistakes to the students.
- **Ridley High School** — Ridley, PA
  Student Teacher — *Sept. 2013 - Dec. 2013*
  - Taught math and physics classes to freshman and sophomore high school students.
  - Coordinated class activities, wrote lesson plans, and created assessments for the material in the curriculum.

Outreach and Broader Impacts

- **Duke Math Circles** — Duke University/Durham Children's Initiative
  Organizer/Instructor — *Jan. 2021 - present*
- **Association for Women in Mathematics** — Duke University
  Mentor — *Oct. 2020 - present*
- **SIAM Student Chapter** — University of Notre Dame
  President — *Dec. 2017 - Aug. 2019*
- **Expanding Your Horizons at Notre Dame** — University of Notre Dame
  Volunteer — *March 2019, April 2020*
- **University of Notre Dame Pi Day 5k** — University of Notre Dame
  Fundraising Committee — *Oct. 2017 - Mar. 2018, February 2020*
- **ACMS Graduate Student Organization/SIAM Student Chapter** — University of Notre Dame
  Treasurer — *May 2017 - Dec. 2017*
- **Schmitt Leadership Conference** — University of Notre Dame
  Mentor/Organizer — *April 2017 - Oct. 2017*

- **Graduate Student Union** — University of Notre Dame
  ACMS Department Representative — *Aug. 2016 - May 2017*
- **Alumni Association** — Swarthmore College
  Class Agent — *Oct. 2015 - present*

Professional Memberships

- Society for Industrial and Applied Mathematics (SIAM)
- Association for Women in Mathematics (AWM)
- American Mathematical Society (AMS)