Isabel Barrio Sanchez

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EDUCATION

Ph.D. in Mathematics | **University of Pittsburgh** | Graduating May 2027

- Advisor: Dr. Catalin Trenchea.
- Research Focus: Numerical Analysis of PDEs, data assimilation, computational fluid dynamics.

B.S. in Mathematics | **West Virginia University Institute of Technology** | 2017 - 2021

- GPA: 4.0/4.0 Summa Cum Laude | Minors: Computer Science, Economics.
- Women's basketball team, Student-Athlete.

TECHNICAL SKILLS

- **Scientific computing & HPC:** AMReX, FreeFem++, adaptive mesh refinement, CFD, numerical PDEs.
- **Programming:** C++, Python, MATLAB, Java.
- **Data Science and ML:** NumPy, SciPy, Pandas, optimization, statistics.
- **Other:** UNIX/Linux, Git, XML, HTML/CSS, Fluent Spanish, Intermediate French.

EXPERIENCE

University of Pittsburgh – Mathematics Department | **Graduate Teaching Assistant** | 2021 – 2026

- Served as ***instructor of record*** for Business Calculus, independently designing lectures, assignments, and assessments.
- Assisted instruction in advanced undergraduate/graduate courses: **Numerical Linear Algebra** (34 students), **Numerical Mathematical Analysis** (40 students), and **Modeling in Applied Math** (20 students).
- Supported multiple sections of Calculus, collectively reaching over **300 students**, through recitations, grading, and office hours.

MathWorks– Engineering Development Group | **Intern** | Summer 2026

- Authored and maintained **technical documentation** for **MATLAB Image Processing Toolbox** features, including large-image and **blocked-image processing** workflows.
- Worked with **XML**-based documentation systems to create and edit, product documentation and examples.
- Identified and resolved software bugs and documentation issues to improve content quality and usability.
- Evaluated and improved Claude **AI skills** for technical documentation workflows.

General Electric | **CT Image Reconstruction Project** | **Math-to-Industry Bootcamp** |Summer 2024

- **Collaborated with General Electric** on exploring CT image reconstruction algorithms as a part of a 6-week Summer program for PhD students.
- Implemented CT reconstruction algorithms (filtered backprojection, iterative methods) in **Python** using *scikit-image* and the Core Imaging Library.
- Applied and compared denoising techniques (Tikhonov, L1, total variation) on both simulated (Shepp–Logan phantom) and real CT data.
- Explored **deep learning approaches** (CNNs, GANs) for image reconstruction and noise reduction.
- Delivered a white paper, a presentation, and a GitHub page for the project.

Lawrence Berkeley National Lab| **Research Intern** | Summer 2023

- Summer research internship with Dr. Ann Almgren and Dr. John Bell at the Applied Mathematics and Computational Research Division of the Lawrence Berkeley National Lab.
- **Developed and implemented an algorithm** extending Adaptive Mesh Refinement (AMR) to new geometries.
- Integrated solution into AMReX/CAMR software framework and deployed on **HPC systems,** contributing to methods now used in production research workflows.

- Co-authored a peer-reviewed journal publication with Dr. Ann Almgren and Dr. John Bell in the Applied Math & Computational Science Division.

WVU Tech – Computer Science Department | Student Assistant | 2018 – 2021

- Developed and led STEM camps and after-school programs for rural and high-poverty girls in Southern West Virginia. Presented my work at the 2020 ASEE Conference.
- **Received grants** from NCWIT to develop these programs.
- Assisted Dr Afrin Naz on her Computer Science classes and labs.

RESEARCH

- I. Barrio Sanchez, C. Trenchea, W.Pei, "Long-Time L2 & H1-Stability of the Family of DLN Methods for the Two-dimensional Incompressible Navier-Stokes Equations", 2026, Preprint, submitted for publication, https://arxiv.org/abs/2605.04455.
- I. Barrio Sanchez, C. Trenchea, W. Pei, "Long-Time H^1-Stability of the Cauchy One-Leg Theta-Method for the Navier-Stokes Equations", *Numerical Methods for Partial Differential Equations*, vol. 42, 2026, https://onlinelibrary.wiley.com/doi/full/10.1002/num.70137.
- I. Barrio Sanchez, A.S. Almgren, J.B. Bell, M.T. Henry de Frahan, W. Zhang. "A new re-redistribution scheme for weighted state redistribution with adaptive mesh refinement." *Journal of Computational Physics*, vol. 504, 2024, https://doi.org/10.1016/j.jcp.2024.112879.
- Ongoing collaborations on projects in **data assimilation, fluid flow modeling, domain coupling.**
- A. Naz, M. Lu, C. Broyles, I. Barrio Sanchez, "Competition of VEX Educational Robotics to Advance Girl's Education (COVERAGE)", June 2020, 2020 ASEE Virtual Annual Conference.

TALKS

- "Long-Time Stability of the Navier–Stokes Equations under the One-Leg θ-Method." Recent Advances in Numerical PDEs, a conference in honor of Professor Bill Layton's 70th birthday, May 16, 2026. (Link).
- "Time-Stepping Methods for the Navier-Stokes Equations: Long-Time Stability, Nonlinear Coupling, and Data Assimilation." PhD Overview Presentation, April 16, 2026.
- "Overcoming Interface Challenges: Second-Order Partitioned Schemes for Heat Transfer." 12th Graduate Student Conference, September 27, 2025. (Link).
- "Second-order in time decoupled time stepping methods for heat transfer." Recent Advances in Numerical PDEs, May 6, 2025. (Link).
- "A new Re-redistribution Scheme for Weighted State Redistribution with Adaptive Mesh Refinement." SIAM Conference on Computational Science and Engineering (CSE25), March 7, 2025. (Link).
- "Long-term H^1-Stability of Cauchy's Method for the Navier-Stokes Equations." The 42nd Southeastern-Atlantic Regional Conference on Differential Equations. November 9th, 2024. (SEARCDE 2024).
- "Second-order partitioned algorithms with subiterations." 11th Graduate Student Conference, Clemson University, April 20th, 2024. (Conference page).
- "A new Re-redistribution Scheme for Weighted State Redistribution with Adaptive Mesh Refinement." AWM Student Seminar, November 10, 2023. (Link to talk).
- "Competition of VEX Educational Robotics to Advance Girl's Education (COVERAGE)." 2020 ASEE Virtual Annual Conference, Computers in Education Division Technical Session 10: STEM Outreach, June 2020.

HONORS AND ACTIVITIES

2026 Nominated to the Elizabeth Baranger Excellence in Teaching Award.

2025 Received the prestigious **Mellon Fellowship**, awarded to a select group of PhD students for exceptional scholarly and institutional contributions.

2025 President of the SIAM student chapter at the University of Pittsburgh.

2025 Received the **Achievement in Pedagogy Badge** from the Center for Teaching and Learning at the University of Pittsburgh, focusing on the areas of **Pedagogy, DEI, and Professional Development.**

2024 Graduate Student Mentor for Girls Math Camp – University of Pittsburgh.

2023-now Officer for the AWM student chapter at Pitt.

2021 Graduated Summa Cum Laude.

2018-2021 Outstanding Freshman, Sophomore, Junior, and Senior for the Mathematics Department.

2017-2021 Intercollegiate women's basketball student-athlete at WVU Tech; four-time conference champion.

2019 Successful Participant – The Interdisciplinary Contest in Modeling, COMAP.

2018 Successful Participant – The Mathematical Contest in Modeling, COMAP.

PROFESSIONAL ORGANIZATIONS

- Society for Industrial and Applied Mathematics (SIAM).
- American Mathematical Society (AMS).
- Association for Women in Mathematics (AWM).
- Real Sociedad Matemática Española (RSME).