

Program of Activities
For the 99th Fall Meeting of the

Mathematical Association of America

Ohio Section



Fall, 2014
Wittenberg University
Springfield, Ohio
October 31-November 1, 2014

MAA Ohio Section Program

Friday, October 31

12:00-4:00	Registration	BDK Atrium (2 nd Floor)
12:00-1:00	Committee Meetings:	
	CENTENNIAL COMMITTEE	BDK 320
	CONCUR (Curriculum)	BDK 327
	CONSACT (Section Activities)	BDK 351
	CONTEAL (Teacher Education & Licensure)	BDK 141
1:00-4:00	Vendor & Book Exhibits	BDK 370
1:15-1:30	Welcome and Announcements	Bayley Auditorium
1:30-2:30	Distinguished Teaching Award Presentation: “Reconsidering Hilbert’s List with a Pedagogical Twist” Lew Ludwig	Bayley Auditorium
2:30-2:55	Break	BDK 370
2:55-3:00	Centennial Minute	Bayley Auditorium
3:00-4:00	Invited Address: “Rediscovering Lost Techniques in Ordinary Differential Equations” Adam Parker	Bayley Auditorium
4:10-5:10	Executive Committee Meeting (Part 1)	BDK 320
4:15-5:50	Contributed Paper Sessions	BDK 260, 262
5:55-6:20	Discussion on Section Meeting Attendance and Participation (Part 1)	BDK 260, 262
6:30-6:45	Social Time	Shouvlin Atrium
6:50-8:00	Banquet	105 Shouvlin
8:15-9:15	After dinner talk: “Chaos Games and Fractal Images” Robert Devaney	Bayley Auditorium

Saturday, November 1

8:00-10:00	Registration	BDK Atrium (2 nd Floor)
8:00-10:00	Book Vendors and Exhibits	BDK 370
8:00-9:25	Coffee and Pastries	BDK 370
8:15-9:15	Executive Committee Meeting (Part 2)	BDK 320
8:50-9:25	Committee On Local Arrangements	BDK 351
9:25-9:35	Welcome and Announcements	Bayley Auditorium
9:35-10:35	Invited Address: “The Fractal Geometry of the Mandelbrot Set” Robert Devaney	Bayley Auditorium
10:35-11:00	Discussion on Section Meeting Attendance and Participation (Part 2)	Bayley Auditorium
11:00-11:15	Break	BDK 370
11:15-11:50	Contributed Paper Session	BDK 260, 262
12:00-1:00	Invited Address: “Two (More) Morsels from Euler” William Dunham	Bayley Auditorium
1:00-1:10	Closing Remarks	Bayley Auditorium

Abstracts of Invited Addresses

Friday

Speaker: Lew Ludwig, Denison University

Title: “Reconsidering Hilbert’s List with a Pedagogical Twist”

Abstract: At the International Congress of Mathematicians in Paris in 1900, Hilbert put forth his list of unsolved problems. This profound list spurred much of the mathematical research in the 20th and even the 21st centuries. In his introduction, Hilbert said the following:

“Who among us would not be happy to lift the veil behind which is hidden the future; to gaze at the coming developments of our science and at the secrets of its development in the centuries to come? What will be the ends toward which the spirit of future generations of mathematicians will tend? What methods, what new facts will the new century reveal in the vast and rich field of mathematical thought?”

In that spirit, this presentation will look behind the veil into our future classrooms. Since the time that many of us started teaching, large advances have been made in cognitive psychology to reveal how the brain learns. We will consider this research and how we can use it to our (and our students’) advantage in the classroom and beyond. This presentation is intended for anyone who has taught mathematics or has been a student in a mathematics course.

Speaker: Adam Parker, Wittenberg University

Title: “Rediscovering Lost Techniques in Ordinary Differential Equations”

Abstract: The pedagogical value of using primary sources in teaching is well-documented. It leverages mathematics’ unique relationship with the past, gives context to mathematical ideas, humanizes the field, and allows us to trace the evolution of mathematical ideas. But it can also lead to “new” mathematics, or at least new to the modern mathematician. This talk will discuss how incorporating primary sources in an ordinary differential equations course leads to rediscovering lost techniques that are certainly novel for students and perhaps you. We will illustrate this with multiple examples including: 1) How mathematicians solved simple separable equations before logarithms were available, 2) that Lagrange and D’Alembert had two, competing, methods for reducing the order of a differential equation 3) what Cauchy contributed in order to get his name attached to “Cauchy-Euler equations”, and 4) how D’Alembert solved systems of differential equations about 100 years before modern matrix techniques were available.

Speaker: Robert L. Devaney, Boston University

Title: Chaos Games and Fractal Images

Abstract: In this lecture we will describe some of the beautiful images that arise from the “Chaos Game.” We will show how the simple steps of this game produce, when iterated millions of times, the intricate images known as fractals. We will describe some of the applications of this technique used in data compression as well as in Hollywood. We will also challenge students present to “Beat the Professor” at the chaos game and maybe win his computer.

Saturday

Speaker: Robert L. Devaney, Boston University

Title: The Fractal Geometry of the Mandelbrot Set

Abstract: In this lecture we describe several folk theorems concerning the Mandelbrot set. While this set is extremely complicated from a geometric point of view, we will show that, as long as you know how to add and how to count, you can understand this geometry completely. We will encounter many famous mathematical objects in the Mandelbrot set, like the Farey tree and the Fibonacci sequence. And we will find many soon-to-be-famous objects as well, like the "Devaney" sequence. There might even be a joke or two in the talk.

Speaker: William Dunham, Muhlenberg College (Retired)

Title: Two (more) Morsels from Euler

Abstract: Leonhard Euler (1707 – 1783) is responsible for a stunning array of famous theorems, formulas, and concepts. In this talk we examine a pair of lesser-known results where his genius was on full display.

The first is a curious problem from number theory. Euler sought four different whole numbers, the sum of any pair of which is a perfect square. With characteristic ingenuity, he came up with this fearsome foursome: 18530, 38114, 45986, and 65570. We'll look over his shoulder to see how he did it.

Moving from number theory to analysis, we consider the series of reciprocals of squares – i.e., $1 + 1/4 + 1/9 + 1/16 + \dots$. Through his career, Euler gave (at least) three different proofs that this sums to $\pi^2/6$. Here we present the argument from his 1755 text on differential calculus. The amazing thing about this derivation is that he used l'Hospital's rule ... not once nor twice, but *thrice*!

These two results, which require only elementary mathematics, are reminders of why Euler is justly considered "the master of us all."

Brief Biographies of Invited Speakers

Lew Ludwig, Denison University



Lew Ludwig is an associate professor of mathematics at Denison University. He earned his Ph.D in 2001 from the Ohio University in point-set topology. He served visiting positions at Miami University and Kenyon College before accepting a position in 2002 at Denison. Dr. Ludwig publishes in point-set topology as well as knot theory. He has given over 75 presentations in 24 states and four continents ranging from his mathematical research to pedagogical techniques. He is particularly interested in undergraduate research and has co-authored papers with four students.

Dr. Ludwig is known for his NSF funded website, *Technically Speaking*, that helps students with their oral communication skills. He is a member of the MAA, AMS, CUR, and Project NExT, and has served in a number of positions including section program chair and member of CTUM. He is married with two children.

Adam Parker, Wittenberg University



Adam Parker is an Associate Professor of Mathematics at Wittenberg University in Springfield, OH. He received B.S. degrees in Mathematics and Psychology from the University of Michigan in 1999, followed by his Ph.D. in Algebraic Geometry from the University of Texas at Austin in 2005 under the guidance of Sean Keel. While still interested in Algebraic Geometry, he is happy to work with students on any project of their interest. A sepia dot (2006-2007 fellow) in Project NExT, he has been involved in several parts of the MAA, particularly the Ohio Section where he has chaired the Curriculum Committee (CONCUR) and the Program Committee. He's won Excellence in Teaching Awards from both Wittenberg's Omicron Delta Kappa Society and the Southwestern Ohio Council for Higher Education (SOCHE).

Adam teaches a wide range of courses and often incorporates primary sources in his teaching. He recently won the 2014 Polya award for a paper that evolved from using original sources in an ODE course. In his spare time, he enjoys sports, cooking, repairing old watches and spending time with his wife, Bernadette.

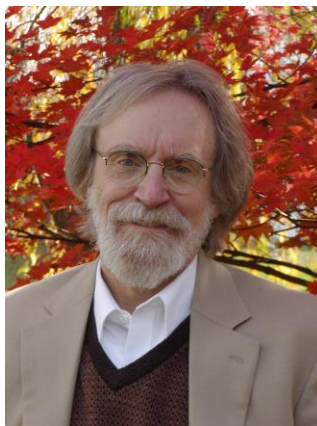
Robert L. Devaney, Boston University



A native of Methuen, Massachusetts, **Robert L. Devaney** is currently Professor of Mathematics at Boston University. He received his undergraduate degree from the College of the Holy Cross in 1969 and his PhD from the University of California at Berkeley in 1973 under the direction of Stephen Smale. He taught at Northwestern University and Tufts University before coming to Boston University in 1980. His main area of research is dynamical systems, primarily complex analytic dynamics, but also including more general ideas about chaotic dynamical systems. He is the author of over one hundred research papers in the field of dynamical systems as well as a dozen pedagogical papers in this field. He is also the (co)-author or editor of fourteen books in this area of mathematics. In 2013-14, he served as the President of the Mathematical Association of America .

Professor Devaney has delivered over 1,500 invited lectures on dynamical systems and related topics in all 50 states in the US and in over 35 countries on six continents worldwide. Like the cartoon character Dilbert, he has an artistic side: he collects a coffee mug from each College or University at which he speaks. He has received many awards including the Award for Distinguished University Teaching from the Northeastern section of the Mathematical Association of America and the Deborah and Franklin Tepper Haimo Award for Distinguished University Teaching at the annual meeting of the Mathematical Association of America. He also was named a Fellow of the American Mathematical Society.

William Dunham, Muhlenberg College (retired)



William Dunham is a historian of mathematics who has written four books on the subject: *Journey Through Genius*, *The Mathematical Universe*, *Euler: The Master of Us All*, and *The Calculus Gallery*. He is also featured in the Teaching Company's DVD course, "Great Thinkers, Great Theorems."

Last December, Dunham retired after 22 years as the Koehler Professor of Mathematics at Muhlenberg College. In the fall of 2008 and again the spring of 2013, Dunham was a visiting professor at Harvard University, where he taught a course on the mathematics of Leonhard Euler, and he held a visiting appointment at Princeton University in the spring of 2014.

Presently he is a visitor at the University of Pennsylvania and serves as the MAA's George Pólya Lecturer.

Contributed Paper Sessions

*denotes undergraduate student

Friday, October 31
4:15—6:20

Time	Session A Room BDK 260 Session Chair: Syvillia Averett	Session B Room BDK 262 Session Chair: Lynne Yengulalp
4:15-4:30	<i>The Effects of a Project-based Course on Students' Attitudes Toward Mathematics And Students' Achievement at a Two-year College</i> Abstract 1 Poranee Julian University of Cincinnati - Raymond Walters College	<i>Optimizing Hyper-Radial Values to Create Intuitive n-Dimensional Visualizations</i> Abstract 2 Todd Paciencia & Trevor Bihl Air Force Institute of Technology
4:35-4:50	<i>Fifty-five Years of Distance Learning</i> Abstract 3 Thomas Hern Bowling Green State University	<i>Modeling Radiation Damage to Bacillus Spores via Reaction-diffusion Equations</i> Abstract 4 Emily Knight Air Force Institute of Technology
4:55-5:10	<i>Public Data, Propensity Scores, and a Puzzling Pipeline</i> Abstract 5 Daniel Showalter Ohio University	<i>The Case of the Disappearing Tablet</i> Abstract 6 Zachary Soja* Ohio Northern University
5:15-5:30	<i>Calculus Communication Circle</i> Abstract 7 Judith Palagallo The University of Akron	<i>Pick 3 Ohio Lottery - A Matter of Randomness</i> Abstract 8 M B Rao University of Cincinnati

5:35-5:50	<i>Gold Glove Winners: Baseball Statistics</i> Abstract 9 James Rader* Ohio Northern University	<i>Enumeration of Parallelograms in Permutation Matrices</i> Abstract 10 Christopher Swanson Ashland University
5:55-6:20	Discussion on Section Meeting Attendance and Participation <i>Chair: John Prather</i>	Discussion on Section Meeting Attendance and Participation <i>Chair: Lew Ludwig</i>

Contributed Paper Sessions

*denotes undergraduate student

Saturday, November 1

Time	Session A Room BDK 260 Session Chair: Anne Albert	Session B Room BDK 262 Session Chair: Moez Ben-Azzouz
11:15-11:30	<i>Exponentials in the Context of Integral Operators</i> Abstract 11 Barbara Margolius Cleveland State University	<i>Visualizing Greatest Prime Factor Sequences: Applications and Applets</i> Abstract 12 Paul Vicol Simon Fraser University
11:35-11:50	<i>Ming Antu' Methods in His Study of Infinite Series</i> Abstract 13 Weiping Li Walsh University	<i>Exploring Gears and Watchmaking</i> Abstract 14 Kerry DuLaney* Ohio Northern University

Abstracts of Contributed Papers

Friday 4:15-4:30

The Effects of a Project-based Course on Students' Attitudes Toward Mathematics And Students' Achievement at a Two-year College

Poranee Julian
University of Cincinnati - Raymond Walters College

Abstract 1: I will discuss the preliminary results of my research (IRB approved) conducted during the Spring 2014 semester at UC Blue Ash. The purpose of this study was to investigate the impact of a project-based course on students' attitudes toward mathematics and students' achievement. The control group consisted of three College Algebra classes using traditional lecture instruction. The treatment group was comprised of three Foundations of QR classes using project-based instruction engaging real-life applications relevant to students.

Optimizing Hyper-Radial Values to Create Intuitive n -Dimensional Visualizations

Todd Paciencia and Trevor Bihl
(co-author: Kenneth Bauer)
Air Force Institute of Technology

Abstract 2: High-dimensional data is increasingly common in many disciplines, and is inherently difficult to visualize in meaningful ways. We present a new algorithm framework and formulation to create intuitive visualizations that can reveal class structure and outliers. Specifically, a statistical Rayleigh quotient is used to optimize groupings of variables that are then converted to hyper-radial distance. We will show examples using datasets ranging in size from four to 717 variables, and 150 to thousands of observations.

Friday 4:35–4:50

Fifty-five Years of Distance Learning

Thomas Hern
Bowling Green State University

Abstract 3: I will relate my experiences, beginning as a high school student (AP calculus with TV lectures by Gaylord Merriman of U. of Cincinnati), a Sunrise Semester economics course (on TV), graduate teaching assistant (under John Riner and Robert Fisher at Ohio state). My views are jaundiced, and skeptical of institutional motivation. We have not made much progress from the televised lecture. Surely we can do better. There are some issues that were, and still should be, a concern to the profession.

Modeling Radiation Damage to Bacillus Spores via Reaction-diffusion Equations

Emily Knight
Air Force Institute of Technology

Abstract 4: This research models and analyzes the inactivation of Bacillus spores following a radiation treatment. Radiation of a spore and the medium surrounding the spore induces chemical reactions that produce reactive oxygen species (ROS). This presentation will consider the reaction-diffusion of these ROS throughout the spore. These ROS can react with the spore's DNA and enzymes to degrade them to such an extent that the DNA cannot be repaired or replicated, thus causing spore death.

Friday 4:55–5:10

Public Data, Propensity Scores, and a Puzzling Pipeline

Daniel Showalter
Ohio University

Abstract 5: Many high school students who are channeled through the Algebra-Calculus pipeline in high school fail to place out of remedial mathematics classes in college, even if they successfully completed Precalculus or Calculus. Using propensity scores, it is possible to estimate the causal effect of taking these classes on postsecondary mathematics placement. In this presentation, I will provide a brief introduction to propensity scores and detail the results of the study.

The Case of the Disappearing Tablet

Zachary Soja*
Ohio Northern University

Abstract 6: We consider the problem of a tablet dissolving in a large reservoir of fluid. The behavior of the system is modeled by three axioms. Using these axioms, we obtain a differential equation which we solve. Applications to pharmaceutical kinetics are discussed.

Friday 5:15-5:30

Calculus Communication Circle

Judith Palagallo
The University of Akron

Abstract 7: Calculus Communication Circle was started in 2008 as a network for the professional development of Advanced Placement Calculus teachers. The Circle provides workshops where teachers meet to share ideas about mathematics and the teaching of calculus. The workshops also provide opportunity for high school teachers to interact with Ohio MAA members. I will describe the progress of the Circle over its seven year existence.

Pick 3 Ohio Lottery - A Matter of Randomness

M B Rao
University of Cincinnati

Abstract 8: Pick 3 Ohio Lottery is drawn twice a day. Like any other random devices, the lottery provides an opportunity to test randomness in the selection of numbers. This work was conducted by a high school student, Arun Pidugu, from Pennsylvania. Starting with an overview of testing randomness of dice, the presentation lays the groundwork in the realm of Pick 3 Lottery and final assessment.

Friday 5:35-5:50

Gold Glove Winners: Baseball Statistics

James Rader*
Ohio Northern University

Abstract 9: We will analyze from a statistical point of view the defensive abilities of Major League players. The players are ranked according to the following criteria: range, arm strength, and fielding percentage.

Enumeration of Parallelograms in Permutation Matrices

Christopher Swanson
Ashland University

Abstract 10: In 1965, John P. Costas introduced a special class of permutation matrices (now called Costas arrays) with applications to improving the target detection performance of radar and sonar systems. Given a permutation matrix, it fails to be a Costas array if and only if it contains 1's that form a (possibly degenerate) parallelogram. I will derive a formula for the number of possible parallelograms of 1's in a permutation matrix of order n .

Friday 5:55 – 6:20

Discussions on Section Membership and Participation

Recently the Executive Committee began exploring the question, “How can the section foster departments that value the MAA?” It was suggested that we could devote time at the fall meeting for a forum to discuss this issue with the whole membership. What do people find valuable? Why do they keep coming to conferences? What changes and additions could be made to better serve our members and to increase attendance and participation at section meetings?

The trend toward decreasing membership and attendance at meetings like ours is being felt much more widely throughout our culture. The exceptions are usually the result of strongly focused efforts on the part of an organization. Hopefully the Ohio Section can become one of the success stories as we draw near to our centennial. The discussion sessions at this fall's meeting will provide a first step in addressing the issue, so please come with ideas.

Saturday 11:15-11:30

Exponentials in the Context of Integral Operators

Barbara Margolius
Cleveland State University

Abstract 11: In this talk we give an example of the exponential of an operator that arises naturally in the context of fluid queues with a Markov-modulating process with time-varying transition rates. A fluid queue is a physical system that has an arrival and departure process but unlike the queue you might see at the checkout counter at the grocery store, the number in the queue is continuous. Fluid queues have been used to model the amount of fluid in a reservoir, the area covered by a forest fire or the volume of internet traffic. A Markov-modulating process is a random process in the background that may be thought to control the valves on a collection of pipes through which the fluid in the queue flows. The exponential of an operator here defines a semi-group with respect to the binary associative operation of taking the integral of the product of two matrix functions. No background in either queueing theory or integral equations is assumed.

Visualizing Greatest Prime Factor Sequences: Applications and Applets

Paul Vicol
Simon Fraser University

Abstract 12: We will investigate special classes of 2-dimensional analogues of the greatest prime factor sequences introduced by Mihai Caragiu and his collaborators at Ohio Northern University. We use rectangular grids (with or without periodic boundary conditions) with cells labeled by prime numbers. The recursion updates any individual cell by the greatest prime factor of the sum of the labels of its eight neighboring cells. Throw in some colors and applets for amazing visual results.

Saturday 11:35-11:50

Ming Antu' Methods in His Study of Infinite Series

Weiping Li
Walsh University

Abstract 13: Ming Antu was an astronomer and mathematician in the Qing Dynasty. He is usually regarded as the first Chinese mathematician studying the theory of infinite series. His method of study did not use any calculus and was based on ideas from traditional Chinese mathematics. We will try to show how he used elementary methods to deduce his formulae of infinite series.

Exploring Gears and Watchmaking

Kerry DuLaney*
Ohio Northern University

Abstract 14: The basis of this project was to explore mathematics linked to gears and watchmaking. The topics investigated include Ford circles and trees, the Stern-Brocot tree, Euclid's algorithm, Farey addition, Fibonacci sequences, matrices and continued fractions. Using these techniques we were able to navigate the Stern--Brocot tree by replicating rows and determining term placement within rows. This is a joint research project together with Dr. Donald Hunt.

Notes

Save these Dates!

2015 Spring Ohio Section MAA Meeting

Marshall University

March 27-28, 2015

Invited Speakers:

Annalisa Crannell (Franklin & Marshall University)

Carl Lee (University of Kentucky)

John Prather (OU-Eastern)

Bonita Lawrence (Marshall University)

MathFest

Washington, DC

August 5-8, 2015