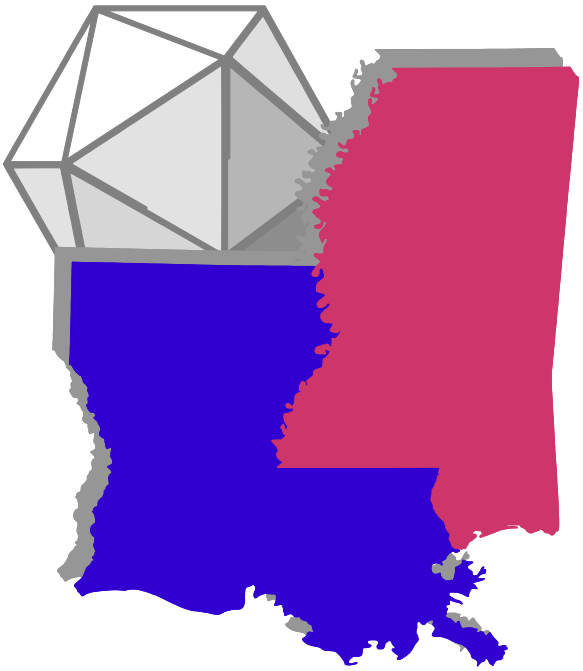
The Mathematical Association of America

Louisiana/Mississippi Section



95th Annual Meeting
hosted by University of Louisiana at Lafayette
Lafayette, Louisiana
March 1-3, 2018

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Plenary Address

How mathematics is making Hollywood movies better

Michael Dorff, Brigham Young University

Friday, March 2nd, 1:00 p.m. – 2:15 p.m.

Student Union, Ballroom B

What's your favorite movie? *Star Wars? Avatar? The Avengers? Frozen*? What do these and all the highest earning Hollywood movies since 2000 have in common? Mathematics! You probably didn't think about it while watching these movies, but math was used to help make them. In this presentation, we will discuss how math is being used to create better and more realistic movies. Along the way we will discuss some specific movies and the mathematics behind them. We will include examples from Disney's 2013 movie *Frozen* (how to use math to create realistic looking snow) to Pixar's 2004 movie *The Incredibles* (how to use math to make an animated character move faster). Come and join us and get a better appreciation of mathematics and movies.

9th Annual R.D. Anderson Lecture

Zeroing in on the Implicit Function Theorem

Carol Schumacher, Kenyon College

Friday, March 2nd, 5:30 p.m. – 6:30 p.m.

Student Union, Ballroom B

In mathematics, it often happens that baroque, highly technical results disguise beautiful underlying principles. This talk traces the path from the elegant contraction mapping principle to the rather inscrutable implicit function theorem---a path that passes through Newton's method for finding roots, linear algebra and linear approximation, and the geometry of multidimensional surfaces.

Outstanding Teacher Address

A canticle for Euclid

John Perry, University of Southern Mississippi

Saturday, March 3rd, 10:30 a.m. – 11:30 a.m.

Student Union, Ballroom B

If you attend this meeting, you probably agree that "Math is beautiful." After all, a recent awardee gave a talk entitled, "The Beauty of Mathematics." Not everyone agrees, and as I learned when teaching high school, it can be quite hard to convince most people otherwise. To be fair, I myself would have dissented at that age. Mathematics wasn't "shiny" enough to be beautiful, it took too long to do anything interesting, and besides, most mathematicians I met said some very strange things.

They still do! This talk will reflect on some of these sayings: sometimes assenting, sometimes dissenting. It will also reflect on some student feedback, most of it instructive in all the wrong ways. We'll also look at some shiny things, and ask whether they're mathematics.

Section NExT Workshop

Friday, March 2nd, 9:00 a.m. – 11:30 a.m.
Student Union, Pelican A

9:00 a.m. **Welcome and Introductions**
Carmen Wright, Jackson State University, Section NExT Committee Coordinator

9:20 a.m. **Opportunities in the MAA**
Michael Pearson, MAA Executive Director

9:45 a.m. **Panel and Q&A on Undergraduate Research**
Frank Serio, Leigh Ann Myers, and Jacqueline Jensen-Vallen.

10:40 a.m. **What I learned in the classroom**
Carol Schumacher, Kenyon College

11:20 a.m. **Closing Remarks**
Carmen Wright, Jackson State University, Section NExT Committee Coordinator

Workshop

Basing a high school recruiter, "outreach" program around the American Mathematics Competition
John Perry, The University of Southern Mississippi
Friday, March 2nd, 9:00 a.m. – 11:30 a.m.
Student Union, River A

The MAA runs the annual American Mathematics Competition for high school students. Colleges and Universities are allowed to host the competition, and many do. It turns out that a lot of high school math clubs/teachers are eager to find math-related activities for their students, and a nationally run activity like this is attractive. As a result, USM has successfully hosted the competition for a little more than 10 years, lately bringing 350-400 high school students.

(Now, make sure you read that properly: 350-400 high school students whose teachers think they have some aptitude for mathematics visit our campus, meet our science faculty, and take a really hard test that probably lowers their self-esteem a notch or two. AND THEY PAY TO DO THIS, YEAR AFTER YEAR. If this somehow doesn't interest you in an age of declining enrollment and state support, then this workshop is probably not for you.)

In this workshop, we will talk briefly about the AMC, look at some problems from the 2018 Competition, and describe both how we run the competition at USM and how it also motivates us to go visit high schools. In this particular workshop, the speaker will also want to hear ideas from the audience on how to improve how we do it at USM.

Student Luncheon

Sponsored by Wiley Publishing

Let's Get Knotty

Jacqueline Jensen-Vallin, Lamar University

Friday, March 2nd, 11:00 a.m. – 12:30 p.m.

Student Union, Ballroom B

My early interests in numbers and patterns lead me down a (nonlinear) path to mathematics, which has led me to the twisty world of knots. Mathematically, knots are non-intersecting closed curves in space. We will use sequences and patterns to explore this world and play with a class question in knot theory – given a knot diagram, how do I identify the knot? There will be plenty of examples, conjectures, and fun!

Student Presentations

Friday, March 2nd, 2:30 p.m. – 4:25 p.m.

Student Union, Magnolia Room

2:30 p.m.

When is a Function's Inverse Equal to its Reciprocal?

Haley Jorgensen, Undergraduate, Northwestern State University

Throughout the fall 2017 semester, I studied properties of functions that make their inverse equal to their reciprocal. Using the functional equation, $f^{-1}(x) = 1/f(x)$, I proved propositions that built on one another until I was able to derive my own theorem on functions that have a finite number of elements in the domain. I started my research by finding some solutions to the functional equation. Using the solutions, the propositions I came across made much more sense. Equivalence relations were also used in finding properties of functions that satisfied the functional equation. If I were to continue my research, I would study continuous functions since the theorem I derived only applies to functions that are not always continuous.

2:50 p.m.

Using a Density Dependent Population Model to Examine Sperm Whale Population Dynamics in the Gulf of Mexico Before and After an Environmental Disturbance

Mark Dibbs**,** Undergraduate, University of Louisiana at Lafayette

This study utilizes techniques of linear algebra to study population dynamics of a sperm whale population. After introducing the density dependent model, we consider the stability of the extinction equilibrium and prove the existence and uniqueness of a positive equilibrium. We then examine the stability of the positive equilibrium and substantiate the results with numerical simulations using Matlab. Finally, we look at the effects of a disturbance, such as the Deepwater Horizon oil spill, on sperm whale population dynamics and consider how the accuracy of the model could be improved.

3:10 p.m.

The Complexities of the Optimum Partition Problem

Bailey Smith, Undergraduate, Belhaven University

An optimum partition divides a set of positive integers into two subsets with the closest sum possible, where a discrepancy of zero is a perfect partition. The optimum partition problem attempts to find a perfect or optimum partition. Two methods of solving this problem are the greedy algorithm and the differencing method which do not always find a solution because of the phase transition. The phase transition is a problem's shift in difficulty from P to NP. Gent and Walsh proved that the phase transition is affected by the ratio of *m*, the average number of digits in the integers, to *n*, the number of integers in a set, [3]. Mertens showed the phase transition occurs when $m = n$, [4].

3:30 p.m.

New Stacked Central Configuration for the Planar Six body problem

Hamas Tahir, Gokul Bhusal, Undergraduate, University Of Southern Mississippi

A Central Configuration (CC) is a special arrangement of masses in the N-body problem where the gravitational force on each body points proportionally toward the center of mass. A stacked CC is a CC that has a proper subset of the N-bodies also forming a CC. In this paper, we study the case where three bodies with masses m1, m2 and m3 form an equilateral CC, and the other three with masses m4, m5 and m6 forms another equilateral CC. Both equilateral CCs share one axis of symmetry. We show the existence and non-existence of this kind of stacked central configurations for the planar 6-body problem.

3:50 p.m.

Generating the Plan of Study Using PERT/CPM

Aastha Ghimire, Undergraduate, Mississippi University for Women

This paper demonstrates the application of PERT/CPM (Program Evaluation Review Technique/Critical Path Method) with load-leveling to automatically generate the plan of study of mathematics students at Mississippi University for Women. The modifications to this technique ensure that prerequisites are satisfied while minimizing the number of semesters to complete the degree without exceeding the maximum load per semester.

4:10 p.m.

The Combinatorics of the Zeckendorf Representation

Paul Lagarde, Mississippi College

In this paper we define the Zeckendorf Representation, which utilizes sums of distinct, non-consecutive Fibonacci numbers to represent the natural numbers. We then explore the properties of this scheme by developing an addition algorithm, investigating a key result about sums of digits formulas, and building a "Zeckendorf Tree", which we then show how to navigate. Rather than aiming to prove one key result, this paper is meant as a curiosity arousing primer on how to build and represent natural numbers in a whole new way.

Contributed Presentations: Session A

Friday, March 2nd, 3:50 p.m. – 5:10 p.m.
Student Union, River A

3:50 p.m.

On Plankton Population Dynamics

Caleb Macdonald, University of Louisiana Lafayette

This paper demonstrates the application of PERT/CPM (Program Evaluation Review Technique/Critical Path Method) with load-leveling to automatically generate the plan of study of mathematics students at Mississippi University for Women. The modifications to this technique ensure that prerequisites are satisfied while minimizing the number of semesters to complete the degree without exceeding the maximum load per semester.

4:10 p.m.

The Method of Transformed Angular Basis Functions for the Laplace Equation

Jaeyoun Oh, University of Southern Mississippi

We propose a new approach to improve the method of angular basis function (MABF) proposed by Young. Numerical experiments demonstrate that the propose approach significantly simplifies the selection of source points in MABF for different types of domains, which makes MABF more applicable. Numerical results of MTABF and MFS are presented for comparison purposes.

4:30 p.m.

Developing Understanding in Precalculus Mathematics.

Susan Ficken, Mississippi University for Women

Students frequently arrive in pre-calculus classes treating mathematics as an arbitrary collection of rules and formulas to be memorized. I will present some of the activities and an interactive spreadsheet that I have developed to enhance understanding of functions, especially exponential and logarithmic functions.

4:50 p.m.

An Algebraic Approach to the Solution of the Biharmonic Equation

Daniel Watson, Mississippi College

The biharmonic equation is a fourth order partial differential equation that can be used to describe the vibration of a thin elastic plate. This talk discusses a simple algebraic approach to derive the solution of a biharmonic equation. After factoring the biharmonic operator, the method of particular solutions (MPS) using polynomial basis functions is used to solve each resulting operator.

Contributed Presentations: Session B

Saturday, March 3rd,
9:00 a.m. – 10:15 a.m.
Student Union, River A and B

9:00 a.m.

Generalized Monotone Method for Riemann-Liouville Fractional Reaction Diffusion Equation with Applications

Pradeep G Chhetri and Aghalaya S. Vatsala, University of Louisiana at Lafayette

Initially, we have obtained the integral representation for the linear Riemann-Liouville fractional reaction diffusion equation of order q, $0 < q \leq 1$. Also, we develop the generalized monotone method for the non-linear Riemann-Liouville fractional reaction diffusion equation using coupled lower and upper solutions where the monotone sequences converge uniformly and monotonically to the coupled minimal and maximal solutions.

9:20 a.m.

Quenching Behavior of One Dimensional Caputo Fractional Reaction Diffusion Equation Using Upper and Lower Solutions.

Subhash Subedi and Aghalaya S. Vatsala, University of Louisiana at Lafayette

We study quenching behavior of the solution of Caputo fractional initial value problem and Caputo-fractional reaction-diffusion equation in one dimensional finite domain using the method of lower the upper solution and comparison of Picard's iterates. Comparison with corresponding integer order differential equations and supporting numerical analysis are presented.

9:40 a.m.

A survey of Color Digital Image Denoising

Eva Comino, The University of Southern Mississippi

Denoising digital images includes a body of work that spans 40 years. Solution methods involving PDE began with the Scaled Space method and continue with the Perona Malik equation and a parade of variations thereof. The proposed method focuses on two Perona Malik equation variants, each able to control backward diffusion to balance denoising and blurring processes, while avoiding any artifacts.

10:00 a.m.

Caputo Fractional Impulsive Differential Equations and Comparison Results

Yunxiang Bai and Aghalaya S. Vatsala, University of Louisiana at Lafayette

In this work, we considered the Caputo fractional impulsive differential equation with initial conditions and impulsive nonhomogeneous terms. Using Laplace transformation, we obtained a closed form of the solution for the linear case and numerical results. We proved the uniqueness, developed a comparison result with coupled lower and upper solutions.

Special thanks for a generous donation made by Dr. Donald "Doc" Voorhies in support of this meeting.

Special thanks to Wiley Publishing for sponsoring the student luncheon.

WILEY

All MAA & AMS members receive a discount of 40% off the list price on MAA Press Title books and 25% off list for all nonmembers. These prices will all be listed on the Titles on Display in the exhibit room Pelican B. MAA members must call AMS customer services in order to receive their discount. The code to receive this discount is **MT240**. If you would like to see what is currently available please go to: https://bookstore.ams.org/maa-press-browse.

Biographies

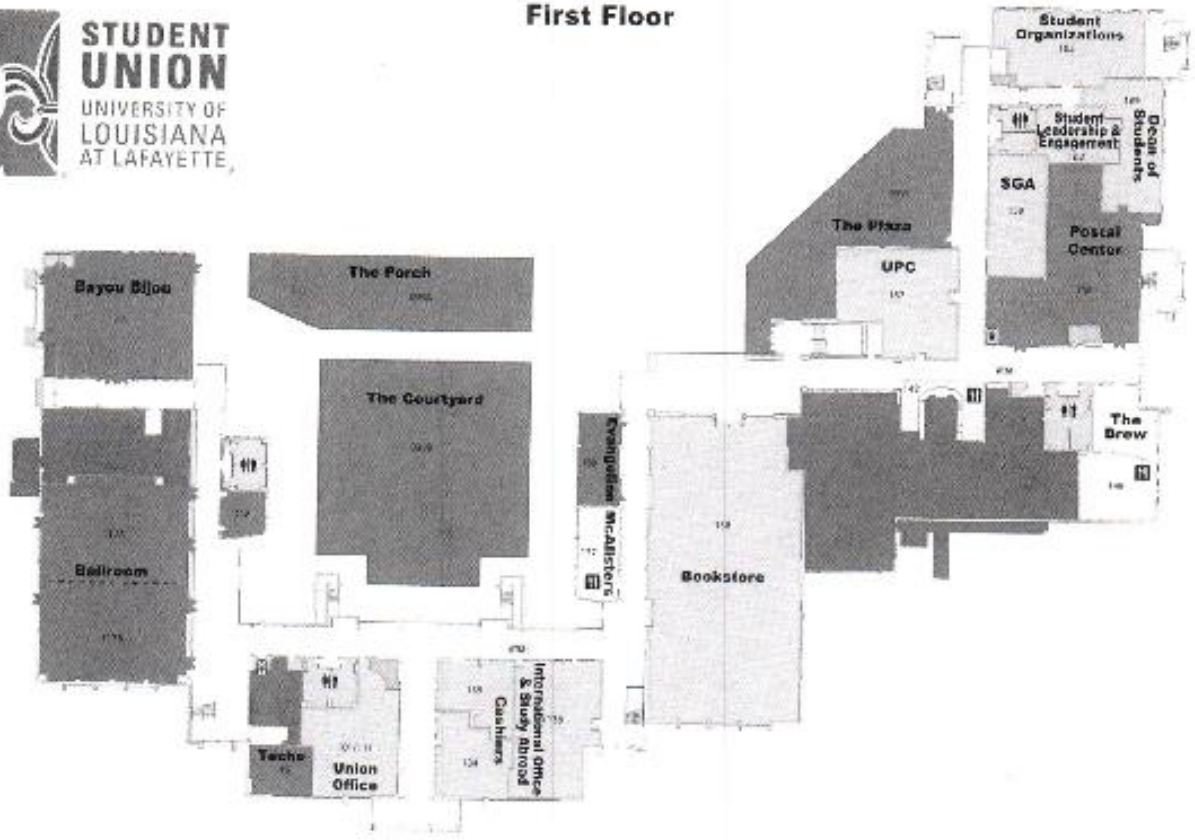
Jacqueline Jensen-Vallin is Editor of MAA FOCUS. She earned her Ph.D. from University of Oregon in 2002, and then taught at Sam Houston State University and Slippery Rock University before settling at Lamar University, where she is now the Director of the First-Year Math Experience. She is a member of the MAA Congress and winner of the MAA's Alder Award for Outstanding Teaching by a beginning faculty member in 2008. She is also co-editor of Springer's *Women in Mathematics: Celebrating the Centennial of the Mathematical Association of America*.

Michael Dorff is the department chair and professor of mathematics at Brigham Young University. He earned his Ph.D in 1997 from the Univ. of Kentucky in complex analysis, has published about 35 refereed papers, and has given about 500 talks on mathematics. He is interested in undergraduate research, in non-academic careers in mathematics, and in promoting mathematics to the general public. He is the President-Elect of the MAA. Also, he is a Fellow of the American Mathematical Society, a Fulbright Scholar in Poland, received a national Haimo Teaching Award from the MAA, and co-directs the PIC Math (Preparation for Industrial Careers in the Mathematical Sciences). He is married with 5 daughters. In any free time he has, he enjoys reading, running, and traveling.

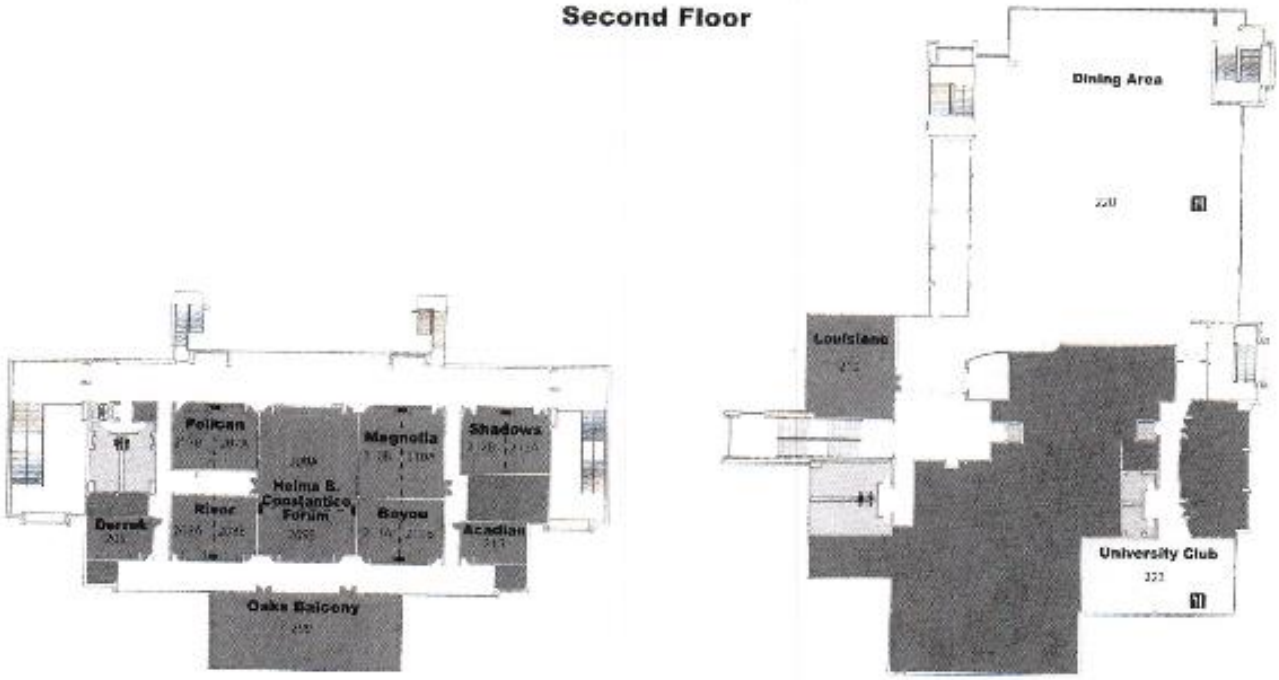
Carol Schumacher is Professor of Mathematics at Kenyon College. At Kenyon she has served three terms as department chair and recently completed a term as chair of the Kenyon College Faculty. She received a BA from Hendrix College and a Ph.D. in mathematics from The University of Texas at Austin. Schumacher is the recipient of Kenyon's Trustee Teaching Award and of the Ohio Section MAA's Distinguished Teaching Award. She is the author of *Closer and Closer: Introducing Real Analysis* and *Chapter Zero: Fundamental Notions of Abstract Mathematics*, 2E.
Dr. Schumacher is active in the Mathematical Association of America. She was co-chair of the steering committee for the *2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences* and is MAA Vice President. In the last several years she has addressed Project NExT fellows at their summer workshop and has been a leader in workshops that help faculty incorporate inquiry into their classrooms.

the STUDENT UNION UNIVERSITY OF LOUISIANA AT LAFAYETTE

First Floor



Second Floor



Event/Meeting Space
Information Desks
Dining
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Schedule of Events

Thursday, March 1st

All activities in Oliver Hall

Registration	5:00 p.m. – 7:00 p.m.	Oliver Hall Lobby
Integration Bee	6:30 p.m. – 9:00 p.m.	Oliver Hall, Room 112
Pizza	7:30 p.m. – 8:00 p.m.	Oliver Hall Lobby

Friday, March 2nd

All activities in the Student Union

Registration	8:00 a.m. – 4:00 p.m.	Outside of the Ballroom
Team Competition	8:00 a.m. – 10:30 a.m.	Ballroom B
Section NExT	9:00 a.m. – 11:30 a.m.	Pelican A
Workshop	9:00 a.m. – 11:30 a.m.	River A
Exhibits	9:00 a.m. – 5:00 p.m.	Pelican B
Student Luncheon	11:00 a.m. – 12:30 p.m.	Ballroom B
Plenary Address	1:00 p.m. – 2:15 p.m.	Ballroom B
Student Presentations	2:30 p.m. – 4:25 p.m.	Magnolia Room
Contributed Presentations A	3:50 p.m. – 5:10 p.m.	River A
R.D. Anderson Lecture	5:30 p.m. – 6:30 p.m.	Ballroom B
Anderson Banquet	6:30 p.m. – 8:30 p.m.	Ballroom A

Saturday, March 3rd

All activities in the Student Union

Registration	8:00 a.m. – 10:00 a.m.	Second Floor Lobby
MAA Liaison Breakfast	8:00 a.m. – 9:00 a.m.	Hilton Garden Inn
Exhibits	9:00 a.m. – 11:00 a.m.	Pelican B
Contributed Presentations B	9:00 a.m. – 10:15 a.m.	River Room
Outstanding Teacher Address	10:30 a.m. – 11:30 a.m.	Ballroom B
Business Meeting	11:45 a.m. – 12:45 p.m.	Ballroom B
Executive Committee	1:00 p.m. – 2:00 p.m.	Ballroom B

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