

# Cashous W. Bortner

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## EMPLOYMENT

Assistant Professor of Mathematics  
California State University, Stanislaus

August 2022 - Present

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## RESEARCH INTERESTS

Algebraic, combinatoric, and graph theoretic approaches to problems in biological and physical systems; parameter identifiability; algebraic statistics.

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## EDUCATION

Ph.D. in Mathematics, North Carolina State University

May 2022

Thesis: “Identifiability Analysis of Two Families of ODE Models” advised by Seth Sullivant

M.S. in Mathematics, North Carolina State University

May 2019

B.S. in Mathematics, University of Nebraska-Lincoln

May 2017

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## PUBLICATIONS

1. **Bortner, C.** *et al.* Maximum Likelihood Degree of the  $\beta$ -Stochastic Blockmodel. *Algebraic Statistics* **16**, 77–94. <https://msp.org/astat/2025/16-1/p04.xhtml> (2025).
2. **Bortner, C.** & Meshkat, N. Graph-Based Sufficient Conditions for the Indistinguishability of Linear Compartmental Models. *SIAM Journal on Applied Dynamical Systems* **23**, 2179–2207. <https://doi.org/10.1137/23M1614663> (2024).
3. **Bortner, C.**, Gross, E., Meshkat, N., Shiu, A. & Sullivant, S. Identifiability of Linear Compartmental Tree Models and a General Formula for the Input-Output Equations. *Advances in Applied Mathematics* **146**. <https://doi.org/10.1016/j.aam.2023.102490> (May 2023).
4. **Bortner, C.** & Sullivant, S. Structural Identifiability of Series-Parallel LCR Systems. *Journal of Symbolic Computation*. **112**, 79–104. <https://doi.org/10.1016/j.jsc.2022.01.002> (Sept. 2022).
5. **Bortner, C.** & Meshkat, N. Identifiable Paths and Cycles in Linear Compartmental Models. *Bulletin of Mathematical Biology*. **84**, 53. <https://doi.org/10.1007/s11538-022-01007-5> (Mar. 2022).
6. Bernstein, P., **Bortner, C.**, Coskey, S., Li, S. & Simpson, C. The Set Splittability Problem. *The Australasian Journal of Combinatorics* **75**, 190–209. [https://ajc.maths.uq.edu.au/pdf/75/ajc\\_v75\\_p190.pdf](https://ajc.maths.uq.edu.au/pdf/75/ajc_v75_p190.pdf) (Oct. 2019).

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## IN PREPARATION

1. **Bortner, C.**, Gilliana, J., Patel, D., & Tamras, Z. Graph Theoretic Proofs of Linear Compartmental Model Indistinguishability. (Submitted.) Preprint available at <https://arxiv.org/abs/2412.01135>
2. **Bortner, C.**, Campos, P., De Silva, J. & Venable, J. Maximum Stars in the Corona of Ladder Graphs. (Expected Submission Fall 2025).

## UNDERGRADUATE RESEARCH ADVISOR

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<b>Identifiability of Linear Compartmental Path Models</b> Ariana Puccini (Math) and Emily Oliveras (Math)	Fall 2025-Present
<b>Graph Shelling as a Measure of Centrality</b> Jacky Sierra Lopez (Math, funded through STEM-CRU) and Leonardo Morales (Math)	Fall 2025-Present
<b>Graph Shelling as a Measure of Centrality</b> Joseph Reynosa (Math) and Emmanuel Mendoza Rosales (Computer Science)	Fall 2025-Present
<b>Indistinguishability of Linear Compartmental Models</b> Eduardo Chamorro (Math, funded through LSAMP, McNair, and LEAPS) and Ingrid Ruvalcaba Gomez (Math/Sociology, funded through LEAPS)	Spring 2025-Present
<b>Data Science in Chemistry</b> Co-Advised with Tyler Knapp (Moses Lake Industries) Francisco Duran (Computer Science, funded through LSAMP) and Jacky Sierra Lopez (Math, funded through STEM-CRU)	Fall 2024-Spring 2025
<b>Global Identifiability Testing of Linear Compartmental Tree Models</b> Tana Randolph (Math, funded through LSAMP) and Omar Rios Cruz (Computer Science, funded through STEM-CRU)	Fall 2024-Spring 2025
<b>Graph Theoretic Proofs of Linear Compartmental Model Indistinguishability<sup>(1)</sup></b> John Gilliana (Math/Economics), Dev Patel (Math), and Zaia Tamras (Math)	Spring 2024 - Fall 2024
<b>Indistinguishability of Linear Compartmental Cycle Models</b> Dev Patel (Math) and Jennifer Ayson (Math, funded through LSAMP)	Fall 2023
<b>Erdős-Ko-Rado Theorem on Graphs<sup>(2)</sup></b> Co-Advised with Jessica De Silva (CSU Stanislaus) Paola Campos (Math) and Jeffrey Venable (Math)	Spring 2023 - Fall 2023

## INVITED PRESENTATIONS

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<b>Identifiability: Using Math and Trees to Solve Problems from Biology</b> MAA MathFest 2025	August 6-9, 2025 Sacramento, CA
<b>Identifiability of Linear Compartmental Tree Models</b> IMSI New Directions in Algebraic Statistics	July 21-25, 2025 Chicago, IL
<b>Indistinguishability of Linear Compartmental Models</b> SIAM Conference on Applied Algebraic Geometry	July 7-11, 2025 Madison, WI
<b>Graph-Based Sufficient Conditions for Indistinguishability of Linear Compartmental Models</b> AMS Western Sectional Meeting	May 3-4, 2025 San Luis Obispo, CA
<b>The Maximum Likelihood Degree of <math>\beta</math>-Stochastic Block Models</b> AMS Joint Mathematics Meeting	January 8-11, 2025 Seattle, WA

**Identifiability of Linear Compartmental Models Using Graphs**  
AMS Central Sectional Meeting

September 14-15, 2024  
University of Texas, San Antonio

**Identifiability of Linear Compartmental Models**  
Workshop on Differential Algebra and Modeling

July 20-22, 2024  
North Carolina State University

**Graph-Theoretic Conditions for Identifiability of Linear Compartmental Tree Models**  
AMS Western Sectional Meeting

May 4-5, 2024  
San Francisco State University

**Graph-Based Sufficient Conditions for Indistinguishability of Linear Compartmental Models** (prepared but canceled)  
AMS Joint Mathematics Meeting

January 3-6, 2024  
San Francisco, CA

**Graph-Based Sufficient Conditions for Indistinguishability of Linear Compartmental Models**  
AMS Central Sectional Meeting

October 7-8, 2023  
Creighton University

**Structural Identifiability of Series-Parallel LCR Systems**  
SIAM Conference on Applied Algebraic Geometry Eindhoven University of Technology (virt.), Netherlands

July 10-14, 2023

**Identifiable Linear Compartmental Tree Models**  
Differential Algebra and Related Topics XI

June 5-9, 2023  
Queen Mary University London, United Kingdom

**Identifiable Linear Compartmental Tree Models**  
Algebraic Statistics 2022

May 16-20, 2022  
University of Hawai'i at Manoa

## COLLOQUIA AND NON-RESEARCH PRESENTATIONS

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**Integrating Career and Professional Development in the Classroom**  
Faculty Center for Excellence in Teaching and Learning Workshop

April 14, 2025  
California State University, Stanislaus

**The Complementary Functions of Instructors and Career and Professional Development Centers in Colleges**  
Higher Education and Student Affairs in the Central Valley Conference

March 14, 2025  
Fresno, CA

**Integrating Career and Professional Development in the Classroom**  
Innovation in STEM Education Summit

March 1, 2025  
California State University, Stanislaus

**The Complementary Functions of Instructors and Career and Professional Development Centers in Colleges**  
California College Personnel Association (CCPA)'s 2024 Fall Institute

October 26, 2024  
Merced, CA

**Using Math and Trees to Solve Problems from Biology**  
Algebra-Geometry-Combinatorics Seminar

October 16, 2024  
San Francisco State University

**Using Math and Trees to Solve Problems from Biology**  
M\*A\*T\*H Colloquium

September 4, 2024  
Sonoma State University

**The Complementary Functions of Instructors and Career and Professional Development Centers in Colleges**  
All-Faculty Convocation State Center Community College District

August 7, 2024  
Fresno, CA

**Using Math and Trees to Solve Problems from Biology**  
Department of Operations Research Colloquium

May 28, 2024  
Naval Postgraduate School

**Using Math and Trees to Solve Problems from Biology**  
Math Department Colloquium

April 11, 2024  
California State University, East Bay

**Using Math and Trees to Solve Problems from Biology**  
MATH Matters Speakers Series

February 2, 2024  
Bakersfield College

**Using Math and Trees to Solve Problems from Biology**  
Math Department Colloquium

April 21, 2023  
California State University, Long Beach (virt.)

**Using Math and Trees to Solve Problems from Biology**  
Math Department Colloquium

April 14, 2023  
Morehead State University (virt.)

**Using Math and Trees to Solve Problems from Biology**  
Math and Computer Science Department Colloquium

October 11, 2022  
Santa Clara University

**Using Math and Trees to Solve Problems from Biology**  
The Speaker Series for the Quantitatively Curious

September 23, 2022  
California State University, Stanislaus

## ORGANIZING AND FACILITATING

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**Exploring Future Paths: Why would I want a PhD in Computational Biology?** March 7, 2025  
Two invited graduate students from the UC Berkeley computational biology program gave presentations and participated in a guided Q&A session for undergraduates at CSU Stanislaus interested in exploring graduate study in computational biology.

**Career and Professional Development Faculty Learning Community** Fall 2024  
A Faculty Learning Community (FLC) related to career and professional development (supported by the University) to facilitate curricular innovation and a connection of faculty, students, and their coursework.

**New Faculty Orientation** August 14-15, 2024  
A two-day workshop introducing new faculty to campus resources and requirements, along with information on inclusive pedagogical techniques.

**How to Find Success In College English/Math/Science** July 24-26, 2024  
Three, 1.5 hour presentations on being successful in collegiate mathematics through the Health Careers Opportunity Pipeline Program with approximately 40 high school and community college students interested in pursuing health-related careers.

**Strategies for Student Engagement in the College of Science:  
An Open Exchange of Ideas** May 9, 2024  
Faculty development workshop funded by the Faculty Development Committee aimed at bringing together faculty to discuss inclusive strategies to increase student engagement in the classroom.

**Career and Professional Development Faculty Learning Community** Spring 2024  
A Faculty Learning Community (FLC) related to career and professional development (supported by the University) to facilitate curricular innovation and a connection of faculty, students, and their coursework.

**Algebraic Approaches to Mathematical Biology** January 3-6, 2024  
An American Mathematical Society Special Session at the Joint Mathematics Meetings with invited speakers from across the country who specialize in applications of algebra and combinatorics to problems in biology.

## **Stan State Summer Research Week**

2023, 2024

Co-facilitated annual presentations including information about summer research programs and the application process, as well as guided Q&A sessions with several undergraduate students discussing their experiences summer research programs.

## **The Speaker Series for the Quantitatively Curious**

Fall 2023 - Present

Co-facilitated biweekly presentations including faculty, members of the community, and students discussing the use of mathematics in their respective disciplines.

## **WORKSHOPS AND TRAININGS**

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### **MathFest**

August 2025

Mathematical Association of America

Sacramento, CA

### **Elevate Your Grading Workshop[s]**

March, April 2025

Division of Academic Affairs

California State University, Stanislaus

### **CSUBIOTECH Planning Meeting**

August 5, 2024

Faculty Consensus Group Representative

Sacramento State University

### **Gallo Future Leaders Symposium**

May 15, 2024

E. & J. Gallo Winery

Modesto, CA

### **Transforming Student Experience & Success in Gateway STEM Courses**

Spring 2024

Faculty Learning Community with weekly meetings

California State University, Stanislaus

### **CSU Symposium on Wellbeing-Informed Teaching**

March 15, 2024

California State University Chancellor's Office

Virtual

### **Faculty Successful Grant Writing and Hands-on Workshop**

October 16-17, 2023

CSUBIOTECH

California State University, Stanislaus

### **Transforming Hispanic Serving Institutions Workshop**

October 13, 2023

Warrior Cross Cultural Center

California State University, Stanislaus

### **Research Experience for Undergraduate Faculty (REUF) Workshop**

August 7-11, 2023

Institute for Computational and Experimental Research in Mathematics (ICERM)

Brown University

### **CSUBIOTECH Planning Meeting**

July 31, 2023

Faculty Consensus Group Representative

California State University, Long Beach

### **Social Justice in the Math Classroom - Putting Theory into Practice**

July 15, 17, 19, 21, 2023

Central California Math Project Summer Institute

California State University, Stanislaus

### **CSU Student Success Dashboard Workshop**

April 26, 2023

Faculty Center for Excellence in Teaching and Learning

California State University, Stanislaus (virt.)

### **Critical Issues in Mathematical Education: Mentoring for Equity Workshop**

March 22-24, 2023

Simons Laufer Mathematical Sciences Institute (formerly MSRI)

Berkeley, CA

### **Becoming More Than the Sum of Our Parts Conference**

March 16-17, 2023

STEM-NET

California State Polytechnic University, Pomona

**Measures of Teaching Effectiveness Workshop**  
Faculty Center for Excellence in Teaching and Learning

October 27, 2022  
California State University, Stanislaus

**S-STEM Grant Planning Meeting**  
Funded grant planning meeting

October 11-12, 2022  
California State University, Stanislaus

**Using Inquiry to Teach Mathematics and Thinking**  
Mathematical Association of America Workshop

September 29, 2022  
Virtual

**MathFest/Project NExT Workshops**

August, 2022  
Philadelphia, PA

- Active Learning with Active Calculus Mini-course (4 hours)
- Teaching with Inquiry: Growing our Practice Together
- How to Create Safe and Community Responsive Outreach Programs
- Teaching and Leading Towards Institutional Change
- Making Teaching Matter More: Active-learning Strategies and Barriers to Implementation
- Townhall on Latinx Mathematicians
- The Role of Culturally Relevant Pedagogy and Identity Dev. in the Teaching and Learning of Math

## MENTORSHIP AND ADVISING

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**McNair Scholars Program Research Mentor**

Summer 2025

Advising one undergraduate research student on a research project and graduate school applications over the course of the summer through the McNair Scholars Program.

**Robert Noyce Teaching Scholarship Program**

Fall 2023-Present

Mentoring two pre-service 6-12 teachers with biweekly meetings discussing organization and class preparation, pedagogical philosophy, and the credential program.

**Cal-Bridge**

Fall 2023-Present

Co-mentoring two Cal-Bridge students (2023-2025 and 2025-present) with biweekly meetings discussing course selection, summer research experiences, and graduate school applications.

**Math Club Faculty Advisor**

Fall 2023-Spring 2025

Co-advising the California State University, Stanislaus Math Club.

**Math Major Advisor**

Fall 2023-Present

Advising California State University, Stanislaus math majors in course work and career preparation every semester (roughly 11-12 students per semester).

**New Student Orientation**

2023, 2025

Orientation advisor for four sessions of new student orientation, helping students choose classes and welcoming them to the university and the department.

**Faculty Mentor Program**

Fall 2022-Present

Mentoring first-generation undergraduate students from a variety of majors. Through this program I have had four mentees so far.

## GRANTS AND FUNDING

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**McNair Undergraduate Student Research Project**

Summer 2025

Overview: Funding for myself and one undergraduate research student (Eduardo Chamorro) to do research over the summer on a project related to linear compartmental models.



## Assigned Time for Exceptional Service to Students

2025-2026

Overview: Three units of release time awarded by the California State University Chancellor for mentoring several undergraduate research projects, helping organized junior high and high school math competitions, and redesigning the math degrees at CSU Stanislaus.

Budget: ≈\$7,110

## NSF Launching Early-Career Academic Pathways Grant

2025-2027

Title: *LEAPS-MPS: Exploring Properties of Linear Compartmental Models\**

Overview: This project explores how mathematical diagrams called linear compartmental models (LCMs) can help researchers understand the structure and behavior of systems involving movement or flow, including how diseases spread, how nutrients cycle through ecosystems, or how medications are processed in the body. These models represent systems as interconnected compartments, with arrows indicating how quantities move between them. The investigator aims to identify when meaningful information about these systems, such as flow rates, can be reliably extracted from data, and when different models might appear identical in practice. The project's goal is to create simple, visual tests for analyzing these characteristics of LCMs, making the process more accessible and less computationally intensive. Housed at a Hispanic-Serving and Primarily Undergraduate Institution, this project provides undergraduates with opportunities to participate in cutting-edge mathematical research and equips them with background needed to pursue further education. A new colloquium series will further expand students' exposure to graduate-level research and support their preparation for advanced study.

Budget: \$249,996

## American Institute of Mathematics SQuaREs 2025-2027

Fall 2024

Title: *Maximum Likelihood Geometry for Statistical Network Models*

Overview: Our research team of six faculty from different, mostly primarily undergraduate institutions received full funding to spend one week per year at the American Institute of Mathematics (AIM) in Pasadena, California for three years.

Budget: ≈\$36,000

## American Institute of Mathematics REUF Continuation Grant 2024

Summer 2024

Title: *Maximum Likelihood Degree of Stochastic Block Models*

Overview: Our research team of six faculty from different, mostly primarily undergraduate institutions received full funding to spend one week at the American Institute of Mathematics (AIM) in Pasadena, California to work on a project that started at the 2023 Research Experience for Undergraduate Faculty (REUF) at the Institute for Computational and Experimental Research in Mathematics (ICERM).

Budget: ≈\$12,000

## CSU Stanislaus Research, Scholarship, and Creative Activity Grant

June 2024-June 2025

Title: *Standards-Based Grading Assessment Generating Application*

Overview: This internal research, scholarship, and creative activity grant is supporting PI Bortner's efforts to develop a web-based, artificial intelligence integrated application to generate exams using the Standards-Based Grading assessment technique. Support for this project comes in the form of 3 units of course release in the Fall 2024 semester, as well as the hiring of a software developer as a special consultant.

Budget: \$10,000

## CSU Stanislaus Faculty Development Committee Workshop Proposal

Spring 2024

Title: *Strategies for Student Engagement in the COS: An Open Exchange of Ideas*

Overview: In this round table discussion-style workshop, we discussed strategies for student engagement in STEM-related fields, including topics such as active learning, alternative grading and assessment strategies.

Budget: \$1,250

## CSU LSAMP Undergraduate Research Assistant Funding

Fall 2023, Spring 2025 (x3)

Overview: Funded by the Louis Stokes Alliance for Minority Participation (LSAMP), four total students across were paid for engaging in undergraduate research.

Budget: \$1,800 each (x4)

## CSU Stanislaus College of Science Faculty Development Travel Grant

- Fall 2024 - Joint Mathematics Meetings, 2025 \$2,000
- Fall 2023 - Joint Mathematics Meetings, 2024 \$2,000
- Spring 2023 - Simons Laufer Mathematical Sciences Institute Critical Issues in Math Education, \$995
- Fall 2022 - Joint Mathematics Meetings 2023, \$2,000

## FELLOWSHIPS

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### Career and Professional Development Center Faculty Fellow

Fall 2023-Present

Faculty Fellowship with the Stanislaus State Career and Professional Development Center (CPDC) consulting with the Executive Director of the CPDC to develop an annual work plan that meets institutional needs, takes advantage of individual faculty strengths and interests, and sustains a manageable workload given the level of assigned time allotted to the position. Also, advising students for four hours per week on career readiness with an emphasis on graduate school.

### CSUBIOTECH Faculty Consensus Group Representative

Summer 2023-Present

One of four Stanislaus State CSUBIOTECH Faculty Consensus group representatives serving as a point-of-contact and mentor for campus grant applications, a reviewer for CSUBIOTECH grants and awards, committee member for program activities, and advisor on program priorities, policy, and governance.

### California State University, Stanislaus Grant Writing Cohort

Spring 2023-Fall 2023, Spring 2025

Weekly professional development meetings focused on all phases of grant application and implementation, with the ultimate goal of submitting an external grant application.

### Mathematics Faculty Fellow: Catalyzing Ideas for the San Joaquin Valley: Innovating Mathematics and Chemistry Curriculum

2022-2023

Biweekly meetings focused on improving course outcomes in lower-division chemistry courses.

### Mathematical Association of America Project NExT Fellow

2022-2023

Professional development program for new or recent Ph.D.s in the mathematical sciences addressing all aspects of an academic career: improving the teaching and learning of mathematics, engaging in research and scholarship, finding exciting and interesting service opportunities, and participating in professional activities. The program also provides the participants with a network of peers and mentors as they assume these responsibilities.



## REVIEWING AND JUDGING

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- CSUBIOTECH 2025 Symposium Undergraduate Poster Abstract Reviewer
- Stanislaus State ASPIRE Hackathon Judge, April 26-28, 2024
- Stanislaus State 38th Annual Undergraduate Research Competition Judge, March 8, 2024
- CSUBIOTECH 2024 Presidents' Commission Scholars Program Reviewer
- 2022 & 2023 CSU Mathematics Conference Session Reviewer

## COMMITTEES

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- Faculty Development Committee (co-chair/chair), 2024-Present [University]
- College of Science Curriculum Committee, 2024-Present [College]
- Committee on Committees, 2024-Present [Department]
- Colloquium Committee, 2023-Present [Department]
- Math/SIAM/PME Club Advisor, 2023-Present [Department]
- Math Major Revamp Committee (chair), 2023-Present [Department]
- Major Advising Committee, 2023-Present [Department]
- Graduate Approval Form Committee, 2023-Present [Department]
- Math Competition Planning Committee, 2023-Present [Department]

## TEACHING EXPERIENCE (CALIFORNIA STATE UNIVERSITY, STANISLAUS)

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MATH 4540: Abstract Algebra II	Fall 2025 (6 students)
MATH 2300: Discrete Structure	Fall 2025 (33 students)
MATH 4530: Abstract Algebra	Spring 2025 (26 students)
MATH 1422: Calculus II Lab	Spring 2025 (7 students)
MATH 1420: Calculus II	Spring 2025 (28 students)
MATH 3400: Set Theory and Logic	Fall 2024 (21 students)
MATH 1422: Calculus II Lab	Fall 2024 (10 students)
MATH 1070: College Algebra	Fall 2024 (33 students)
MATH 4980: Independent Study on Machine Learning with Graphs	Spring 2024 (7 students)
MATH 3600: Theory of Numbers	Spring 2024 (25 students)
MATH 2460: Introduction to Differential Equations	Spring 2024 (27 students)
MATH 3400: Set Theory and Logic	Fall 2023 (19 students)
MATH 3400: Set Theory and Logic	Spring 2023 (21 students)
MATH 2300: Discrete Structures	Spring 2023 (27 students)
MATH 1070: College Algebra	Spring 2023 (33 students)
MATH 1420: Calculus II	Fall 2022 (16 students)
MATH 1410: Calculus I	Fall 2022 (24 students)

## ACADEMIC HONORS AND AWARDS

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- Nominated for the Elizabeth Anne B. Papageorge Award, 2023-2024
- North Carolina State University Franke Norris Griggs Award for Service, 2022
- University of Nebraska-Lincoln Chair's Prize for Outstanding Graduating Undergraduate, 2017
- University of Nebraska-Lincoln Parents' Recognition Award for Outstanding Faculty and Staff, 2017

## PROFESSIONAL MEMBERSHIPS

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- American Mathematical Society (AMS), 2022-Present
- Mathematical Association of America (MAA), 2019-Present
- Society for Industrial and Applied Mathematics (SIAM), 2019-Present