Spring Meeting of The Southern California-Nevada Section of The Mathematical Association of America

Program and Abstracts

April 23th, 2022

Acknowledgements

The Southern California-Nevada Section of the MAA welcomes participants to our 2022 Spring Meeting.

We would like to thank our invited speakers and our poster session presenters for their participation in the meeting.

Finally, the Section thanks Pomona College Mathematics Department for their hospitality in hosting the meeting. We would like to especially thank Edray Goins and Konrad Aguilar, who handled the local arrangements for the meeting.

To help reduce the costs of future MAA Meetings, please recycle your name tags at the end of the conference using the boxes provided.

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Schedule

8:30-12:00	Registration	Estella Laboratory Courtyard
8:30-10:30	Poster Presentation Check-In	Estella Laboratory Courtyard
9:15-9:30	Welcome Remarks	Argue Auditorium (Rm 1051)
9:30-10:30	Invited Address **Cynthia Flores**, CSU Channel Islands *From local to peridynamic modeling and theoretical aspects of nonlocal Helmholtz-Hodge decompositions of a vector field*	Argue Auditorium (Rm 1051)
10:30-11:00	Section Business Meeting	Argue Auditorium (Rm 1051)
11:00-12:00	Student Poster Session	Estella Laboratory Courtyard
12:00-1:30	Lunch Break	
1:30-1:40	AWM Announcements	Argue Auditorium (Rm 1051)
1:40-2:00	SPECTRA Announcements	Argue Auditorium (Rm 1051)
2:00-3:00	Invited Address **Robin Wilson**, CSU Pomona *Moving towards a Culturally Responsive Pedagogy for the Undergraduate Mathematics Classroom*	Argue Auditorium (Rm 1051)
3:00-3:30	Poster Awards and Closing Remarks	Argue Auditorium (Rm 1051)
3:30-4:30	Community Session and Informal Gathering	Estella Laboratory Courtyard
4:00-5:30	Section NExT Workshop (separate registration) **Darryl Yong**, Harvey Mudd College *Practical strategies for implementing active learning equitably and sustainably* sponsored and organized by COMMIT-CaN	Argue Auditorium (Rm 1051)

Invited Addresses

Cynthia Flores California State University, Channel Islands
"From local to peridynamic modeling and theoretical aspects of nonlocal Helmholtz-Hodge decompositions of a vector field"

Do you remember those operators from vector calculus: gradient, divergence, and curl? This talk will discuss some of the classical applications of these vector operators and their limitations when used to understand the modeling of discontinuous phenomena. Moreover, we introduce nonlocal theories in the mechanics of solids where the propagation of cracks and fractures hinders the use of classical differential operators. By replacing these with integral operators, nonlocal frameworks allow the consideration of solutions to the peridynamics equation of motion with little to no regularity. Moreover, a collection of nonlocal tools can be identified that is useful for analyzing the Helmholtz-Hodge Decompositions (HHD) of a vector field into its nonlocal divergence-free and curl-free components. Finally, we will discuss industrial applications, including a materials model for capturing the damage and fractures of metals due to corrosion and new avenues to apply nonlocal ideas in social science settings.

Robin Wilson, California Polytechnic University, Pomona
"Moving towards a Culturally Responsive Pedagogy for the Undergraduate Mathematics Classroom"

Education researchers, mathematics education researchers, and mathematicians working in the scholarship of teaching and learning have provided many different tools that undergraduate mathematics faculty can draw on to support the most marginalized students in their classrooms. Often these students are Black, Latinx, Pacific Islander, Native American, or come from poor communities, and often these practices that focus on increasing the academic success and building the identities of the most underserved students in our classrooms benefit everyone. In this talk we will explore some of the literature on frameworks, practices, and principles that begin to show how we can incorporate culturally sustaining, anti-deficit, and re-humanizing pedagogies into mathematics teaching at the undergraduate level.

Speaker Biographies

Cynthia Flores, California State University, Channel Islands

Cynthia Flores is an American Latina recognized nationally as a 2019 Diverse: Issues in Higher Education "Emerging Scholar" whose parents migrated from El Salvador. She grew up in Los Angeles, CA, in the Pico-Union community, working at local outdoor swapmeets every weekend. Inspired by her hard-working family, she received her mathematics BS and MS from California State University Northridge while receiving support and mentorship from the PUMP Program (Preparing Undergraduates through Mentoring for PhDs. In 2014 she completed a Ph.D. in mathematics from the University of California Santa Barbara in dispersive partial differential equations. She then joined the faculty at California State University Channel Islands, where she enjoys teaching ordinary and partial differential equations and contributing to the Dolphin community. Her activities include introducing new technologies to the classroom, supervising undergraduate research, collaborating on NSF-funded grants, and working with community partners in applied mathematics projects. She has been inspired by several mentors and advisors and aims to continue their shared work and legacy in creating opportunities for diversity within the mathematics community.

Robin Wilson, California Polytechnic University, Pomona

Dr. Robin Wilson is a Professor in the Department of Mathematics and Statistics at California Polytechnic University Pomona. He finished his PhD at UC Davis and he joined the faculty at Cal Poly Pomona in 2007 after an appointment as a UC President's Postdoctoral Scholar in the Department of Mathematics at UC Santa Barbara. He has also been a Visiting Professor at Georgetown University and Pomona College. Dr. Wilson is currently Co-Director of the California Math Project at Cal Poly Pomona, a program that supports the professional development of K-12 teachers. He is also Co-Director of the Bolstering the Advancement of Masters in Mathematics (BAMM!) Program. His current research interests include both low-dimensional topology and mathematics education.

Robin Wilson is the recipient of the 2021 MAA SoCal-Nevada Section Distinguished Teaching Award.

Poster Session Abstracts

Presenter(s): Michael Williams, California State University Channel Islands
Title: *Inverted Cassini Ovals and Their Surfaces*
Abstract: An Apollonian cubic is the locus of points that view two segments at oriented angles which add to zero or π radians. In this work we extend this idea to any angle and find, in general, the resulting curve is a Cassini oval inverted over some circle. Cassini ovals have a natural extension called a Cassini surface. In this research we use the previously mentioned Inverted Cassini Ovals to form surfaces described by a quartic or quintic polynomial. We find that these polynomials are irreducible and the surfaces they describe have no singularities except in degenerate cases.
Advisor: Ivona Grzegorczyk
Poster Area(s): Geometry, Algebra

Presenter(s): Nicholas Drain, California Lutheran University
Title: *Public Key Cryptography Using Graph Theory*
Abstract: Cryptography is the science of securely transmitting information through the use of math; the most popular algorithms in the field being AES and RSA. RSA, the most popular public key algorithm, relies on prime number factoring as a way to secure its data. The principle I decided to use is the maximum independent set of a graph, where you must find the largest set of non-adjacent vertices. In this algorithm a very large number of graphs containing information used to decode a message is sent over, one is chosen at random and solved. The solution is used to create a key and a message is sent to the original person who will decode it using brute force from a list of answers they have stored. To test this algorithm, I have tried attacks on the key, the individual graphs, and the first message sent with the decoded graph.
Advisor: John Villalpando
Poster Area(s): Graph Theory/Combinatorics

Presenter(s): Jacob Cornejo, California State University - Long Beach
Title: *Matrix-valued Holomorphic Cross-sections Over an Annulus*
Abstract: Let ρ_1 and ρ_2 be two representations of the fundamental group of an annulus to the projective unitary group. For each representation as above, there is an associated continuous holomorphic function algebra. It is known that if the two said representations are equivalent, then the associated function algebras are completely isometrically isomorphic. This presentation will focus on an equivalence of unitary representations assuming a complete isometric isomorphism of continuous holomorphic function algebras defined on an annulus, where ρ_2 is the trivial representation.
Advisor: Kathryn McCormick
Poster Area(s): Analysis

Presenter(s): Johnny Sierra and Jessica Toy, Cal State LA Mathematics Dept.
Title: *Antimagic Labeling of Forest*
Abstract: A graph is a structure made up of vertices and edges that connect the vertices. A labeling of a graph is a function that assigns numbers to the edges of the graph. The vertex-sum function assigns a value to a vertex v by adding the labels of all the edges incident to the vertex v. Suppose a graph has N edges. The labeling is called an antimagic labeling if the labeling is a bijection between the edge set and $\{1, 2, \ldots, N\}$. Additionally, each vertex must have a distinct vertex-sum. A graph with an antimagic labeling is called antimagic. We use a method of labeling a single tree to create an antimagic labeling of a forest.
Advisor: Daphne Liu
Poster Area(s): Graph Theory/Combinatorics

Presenter(s): Valerie Trujillo and Michael Yates, University of La Verne/Cal Poly Pomona
Title: *PRYME Pomona Hope*
Abstract: PRYME (Pomona's Rising Youth in Mathematics Empowerment) is a program within the non-profit after school program Pomona Hope. PRYME aims to cultivate meaningful relationships and empower people of all backgrounds, particularly at-risk youth and their families, to work together toward personal and community transformation. Students interact in meaningful mathematic instruction and activities emphasizing on mathematics, leadership, and social justice for the middle school grade levels.
Advisor: Gail Tang
Poster Area(s): Education/Pedagogy

Presenter(s): Clayton Coe, California State Polytechnic University, Pomona
Title: *Generalization of Problem 4716 from Crux Mathematicorum*
Abstract: Problem 4716 from Crux Mathematicorum Vol. 48 Issue 2 asks us to find a geometric property of a family of triangles determined by a cubic equation. Using a variety of methods, we solve the problem by showing that this is a family of isosceles triangles. Furthermore, our methods generalize this problem for a family of cubic polynomials, and the answer to this generalized problem results in an invariant slope of the Euler line.
Advisor: Ioana Mihaila
Poster Area(s): Geometry, Algebra

Presenter(s): Jonathan Cervantes, California State University, Los Angeles
Title: *Coloring Abelian Cayley Graphs*
Abstract: We study connected finite degree Cayley graphs on abelian groups. We explore, as in the work of Heuberger and others, how these graphs can be represented by integer matrices. Adding or subtracting rows produces a graph homomorphism to graphs associated with matrices with smaller. We give numerical conditions that determine the chromatic number for graphs associated with $n \times 1$ and 2×2 matrices.
Advisor: Mike Krebs
Poster Area(s): Graph Theory/Combinatorics, Algebra

Presenter(s): Ricardo Suarez, UNITO (University of Turin) and CSUCI
Title: *Idempotent Clifford Bundles*
Abstract: In this paper we use the idempotent Clifford modules , sub-modules of Clifford algebras with signatures (p, q) generated by a primitive idempotent element. With these modules we construct real vector bundles known as spinor bundles over compact topological spaces, and with the complexification of these idempotent modules we construct complex topological vector bundles. These bundles are naturally graded, and with the Clifford multiplication morphism we have explicit representatives of the Thom classes in the Thom space of the tangent bundle. We conclude the with examples in dimensions 2 and 4.
Advisor: Ivona Grzegorczyk (CSUCI), Anna Fino (UNITO)
Poster Area(s): Geometry, Algebra, Topology

Presenter(s): Dylan Stover, California State University Channel Islands
Title: *Introduction to Numerical Sets and Primality*
Abstract: We present an introduction to higher-level mathematics by studying various subsets of integers, rational and real numbers. We define operations on these sets and study their properties. We introduce concepts of groups, rings, fields, and operations in this context. We introduce primality to study integers modulo given numbers and identify differences in these sets. The goal of this lesson is to improve students' comprehension of numbers beyond the traditional scope of the algebra curriculum.
Advisor: Ivona Grzegorczyk
Poster Area(s): Education/Pedagogy

Presenter(s): Zoë Batterman, Pomona College
Title: *Metrics on Ideals and the Hausdorff Distance*
Abstract: For approximately finite-dimensional algebras, Aguilar introduced a metric that calculates distances between ideals of the algebra. When the algebra is commutative, it is isomorphic to a space of complex-valued continuous functions on a compact metric space, X. The ideals in this case are in bijection with the closed subsets of X, which induces a metric on the closed subsets of X, called the ideal metric. However, there is a well-known metric on the closed subsets of any compact metric spaces called the Hausdorff distance. Therefore, our work focuses on comparing the Hausdorff distance with this ideal metric. For a particular X, we have calculated the Hausdorff distance and ideal metric on certain subsets and have discovered cases where they agree or disagree. These comparisons suggest that the ideal metric is not ideal, and current/future work will develop a new ideal metric that behaves similarly to the Hausdorff distance.
Advisor: Konrad Aguilar
Poster Area(s): Analysis, Algebra

Presenter(s): Erik Bravo, CSU Channel Islands
Title: *Students and the Struggle with Mathematical Quantifiers*
Abstract: This research is on student understanding of mathematical quantifiers. Our research began with a pilot study, analyzing answers given to university freshmen in a logic course. Each question had a formal statement, and the students were asked to rewrite it informally or vice-versa. The results depended strongly on the number of quantifiers included and the majority of students had problems with the proper order of two or more quantifiers. Next, we prepared an in-depth survey that was administered to 3-groups of students at different levels of their academic developments. We also compared 2-different ways of teaching quantifiers at the introductory level (active learning vs. traditional). We analyzed data using T-test applied to different samples and presented the results. Our goal is to study the obstacles to comprehending mathematical quantifiers and improve the methodology for teaching and assessing the retention of this knowledge a few years after the learning happened.
Advisor: Ivona Grzegorczyk
Poster Area(s): Education/Pedagogy, Understanding Mathematical Quantifiers

Presenter(s): Steven Jang, Cal Poly Pomona
Title: *Computing an Interesting Limit*
Abstract: I have found an interesting solution to a problem in Kappa Mu Epsilon's Problem Corner (Problem 889), related to the computation of a limit. Most techniques regarding the evaluation of limits include some variation of L'Hopital's rule, but my method involves interpreting the limit as a Riemann Sum and converting it to an improper integral.
Advisor: Ioana Mihaila
Poster Area(s): Analysis

Presenter(s): Citlalli Villegas, California State University Channel Islands
Title: *Understanding of Mathematical Induction*
Abstract: Many undergraduates have difficulty when they are first introduced to mathematical induction. This project seeks to understand the common struggles students have with mathematical induction and how it relates to their overall performance in the course. We gathered data from fifty students and analyze their response to an induction problem on a midterm. Our data explored correlations between their understanding of checking for small numbers, formulating $k+1$ and correctly performing the induction step. This data will be used to explore how professors can better prepare students to combat their struggles with mathematical induction.
Advisor: Ivona Grzegorczyk
Poster Area(s): Education/Pedagogy, Mathematical Proofs

Presenter(s): Natasha Arnold, Tianna Couch, Brandon Douglas, Tadius Frank, and Christina Marsh, Cal Poly Pomona/Pomona College
Title: *Searching for Black Women in Mathematics*
Abstract: Historically, Black women are underrepresented in the field of mathematics. While the achievements of some Black female mathematicians have been celebrated in popular culture, many of their accomplishments have gone unrecognized. Through teaching, research, collaboration and mentorship the contributions of Black female mathematicians should be honored and celebrated. This project revisits archives and databases to compile a comprehensive list of Black female Ph.Ds in mathematics through history. This list is part of an ongoing project tracking and documenting the contributions of mathematicians of the African diaspora. Through this project, we hope to highlight the resilience and unique stories of Black women in academia.
Advisor: Robin Wilson
Poster Area(s): History/Philosophy of Mathematics

Presenter(s): Dante Christian, Virgil Munyemana, and Erin Sewell, Pomona College
Title: *Modern Magic: Black Math PhDs from 2000 to Present*
Abstract: A group of undergraduate researchers under the supervision of Dr. Edray Goins (Pomona College) and Dr. Robin Wilson (Cal Poly Pomona) have undertaken Scott Williams' original project to highlight mathematicians of the African Diaspora and are currently expanding that same database. One subgroup, in particular, is focusing on uncovering the names of those with Ph.Ds in Mathematics from the year 2000 to the present day. This poster highlights their process, key findings, and overall takeaways from the project.
Advisor: Edray Goins
Poster Area(s): History/Philosophy of Mathematics

Presenter(s): Daniel Agbeo, Kamil English, Reia Li, and Devon Woodfine, Pomona College
Title: *Filling the Gaps: Numbers of Black PhD Recipients in Mathematics*
Abstract: We set out to count the number of Black PhD recipients of a doctoral degree in mathematics from a US institution because no one has ever compiled a comprehensive list. In 1925, Elbert Frank Cox was the first Black person to receive a PhD in mathematics. Our research begins with Cox and goes all the way to the present day. We scoured university websites, the Math Genealogy Project, Wikipedia, and the archived Mathematicians of the African Diaspora website in order to begin making our list. We want future researchers to access a central location for this information. Black mathematicians are made invisible by time and we want the crucial work of existing Black mathematicians to be recognized.
Advisor: Edray Goins
Poster Area(s): History/Philosophy of Mathematics

Presenter(s): Dylan Joseph Stover, California State University Channel Islands
Title: *Investigating Diagonalizable Matrices Modulo m*
Abstract: A major topic from Linear Algebra is about diagonalizing a matrix. This is classically always done over a field, such as $\mathbb{R}$ or $\mathbb{C}$. It is well known that in this context, the diagonalization is unique, up to the order of the diagonal elements. We investigate whether this is still true if we instead work over the ring $\mathbb{Z}_m$, especially in the case where m is not a prime number.
Advisor: Brian Sittinger
Poster Area(s): Number Theory, Algebra