Abstracts

Friday, February 13, 2009

Plenary Session 2:00 – 2:50

#1 Joseph A. Gallian, University of Minnesota Duluth ACAD5 112

Using groups and graphs to create symmetry patterns

We use video animations to explain how Hamiltonian paths, spanning trees, cosets in groups, and factor groups can be used to create computer generated symmetry patterns in hyperbolic and Euclidean planes. These methods were used to create the image for the 2003 Mathematics Awareness Month poster.

Contributed Papers Session 3:00 – 3:45

#2 David Rose, Florida Southern College Lutgert 1201

Undergraduate Student Research and Union Spaces

Union spaces are partial topological spaces where only unions of open sets, not finite intersections, are assumed open. This is a wide-open brand new area of study accessible to undergraduates and rife with applications of unification and generalization. Joint work with an undergraduate, Adam Trewyn, will be highlighted.

#3 Lubomir Markov, Barry University Lutgert 1202

A short proof of the irrationality of the tangent at nonzero rational points

The first part of the talk will introduce several analytic techniques in the study of irrational and transcendental numbers. In the second part, we shall present a new

(shortest to date?) proof of the irrationality of tan(r) for rational r≠0. As a consequence, one obtains the irrationality of π.

#4 Don Ransford, Edison Community College Lutgert 1203

The Road Ahead for Undergraduate Mathematics

The implications of the post-industrial society in the 21st century and the impact they are having on undergraduate mathematics education are evident in the characteristics of students in today's classrooms and the statistics associated with the pursuit of mathematically-related degrees. The presenter will share a short history of undergraduate mathematics education and some personal suggestions for areas that need to be reexamined and possible solutions, and will then open the floor for a sharing of observations and ideas from the participants.

#5 Michael Jones, Stetson University Lutgert 1206

Modeling a potential spread of the Avian Flu Influenza (H5N1) for the United States

Identified by health organizations across the world as the next potential epidemic, the H5N1 flu virus has received extensive attention in the past 5-7 years. While not transmittable between humans, many governments are attempting to develop models to represent a worse case scenario of an avian flu influenza outbreak.

While there are several epidemic models to choose from, we choose to look into a Susceptible, Exposed, Infected, and Recovered (SEIR) compartmental model. A time dependent SEIR model in terms of a system of ordinary differential equations (ODE) is implemented and solved. In addition, a new time and spatial model is developed in terms of a system of partial different equations (PDE). A constant population model with a nonzero and zero birth and death zero is considered. Using the basic SEIR model, we can look into developing future models incorporating vaccine strategies that may be utilized for any location in the United States, while also looking into the potential behavior of the disease.

#6 Ryan Rogers, Stetson University Lutgert 1206

Using Hamilton's Principle to Approximate Soliton Solutions for Nonlinear Partial Differential Equations

This project will involve the analysis of nonlinear PDE's and ODE's using Hamilton's Principle. Pre-existing models will be utilized, such as the KdV and the NLS equations, to find soliton (localized structure) solutions. The use of Hamilton's Principle will be used to justify the existence of solitons in particular systems.

#7 Menaka Navaratna, Florida Gulf Coast University Lutgert 2208
Channa Navaratna, Indiana University of Pennsylvania

Non-linear filtering with mobile/fixed Antennas.

Nonlinear filtering technique, particle filter, is compared against the traditional triangulating and linearized techniques in locating wildlife. In particular, localization is considered under realistic situations where temporary equipment malfunctions. Mobile receivers in conjunction with stationary receivers are studied in order to improve faster and accurate tracking.

#8 Wendy Perry, University of Tampa Lutgert 2209

Using Technology to Teach Introductory and College Algebra

Today's students are mathematically challenged, but technologically savvy. This presentation is about the use of PowerPoint presentations, Flash animations, IBM tablet PC, laptops in the classroom, MyMathLab (online homework system), Blackboard and eBooks to teach Algebra. Although the focus is on teaching Algebra, this technology applies to all other courses.

Contributed Papers Session 4:00 – 4:45

#9 Scott White, St. Petersburg College Lutgert 1201

Math in Sports; or … How to Serve a Volleyball

Believe it or not, math is integral to all sports. In volleyball, it defines the dynamics of the serve which is the best determinant of victory. The team with a better serve will usually win the game so being proficient in serving is very important.

The flight of the volleyball can be modeled using parametric equations derived by integrating from acceleration to velocity to position. Then the model can be used to determine an "optimal" serve. The exercise can then be expanded to include the higher order affects of air drag, boundary layer separation, lift, and vortex shedding.

#10 Shanzhen Gao, Florida Atlantic University Lutgert 1202

Some Remarks On Some Classical Combinatorics Problems

The term Classical Combinatorics, is roughly the combinatorial analog of Classical Analysis. Today it is better known as Enumerative and Algebraic Combinatorics. One of the fastest growing areas of modern mathematics, it touches upon many areas of mathematics and science. I will emphasize the more classical aspects of enumerative combinatorics.

#11 Daniel Dreibelbis, University of North Florida Lutgert 1203

What is Elliptic Curve Cryptography?

This talk will cover the basics of the Key Exchange Problem, elliptic curves over finite fields, the Elliptic Curve Discrete Log Problem, and how this hard problem is used to solve the KEP.

#12 Stephen Rowe, Wilkes Honors College, FAU Lutgert 1206

Invariant subspaces and orbits of operators

We discuss orbits of operators and their connection to invariant subspaces. Starting with a point x in a normed space and repeatedly applying an operator T on x, the sequence $\{x,Tx,T^2x,...\}$ is an orbit. We will analyze the existence of certain types of orbits and solutions to the invariant subspace problem.

#13 Isaac DeFrain, Justin Owen, Wilkes Honors College, FAU Lutgert 1206

The Leap from Classical Physics to Quantum Mechanics

In this talk we look at the development of ideas and concepts (such as position and momentum) from classical physics to quantum mechanics and show that many classical equations have direct analogy in quantum mechanics. We discuss the use of Hilbert space techniques and the role of unbounded linear operators.

#14 Kari Fowler, University of Tampa Lutgert 2208

Value Distribution for Differential Polynomials in the Unit Disk

Value distribution theory of functions measures the number of times a function $f(z)$ assumes a value a, as z grows in size. We investigate values assumed by linear combinations of $f(z)$ and its derivatives, when such combinations are nonconstant. We further discuss Riccati versions of these results.

#15 Cathleen Horne, Broward College Lutgert 2209
John Adam, Old Dominion University

Student Projects: Quadratics and Birds' Eggs for the Pre-Calculus and Calculus Students

Connections between topics and more in-depth study are the goals of our student projects. For the Precalculus students, a project on Quadratic Equations, and for the Calculus students, several mathematical models of the shape, surface area and volume of birds' eggs are presented.

Contributed Papers Session 5:30 – 6:15

#16 Catherine Beneteau, University of South Florida Lutgert 1201

Lifting Algorithms for Wavelet Transformations

In this talk, I will discuss so-called lifting algorithms for discrete wavelet transformations. Such transformations are used in image processing applications. In particular, I will define what lifting means, why it is useful, and what some of its applications are (for example, in integer to integer transformations). Finally, I will briefly describe how this topic can be used as an undergraduate research problem or as an end of semester final project.

#17 Ted Andresen, St. Petersburg, Florida Lutgert 1202

Bone Mineral Density, Hip Fractures and Running in Space

This presentation will review the concepts behind the z and t-scores associated with the Bone Mineral Density (BMD) and the correlation between BMD and hip fractures. Activities to prevent loss of bone mineral density and muscle strength on earth and for astronauts working on the space stations will be described.

#18 Jordan Enzor, Hawkes Learning Systems Lutgert 1203

Improving Student Performance With Mastery Based Software

Discover the benefits of using interactive software in teaching and learning mathematics. Hawkes Learning Systems (HLS) promotes grade improvement and motivates students to succeed by engaging them in the learning process. Students learn more efficiently and effectively through tutorials, unlimited practice, mastery-based homework assignments, and error-specific feedback. HLS is the solution for your students' success!

#19 Cori Ouellette, William Severa, Wilkes Honors College, FAU Lutgert 1206

From Textbook to Reality: Was Torricelli Right?

Torricelli's law relates the rate at which a tank drains through a small aperture to the water level in the tank. In reality, the ideal rate is adjusted by an experimental "fudge factor." We fit data from draining various bottles to estimate this factor and verify Torricelli's model.

#20 David Holz, Wilkes Honors College, FAU Lutgert 1206

Where is the Light? Connecting Shadows and Lights with Dandelin Spheres

The position of a light source can be inferred from the shadow cast by a sphere on a plane. According to Dandelin's Theorem, the sphere touches its elliptical shadow on its focus. We discuss the numerical stability of this construction and several alternatives, with applications to computer vision.

#21 Scott Hochwald, University of North Florida Lutgert 2208

Mathematical Amusements

I will present mathematics that has a twist. Here's an example. A fair coin is tossed until two heads in a row are observed. What is the probability that this experiment ends on the 12th toss? The answer involves the Fibonacci sequence.

#22 Tom Vogel, Stetson University Lutgert 2209

Solitons in Microstructured Solids and Biological Transport Models

The model used for one-dimensional longitudinal wave propagation through microstructured solids is a KdV-type equation with third- and fifth-order dispersions as well as first- and third-order nonlinearities. Recent work has identified periodic soliton solutions in the aforementioned model using numerical integration techniques. The present work utilizes a variational approximation to locate (in parameter space) where ordinary solitons exist in the model, as well as extends the known family of soliton solutions in the model to include embedded solitons. The variational results for both ordinary solitons and embedded solitons are validated with selected numerical solutions. Additionally, recent work will be presented regarding the search for soliton-type solutions in a commonly used

biological transport model which physically describes ion transport across a cell membrane by way of a modified Burger's equation.

Abstracts

Saturday, Valentine's Day, 2009

Plenary Session 9:00 – 9:50

#23 Meredith Blue, NextEra Energy ACAD5 112

Accidents Will Happen – Estimating Risk in Nuclear Power Plants

The strong nuclear force encompasses vast amounts of energy. Nuclear power plants convert much of this energy into useable electric power. Of course, "with great power comes great responsibility", and we must weigh the risks and ensure nuclear plants are operated in a safe manner. A Probabilistic Risk Assessment (PRA) model is built by developing fault trees (a logic structure combining logical operators with failure events) that are linked to particular accident sequences. Each unique accident scenario has a minimal set of individual events that must all occur in order for the accident to result. That is, each unique accident scenario corresponds to a particular set of individual failures (component failures, human errors, system failures etc). The probability of each unique accident scenario can only be estimated as many assumptions are required for computation to occur; resulting in uncertainty in the "accident frequency."

Contributed Papers Session 10:00 – 10:45

#24 I. A. Sakmar, University of South Florida Lutgert 1201

Double Triangular Numbers

We study the problem of existence and types of the double triangular numbers.

#25 Joel M. Berman, Valencia Community College Lutgert 1202

Just Jing It

Jing is a screen-capture program designed for quick and dirty communication. The presenter will show how to use the program to create short math demonstrations and grade homework, and will discuss the program's advantages and limitations.

#26 Jim Condor, Manatee Community College Lutgert 1203

Transition Modules in Higher Education: Redesigning the Mathematics Curriculum

Technology has redefined the skills necessary for gainful employment in science and non-science related fields. This workshop will discuss the need for significant changes in pedagogical content and the way mathematics is taught. The participants will be given an opportunity to explore the idea of a transition module that is driven by technology in order to visualize probabilistic modeling in a constructivist environment.

#27 Eugene Belogay, Wilkes Honors College, FAU Lutgert 1206

Exit Strategy in the Rain: Walk or Run? Myth Busted!

Which is better: walk or run in the rain? Surprisingly, this timeless nondifferentiable optimization problem (discussed even on *Myth Busters*) has no simple answer. The strategy depends in complicated ways on the wind direction and the runner's shape. We present a geometric solution, accessible to undergraduates and aided by spreadsheet computations.

#28 Raid Amin, Rohan Hemasinha, Kuiyuan Li, Josaphat Uvah Lutgert 2208
University of West Florida

Using an Interactive Learning Environment in Graduate Mathematics Science Courses

Commencing in Summer 2008, the Department of Mathematics & Statistics started offering selected mathematical sciences graduate courses simultaneously to distance students and to local students in a face-to-face classroom. One of the challenges was to engage students who were taking the course remotely at the same level as the students who are taking this course in a face-to-face format. Our goals were multi-faceted as we wanted theses courses to attain high levels of student learning in addition to achieving a high level of retention, engagement, and course satisfaction of the distance students.

We made use of the software *Elluminate* to bridge the gap between local and distance students and the lecturer. We used a smartboard to write the lectures on, while distance students were able to log on at the same lecture time to see my writing and to hear my voice as we were giving our lectures. All students were able to ask questions at any time of their choice during the lectures. Distance students would "raise their hands" on the Elluminate screen visible to us on the smartboard. In certain classes the handwritten lectures and other supplementary course material were made available to all students, via posting in the e-learning course site.

One of the objectives of the endeavor was to find out how to enhance the learning experience in *Elluminate* enabled hybrid interactive distance learning courses. In this presentation we discuss similarities and disparities among instructional methods, and learning processes in three types of graduate courses, a pure mathematics course, an applied statistics course and two applied mathematics courses.

#29 Ben Fusaro, Florida State University Lutgert 2209

Environmental Modeling

This material can be used for a six-week module in a general education course or as a module in an introductory modeling course. The core notion is a five-stage modeling process –

1st Draw an energy/material *flow diagram* using simple, intuitive components.
2nd Draw a *qualitative* energy *vs.* time graph.
3rd Develop a *flow equation* (a D.E. in disguise).
4th Solve the flow equation numerically.
5th Construct a conventional energy *vs.* time graph.

Please bring a calculator or (if you're comfortable using Excel or BASIC) a laptop.

Contributed Papers Session 11:00 – 11:45

#30 Paul Yiu, Florida Atlantic University Lutgert 1201

Heptagonal triangles and their companions

A heptagonal triangle is a non-isosceles triangle formed by three vertices of a regular heptagon. Its angles are $\pi/7$, $2\pi/7$ and $4\pi/7$. As such, there is a unique choice of a companion heptagonal triangle formed by three of the remaining four vertices. Given a heptagonal triangle, we display a number of interesting companion pairs of heptagonal triangles on its nine-point circle and Brocard circles. Among other results on the geometry of the heptagonal triangle, we prove that the circumcenter and the Fermat points of a heptagonal triangle form an equilateral triangle. The proof is an interesting application of Lester's theorem that the Fermat points, the circumcenter and the nine-point center of a triangle are concyclic.

#31 Alex Kane, University of North Florida Lutgert 1206

Closure Properties of Involution Codes

Involution codes were inspired by difficulties with DNA strand design associated with undesirable hybridization. This talk presents examples of morphic and antimorphic involutions and discusses coding properties of languages that are preserved under certain language operations such as union and concatenation.

Scott Hochwald, University of North Florida Lutgert 1206

Governor's Session

How does the MAA attract and retain new members and increase attendance at meetings? What should the national MAA be doing for sections? What should sections be doing for the national MAA?

#32 Kuiyuan Li, Josaphat Uvah, Raid Amin, Rohan Hemasinha Lutgert 2208
University of West Florida

A Study of Non-traditional Instruction on Qualitative Reasoning and Problem Solving in General Studies Mathematics Courses

In this paper we discuss pair-wise comparisons of students' performance in College Algebra and Elements of Statistics courses among three instruction formats: the traditional face-to-face lecture without technology enhancement, the blended face-to-face lecture with web-based homework, and the fully online. Overall, there was no evidence of a difference in the students' mastery of College Algebra concepts between instruction given in the traditional and blended modes. Students in the blended Elements of Statistics classes outperformed those in the traditional format. These findings are consistent with previous studies such as those reported by Barnes, Cerrito, & Levi (2004). However, students in the fully online classes performed significantly worse than those who had the face-to-face lectures in the blended and traditional formats. Our results illuminate nuances which suggest that the very attributes of face-to-face instruction with web-based homework systems and fully online classes that are beneficial to the top performing students may be detrimental to the lowest performing students. We offer some suggestions to rectify the situation.

Plenary Session 12:00 – 12:50

#33 Edward B. Burger, Williams College ACAD5 112

"How Always to Win at Limbo" or "You can sum some of the series some of the time, and some of the series none of the time... but can you sum some of the series ALL of the time?"

Have you ever gone out with someone for a while and asked yourself: "How close are we?" This presentation will answer that question by answering: What does it mean for two things to be close to one another? We'll take a strange look at infinite series, dare to mention a calculus student's fantasy, and momentarily consider transcendental meditation. In fact, we'll even attempt to build some very exotic series that can be used if you ever have to flee the country in a hurry: we'll either succeed or fail... you'll have to attend the lecture to find out. Will you be at the edge of your seats? Perhaps; but if not, then you'll probably fall asleep and

either way, after the talk, you'll feel refreshed. No matter what, you'll learn a sneaky way to always win at Limbo.

This presentation is open to all math fans--young and old alike. A familiarity with infinite series is helpful. If you've ever heard of the words "triangle inequality", then this is the talk for you.

Don Ransford, Edison Community College

The Road Ahead for Undergraduate Mathematics

The implications of the post-industrial society in the 21st century and the impact they are having on undergraduate mathematics education are evident in the characteristics of students in today's classrooms and the statistics associated with the pursuit of mathematically-related degrees. The presenter will share a short history of undergraduate mathematics education and some personal suggestions for areas that need to be reexamined and possible solutions, and will then open the floor for a sharing of observations and ideas from the participants.