

The 74th Meeting of the Alabama Association of College Teachers of Mathematics

Samford University, Birmingham, AL
February 8, 2025

The 2025 Lewis-Parker Lecture

The Race Against the Machine: AI in Computational Mathematics
Dr. Carmeliza Navasca, University of Alabama at Birmingham

ABSTRACT: AI is now a household name. A specific type of AI is machine learning. In this talk, I will discuss machine learning in applied and computational math. I will include interesting applications in image processing used in self-driving cars, dental intraoral cameras and others.

Alabama Journal of Mathematics

Editorial Board: <https://www.ajmonline.org/editorial-board/>

Journal website: <https://www.ajmonline.org/about/>

The Alabama Journal of Mathematics (AJM) is published under the auspices of the Alabama Council of Teachers of Mathematics (ACTM) and the Alabama Association of College Teachers of Mathematics (AACTM). The AJM is designed to meet a number of needs of the mathematics community in the State of Alabama. Specifically, the intent of the Journal is to knit together the various components of this mathematical community. As such, the journal includes research articles in mathematics and mathematics education appropriate for a general audience and activities and problems for K-16 mathematics teachers.

Acknowledgements

The AACTM sincerely appreciates Samford University for generously hosting this year's conference. A heartfelt thank you goes to the local organizers, Janie Kennedy and Kwadwo Antwi-Fordjour, whose dedication and efforts were instrumental in making this event a success.

AACTM Officers

President: Kwadwo Antwi-Fordjour, Samford University
Vice President: Jamie Adams, University of South Alabama
Secretary/Treasurer: Janie Kennedy, Samford University
Member at Large (2023-2025): George Lytle, University of Montevallo
Member at Large (2024-2026): Laura Erin Watley, University of Alabama

AACTM 2025 SCHEDULE

Time	Event/Presenter
8:15am–8:50am	Registration and Refreshments
8:50am–9:00am	Welcome remarks
9:00am–9:15am	Mingwei Sun , Samford University <i>Penalized Poisson Regression with a Referee Index for Professional Soccer Performance Analysis</i>
9:20am–9:35am	Laura Erin Watley , University of Alabama <i>Navigating the Alabama Numeracy Act: How will mathematicians blend the study of content and pedagogy?</i>
9:40am–9:55am	Marcus Shell* and Jaedeok Kim , Jacksonville State University <i>A Look at The Symmetric Modular Group</i>
10:00am–10:15am	Janie Kennedy , Samford University <i>Precalculus Problems to Enhance Understanding</i>
10:15am–10:30am	Break
10:30am–11:30am	LEWIS-PARKER LECTURE: Carmeliza Navasca , University of Alabama at Birmingham <i>The Race Against the Machine: AI in Computational Mathematics</i>
11:35am–12:35pm	Lunch and Group Photo
12:45pm–1:00pm	Jim Gleason , University of Alabama <i>Faculty Conceptions of Mathematics: Views of the Partner Disciplines</i>
1:05pm–1:20pm	Muhammad Mohebujjaman , University of Alabama at Birmingham <i>Non-linearly coupled PDE based Stocking and Harvesting Models: Exploring Decoupled Algorithms and Analysis</i>
1:20pm–1:30pm	Break
1:30pm–1:50pm	PANEL DISCUSSION: <i>Bridging the Gap Between High School and College-Level Mathematics</i>
1:50pm–2:00pm	Break
2:00pm	Business Meeting

ABSTRACTS

(in alphabetical order by presenter's last name)

Jim Gleason

University of Alabama

Faculty Conceptions of Mathematics: Views of the Partner Disciplines

Using a survey of faculty from Engineering, Economics, and Mathematics we see how different groups of faculty members prioritize different ways of defining and conceptualizing mathematics. We will then discuss how these different priorities impact the content and methods of teaching mathematics at the college level.

Janie Kennedy

Samford University

Precalculus Problems to Enhance Understanding

We discuss nonroutine Precalculus problems that could lead to enhanced understanding in the Precalculus classroom.

Muhammad Mohebujjaman

University of Alabama at Birmingham

Non-linearly coupled PDE based Stocking and Harvesting Models: Exploring Decoupled Algorithms and Analysis

We propose time-dependent non-linearly coupled Advection Reaction Diffusion (ARD) N -species competition models to investigate the Stocking and Harvesting (SH) effect on population dynamics in a heterogeneous environment. We also propose, analyze, and test two novel fully discrete decoupled linearized schemes for the coupled ARD-SH competition model. The time-stepping algorithms are first and second order accurate in time and optimally accurate in space. Stability and optimal convergence theorems of the decoupled schemes are proved rigorously. We verify the predicted convergence rates of our analysis and the efficacy of the algorithms using numerical experiments and synthetic data for analytical test problems. We also study the effect of harvesting or stocking and diffusion parameters on the evolution of species population density numerically and observe the coexistence scenario subject to optimal stocking or harvesting.

Marcus Shell* and Jaedeok Kim

Jacksonville State University

A Look at The Symmetric Modular Group

The modular group $\mathrm{PSL}_2(\mathbb{Z})$ is the subcollection of

$$\mathrm{SL}_2(\mathbb{Z}) = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} \mid a, b, c, d \in \mathbb{Z} \text{ and } ad - bc = 1 \right\}$$

wherein the two matrices A and $-A$ are considered identical. $\mathrm{PSL}_2(\mathbb{Z})$ is a group under matrix multiplication consisting of 2×2 matrices with integer entries and determinant 1. In this project, we study the subcollection

$$\mathrm{PSSL}_2(\mathbb{Z}) = \left\{ AA^T \mid A \in \mathrm{PSL}_2(\mathbb{Z}) \right\}$$

consisting of all symmetric matrices in $\mathrm{PSL}_2(\mathbb{Z})$. A binary operation $*$ on $\mathrm{PSSL}_2(\mathbb{Z})$ is defined by $(AA^T) * (BB^T) = ABB^T A^T$. Then $(\mathrm{PSSL}_2(\mathbb{Z}), *)$ forms a group. We discuss interesting group-theoretic and number-theoretic properties of the new group.

*Presenter: in joint authorship

Mingwei Sun

Samford University

Penalized Poisson Regression with a Referee Index for Professional Soccer Performance Analysis

Understanding the factors that influence team performance is critical in sports analytics. In this study, we developed and implemented a penalized Poisson regression model capable of performing simultaneous variable selection and regression coefficient estimation. A novel referee index was introduced as a key variable to quantify the impact of referees on team performance. The model was applied to match data from Manchester City F.C. in the English Premier League to identify the essential predictors of the number of goals scored per game. Our results demonstrate that the proposed model outperforms standard linear regression in predictive accuracy, highlighting its robustness and utility. Furthermore, the framework is adaptable and can be generalized to analyze performance in other sports domains, providing a versatile tool for performance evaluation and decision-making in sports management.

Laura Erin Watley

University of Alabama

Navigating the Alabama Numeracy Act: How will mathematicians blend the study of content and pedagogy?

In accordance with Act 2022- 249, the Alabama State Board of Education (ALSBE) modified the numeracy coursework standards relative to teaching of numeracy, including algebraic reasoning, cardinality, computational fluency, and conceptual understanding in the Educator Preparation Programs (EPPs). To ensure alignment with these standards, the Mathematics Department at the University of Alabama has collaborated with our College of Education to develop two mathematics for elementary education courses that integrated both content and pedagogy. During this discussion, I will illustrate how we have reimagined our mathematics for elementary education courses to meet the new numeracy coursework standards and pedagogy requirements with a focus on developing a deeper conceptual knowledge of mathematics for preservice teachers.