Program of Activities
For the Spring Meeting of the

# Mathematical Association of America

# Ohio Section


Spring, 2014
University of Toledo
Toledo, Ohio
April 4-5, 2014

MAA Ohio Section

# Program

## Friday, October 4

| | | |
|---|---|---|
| 12:00-4:00 | Registration | East Lobby |
| 12:00-1:20 | Student Team Competition | UH4410 |
| 12:00-1:00 | Committee Meetings: | |
| | Centennial Committee | FH 2620 |
| | CONCUR (Curriculum) | FH 2640 |
| | CONSACT (Section Activities) | FH 2660 |
| | CONTEAL (Teacher Education & Licensure) | FH 2680 |
| 1:00-4:00 | Vendor & Book Exhibits | Atrium |
| 1:30-1:45 | Welcome and Announcements Lloyd Jacobs, Karen Bjorkman | FH 2100 |
| 1:45-2:45 | Invited Address: **"How Math is Changing the World"** Michael Dorff | FH 2100 |
| 2:45-3:10 | Break | Atrium |
| 3:10-3:15 | Centennial Minute | FH 2100 |
| 3:15-4:15 | Invited Addresses:<br>2 25-minute presentations<br>**"Vehicle Impact Test Form Based on a Modified Super-Ellipse"** Steve Goldner<br><br>**"Protected Mobility Optimization for the Army Ground Fleet"** David A. Lamb | FH 2100 |
| 4:25-6:20 | **Contributed Paper Sessions** | FH 2200-2260 |
| 4:25-6:20 | Executive Committee Meeting | FH 2430 |
| 6:30-6:50 | Social Time | Libbey Hall |
| 6:30-8:00 | Student Pizza Party | Atrium |
| 6:50-8:00 | Banquet | Libbey Hall |
| 8:15-9:15 | After dinner panel: **"A Mathematics Education, Today's Industrial Opportunities"** Steve Goldner, David Lamb, Emmanual Tsimis | FH 2100 |
| 9:15 | Business Meeting and Presentation of Teaching Award | FH 2100 |

MAA Ohio Section

# Program

## Saturday, April 5

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|---|---|---|
| 8:00-10:00 | Registration | East Lobby |
| 8:00-10:00 | Book Vendors and Exhibits | Atrium |
| 8:00-8:50 | Coffee and Pastries | Atrium |
| 8:05-8:40 | Committee on Local Arrangements | FH 2620 |
| 8:05-8:40 | Meeting of Department Chairs and Liaisons | FH 2640 |
| 8:50-9:00 | Welcome and Announcements Paul Hewitt | FH 2100 |
| 9:00-10:00 | Invited Address: **"A Couple of Integrals, a French Friar, and a Wacky Experiment"** Charles Groetsch | FH 2100 |
| 10:00-10:20 | Break | Atrium |
| 10:25-11:40 | **Contributed Paper Session** | FH 2200-2260 |
| 11:50-12:50 | Retiring President's Address: **"Ideal Prime Factors to Ideals: A Glimpse of a Structural View of Algebra"** Phil Blau | FH 2100 |
| 12:50-1:00 | Closing Remarks | FH 2100 |

# Abstracts of Invited Addresses

## Friday

### *How math is changing the world*

Michael Dorff
Brigham Young University

**Abstract:** In Oct 2010, an article called "How much math do we really need?" was published in the Washington Post. The author, a mathematician, wrote "Unlike literature, history, politics and music, math has little relevance to everyday life" and "All the mathematics one needs in real life can be learned in early years without much fuss." Is this true? Have you ever been asked, "What can you do with a degree in math?" Besides teaching, many people are clueless on what you can do with strong math skills. In this talk, we will talk about some of the exciting things mathematicians in business, industry, and government are doing in their careers and how these things are changing the world. And we will reveal the three things that recruiters say every math student should do to get a job.

### *A Vehicle Impact Test Form Based on a Modified Super-Ellipse*

Steve Goldner
First Technology Safety Systems

**Abstract:** The physical form and use of an automotive impact testing head is based on a modified super-ellipse of the mathematical form (X/X0)2 + (Z/Z0)3 = 1. A comparison to the shape of an equivalent human head is given. The utility and effects of the tests and the test program on motor vehicle safety are introduced. Comparisons to other uses of standard super-ellipses are discussed

### *Protected Mobility Optimization for the Army Ground Fleet*

David A. Lamb, Ph.D.,
TARDEC

**Abstract:** The Army wants its ground vehicle fleet to be highly mobile, while also protecting the soldiers inside from both enemy activity and automotive accidents. The term for this is “protected mobility,” and TARDEC is striving to optimize the portfolio of ground vehicles in this way. A lot of the modeling and simulation (M&S) for ground vehicle engineering is used to design platforms to have optimized protected mobility. Because of the inherent complexity of the problem, the mathematics used for protected mobility optimization is interesting and challenging. This talk will discuss several ways the Army is improving the protected mobility of the ground fleet using mathematical modeling and simulation.

# Saturday

## *A Couple of Integrals, a French Friar, and a Wacky Experiment*

Charles Groetsch
The Citadel

**Abstract:** This talk is for calculus students and their instructors. It is partly homage to a remarkable, yet under-appreciated, seventeenth century scholar, but mostly it is an illustration of the power of calculus to model physical processes and validate experimental observations. Prior to Newton's mathematization of motion, symmetry was often assumed as a matter of course in natural motions. But some bold (some would say 'wacky') experiments conducted early in the seventeenth century suggested a surprising temporal asymmetry in a simple violent motion. We tell this story and 'do the math' to shed light on this centuries old experiment.

## *Ideal Prime Factors to Ideals: A Glimpse of a Structural View of Algebra*

Phil Blau
Shawnee State University

**Abstract:** The failure of unique factorization in some domains of complex numbers led Kummer to develop the notion of an ideal prime factor in 1846. With Kummer's work as a point of departure, Dedekind developed his theory of ideals, publishing four versions between 1871 and 1894. Meanwhile, Kronecker expanded on Kummer's work through his theory of divisors, first published in 1881 but worked out more than 20 years earlier. This talk will include biographical facts about these three mathematicians. We will also look at the role their work played in the evolution of the idea of an algebraic structure. This structural image of algebra can first clearly be discerned in the1930 classic text *Moderne Algebra* by van der Waerden.

# Brief Biographies of Invited Speakers/Panelist

## Michael Dorff, Brigham Young University

**Michael Dorff** is a professor of mathematics at Brigham Young University. He earned his Ph.D in 1997 from the Univ. of Kentucky in complex analysis. He was a professor at the Univ. of Missouri-Rolla before accepting a position in 2000 at BYU. He has published about 35 refereed papers and has given about 250 talks on mathematics. He is interested in undergraduate research, in non-academic careers in mathematics, and in promoting mathematics to the general public. Currently, he directs or co-directs three NSF funded programs: CURM (the Center of Undergraduate Research in Mathematics), MAA's RUMC (Regional Undergraduate Mathematics Conferences), and PIC Math (Preparation for Industrial Careers in the Mathematical Sciences). He is a member of the MAA, AMS, SIAM, CUR, AAAS, and Project NExT, and has served in many positions including governor of the MAA Intermountain section, member of the Executive Board of CUR, and member of the editorial boards of the American Math Monthly, Math Horizons, and Involve. He was a Fulbright Scholar in Poland, a Fellow of the AMS, and received a Deborah and Franklin Tepper Haimo Award from the MAA. He is married with 5 daughters.

## Steve Goldner, First Technology Safety Systems

Mr. Steve Goldner joined Humanetics in 1973 in charge of certification testing of automotive dummies. He also produced and certified radioactively loaded phantoms for simulated human safety applications. He later became Chief Test Engineer. When the Humanetics' operation located in Carson, California was transferred to the Plymouth, Michigan Technical Headquarters Office he relocated as Senior Project Engineer for First Technology Safety Systems. He has been the Project Manager on a number of different ATD Programs. Steve was project engineer on the Six-Year-Old dummy (Part 572 Sub Part G.) His initials can be found on the drawings of the Six-Year-Old dummy that is contained in the legislative package today.

He has worked on the development of dummies for military programs including the "Live Fire Project", the "Airman Manikin" and the Sea Water Immersion Manikin. He has also worked on the development of dummies for ejection seat testing and FAA commercial aircraft tests, as well as updated aerospace manikins to JPATS anthropometry, and developed new headforms using CAESAR data (JSF heads). He was involved in developing a new headform for ejection mitigation testing and lateral impact testing of side curtain air bags (18KG head). In addition, he has designed and developed test equipment for the calibration of the Hybrid II and Hybrid III dummies. One of his key roles currently is to coordinate modifications to our products per customer specifications. He also is responsible for engineering support on frontal impact dummies and various headform dummies.

He is currently serving as the treasurer of the SAFE Association. Mr. Goldner holds a Master degree in Material Sciences and a Bachelor of Science degree in Physics from the California Institute of Technology**.**

## David A. Lamb, United States Army

Dr. Lamb is an applied mathematician and computer scientist working for the U.S. Army. He is the Senior Technical Expert for military ground vehicle modeling and simulation (M&S), and his personal research is in optimization, especially optimization under uncertainty. He has a B.S. with honors from George Mason University in 1985, where he majored in mathematics. He earned a Ph.D. from the University of Wisconsin-Madison in 1992, under the direction of Prof. Ken Kunen, with a major in mathematics and a minor in computer sciences. He is active with SAE, where he is currently the chairman of the Ground Vehicle Reliability committee, and also with SIAM, where he is the co-President of the Great Lakes Section. He has worked for the U.S. Army Tank-automotive Research, Development, and Engineering Center (TARDEC) since 1994.

## Emmanual Tsimis, Siemens

Received Diploma in Civil Engineering from the Polytechnic School of the Aristotle University of Thessaloniki, Greece, in 1969. In 1971 received Master's Degree in Applied Mathematics from the State University of New York at Stony Brook. In 1972 received Master's Degree in Geodesic Science from The Ohio State University at Columbus Ohio. In 1977 received the Ph.D. degree in Applied Mathematics from the State University of New York at Stony Brook. 1977 - 1981 was Assistant Professor of Mathematics at Wayne State University in Detroit, Michigan. 1982-1983 served in the Greek Army and
taught in the School for Technical Lyceum Teachers. 1983-1998 worked on the General Motor's in-house CAD system, serving as technical leader in the design and implementation of many CAD operations. In 1984 developed the first industrial automatic approximation of a general parametric surface by NURBS and Piecewise Polynomial representation for data exchange purposes. Those algorithms are still in use. Other CAD operations were intersection of surfaces, various projections of a curve on a surface, tracing of geodesics, curvature lines, and isoclines on a surface, computation of the minimum/maximum distance between geometric entities, and the implementation of a feature-based general design method, patented by GM Research Labs.
1999 - 2009 worked for the Unigraphics CAD System, particularly in the development of tools used in the manufacturing processes of Die Engineering and Die Design. Challenging problems here were: (a). the generation of a variational sweep surface, tangent to two surfaces along given curves, with curvature constraints, automatically filling in gaps and resolving overlaps. (b). the automatic reconstruction from scanned point-data of a sheet-metal panel compensated for spring-back after a stamping operation. The original surface continuity and topology of the design are kept. (c). Create the kinematic surface of a straight segment sweeping along a guide curve, satisfying given constraints, and handling singular components as well as corners. 2009 to present worked for the Siemens PLM NX Freeform modeling. Challenging problem was the creation of the developable surface connecting two given curves in 3D geometric space.

## Chuck Groetsch, The Citadel

**Chuck Groetsch**, a New Orleans native, is the founding dean of the School of Science and Mathematics at The Citadel, where he currently is Citadel Distinguished Professor of Mathematical Science. During a long career at the University of Cincinnati he served as dean of the McMicken College of Arts and Sciences, and head of the Department of Mathematical Sciences. Groetsch is the author of nine books, some of which have been translated into Japanese and Chinese, and numerous research papers. He serves on the editorial boards of several journals, including a stint as book review co-editor, with his colleague Ken Meyer, of *SIAM Review*. He has held visiting appointments at universities in the US, England, Germany, Switzerland, and Australia. The MAA recognized him with the *George Pólya Award* for expository excellence in 1994, and the editors and authors of the *Journal of Integral Equations and Applications* dedicated two special issues to Groetsch in 2010 citing his "many contributions to the world of mathematics" and his "fundamental contributions to the field of inverse problems." He was inducted a Fellow of the American Association for the Advancement of Science in 2011 in recognition of his "distinguished contributions of the application of mathematics to science, particularly in the areas of inverse or ill-posed problems, approximation theory, and mathematical modeling" (AAAS Citation). Chuck enjoys nothing better than blending mathematics, science and history in his teaching.

## Phil Blau, Shawnee State University

Phil Blau received his Mathematics Ph.D. from the University of Massachusetts in the area of ring theory. After 4 years teaching at Boston University's College of General Studies, he has been at Shawnee State University, where he is currently a Professor of Mathematical Sciences and the Director of the General Education Program. Currently President, his service to the MAA Ohio Section includes membership on the Program Committee, CONTEAL, and CONSACT (including a year as chair), as well as the local arrangements for the 2007 Spring Meeting. Prior to this involvement with the Ohio Section, he co-chaired the program committee for a meeting of the Northeastern Section. His current interests include studying original source material in mathematics, so he is grateful to be a member of the ORESME reading group.

# Contributed Paper Sessions
# Friday, April 4

| Time | Session A<br>Room 2200<br>Session Chair:<br>Nate Iverson | Session B<br>Room 2210<br>Session Chair:<br>Chris Swanson | Session C<br>Room 2220<br>Session Chair:<br>Tom Wakefield |
|---|---|---|---|
| 4:25-4:40 | ***MindTap***<br>Abstract 1<br><br>Mary Beth Segerlind<br>Cengage | ***Dicey Art***<br>Abstract 2<br><br>Keenan Brooks<br>Denison University | ***The Pythagorean Theorem: A Geometric Series Approach***<br>Abstract 3<br><br>Emily Hoopes &<br>Jenna Wise<br>Youngstown State |
| 4:45-5:00 | ***Fluid Queues: What are they and what is the mathematics behind them?***<br>Abstract 7<br><br>Barbara Margolius<br>Cleveland State University | ***An Elegant Mathematical Magic Trick***<br>Abstract 8<br><br>Jon Stadler<br>Capital University | ***The Lost Art of Spherical Trigonometry***<br>Abstract 9<br><br>Katie Cerrone<br>University of Akron |
| 5:05-5:20 | ***Jackknife Empirical Likelihood Method for Testing the Equality of Two Variances***<br>Abstract 13<br><br>Ying-Ju Chen<br>Bowling Green State University | ***Fun with the Mobius Band***<br>Abstract 14<br><br>Claire Van Fossen<br>Denison University | ***Constructability and Greek Number Sense***<br>Abstract 15<br><br>Shawn Doyle<br>Youngstown State University |
| 5:25-5:40 | ***Particle Swarm Optimization: A Stochastic Approximation Approach***<br>Abstract 19<br><br>Quan Yuan<br>Wayne State University | ***Magic Squares and Some Combinatorics***<br>Abstract 20<br><br>Ashley Orr<br>Youngstown State University | ***The Summation of the Reciprocals of Fibonacci Numbers***<br>Abstract 21<br><br>Eric Stone<br>Youngstown State University |
| 5:45-6:00 | ***Sperm Banks – A Probability Problem***<br>Abstract 25<br><br>MB Rao<br>University of Cincinnati | ***The Search for Transcendental Numbers***<br>Abstract 26<br><br>Blain Patterson<br>Youngstown State University | ***An Introduction to Arithmetico-Geometric Series***<br>Abstract 27<br><br>Alissa Geisse & Cassandra Shaffer<br>Youngstown State University |
| 6:05-6:20 | ***Tikhonov Regularization via Flexible Arnoldi Reduction***<br>Abstract 31<br><br>Xuebo Yu<br>Kent State University | ***View of an Art Gallery***<br>Abstract 32<br><br>Ra'Jene Martin<br>Denison University | ***An Algebraic Theorem of Frobenius and Its Applications***<br>Abstract 33<br><br>Josiah Banks<br>Youngstown State University |
| 6:25-6:40 | ***Bringing Math Education to the Tablet***<br>Abstract 37<br><br>Kristin Marley<br>Hawkes Learning Systems | ***Investigating the Algebraic Properties of Cayley Digraphs***<br>Abstract 38<br><br>Alexis Byers<br>Wittenberg University | ***Invariant subspaces and shift operators***<br>Abstract 39<br><br>Giorgi Shonia<br>Ohio University Lancaster |

| Time | Session D<br>Room 2230<br>Session Chair:<br>Paula Federico | Session E<br>Room 2240<br>Session Chair:<br>Mike Schroeder | Session F<br>Room 2260<br>Session Chair:<br>Ed Moylan, SIAM |
|---|---|---|---|
| 4:25-4:40 | ***Using Binary Logistic Regression to Predict UFC Title Defense Outcomes***<br>Abstract 4<br><br>Bob Hager<br>John Carroll University | ***Supplemental Instruction in Calculus I-II***<br>Abstract 5<br><br>Syvillia Averett<br>Central State University | ***Developable surfaces in Design and Manufacturing***<br>Abstract 6<br><br>Emmanual Tsimis<br>Siemens Corporation |
| 4:45-5:00 | ***Computational Biology and Sequence Alignment***<br>Abstract 10<br><br>Viet Phan<br>Denison University | ***Breaking the Silence***<br>Abstract 11<br><br>David Cusick<br>Marshall University | ***The Geometry of a CVT***<br>Abstract 12<br><br>Thomas Hern<br>Bowling Green State University |
| 5:05-5:20 | ***Agent-based Modeling of Pandemic Influenza***<br>Abstract 16<br><br>Anna Mummert<br>Marshall University | ***Classifying YSU's Peer Institutions: An Analytical Approach***<br>Abstract 17<br><br>Daniel Catello<br>Youngstown State University | ***Spectral Finite Volume Scheme for PDE's that Model Atmospheric Flow***<br>Abstract 18<br><br>Vani Cheruvu<br>University of Toledo |
| 5:25-5:40 | ***Scaling, Sneezes, and the Elephant's Trunk***<br>Abstract 22<br><br>Nathan Knodel<br>Ohio Northern University | ***Creating an Authentic Online Learning Experience***<br>Abstract 23<br><br>Lynn Adams<br>Kent State University - Stark | ***A Balanced Moving Mesh Method***<br>Abstract 24<br><br>Joan Remski<br>University of Michigan - Dearborn |
| 5:45-6:00 | ***The Optimization of Traffic Lights***<br>Abstract 28<br><br>Emilie Larned<br>Wittenberg University | ***The Social and Moral Life of Teenagers***<br>Abstract 29<br><br>Indiana Agyei<br>Cleveland State University | ***Flocking Models at the Microscopic, Mesoscopic, and Macroscopic Levels***<br>Abstract 30<br><br>Alethea Barbaro<br>Case Western Reserve University |
| 6:05-6:20 | ***Duplicate Bug Report Detection Using Textual Similarity Measures***<br>Abstract 34<br><br>Sarah Ritchey<br>Youngstown State University | ***Can you Loose the Absolute Minimizer in Proper Variational Problem?***<br>Abstract 35<br><br>Salim Haidar<br>Grand Valley State University | ***Queuing Systems at Disney World***<br>Abstract 36<br><br>Megan Chambers<br>Youngstown State University |
| 6:25-6:40 | ***How to Teach a Robot***<br>Abstract 40<br><br>Taylor Kessler Faulkner<br>Denison University | ***Student Teaching Students: Really? How?***<br>Abstract 41<br><br>Tim Lorion<br>Cleveland State University | ***Polynomial Approximation and Peak Points***<br>Abstract 42<br><br>Swarup Ghosh<br>Bowling Green State University |

# Contributed Paper Sessions
# Saturday, April 5

| Time | **Session A**<br>Room 2220<br>Session Chair:<br>Mao-Pei-Tsui | **Session B**<br>Room 2240<br>Session Chair:<br>Vani Cheruvu | **Session C**<br>Room 2260<br>Session Chair:<br>Ed Moylan, SIAM |
|---|---|---|---|
| 10:25-<br>10:40 | ***A History of Mathematics Course for the Liberal Arts***<br>Abstract 43<br><br>Nuh Aydin<br>Kenyon College | ***Evaluating Risk in the Board Game Risk***<br>Abstract 44<br><br>Christopher Swanson<br>Ashland University | ***A Discontinuous Galerkin – Front Tracking Scheme and its Optimal-Optimal Error Estimation***<br>Abstract 45<br><br>Tong Sun<br>Bowling Green State University |
| 10:45–<br>11:00 | ***Do My Students Hear What I'm Saying?***<br>Abstract 46<br><br>Matt Menzel<br>Marietta College | ***Comparing Squares with Products of Primes***<br>Abstract 47<br><br>David Stuckey<br>Defiance College | ***An Interface-fitted Adaptive Mesh Method for Elliptic Problems and its Applications in Free Interface Problems with Surface Tension***<br>Abstract 48<br><br>Xiaoming Zheng<br>Central Michigan University |
| 11:05-<br>11:20 | ***Impacts of Operation STEM***<br>Abstract 49<br><br>Corinne Sandor & Kristen Schuler<br>Cleveland State University | ***Srcmalbnig Rubik's Cube with Purpose***<br>Abstract 50<br><br>Lacine Myers & Jordan Karg<br>The University of Findlay | ***A Brief History of CAD and its Role in the Establishment of the SIAM Great Lakes Chapter***<br>Abstract 51<br><br>Ed Moylan<br>Ford Motor Company (retired) |
| 11:25-<br>11:40 | ***Impacts of Operation STEM***<br>Abstract 49<br><br>Corinne Sandor & Kristen Schuler<br>Cleveland State University | ***Polygonal numbers, Riesel numbers, Sierpinski numbers, and MORE***<br>Abstract 52<br><br>Justin Eitner<br>The University of Findlay | ***Modeling of Fibrin Networks under Physical Load***<br>Abstract 53<br><br>Timur Kupaev<br>University of Notre Dame |

# Abstracts of Contributed Papers

## Friday 4:25 – 4:40

### *MindTap*

Mary Beth Segerlind
Cengage

**Abstract 1:** MindTap is a fully online, highly personalized learning experience built upon authoritative Cengage Learning content. By combining readings, multimedia, activities, and assessments into a singular Learning Path, MindTap guides students through their course with ease and engagement. Instructors personalize the Learning Path by customizing Cengage Learning resources and adding their own content via apps that integrate into the MindTap framework seamlessly with Learning Management Systems. Come and hear about the exciting features of this highly sought after solution in higher education!

### *Dicey Art*

Keenan Brooks
Denison University

**Abstract 2:** The history of using computers to generate photomosaics is a short one, but the study of how to optimally create the best picture from smaller images has sparked the interest of mathematicians and artists alike. In this presentation we will delve into Dr. Robert Bosch's work with domino portraits, just what makes a good photomosaic, and how basic levels of computer science can be used to make your own photomosaic! This presentation is suitable for a general audience.

### *The Pythagorean Theorem: A Geometric Series Approach*

Emily Hoopes and Jenna Wise
Youngstown State University

**Abstract 3:** The Pythagorean Theorem is a famous mathematical finding dating back to before 250 B.C. Today, hundreds of proofs of this theorem exist. This presentation uses a diagram like that used by the Chinese in 250 B.C., but quickly takes a different path that involves removing area from a square. Using this idea and a geometric series, we obtain an original, and possibly new, proof of the Pythagorean Theorem.

### *Using Binary Logistic Regression to Predict UFC Title Defense Outcomes*

Bob Hager
John Carroll University

**Abstract 4:** Statistics play a valuable role when predicting Ultimate Fighting Championship (UFC) title defenses. Using a Binary Logistic Regression Model, I've found some significant variables that affect a UFC title defense, such as reach, experience, and weight class. I will share my approach and some functions of R, a free, open-source statistical programming environment.

### *Supplemental Instruction in Calculus I-II*

Syvillia Averett
Central State University

**Abstract 5:** Supplemental Instruction was introduced by Dr. Deanna Martin in 1973 as a program designed to increase course completion and ultimately student retention at the University of Missouri-Kansas City. In this presentation we will explore the various challenges and successes associated with the use of supplemental instruction in Calculus II and I.

### *Developable surfaces in Design and Manufacturing*

Emmanual Tsimis
Siemens Corporation

**Abstract 6**: A developable 3-dimensional surface can be formed from a single planar surface without stretching or tearing. Industrial design has many uses of developable surfaces. Also, the manufacturing of large panels, such as ship hulls and modern architectural structures, requires their segmentation into easily manufactured pieces, resulting to an aesthetically pleasing whole. These segmentation pieces are planar or single-curved (developable) surfaces. Complexity is added to the design with developable surfaces when curved folds (creases) are allowed. Designing with developable surfaces is not a trivial task; that is why the current state of Computer Aided Design (CAD) systems is not mature enough to accommodate such design. This talk will place emphasis on developable surfaces connecting two curves in 3-dimensional geometric space.

# Friday 4:45 – 5:00

### *Fluid Queues: What are they and what is the mathematics behind them?*

Barbara Margolius
Cleveland State University

**Abstract 7:** Queuing theory is the mathematical study of waiting lines or queues. We assume a probability distribution for the arrivals and for completion of service for customers in the system. Queues are used for the study of a wide variety of applications including internet communication, emergency service, organ donation, awaiting the elevator, scheduling jets for takeoff and many others. In this talk, we introduce the topic of fluid queues where the number of customers is uncountable.

### *An Elegant Mathematical Magic Trick*

Jon Stadler
Capital University

**Abstract 8:** To celebrate this year's Mathematics Awareness Month's theme, Mathematics, Magic, & Mystery, we will discuss an elegant magic trick that utilizes some basic concepts from discrete mathematics. We will also discuss some other applications of the underlying principles to demonstrate the pervasiveness of math.

### *The Lost Art of Spherical Trigonometry*

Katie Cerrone
University of Akron

**Abstract 9:** Spherical trigonometry has been used for centuries by navigators and engineers. A historical perspective on the topic, along with modern uses such as surveying and geodesy will be discussed.

### *Computational Biology and Sequence Alignment*

Tan Viet Phan
Denison University

**Abstract 10:** Sequence alignment is a valuable tool in Computational Biology. Its application plays an important roll in tracing clues of evolution and determining the function of each gene. The Smith-Waterman algorithm is a dynamic programing algorithm finding local gene sequence alignment. This presentation focuses on how the algorithm works, the pros and cons of using the

algorithm, and its uses beyond computer science and Biology. This presentation is intended for a general audience.

### *Breaking the Silence*

David A. Cusick
Marshall University

**Abstract 11:** Why are students silent? Citing the Wall Street Journal, Professor Preston Ni reports that fear of public speaking ranks above fear of death. Public speaking risks an emotional death by audience rejection. Wow! That's gotta hurt! For 18 years my students have been speaking and putting problems on the board. Respect, credits and techniques make my classes lively and productive. This was well received at 2013's R. L. Moore Conference.

### *The Geometry of a CVT*

Thomas Hern
Bowling Green State University (Ret.)

**Abstract 12**: My new Honda Accord, *built in Ohio*, has a CVT: Continuously Variable Transmission. No discrete changing of gears necessary. Conceptually a belt runs over two cones side by side, one inverted to the other, instead of having two meshed gears. The belt is claimed to be of fixed length no matter where on the cones the belt lies, so the 'gear' ratio can be continuously varied without changing fixed gears and all the complexity that involves. We examine that claim.

## Friday 5:05 – 5:20

### *Jackknife Empirical Likelihood Method for Testing the Equality of Two Variances*

Ying-Ju Chen
Bowling Green State University

**Abstract 13:** Equality of variances is a common assumption for some parametric and nonparametric statistical methods. For example, it serves as an underlying assumption for ANOVA and Kruskal-Wallis one-way analysis. I will introduce the nonparametric method based on jackknife empirical likelihood to test the equality of two variances. The limiting distribution of the likelihood-ratio-type statistic has been established. The proposed method has been applied to some underling distributions and real data example.

### *Fun with the Mobius Band*

Claire Van Fossen
Denison University

**Abstract 14:** Most people have heard of the Möbius Band - a loop of paper with one twist. In this presentation we'll conduct several experiments with the band that will lead to some surprising results. We'll also explore the band's four-dimensional counterpart - the Klein bottle. This presentation is appropriate for all math levels.

### *Constructability and Greek Number Sense*

Shawn Doyle
Youngstown State University

**Abstract 15:** We will discuss the notion of constructible numbers as well as their appearance in the classical geometric problems of antiquity, including the quadrature of the circle and the Delian problem.

### *Agent-based Modeling of Pandemic Influenza*

Anna Mummert
Marshall University

**Abstract 16:** In this project we use agent-based modeling to investigate mechanisms that can generate two peaks of infection as seen in the 2009 influenza pandemic. We develop a susceptible-exposed-infectious-recovered agent-based model in Netlogo representing the 2009 pandemic. The model is calibrated by matching key epidemiological and social quantities. We incorporate waning immunity and other mechanisms, which can generate multiple peaks of infection. The effects of social control measures such as vaccination are also considered.

### *Classifying Youngstown State University's Peer Institutions: An Analytical Approach*

Daniel Catello
Youngstown State University

**Abstract 17:** Institutions of higher education across the nation use peer group comparisons in their strategic planning. From policies to budgets, a university's goals are benchmarked to their peers. Thus, it is important that this peer group is defined correctly. Youngstown State University's peer group is derived by using factor analysis and clustering on key characteristic variables. This method generates a best peer list based on data.

***Spectral Finite Volume Scheme for PDEs that Model Atmospheric Flow***

Vani Cheruvu
University of Toledo

**Abstract 18**: In this talk, I will present a high-order scheme (spectral finite volume method) for partial differential equations that model atmospheric flow. Implementation details include third-order explicit strong stability preserving scheme for time integration and efficient limiters (for example flux-corrected transport scheme) to enforce monotonicity in the numerical scheme. Examples for which solutions have both smooth features and discontinuities will be discussed. Numerical results demonstrate the efficiency of the spectral finite volume method.

# Friday 5:25 – 5:40

***Particle Swarm Optimization: A Stochastic Approximation Approach***

Quan Yuan
Wayne State University

**Abstract 19:** We introduce four coefficients and rewrite the PSO procedure as a stochastic approximation type recursive algorithm. Then we analyze its convergence using weak convergence method. Moreover, convergence rates are ascertained by using weak convergence method. A centered and scaled sequence of the estimation errors is shown to have a diffusion limit. Furthermore, we demonstrate that our PSO algorithms perform much better than the traditional PSOs on some test functions for optimization problems.

***Magic Squares and Some Combinatorics***

Ashley Orr
Youngstown State University

**Abstract 20:** Inspired by Dr. Arthur Benjamin, the Mathemagician, this talk will begin by exploring algorithms for the creation of simple magic squares and then move onto squares that are more complicated. We will then explore the different combinations for allowing audiences to pick random digits and their locations on the magic square. This leads to the Combinatorics of some orthogonal Latin squares applied to the magic squares.

### *The Summation of the Reciprocals of Fibonacci Numbers*

Eric Stone
Youngstown State University

**Abstract 21:** In this talk I consider the convergence of the infinite sum of the reciprocals of the famous Fibonacci numbers. To analyze this series, I will derive a general formula for the nth Fibonacci number and apply standard techniques found in a typical second semester Calculus course.

### *Scaling, Sneezes, and the Elephant's Trunk*

Nathan Knodel
Ohio Northern University

**Abstract 22:** We consider the problem of the length of the elephant's trunk using tools from dimensional analysis. Starting with a hypothesis concerning the dissipation of sneezes, and using the case of the elephant as an example, we are able to arrive at a law of nasal elongation.

### *Creating an Authentic Online Learning Experience*

Lynn Adams
Kent State University – Stark Campus

**Abstract 23:** Online courses are becoming popular because of their ease of accessibility and flexibility, but many mathematics students and professors are used to more traditional, "blackboard-style" courses. In my presentation, I will discuss several techniques that help make my online courses comparable to more traditional ones. I will explain the methods I use to engage students during recorded lectures and how I use assignments to interact with them throughout the course.

### *A Balanced Moving Mesh Method*

Joan Remski
University of Michigan - Dearborn

**Abstract 24**: Moving mesh methods are a widely used numerical solution technique for partial differential equations (PDEs) where a transformation maps grid points from a computational domain into the physical domain of the original PDE. The goal is to use this transformation to obtain a non-uniform mesh in the physical domain that better captures the behavior of the solution. In this talk we focus on mesh transformations that are governed by a moving mesh PDE with an associated monitor function. This leads to a coupled system of PDEs, one for the mesh and one for the physical problem that must be solved simultaneously. We show that under certain circumstances and with certain choices of the monitor function, we can balance properties of the

solution to the mesh PDE with properties of the physical PDEs. This balance is demonstrated with the Allen-Cahn equations and a reaction problem that exhibits blow-up in finite time.

# Friday 5:45 – 6:00

### *Sperm Banks - A Probability Problem*

M B Rao
University of Cincinnati

**Abstract 25:** Sperm Banks are proliferating all over the world, especially in North America and Western Europe. The business is confronting some ethical issues. A probability problem arose when exporting sperm from the same donor to the same destination. I will present my solution in this presentation.

### *The Search for Transcendental Numbers*

Blain Patterson
Youngstown State University

**Abstract 26:** What is a transcendental number? We will answer this question, and prove the transcendence of e. This fact will then be used to quickly prove that pi is transcendental as well. Finally, we will discuss some forms of transcendental numbers and examples of each.

### *An Introduction to Arithmetico-Geometric Series*

Alissa Geisse and Cassandra Shaffer
Youngstown State University

**Abstract 27:** Infinite series are encountered in many disciplines, from physics to finance. Two commonly seen types of series are arithmetic and geometric series. These two series can be combined to produce a new series called an arithmetico-geometric series. In our talk, we will look at this arithmetico-geometric series and apply it to solve a hypothetical problem involving the ratio of boy to girl children in a country that desires children of a specific gender.

### *The Optimization of Traffic Lights*

Emilie R. Larned
Wittenberg University

**Abstract 28:** This project optimizes and synchronizes the scheduling of four traffic lights in Springfield, Ohio. This was accomplished using graph theory, optimization, linear programming and Mathematica. The result of this project takes the optimized traffic lights and synchronizes

them. After determining a satisfactory conclusion, the results will eventually be presented to the city with the hope that they will accept the aforementioned optimization, and implement it.

### *The Social and Moral Life of Teenagers*

Indiana Agyei
Cleveland State University

**Abstract 29:** This paper is a retrospective study of a research conducted by Dr. Schneider and Dr. Waite of the University of Chicago. The study is a stratified sample of 500 families from different cities across the United States and from local sites. Data collection was by interviews (face-to-face and phone calls), and surveys. The hypothetical question of this study is; does gender has any association with some of the social vices teenagers face in school? The results provide strong evidence that a relationship exist between gender and engaging in a physical fight/being threatened/being robbed.

### *Flocking Models at the Microscopic, Mesoscopic, and Macroscopic Levels*

Alethea Barbaro
Case Western Reserve University

**Abstract 30:** Agent-based models are used in many different fields, and a particular type of agent-based models, called flocking models, have been particularly well-studied by the mathematics community recently. In this talk, I will present an agent-based Vicsek-type model for fish migration; I will then discuss the associated kinetic model for flocking and the derivation of its hydrodynamic limit via the Chapman-Enskog expansion.

## Friday 6:05 – 6:20

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### *Tikhonov Regularization via Flexible Arnoldi Reduction*

Xuebo Yu
Kent State University

**Abstract 31:** Linear discrete ill-posed problems arise when one wants to determine the cause of an observed effect, e.g., in computerized tomography and image restoration. Tikhonov regularization is probably the most popular method to solve ill-posed problems. It is hard to solve when the problem of large size. In this work we will introduce a new reduction method based on flexible Arnoldi process and apply it to solve large-scaled Tikhonov regularization problems.

### *View of an Art Gallery*

Ra'Jene Martin
Denison University

**Abstract 32:** Have you ever wondered how an art gallery owner is able to efficiently protect his or her beautiful pieces of art? Then this presentation is for you! We will discuss how to efficiently position the fewest number of security cameras in an art gallery with flat walls. This presentation is appropriate for a general audience.

### *An Algebraic Theorem of Frobenius and Its Application*

Josiah Banks
Youngstown State University

**Abstract 33:** Frobenius is a widely known mathematician that has provided many great theorems. Frobenius's Algebraic Theorem states that if d is a divisor of the order of a finite group G, then the number of solutions of x^d = 1 in G is a multiple of d. In this talk we will discuss this theorem and some of its applications in number theory and group theory.

### *Duplicate Bug Report Detection Using Textual Similarity Measures*

Sarah Ritchey
Youngstown State University

**Abstract 34:** Software maintenance is an important part of software development. Of the hundreds of bugs reported each day, up to a third are duplicates of another report. Processing these reports is a time consuming task. Therefore, automated techniques are being developed. By implementing Natural Language Processing, Similarity Measurements, and Machine Learning, we can improve the accuracy and efficiency of these automated system to detect if a new report is already in the system.

### *Can you Loose the Absolute Minimizer in a Proper Variational Problem?*

Salim Haidar
Grand Valley State University

**Abstract 35:** In our study of the question of regularity of weak equilibrium solutions to the field equations of nonlinear hyper-elasticity, we gained insights that would inject new ideas into traditional concepts associated with variational calculus problems. In this talk, we give a heuristic discussion of some of these insights by way of an example of a minimization problem.

### *Queuing Systems at Disney World*

Megan Chambers
Youngstown State University

**Abstract 36:** Queuing theory is the mathematical study of queues, or waiting lines. It is a subject that strongly lends itself to real world applications. This talk discusses one of these applications: examining wait times for attractions at Disney World. A mathematical model of a Disney attraction will be presented and implemented, and Disney's current operations research technology will be discussed.

## Friday 6:25 – 6:40

### *Bringing Math Education to the Tablet*

Kristin Marley
Hawkes Learning Systems

**Abstract 37:** Courseware Development Engineers at Hawkes Learning have designed an innovative, browser-based platform built specifically with the tablet in mind. Our Expert System offers a distinctive approach to mastery-based learning with instant and specific feedback when students make a mistake, thus improving learning outcomes and reducing anxiety. Plugins or installations are no longer required, allowing students to quickly jump into the material.

### *Investigating the Algebraic Properties of Cayley Digraphs*

Alexis Byers
Wittenberg University

**Abstract 38:** Graph Theory can be used to analyze a Cayley digraph in order to gain insight into the algebraic structure of the group which the digraph depicts. In this presentation, we investigate the results of removing generators from a Cayley digraph, and what it means if the digraph remains connected or is disconnected by the process.

### *Invariant Subspaces and Shift Operators*

Giorgi Shonia
Ohio University – Lancaster

**Abstract 39:** Following Beurling's theorem R. Douglas and C. Pearcy have studied topology of invariant subspace lattice. R.Yang offered a description of path-connected components of invariant subspace lattice for shift of multiplicity one. This paper generalizes the result to arbitrary finite multiplicity. We show that there exists a one to one correspondence between the invariant subspace lattice of shift of arbitrary finite multiplicity and the space of inner functions.

### *How to Teach A Robot*

Taylor Kessler Faulkner
Denison University

**Abstract 40:** What is artificial intelligence? How can we use it to create "smart" robots? As the jobs that robots are expected to accomplish come to rely less on simple repetitive movements and more on being able to adapt to their environment, it becomes more important for robots to be able to "learn" how to accomplish tasks on their own. In this presentation, we will discuss how to use artificial intelligence techniques to teach a robotic arm how to find and pick up an object using positive reinforcement. This presentation is appropriate for a general audience.

### *Student Teaching Students: Really? How?*

Tim Lorion
Cleveland State University

**Abstract 41:** Exploration of the concept of undergraduates teaching other undergraduates as peer mentors in mathematics. This includes a multitude of benefits for both the teacher and student, which tend to be long lasting. To some extent we've all experienced this benefit resulting from peer-to-peer interaction, and we'd like to share with you our experiences!

### *Polynomial Approximation and Peak Points*

Swarup Ghosh
Bowling Green State University

**Abstract 42:** In the theory of polynomial approximation, polynomial convexity plays a crucial role. In fact, polynomial convexity is a necessary condition for approximating arbitrary continuous functions on a compact subset of complex Euclidean space by polynomials. Another such condition is that each point of the compact subset is a peak point. Are these two conditions

together sufficient for approximating arbitrary continuous functions by polynomials? In this talk the answer to this question will be discussed.

## Saturday 10:25 – 10:40

### *A History of Mathematics Course for the Liberal Arts*

Nuh Aydin
Kenyon College

**Abstract 43:** I began teaching a new course on the History of Mathematics in the Islamic World for the general liberal arts audience. This course is quite different from a general history of mathematics course commonly offered at many colleges and universities. It brings together three disciplines: mathematics, history, and religion. It also examines fascinating connections between civilizations, and challenges some commonly accepted views on the history of Islamic science based on research findings. I will describe features of this course that make it quite unique and challenging.

### *Evaluating Risk in the Board Game Risk*

Christopher Swanson
Ashland University

**Abstract 44:** In the board game Risk, players attempt to conquer the world by capturing all territories on the board, with battle outcomes determined by dice rolls. Let A be the number of attacking armies and D be the number of defending armies in two adjacent territories. This talk will present the probability the defending territory will be captured and the expected number of armies lost by the attacking territory in the capture.

### *A Discontinuous Galerkin - Front Tracking Scheme and its Optimal-Optimal Error Estimation*

Tong Sun
Bowling Green State University

**Abstract 45:** An error estimate of optimal convergence rates and optimal error propagation (optimal-optimal) was given for the numerical solutions produced by the Runge-Kutta discontinuous Galerkin (RKDG) method on the scalar nonlinear conservation laws in the case of smooth solutions before. This talk generalizes the problem to the case of a piecewise smooth solution containing one fully developed shock. A front tracking technique is incorporated in the RKDG scheme to produce a numerical solution with a truly high order error. The numerical smoothness approach of error analysis is generalized to this particular case of a discontinuous solution.

## Saturday 10:45 – 11:00

### *Do My Students Hear What I'm Saying?*

Matt Menzel
Marietta College

**Abstract 46:** It can be tempting to assume that if class periods are organized with well-thought out examples, questions, and discussions, students will absorb everything just as it's presented. In reality, however, there often is a disconnect between what teachers say and what students hear and understand. This talk will focus on ways in which I have encouraged students to focus on understanding basic concepts deeply, and methods that I have used for determining how well students are understanding core ideas.

### *Comparing Squares with Products of Primes*

David Stuckey
Defiance College

**Abstract 47:** The underlying question deals with how squares of numbers compare with the product of the first primes. In particular, some multiple of the product is 1 less than a perfect square. This talk will use algebra to determine which multiples are feasible to have this feature and how many integers less than the product will meet this condition.

### *An Interface-fitted Adaptive Mesh Method for Elliptic Problems and its Application in Free Interface Problems with Surface Tension*

Xiaoming Zheng
Central Michigan University

**Abstract 48**: This work presents a novel two-dimensional interface-fitted adaptive mesh method to solve free interface problems with surface tension. First, we present a very simple and practical P1 finite element method prove for elliptic problems where both the solution and its normal derivative have nonzero jumps across the interface and prove its nearly second order accuracy. Afterwards, we present its adaptive mesh applications to the evolution of two free boundary problems, a sheared drop in Stokes flow and the growth of a solid tumor.

## Saturday 11:05 – 11:20

### *Impacts of Operation STEM*

Corinne Sandor and Kristen Schuler
Cleveland State University

**Abstract 49:** Operation STEM is a forthcoming program that is significantly improving the way math is learned and taught. After only one semester of implementation, Operation STEM has tremendously impacted statistics and other aspects one wouldn't have imagined. With such great results, this program is one worth keeping.

### *Srcmalbnig Rubik's Cube with Purpose*

Lacine Myers and Jordan Karg
The University of Findlay

**Abstract 50:** Rubik's cubism has been an art form since the 80s. A digital photograph was pixelated and a mathematical algorithm was written to output the required movements needs to transform a solved Rubik's Cube to match a portion of the pixelated photograph. The pixelated photo was then reproduced with 324 Rubik's Cubes. Elements of discrete math and group theory were used in the algorithms.

### *A Brief History of CAD and its Role in the Establishment of the SIAM Great Lakes Chapter*

Ed Moylan
Ford Motor Company (retired)

**Abstract 51**: Development of CAD (Computer Aided Design) was driven by the automotive and aerospace industries. It evolved from initial rudimentary applications to today's sophisticated simulations. The mathematics community continually played an essential role and the SIAM Great Lakes Chapter was formed to provide a forum. Over time, member interests have broadened to include biosciences, complex systems, numerical methods for PDEs, data mining, et al.

## Saturday 11:25 – 11:40

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### *Polygonal numbers, Riesel numbers, Sierpiński numbers, and MORE*

Justin Eitner
The University of Findlay

**Abstract 52:** Polygonal numbers are those that can be expressed geometrically by an arrangement of equally spaced points. Such examples include: triangular, pentagonal, and hexagonal numbers, which all can be expressed with the corresponding geometric shape. Through the use of coverings, one can find an intersection with these polygonal number sequences and the Riesel numbers or the Sierpiński numbers.

### *Modeling of fibrin networks under physical load*

Timur Kupaev
University of Notre Dame

**Abstract 53:** Blood clot structure consist of biological polymers called fiber gels, they differ from other biological gels by their high extensibility properties. The task was to develop a physical model, where fibers are represented as non-linear springs, that corresponds to performed experiments - samples of fibrin networks were stretched. Two aspects are to be explained - generating a network that would have real fiber network properties and stretching the generated network using the model.

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