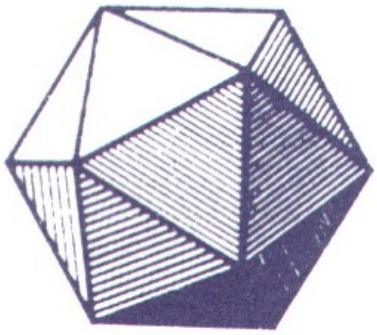
North Central Section (Founded in 1916)

Mathematical Association of America



Spring Meeting ⁑ April 25-26, 2014
St. Cloud State University
St. Cloud, Minnesota

Friday, April 25, 2014

6:30 – 8:30 **Registration** – Integrated Science and Engineering Lab Facility (ISELF) Lobby
$10 Regular (Students, First time attendees, and Speakers are free)
$5 for MAA-NCS section NExT members.

6:30 – 8:00 **Book Sales**, ISELF #108
Internet access: available upon request at registration table

Evening Session – ISELF #110, Dr. Peiyi Zhao, Presiding
7:05 – 7:25 **Prof. In-Jae Kim, Minnesota State University, Mankato**
Eventual Positive and Data Analysis

7:30 – 7:50 **Prof. Aaron Wangberg, Winona State University**
Student Insight from Raising Calculus to the Surface

Invited Lecture
8:00 – 8:50 **Prof. Carmen M. Latterell , University of Minnesota, Duluth**
What is Math? And Other Questions

8:50 – 10:00 **Reception** - Integrated Science and Engineering Lab Facility (ISELF) #118

Saturday, April 26, 2014

8:15 – 11:00 **Registration** – Integrated Science and Engineering Lab Facility (ISELF) Lobby
8:15 – 11:00, 12:00-1:40 **Book Sales** – ISELF #108

Morning Session – ISELF #110, Dr. Dale Buske, Presiding

9:00 – 9:05 Welcome
Dr. Dan Gregory, Interim Dean of the College of Science and Engineering

9:05 – 9:25 **Prof. Walter Sizer, Minnesota State University, Moorhead**
Solutions to the Difference Equation $x_{n+1}=\frac{x_n^k}{x_{n-1}}$

9:30 – 9:50 **Prof. Tom Sibley, St. John's University, College of St. Benedict**
Congruence and Its Modern Rivals: Isometries

9:50 – 10:10 **Break –** ISELF Lobby

10:10 –10:30 **Prof. Danrun Huang, St. Cloud State University**
Teaching Mathematics Using Current Events

10:35 – 10:55 **Prof. Don Flath, Macalester College**
Fill your Calculus Class with Applications

Invited Lecture – ISELF #110, Dr. Dale Buske, Presiding
11:00 – 11:50 **Prof. Ravi Vakil, Stanford University**
The Mathematics of Doodling

12:00 – 1:00 **Luncheon** – Valhalla Room (in the basement of the Atwood Memorial Union)

1:00 – 1:30 **Business Meeting** – ISELF #110, Dr. Randy Westoff, Section President Presiding

Afternoon Concurrent Session I ISELF #110, Dr. Dan Scully, Presiding

1:40 – 2:00 **Prof. Sayel Ali, Minnesota State University, Moorhead**
General Phi-Ratio Tests

2:05 – 2:25 **Prof. George Bridgman, retired**
Differentiability of a Rational Function of Two or more Real Variables

2:30 – 2:50 **Prof. Bret Benesh, College of Saint Benedict and Saint John's University**
Order Subsets Dividing the Order of a Group

2:55 – 3:10 **Loren Anderson, North Dakota State University**
Constructively Coloring the Line

Afternoon Concurrent Student Session II -- ISELF #109, Dr. William Branson, Presiding

1:40 – 2:00 **Prof. Ruijun Zhao, Minnesota State University, Mankato**
Challenges in Mathematical Modeling of Malaria

2:05 – 2:25 **John Hanenburg, Amateur Mathematician, Cost Estimator**
Construction of Unconventional Data Modeling Approximating Equations

2:30 – 2:50 **Hyun Lim, South Dakota State University**
Time Parallel Methods based on Space-Time Finite Element for Wave Equations

2:55 – 3:15 **Jordan Tait, Minnesota State University, Mankato**
Searching for Optimal Betting Points in Major League Baseball Games

Local Organizing Committee:
Dale Buske (chair), Peiyi Zhao, Sandra Johnson, Dan Scully, William Branson

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Abstracts

Invited Addresses

Carmen M. Latterell, University of Minnesota, Duluth**,**
What is Math? And Other Questions

Many questions are asked about the teaching and learning of mathematics. What are the goals of mathematics education? Who should study mathematics? What type of technology should be used? What methods work best for teaching mathematics? While each of these questions (and more) are important questions, I suggest that the answer to each of them is dependent on what is meant by mathematics. What is math? is a deceptively difficult question to answer. In my talk, I present the answers given by various groups of people, and also give some responses on related questions.

Bio: Carmen M. Latterell is a Professor of Mathematics at the University of Minnesota Duluth. She holds a BA from the College of St. Scholastica, a MS from the University of Minnesota Duluth, and a PhD from the University of Iowa. She was awarded the title Distinguished University Teaching Professor in 2007, when she also received the University of Minnesota's highest teaching award. She was awarded a 2.9 million grant from NSF in 2007 to work with STEM graduate students. Her book "Math Wars" has been translated into Turkish and Korean, and continues to sell in the United States. Currently, her research is taking a philosophical bend in trying to delineate how various groups of people view mathematics.

Ravi Vakil, Stanford University**,**
The Mathematics of Doodling

Doodling has many mathematical aspects: patterns, shapes, numbers, and more. Not surprisingly, there is often some sophisticated and fun mathematics buried inside common doodles. I'll begin by doodling, and see where it takes us. It looks like play, but it reflects what mathematics is really about: finding patterns in nature, explaining them, and extending them. By the end, we'll have seen some important notions in geometry, topology, physics, and elsewhere; some fundamental ideas guiding the development of mathematics over the course of the last century; and ongoing work continuing today.

Bio: Ravi Vakil is a Professor of Mathematics at Stanford, where he is also the Robert K. Packard University Fellow and the David Huntington Faculty Scholar. He is an algebraic geometer, and his work touches on many other parts of mathematics, including topology, string theory, applied mathematics, combinatorics, number theory, and more. He was born in Toronto, Canada, and studied at the University of Toronto, where he was a four-time winner of the Putnam competition (``Putnam Fellow"). He received his Ph.D. from Harvard in 1997, and taught at Princeton and MIT before moving to Stanford in 2001. He has received the Dean's Award for Distinguished Teaching, the American Mathematical Society Centennial Fellowship, the Frederick E. Terman fellowship, an Alfred P. Sloan Research Fellowship, the NSF CAREER grant, and the Presidential Early Career Award for Scientists and Engineers. He has also received the Coxeter-James Prize from the Canadian Mathematical Society, and André-Aisenstadt Prize from the CRM in Montréal. He was the 2009 Earle Raymond Hedrick Lecturer at MathFest, and is the Mathematical Association of America's Pólya Lecturer 2012-2014. He is a director of the new website mathoverflow, and also of the soon-to-be-launched "Proof School", a school for kids who like math. He works extensively with talented younger mathematicians at all levels, from high school (through math circles, camps, and olympiads), through recent Ph.D.'s.

Contributed Talks

Sayel Ali, Minnesota State University, Moorhead**, General Phi-Ratio Tests**

The Ratio Tests are convergence tests for positive term series. These tests are sharper than the normal ratio test: they succeed in many cases when the normal ratio test fails. [*Ali, Sayel, The m^{th} Ratio Tests, American Mathematical Monthly, 115(6) (2008), 514-524.]*
The -Ratio Tests [*Ali, S and Deutsche Cohen, M; The Phi-Ratio Tests, Elemente der Mathematik 67, 2012.*] are generalizations of a special case of the Ratio Tests when the series has a positive and decreasing sequence . We will discuss these tests and possible generalizations of the -Ratio Tests that apply to any positive term series.

Loren Anderson, North Dakota State University**, Constructively Coloring the Line**

Kemnitz and Marangio showed that for any list of k distances, the real line can be colored with $k+1$ colors so that all k of the distances are "forbidden", meaning that two points any of those distances apart must be colored differently. Their proof is non-constructive, as it appeals to a famous theorem of de Bruijn and Erdös, from the proof of which the axiom of choice cannot be excised. Here, we give explicit instructions for obtaining distance-forbidding colorings. Also, we examine extensions to periodic colorings.

Bret Benesh, College of St. Benedict & St. John’s University,
Order Subsets Dividing the Order of a Group

Consider the symmetric group S_3 acting on three letters. It has one element of order 1, three elements of order 2, and two elements of order 3. Notice that for each order, the number of elements of that order (one, three, and two, respectively) divide the order of the group, which is 3!=6. Groups with this property are called "perfect order subset groups," or POS groups. Finch and Jones have already done a lot of work on abelian POS groups. This talk - based on work done with Shadow Zhao - will focus on nonabelian POS groups.

- **George Bridgman,** retired,
  Differentiability of a Rational Function of Two or more Real Variables

We present necessary and sufficient conditions for a function such as $\frac{x^m \cdot y^n}{x^P + y^Q}$ to be differentiable, where exponents are nonnegative. For example, $\frac{x^{P+1}}{x^P + y^Q}$ is differentiable iff Q is greater than P. We also consider functions where x and y are replaced by exponential or logarithmic expressions in x or y.

- **Don Flath,** Macalester College, **Fill your Calculus Class with Applications**

Most beginning calculus students are motivated by the desire to use calculus to solve real world problems. Working with applications is the best way for many, perhaps all, students to develop intuition about the subject, which should be their main goal. It is intuition that enables them to use calculus as a thinking tool, not just a calculating tool. This talk will suggest a variety of applications that fit naturally into calculus classes.

- **Danrun Huang,** St. Cloud State University, **Teaching Mathematics Using Current Events**

In this talk, I will share some recent projects for my calculus, linear algebra, and abstract algebra classes using current resources. We can see how students use textbook skills and beyond to solve real-world problems, including wining a mathematical battle on Wikipedia, correcting mathematical errors in new MAA journals, solving open problems, processing images, etc.
Pro: Students learn more math and critical reading.
Con: Students' list of people that they cannot totally trust is extended from politicians and car dealers to mathematicians through their "painful" experiences!

- **John Hanenburg,** Amateur Mathematician, Cost Estimator,
  Construction of Unconventional Data Modeling Approximating Equations

In this presentation, I will demonstrate how to generalize the Least Squared method of data modeling (generating an approximating equation) to generate a Least Cubed approximating equation, a Least Forth approximating equation and so forth. I will demonstrate how to, easily, generate Exponential or Power approximating equations. Also, how to generate Weighted Least Squared approximating equations and Perpendicular Least Squared approximating equations. I will present some examples of the approximating equations that I use in my job.

- **In-Jae Kim,** Minnesota State University, Mankato, **Eventual Positive and Data Analysis**

An eventually positive matrix is a real square matrix all of whose powers are positive when the exponents are greater than a threshold. A sign pattern with an eventually positive realization is called potentially eventually positive (PEP). In this talk we will discuss properties of PEP sign patterns and its connection to multivariate data analysis.

Hyun Lim, Jung-Han Kimn and Matthew Anderson, South Dakota State University,
Time Parallel Methods based on Space-Time Finite Element for Wave Equations

In this talk, we will present a time parallel approach for linear and semi-linear wave equations. We show the critical behavior in the spherical symmetry and self-similarity solution. The time parallel method is based on time additive Schwarz preconditioner for a Krylov subspace method and space time finite element methods. The results show that the proposed numerical procedures can be extended to higher dimension and resolution simulations for more physically realistic simulation.

Thomas Q. Sibley, College of St. Benedict & St. John's University,
Congruence and Its Modern Rivals: Isometries

The Euclidean tradition emphasizes congruent figures and student favorites such as SAS. Transformational geometry studies isometries as the corresponding concept. The Common Core State Standards focuses on using transformations to understand congruence. We can investigate in which geometries these two ideas are equivalent and what mathematical questions arise from asking this question.

Walter Sizer, Minnesota State University, Moorhead,
Solutions to the Difference Equation $x_{n+1}=\frac{x_n^k}{x_{n-1}}$

As k varies over the real numbers in the above equation solutions behave differently. We show which converge, which diverge (and how), which oscillate, and some which are periodic.

Jordan Tait, Jimmy Broomfiled, In-Jae Kim, Benjamin Sencindiver, Jacob Westman
Minnesota State University, Mankato,
Searching for Optimal Betting Points in Major League Baseball Games

In this talk we will present an exploratory study on Major League Baseball data and a predictive model for wins and losses based on the exploratory data analysis. The predictive model provides an optimal betting point for a team in MLB. The model primarily uses winning and losing streaks, not individual performance variables.

Aaron Wangberg, Winona State University, **Eric Webber,** Oregon state University, **Jason Samuels,** CUNY-BMCC, **Brian Fisher,** Pepperdine University
Student Insight from Raising Calculus to the Surface

Using plastic surfaces with a dry erase finish, students are able to explore the geometry, and discover the major theorems, surrounding the concepts of multivariable calculus. In this talk, I'll describe how we use the plastic surfaces in class and share ideas uncovered by students using the materials. The 'Raising Calculus to the Surface' project has been partially supported by NSF DUE #1246094.

Ruijun Zhao, Minnesota State University, Mankato,
Challenges in Mathematical Modeling of Malaria

In this talk, I will briefly give a history of mathematical modeling in understanding. Then, I will spend some time on discussing the current campaign in controlling/eliminating malaria worldwide and the challenges of using mathematical models on this battle.

NCS MAA Fall 2014 Meeting: September 26-27, 2014 at North Dakota State University