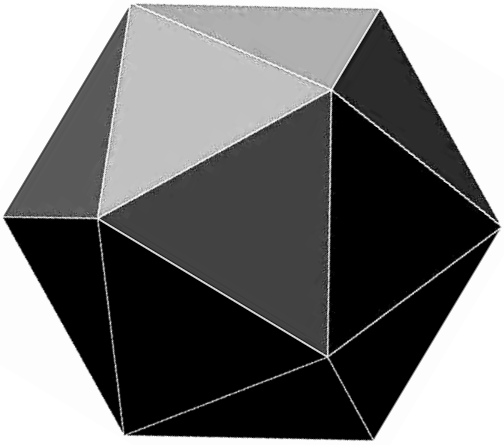
XLV Joint Meetings of the Florida Section of the Mathematical Association of America And the Florida Two-Year College Mathematics Association



University of North Florida

February 17-18, 2012

Florida Section of the Mathematical Association of America

Executive Committee 2010 – 2011

Governor	Mike Mears, State College of Florida
President	Monika Kiss, Saint Leo University
Past President	Charles Lindsey, Florida Gulf Coast Univ.
Vice-President for Programs	Sidra Van de Car, Valencia College
Vice-President for Site Selection	Joni Pirnot, State College of Florida
Secretary-Treasurer	John Waters, Jr., State College of Florida
Newsletter Editor	David Kerr, Eckerd College
Coordinator of Student Activities	Julie Francavilla, State College of Florida
	Christina Dwyer, State College of Florida
	Janet Samuels, State College of Florida
Webmaster	Altay Özgener, State College of Florida
President-Elect	Daniela Genova, University of North Florida
Vice-President-Elect, Programs	Jacci White, Saint Leo University
Vice-President-Elect, Site Selection	Scott H. Hochwald, Univ. of North Florida

Florida Two-Year College Mathematics Association

Executive Committee 2010-2011

President	Deepankar Rick Pal, Valencia College
Past President	Don Ransford, Edison State College
Vice-President for Programs	Bill Hemme, St. Petersburg College
Secretary	Janet Campbell, Palm Beach State College
Treasurer	Byron Dyce, Santa Fe College
Newsletter Editor	Deepankar Rick Pal, Valencia College
Vice-President for Membership	Ryan Kasha, Valencia College
Webmaster	Altay Özgener, State College of Florida
Historian	Mike Mears, State College of Florida
President-Elect	Penny Morris, Polk State College

Future Joint Mathematics Meetings FL-MAA/FTYCMA

February 22-23, 2013, University of Tampa

PROGRAM

Friday, February 17, 2012

Committee & Business Meetings

10:00 - 11:30	FL – MAA Executive Committee Meeting	Room 42/2120
10:00 – 10:50	FTYCMA Officers' Meeting	Room 42/1113-1114
11:00 – 1:30	FTYCMA Annual Business Meeting and Luncheon	Room 42/1113-1114

12:00 – 6:30 **Registration** Room 51/Lobby

Sign in and browse the displays from several publishing companies.

2:00 – 2:15 **Welcoming Remarks** Room 15/1304

Mark Workman, Provost, University of North Florida
Scott H. Hochwald, Chair, Dept. of Mathematics & Statistics
Annette Cook, Vice-President, AMATYC Southeast Region
D. Rick Pal, President, FTYCMA
Monika Kiss, President, FL-MAA

2:15 – 3:05 **Plenary Session** Room 15/1304

Joseph O'Rourke, Smith College
Folding & Unfolding Convex Polyhedra

3:15 – 5:15 **Student Events** Room 15/1304

3:15 - 4:15 Student Integration Contest
Come test your integration abilities!

4:15 – 5:15 Student Math Puzzle Contest
Attempt to solve our Sudoku and Ken-Ken puzzles.

Please note that Room 51/1201 is a Hospitality/Internet room beginning at 4:00 p.m. Friday and continuing throughout the conference. Feel free to come socialize and check e-mail here!

3:15 – 4:00 **Contributed Papers Session I**

Linda M. Martin, Florida State College — Room 51/1101

Mathematics, Reading Literacy, Self-Efficacy And Problem Solving: An Analysis Of The 2003 Pisa Data

Cameron Browne, Graduate Student University of Florida — Room 51/1102

Modeling Within-Host Virus Dynamics: The standard model, applications, and extensions

Tom Vogel, Stetson University — Room 51/1103

Solitons and the KdV Equation

Dan Dreibelbis, Univ. of North Florida — Room 51/1205

Swallowtails, Bumpy Oranges, and Monkey Saddles

Patrick Bibby, University of Miami — Room 51/1209

Jensen's Inequalities

Workshop: **Nancy Johnson, C. Altay Özgener, Brad Trotter**, State College of Florida — Room 51/1202

LaTeX

4:00 – 4:45 **Conference Break**

Please visit the textbook publishers in room 51/Lobby and browse their displays.

4:10 – 4:40 **Governor's Session** Room 51/1205

Mike Mears, State College of Florida

Governor's Session: Top 10 (or so) Updates from MAA – The Sequel

This informational sharing session is a chance for you to not only receive updates about recent policies and direction of the MAA ("hot off the press"), but to provide input into how the organization can better serve its members. It follows up a session that was held at 2011 conference, but the speaker is prepared to talk even slower in case you missed that session.

4:45 – 5:30 **Contributed Papers Session II**

Nancy Eschen, Florida State College Room 51/1101

Trends in Presentation in Calculus Textbooks (a Thesis study)

Warren McGovern, Florida Atlantic Univ. Room 51/1102

Commutative Clean Rings

Richard Decker, Jim Rhodes, Room 51/1103
Polk State College

How big is a zillion?

Ben Fusaro, Florida State University Room 51/1205

Sustainability and Energy-based Economics

Scott Hochwald, Univ. of North Florida Room 51/1209

Euclidean Geometry is Officially Dead But It Shouldn't Be

Su Hua, Graduate Student Room 51/1104
University of West Florida

Cubic Spline with QR decomposition

Workshop: **4:45 – 6:30**	**Timothy W. Jones**, Edison State College/Collier	Room 51/1202
	Poker and Popcorn: the Mathematics of Eating	
5:45 – 6:30	**Contributed Papers Session III**	
	Marcelle Bessman, Florida State College	Room 51/1101
	Teaching Calculus in the 21st Century	
	Richard Tamburro, Daytona State College	Room 51/1102
	Incredible Irrational Numbers	
	Carrie E. A. Grant, Julie A. Jurgens Flagler College,	Room 51/1205
	Investigating Sport Trends	
Workshop:	**Ivars Peterson**, Director of Publications and Communications at the MAA	Room 51/1209
	Writing Mathematics Well	
5:45 – 6:05	**Nikki Holtzer,** Undergraduate Student, Stetson University	Room 51/1103
	The Musicality of Continued Fractions	
5:45 – 6:05	**Rachel Levanger**, Undergraduate Student, University of North Florida	Room 51/1104
	Bent out of Shape: Taking a look at Perturbed Eigenvalues	
6:10 – 6:30	**Andrew D Hedman**, Undergraduate Student, Florida Gulf Coast University	Room 51/1103
	Spatial dispersion of interstellar civilizations: a site percolation model in three dimensions	

6:10 – 6:30 **Katie Bakewell**, Undergraduate Student, University of North Florida — Room 51/1104

Optimizing Hamiltonian Paths in Jacksonville

6:45 – 8:45 **Conference Banquet and Awards Ceremony** — Room 58W/3703 Student Union

Saturday, February 18, 2012

9:00 – 9:50 **Plenary Session** — Room 15/1304

Monica K. Hurdal, Florida State University

Understanding Cortical Folding Patterns in Development, Aging and Disease

10:00 – 10:45 **Contributed Papers Session IV**

Robert Shollar, Matthew Carr, Bradley Trotter, Thomas Haugh, Emre Özgener, Mike Mears, C. Altay Özgener, Anthony Salain State College of Florida — Room 51/1101

Integrals From Room 27-132

Timothy W. Jones, Edison State College/Collier — Room 51/1102

Euler's Identity, Leibniz Tables, and the Irrationality of Pi

Daniela Genova, Univ. of North Florida — Room 51/1104

Words, DNA Codes, and Combinatorial Problems

Debbie Garrison, Valencia College — Room 51/1205

Hands on Activities to help Students Understand Algebra Concepts

Penny Morris and Jim Rhodes, Polk State College — Room 51/1209

A Day Without Statistics Is Like a Day Without Sunshine

Workshop: **Steven L. Blumsack**, Florida State Univ. — Room 51/1202

Using GeoGebra to Analyze Pictures and Generate String Art

11:00 – 11:45 **Contributed Papers Session V**

Kuiyuan Li, Raid Amin, Josaphat Uvah, University of West Florida — Room 51/1101

A Study on the Fully Online Hybrid Program in Math at UWF

David A. Rose, Polk State College — Room 51/1102

Fair Selection by Tossing a Coin

Jacci White, Saint Leo University — Room 51/1103

Dynamic MAA-FL Program in 2013

Xiaoming Wang, Florida State University — Room 51/1104

Characterization of the divergence of test functions

Dennis Runde, State College of Florida, Manatee-Sarasota — Room 51/1205

Ten (or More) Ideas for Writing the Best Possible Final Exam

John T. Taylor, Florida State College — Room 51/1209
Sharon E. Sweet, Brevard Community College

Modeling Linear Functions Using Temperature Conversion Scales

Workshop: **Marcelle Bessman**, Florida State College — Room 51/1202

Clickable Calculus

12:00 – 12:50 **Plenary Session** — Room 15/1304

Ivars Peterson, Director of Publications and Communications at the MAA

The Jungles of Randomness

Closing Remarks

D. Rick Pal, President, FTYCMA
Monika Kiss, President, FL-MAA

1:00 – 3:00 **FL-MAA Business Meeting and Luncheon** — Room 58W/3703 Student Union

ABSTRACTS

Contributed Papers Session I

Linda M. Martin, Florida State College

Mathematics, Reading Literacy, Self-Efficacy And Problem Solving: An Analysis Of The 2003 Pisa Data

The results of an analysis of the 2003 Program for International Student Assessment (PISA) data will be presented. Several factors identified in the literature as important for mathematical problem solving were investigated, including specific mathematical skills, reading literacy, and student self-efficacy. The findings suggest that more than practice and proficiency with routine exercises is required for problem solving success.

Cameron Browne, Graduate Student, University of Florida

Modeling Within-Host Virus Dynamics: The standard model, applications, and extensions

Mathematical modeling of viruses has been a popular and fruitful research area over the past couple decades, particularly in the case of HIV. I will describe the standard within-host virus model, along with some historical applications to HIV. I will then present two mathematical extensions of the model that I have been working on. Specifically, I add periodic combination drug therapy in the first model, and age structure in the second model.

Tom Vogel, Stetson University

Solitons and the KdV Equation

Solitons are mathematical solutions to certain types of nonlinear partial differential equations. The first (recorded) observation of a naturally occurring soliton was in 1834 by John Scott Russell. It wasn't until 1895 that the mathematics of such solutions was understood. This talk will discuss solitons in both a historical and technical context. The first mathematical derivation of a soliton solution was in an equation governing waves on a shallow water surface. Today, this equation is known as the Kortweg-de Vries (KdV) equation. This talk will include a derivation of a 1-soliton solution of the KdV equation. Examples of physical systems which admit atmospheric, optical, and other physical solitons will also be discussed.

Dan Dreibelbis, University of North Florida

Swallowtails, Bumpy Oranges, and Monkey Saddles

In Calculus III, the Second Derivative Test classifies critical points as min, max, saddle, or the test fails. But what happens when the test fails? The field of singularity theory answers this question. We will explore some of the ideas behind this branch of mathematics, describe some of the applications, and look at some of the exotic curves and surfaces that show up when we break the Second Derivative Test.

Patrick Bibby, University of Miami

Jensen's Inequalities

Many important properties of real numbers are expressed as inequalities. In 1906, the Swedish mathematician Johan Jensen (Yĕn´-sĕn) derived two generic inequalities that have a whole host of classical inequalities as special cases. One of Jensen's inequalities can be applied to any function that is convex (concave upward) on an interval, and the other to any function that is concave (concave downward) on an interval.

Nancy Johnson, C. Altay Özgener, Brad Trotter, State College of Florida

Workshop: LaTeX

LATEX is especially nice for typesetting mathematical work. It has beautiful mathematical fonts and extremely powerful tools for handling tables of contents/figures/etc, citations, bibliographies and indices. The interface is more like programming than the Word-like "WYSIWYG" approach, but the initial learning curve is not too steep and is worth the effort. We will discuss the basics of certain presentation packages such as Beamer, PS-Tricks, TiKZ.

Contributed Papers Session II

Nancy Eschen, Florida State College

Trends in Presentation in Calculus Textbooks (a Thesis study)

During the 1980s, calculus instruction became the focus of a reform movement. Many mathematicians felt that some aspects of traditional calculus instruction did not provide students with a true understanding of calculus.

This thesis study examined two widely used college calculus textbooks to determine how calculus instruction has changed or not changed from 1994 to 2006. The study showed a definite trend toward incorporating more reform elements (graphical, numerical, verbal, and technological) with traditional methods.

Warren McGovern, Florida Atlantic University

Commutative Clean Rings

Recall that a ring is (loosely) a set with two operations: + and *. The study of clean rings has been keeping mathematicians busy over the last few decades. It is interesting and fascinating subject. Let R be a commutative ring with 1 and x\in R. We say x is a unit if there is some y\in R such that xy=1. We call x an idempotent if x^2=x. An element that is the sum of a unit and an idempotent is called clean. In this talk I will motivate the study of clean ring through the use of examples: modular arithmetic, matrix rings, finite group rings.

Richard Decker, Jim Rhodes, Polk State College

How big is a zillion?

The goal of our talk is to instill an appreciation of the size of large numbers such as a million, billion, trillion, zillion, and googol. We relate these numbers to familiar examples from the real world to promote an understanding of their relative size. We have used the presentation in our math club and professional development sessions and it will be made available for all who attend.

Ben Fusaro, Florida State University

Sustainability and Energy-based Economics

Economists tend to underestimate the value of *natural* capital. This leads to an emphasis on fiscal policy and currency manipulation rather than environmental or resource limitations. A crucial role is played by the bio-physical counterpart of Return on Investment (ROI). Using little beyond arithmetic, it will be shown that an economics based on energy-based ROI and a systems approach will provide realistic expectations for the successful replacing of fossil fuels – particularly oil – by such presumably sustainable "green energy" sources as biofuels, fish farms, wind, tides or the Gulf Stream.

Scott Hochwald, University of North Florida

Euclidean Geometry is Officially Dead But It Shouldn't Be

This talk will present fascinating results from Euclidean Geometry that do not appear in Euclid's book. The intriguing results will often be complemented by unexpected proofs.

Su Hua, Graduate Student, University of West Florida

Cubic Spline with QR decomposition

To construct the cubic spline in an interval [a,b], a linear system is set up and there are two more variables than the number of equation. To make a square system, two arbitrary equations are inserted in all textbook, such as f"(a)=f"(b)=0 for the so called "cubic splines". This is unnecessary. There is another way to do it: Just accept the linear system as "under-determined" and apply the QR decomposition and solve the under-determined system for minimum norm solution.

Timothy W. Jones, Edison State College/Collier

Workshop: Poker and Popcorn: the Mathematics of Eating

Like to lose weight, learn a language, understand your mind as a biological computer, help bring the world into sustainability, and, in general, be all you can be? In this workshop we will engage in various activities that highlight the biological problem of acquiring nutrients from environments. For us humans our chief biological strategy is to use language. We explore how a subset of natural language, the natural numbers, allows an optimal solution to this most pressing problem.

Contributed Papers Session III

Marcelle Bessman, Florida State College

Teaching Calculus in the 21st Century

The technological resources for teaching are advancing rapidly
Our current economy demands we look at ways to promote cost-effective, quality instruction in Calculus. We consider here the MAA e-book publication: *Calculus, Modeling and Applications by David A Smith and Lawrence C. Moore.* The CD containing this book, which includes two semesters of Calculus, can be purchased

by students directly from the MAA for *$25.* I will discuss the book's use, resources, current status and activities.

Richard Tamburro, Daytona State College

Incredible Irrational Numbers

Irrational numbers are examined from the perspective of an irrational number-line including density and the modular patterns between successive irrational numbers. Geometric and non-geometric expressions of irrational numbers are explored with the Cantor-Dedekind hypothesis and irrational Pythagorean triangles. In addition, the two types of irrational numbers and a simple proof that repeating decimals are not irrational provide creative classroom discussions.

Carrie E. A. Grant, Julie A. Jurgens, Flagler College

Investigating Sport Trends

In this session, discover how Drs. Grant and Jurgens linked an elementary statistics with a business computer course to engage students through active and collaborative learning. Students in these courses used spreadsheets to organize, present, and statistically analyze real data. The sport-themed projects covered graphical displays of data, descriptive statistics, regression analysis, confidence intervals, and hypothesis tests. Data was collected from professional and college sports websites, as well as, from student participation in Wii Sports.

Ivars Peterson, Director of Publications and Communications at the MAA

Workshop: Writing Mathematics Well

The importance of communicating mathematics clearly and effectively is evident in the many ways in which mathematicians must write, whether to produce technical reports, expository articles, book reviews, essays, referee's reports, grant proposals, research papers, evaluations, or slides for oral presentations. With a focus on exposition, this workshop offers tips for improving writing skills, from grammar and usage to organization and manuscript or slide preparation. It also suggests how participants can contribute to the public understanding of mathematics.

Nikki Holtzer, Undergraduate Student, Stetson University

The Musicality of Continued Fractions

It is commonly known that the customary twelve tone scale, used for music in modern Western culture, can be represented in terms of ratios. This is largely attributable to mathematics established by Pythagoras. Utilizing his original ratios

to compute all frequencies of the chromatic scale, however, results in a contradiction. This discrepancy is commonly known as the Pythagorean Comma. This talk will focus on using continued fractions to create a mathematical model of the equal temperament, which cannot be achieved using Pythagorean ratios alone.

Rachel Levanger, Undergraduate Student, University of North Florida

Bent out of Shape: Taking a look at Perturbed Eigenvalues

In linear algebra we learn about finding the eigenvalues of a square matrix. What happens if the entries of this matrix change over time? How does this affect the eigenvalues? In this presentation, we will parameterize a matrix by a real variable and then see what can be said about the eigenvalues as the parameter changes, or as the matrix is perturbed. Will the eigenvalues exhibit a continuous or a smooth behavior? Let's find out!

Andrew D Hedman, Undergraduate Student, **Thomas W Hair,** Florida Gulf Coast University

Spatial dispersion of interstellar civilizations: a site percolation model in three dimensions

A site percolation model is presented that simulates the dispersion of an emergent civilization into a uniform distribution of stellar systems. This process is modeled as a three-dimensional network of vertices within which an algorithm is run defining both the number of daughter colonies the original seed vertex and all subsequent connected vertices may have and the probability of a connection between any two vertices. This algorithm is then run over a wide set of these parameters and for iterations that represent up to 250 million years within the model's assumptions.

Katie Bakewell, Undergraduate Student, University of North Florida

Optimizing Hamiltonian Paths in Jacksonville

A real-life problem concerning visiting the bridges crossing the St. Johns River in Jacksonville is modeled by a graph and optimal Hamiltonian paths are sought. This presentation discusses the advantages of a two step Hamiltonian Path Problem (HPP) and optimization approach to traditional Travelling Salesman Problem algorithms. Ore's theorem, HPP algorithms, and contextual applications are considered.

Contributed Papers Session IV

Robert Shollar, Matthew Carr, Bradley Trotter, Thomas Haugh, Emre Özgener, Mike Mears, C. Altay Özgener, Anthony Salain State College of Florida

Integrals From Room 27-132

Our calculus textbook "Larson et. al." contains a corner called "Putnam Exam Challenge."

We investigated some of these problems during our regular "Room 132 Problem Sessions" on Fridays, and come up with some solutions. We will present these solutions.

Timothy W. Jones, Edison State College/Collier

Euler's Identity, Leibniz Tables, and the Irrationality of Pi

There are several proofs of the irrationality of pi. We present a particularly simple one that uses Euler's famous formula -- the one that combines all the great mathematical constants: pi, e, -1, and 0. We also introduce a way of computing all the derivatives of the product of two functions quickly using Pascal's triangle: we show how to create a Leibniz tables. This table is the final step in the proof.

Daniela Genova, University of North Florida

Words, DNA Codes, and Combinatorial Problems

Mathematical limitations of classical computing have inspired many unconventional models of computation. In DNA computing, a problem is encoded on DNA strands, which then perform the computation according to Watson-Crick complementarity, and the result is decoded. This presentation will focus on some non-classical models of computation that were created to model molecular reactions more closely. These models are capable of defining the solutions to hard combinatorial problems and give rise to interesting mathematical questions.

Debbie Garrison, Valencia College

Hands on Activities to help Students Understand Algebra Concepts

Even college students can enjoy and benefit from hands-on learning. Come see what all the fun is about. I will share some classroom-tested activities that have

helped my students better understand algebra concepts like slope, piece-wise functions and rate of change.

Penny Morris and Jim Rhodes, Polk State College

A Day Without Statistics Is Like a Day Without Sunshine

If there is significant personal meaning, the student will be engaged. In statistics, there is a wide range of possibilities for projects that can make a student feel invested to see it through. This presentation explores those possibilities and provides ideas to actively involve students in the learning process.

Steven L. Blumsack, Florida State University

Workshop: Using GeoGebra to Analyze Pictures and Generate String Art

Participants will use available GeoGebra sketches to determine whether pictures of familiar objects—both man-made and natural-- correspond closely to conic sections and identify key parameters of the conic section. In addition, participants will use other available sketches to generate several examples of string art. These ideas have significant potential in Honors Algebra 2, Analytic Geometry, and Mathematics Appreciation courses.

Contributed Papers Session V

Kuiyuan Li, Raid Amin, Josaphat Uvah, University of West Florida

A Study on the Fully Online Hybrid Program in Math at UWF

A fully online program in mathematical science using hybrid synchronous instruction developed by at UWF has been successfully implemented since 2008. Distance students are taught simultaneously with face-to-face students in the same classes. In spring 2011, an assessment on several courses was conducted. The assessment results showed that the developed model is flexible and cost efficient, and benefits both groups of students and the distance students do as well as the face-to-face students.

David A. Rose, Polk State College

Fair Selection by Tossing a Coin

A fair coin is tossed using geometric methods to randomly select one object of N. For N not a power of 2, two different methods, branching and modified imaginary complement, compete for best efficiency.

Jacci White, Saint Leo University

Dynamic MAA-FL Program in 2013

This session is for you if you want to influence the MAA-FL program and conference for 2013. Come join us if you have ideas for keynote speakers, round table sessions, conference themes/strands, or other ideas or interests for the program. This is your section and your conference, have a voice and get involved.

Xiaoming Wang, Florida State University

Characterization of the divergence of test functions

Utilizing integration by parts, we show that a scalar test function (smooth function with compact support) on a domain in R^n is the divergence of a vector valued test function if and only if its integral over the domain vanishes. Using this result, we are able to provide an elementary proof of the characterization of the gradient of a distribution, i.e., when a vectored valued distribution is conservative. Applications to mathematical analysis of fluid problems will be mentioned at the end.

Dennis Runde, State College of Florida, Manatee-Sarasota

Ten (or More) Ideas for Writing the Best Possible Final Exam

Many teachers find the task of writing a final exam a truly daunting task. This talk will focus on several ideas to make this task easier and on ideas that will produce a better instrument to measure students' learning. Discussion will include writing a departmental common final exam as well as final exams given to individual classes. The talk will conclude with participants providing feedback on sample questions from a real final exam.

John T. Taylor, Florida State College, **Sharon E. Sweet**, Brevard Community College

Modeling Linear Functions Using Temperature Conversion Scales

The functional relationship between the Fahrenheit and Celsius scales are derived using the corresponding boiling and freezing points of water. Students then each create a unique scale using the student's body weight and the student's age as the boiling and freezing points of water respectively. This "student" scale is then compared to the Fahrenheit and Celsius scales. The resulting functions are

graphed and compared. We will illustrate this on the webpage:
http://www.lsua.info/mathworkshop1/frametemp2.html

Marcelle Bessman, Florida State College

Workshop: Clickable Calculus

Recent versions of the software Maple have reduced the need for programming skill by supplying menus from which you can pick mathematical symbols such as derivative, integral, radicals then use the Tab key to fill in the information you need. The learning curve to utilize Maple for visualization, computation and creating project reports has lost much, if not all, of its steepness. This presentation will focus on visualization and project reports mathematical "laboratory" reports.

Plenary Sessions

Joseph O'Rourke, Smith College

Bio: Joseph O'Rourke is professor and chair of the Computer Science Department at Smith College, a professor Mathematics, and director of Arts & Technology. He obtained his Ph.D. at the University of Pennsylvania in 1980, and taught at Johns Hopkins University for eight years before moving to Smith to found the Computer Science Department. His research is in computational geometry, developing algorithms for geometric computations. He has won several awards, including a Guggenheim Fellowship in 1987, and the NSF Director's Award for Distinguished Teaching Scholars in 2001. His early research is summarized in the monograph "Art Gallery Theorems and Algorithms." He subsequently wrote a textbook in computational geometry, and co-edited the "Handbook of Discrete and Computational Geometry." Recently he published with Erik Demaine a monograph "Geometric Folding Algorithms: Linkages, Origami, Polyhedra," and he has a new textbook with Satyan Devadoss on "Discrete and Computational Geometry." He has published more than 150 papers in journals and conference proceedings, more than 30 of which were coauthored with undergraduates. His most recent book, "How To Fold It," is written for high-school students.

Folding & Unfolding Convex Polyhedra

The surface of a convex polyhedron can be cut open and flattened to the plane as a simple polygon. In particular, the unfolding does not self-overlap. So the polygon may be cut out of paper and folded to the convex polyhedron. It is most natural to

restrict the cuts to follow the edges of the polyhedron. It remains an open problem to settle whether or not every convex polyhedron can be cut open to a "net" along edges. Without the edge restriction, there are several methods known to cut open any convex polyhedron to a polygon. I'll describe two recently discovered methods, both based on an idea of Alexandrov from the 1940's. The reverse process is equally interesting: Given a planar polygon, can it be folded to a convex polyhedron? I will show that every convex polygon folds to an infinite variety of distinct convex polyhedra. Nonconvex polygons are less well understood. I will show that the standard "Latin-cross" unfolding of the cube refolds to precisely 23 different convex polyhedra.

Monica K. Hurdal, Florida State University

Bio: Dr. Monica K. Hurdal is an Associate Professor of Biomathematics in the Department of Mathematics at Florida State University (FSU) in Tallahassee, Florida. She was awarded her Ph.D. in 1999 from Queensland University of Technology, Australia in Applied Mathematics. She completed her Bachelor of Mathematics degree in Computer Science and Statistics at the University of Waterloo, Canada in 1991 and worked in industry as a programmer for a few years in Canada and Australia before completing a Master of Science degree in Applied Mathematics and Psychology at the University of Newcastle, Australia in 1994. After completing her Ph.D., Dr. Hurdal was a postdoctoral research associate for two years at FSU in Mathematics and in Computer Science, working on conformal flat mapping the human brain and received funding from the Human Brain Project. She continued her research at Johns Hopkins University in the Center for Imaging Science as a Research Scientist, followed by her position in 2001 at FSU. Her research interests include applying topology, geometry and conformal methods to analyzing and modeling neuroscientific data from the human brain. She is developing models to study cortical folding pattern formation and she is investigating topology issues associated with constructing cortical surfaces from MRI data, computing conformal maps of the brain and applying topological and conformal invariants to characterize disease in MRI studies. Her research has been featured in Scientific American and in The Economist.

Understanding Cortical Folding Patterns in Development, Aging and Disease

There is controversy and debate regarding the mechanisms involved in cortical fold formation. Current cortical morphogenesis theories describe folding using tension-based or cellular-based arguments. Modeling and understanding cortical folding pattern formation is important for quantifying cortical development. Hypotheses concerning brain growth and development can lead to quantitative biomarkers of normal and abnormal brain growth. Cortical folding malformations have been related to a number of diseases, including autism and schizophrenia. In this seminar I will present a biomathematical model for cortical folding pattern

formation in the brain. This model takes into account global cortex characteristics and can be used to model folds across species as well as specific diseases involving cortical pattern malformations that can occur in human brain folding patterns, such as polymicrogyria. We use a Turing reaction-diffusion system to model cortical folding. Turing systems have been used to study pattern formation in a variety of biological applications. They use an activator and inhibitor and under certain conditions a pattern forms. We use our model to study how global cortex characteristics, such as shape and size of the lateral ventricle, affect cortical pattern formation. Due to the complex shape and individual variability in folding patterns and the surface-based functional processing of the brain, "flat" maps of the brain can lead to improved analysis, visualization and comparison of anatomical and functional data from different subjects. It is impossible to flatten a surface with intrinsic curvature (such as the brain) without introducing linear and areal distortion but it is possible to preserve angular (conformal) information under flattening. I will also discuss a method called "circle packing" which I am using to generate quasi-conformal maps of the human brain. I will present examples of some of the brain maps I have created and discuss how 150-year-old and modern mathematics may be applied to enable neuroscientists to better understand the functioning of the human brain.

Ivars Peterson, Director of Publications and Communications at the MAA

Bio: Ivars Peterson is Director of Publications and Communications at the Mathematical Association of America. As an award-winning mathematics writer, he previously worked at Science News for more than 25 years and served as editor of Science News Online and Science News for Kids. His books include The Mathematical Tourist, Islands of Truth, Newton's Clock, The Jungles of Randomness, and Fragments of Infinity: A Kaleidoscope of Math and Art. In 1991, Ivars Peterson received the Joint Policy Board for Mathematics Communications Award recognizing him for his "exceptional ability and sustained effort in communicating mathematics to a general audience." During the spring semester of 2008, Ivars Peterson served as the Basler Chair of Excellence for the Integration of the Arts, Rhetoric, and Science at East Tennessee State University in Johnson City.

The Jungles of Randomness

From slot machines and amusement park rides to dice games and shuffled cards, chance and chaos pervade everyday life. Sorting through the various meanings of randomness and distinguishing between what we can and cannot know with certainty proves to be no simple matter. Inside information on how slot machines work, the perils of believing random number generators, and the questionable fairness of dice, tossed coins, and shuffled cards illustrate how tricky randomness can be.

XLV Joint Meetings of the

Florida Section of the

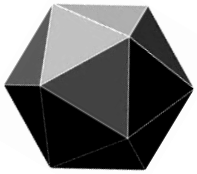
Mathematical Association of America

And the

Florida Two-Year College Mathematics Association

University of North Florida

February 17-18, 2012



SPECIAL THANKS TO

The University of North Florida
The Department of Mathematics and Statistics

The Organizing Committee

Scott H. Hochwald, Daniela Genova, Cassie Walther, Robert Farley
The UNF faculty and student volunteers who helped execute this event

Publishers

W. H. Freeman/Macmillan, Cengage Learning,
John Wiley & Sons, Inc., Pearson Education