

Katherine J. Pearce

Postdoctoral Research Fellow

Research Interests

Randomized numerical linear algebra; mathematical modeling; parameter identifiability; uncertainty quantification.

Education

Aug 2017 - **North Carolina State University, Raleigh, NC**, *Ph.D., Applied Mathematics*.

May 2022 "Methods for Parameter Identifiability Analysis of Dynamical Systems with Applications to Data-Driven Models."
Research Advisor: Mansoor Haider

2014 - 2016 **University of Denver, Denver, CO**, *M.S., Mathematics*.

2009 - 2013 **University of Texas, Austin, TX**, *B.S., Mathematics*.

2009 - 2013 **University of Texas, Austin, TX**, *B.A., English Literature*.

Publications

- KJ Pearce (2023). "Extreme cases: Math education within the U.S. prison system," accepted by *Notices of the American Mathematical Society*, .
- KJ Pearce, K Nellenbach, RC Smith, AC Brown, and MA Haider (2021). "Modeling and parameter subset selection for fibrin polymerization kinetics with applications to wound healing," *Bulletin of Mathematical Biology*, 83(47):1-22.
- KJ Pearce, AK Saibaba, MA Haider, RC Smith, and ICF Ipsen (in review). "Column Subset Selection Algorithms for Parameter Identifiability Analysis," *SIAM Review*.
- MA Haider, KJ Pearce, NC Chesler, NA Hill, and MS Olufsen (in review). "Application of the HGO model to capturing in vitro relationships between pressure, area, and wall thickness in murine left pulmonary arteries," submitted to *Biomechanics and Modeling in Mechanobiology*, <http://arxiv.org/abs/2202.12711>.

Fellowships and Awards

Sep 2022 **Peter O'Donnell Jr. Postdoctoral Research Fellowship**, *Oden Institute for Computational Engineering and Sciences*, The University of Texas at Austin.

1 of 5 postdoctoral fellows for 2022-2024, working with Dr. Per-Gunnar Martinsson

May 2022 **Winton-Rose Research Award**, North Carolina State University.

Recipient of annual departmental research award

Spring 2022 **AAAS Mass Media Fellowship**.

Semi-finalist for science communication training and placement with participating national media organization.

Spring 2020* **AMS Catalyzing Advocacy in Science and Engineering (CASE) Fellowship**.

1 of 2 students nationwide to receive annual award (*DC in-person event postponed to Sep 2021 due to COVID-19).

Summer 2020 **NC State Graduate School Summer Fellowship**.

Awarded by the Graduate School for excellent degree progress.

Presentations

- ICIAM 2023: Randomized numerical linear algebra minisymposium, Tokyo, Japan, August 2023
- Joint Mathematics Meeting - Advocacy Panel, Seattle, WA, January 2022
- Triangle Area Graduate Mathematics Conference (TAGMaC), Duke University, November 2021
- paraDIGMS Fall 2021 Conference, Diversity Committee Lightning Talk, October 2021
- Society for Mathematical Biology Annual Meeting, Methods for Biological Modeling, June 2021
- SAMSI Numerical Analysis in Data Science Transition Workshop, June 2021
- SAMSI Undergraduate Modeling Workshop, June 2021
- SAMSI Seminar, February 2021
- Triangle Area Graduate Mathematics Conference (TAGMaC), UNC, December 2020
- Repperger Closing Workshop, Air Force Research Lab, August 2019
- Association for Women in Mathematics Conference, UNC, February 2018

Research

- Sep 2022 - **Randomized LU for Interpolative Decompositions**, ODEN INSTITUTE.
Present Developing and implementing high-performance GPU-accelerated versions of randomized algorithms to find ID/CUR decompositions adaptively using LU factorization with partial pivoting.
- Sep 2022 - **Randomized algorithms for black-box compression of rank-structured matrices**, ODEN INSTITUTE.
Present Developing and implementing algorithms for randomized sketching and compression of block low-rank matrices with uniform bases conditions.
- Jan 2019 - **Mathematical models and parameter subset selection techniques for fibrin matrix polymerization in a biomimetic wound healing system**, NC STATE.
May 2022 Developed mathematical model of hemostasis for a wound healing application and implemented algorithms to detect unidentifiable model parameters.
- Aug 2020 - **Numerical analysis in data science**, SAMSI.
June 2021 Participated in Global Sensitivity Analysis working group to design and implement Monte Carlo-based algorithms for parameter sensitivity analysis.
- May 2019 - **Network measure framework for topological data analysis (TDA)**, AIR FORCE RESEARCH LABORATORY.
Aug 2019 Researched foundations of TDA. Implemented MAPPER algorithm in R to study effects of parameter variation on the topology of data and investigated a framework for network analysis.
- Aug 2018 - **Holzapfel-Gasser-Ogden (HGO)-based model for pulmonary hypertension**, NC STATE.
Dec 2018 Developed and calibrated hyperelastic models for murine left pulmonary arterial wall using HGO constitutive framework. Estimated values and local sensitivities for parameters in two-layer model.
- May 2018 - **Polynomial sum-of-squares optimization without semidefinite programming**, NC STATE.
Dec 2018 Researched hybrid numeric-symbolic multivariate root-finding methods and applications of SOS in nonlinear optimization.
- Jan 2016 - **Decoding methods and efficiency in error-correcting codes**, UNIVERSITY OF DENVER.
Dec 2016 Investigated interleaver efficiency in Shannon decoding algorithm for turbo codes in C. Compared turbo codes to Reed-Solomon error-correcting codes in Voyager II.

Teaching

Instructor of Record

- Fall 2023 **Preparation for Calculus**, UT Austin, Texas Prison Education Initiative.
Summer 2023 **The Art of Mathematics**, UT Austin, Texas Prison Education Initiative.
Spring 2023 **Algebra (College Prep)**, UT Austin, Texas Prison Education Initiative.
Spring 2020 **Calculus 3**, North Carolina State University.
Fall 2019 **Calculus 2**, North Carolina State University.

Recitation Leader

- Fall 2018 **Calculus 2**, North Carolina State University.
Winter 2017 **Differential Equations**, University of Denver.
Fall 2016 **Linear Algebra**, University of Denver.
Winter 2016 **Calculus 2**, University of Denver.
Fall 2015 **Calculus 1**, University of Denver.
Spring 2015 **Business Calculus**, University of Denver.
Winter 2015 **Business Calculus**, University of Denver.

Lecture Assistant

- Spring 2019 **Algebra and Trigonometry**, North Carolina State University.
Fall 2017 **Precalculus I**, North Carolina State University.
Spring 2016 **Graph Theory for Non-Math Majors**, University of Denver.

Service

- National Postdoctoral Association**, *The University of Texas at Austin*.
Co-chair and co-founder of UT Austin Chapter
- Texas Prison Education Initiative (TPEI)**, *The University of Texas at Austin*.
Volunteer instructor of university mathematics courses at local women's prison
- Graduate Resource Teaching Assistantship**, *North Carolina State University*.
Co-creator of new TA position and graduate course curriculum to support first year math grad students.

Diversity, Equity, and Inclusion (DEI) Committee, *North Carolina State University*.

Founding member of math faculty and graduate student departmental committee to create and continue DEI initiatives.

Undergrads Union Grads (UUG), *North Carolina State University*.

Mentor to undergraduate mathematics students interested in attending graduate school.

SAMSI Undergraduate Modeling Project, *North Carolina State University*.

Co-organized workshop for undergraduate students on mathematical modeling of the COVID-19 pandemic, May 2021.

Association for Women in Mathematics (AWM), *University of Denver*.

President and co-founder of DU Chapter.

Work Experience

Sep 2022 - Present - **Postdoctoral Research Fellow**, ODEN INSTITUTE FOR COMPUTATIONAL ENGINEERING AND SCIENCES, TX.

Aug 2020 - May 2022 - **Graduate Research Assistant**, STATISTICAL AND APPLIED MATHEMATICAL SCIENCES INSTITUTE, NC.

Aug 2019 - May 2020 - **Instructor of Record**, NORTH CAROLINA STATE UNIVERSITY, NC.

May 2019 - Aug 2019 - **Repperger Intern**, AIR FORCE RESEARCH LABORATORY, Wright-Patterson AFB.

Sep 2017 - May 2019 - **Graduate Teaching Assistant**, NORTH CAROLINA STATE UNIVERSITY, NC.

Sep 2014 - Mar 2017 - **Graduate Teaching Assistant**, UNIVERSITY OF DENVER, CO.

Jun 2013 - Aug 2014 - **Mathematics Tutor**, MATHNASIUM, Austin, TX.

May 2012 - Aug 2012 - **Data Analytics Intern**, PERVASIVE SOFTWARE, Austin, TX.

Relevant Skills

Programming MATLAB, PYTHON, MAPLE, R, C

Software HPC, L^AT_EX, AYASDI

Communication Technical writing and editing, intermediate Spanish

Certifications and Trainings

- Modern Workplace and Managing Bias Training
- QPR+ Suicide Prevention Training
- Creating an Academic Continuity Plan Training
- First Amendment and DEI Impact Response Seminar
- edX Inclusive STEM Teaching Certificate
- How to Create an Inclusive Classroom Workshop
- Creating an Effective Lecture Video Seminar
- Identifying Learning Objectives for Your Course Seminar

Memberships and Affiliations

- American Mathematical Society (AMS)
- Society for Mathematical Biology (SMB)
- Local Science Engagement Network (AAAS)
- Association for Women in Mathematics (AWM)
- Society for Industrial and Applied Mathematics (SIAM)
- Texas Exes Hispanic Alumni Network