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Newsletter

Metropolitan New York Section of
The Mathematical Association of America

April 2018

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Bronx	**Brooklyn**	**Columbia**	**Dutchess**
Greene	**Manhattan**	**Nassau**	**Orange**
Putnam	**Queens**	**Richmond**	**Rockland**
Suffolk	**Sullivan**	**Ulster**	**Westchester**

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ANNUAL MEETING

Sunday, 13 May 2018
8:30 AM – 5:15 PM

Hofstra University
Hempstead, NY

(*More Information Contained Within*)

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Section Web Page – sections.maa.org/metrony

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Membership Count: 531 as of 30 March 2018

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MESSAGE FROM THE SECTION CHAIR

I would like to begin this message by thanking the team of section officers, committee chairs, and members. The Section has a great team of people working together to make sure that it is active and that the programming remains diverse, meaningful, and rewarding for the entire membership. It is a real pleasure and honor to work for them and with them.

The 2017 Annual Section Meeting at Hostos Community College was extremely successful. Hostos Community College did an amazing job hosting the event, and I want to thank all the people that were involved in planning and putting this event together. We hope that we will enjoy this meeting as well.

Our next Annual Section meeting will take place at Hofstra University on May 13, 2018. We have an amazing list of speakers. We invited Steven G. Krantz from Washington University in St. Louis to talk about A Matter of Gravity, Joe Mitchell from Stony Brook University to introduce Geometric Optimization Problems for Efficient Viewing: Finding Good Ways to See Things Well. Lionel Levine from Cornell University will have a presentation onThe Future of Prediction, and Nathan Kallus from Cornell University will give a talk on Learning to Personalize from Observational Data. We'll have Math Bowl and Panel on Mathematics in Partner Disciplines. Please come, enjoy the presentations and participate in the Contributed Paper and Poster Sessions: Research, Pedagogical, and Student Presentations. Please visit http://sections.maa.org/metrony for detailed descriptions, registration, complete schedule, abstract submission, directions, etc.

Young faculty, please come and join Section NExT (Metro NExT). This program is active again. It is aimed at supporting young faculty, new and rising PhD's in mathematics or mathematics education. This year our Section created a grant to support the most active Metro NExT fellow of the year: http://sections.maa.org/metrony/MetroNExT.html.

Dear Colleagues, we invite you to be actively involved in the Section! Please submit your nominations for the Section Teaching and Service Awards, use our Speakers Bureau. We will be happy to serve local schools and communities by providing interesting speakers on a wide variety of mathematical topics.

This year is a very important year for the Section. This year the new team of officers will be elected. The new team will be introduced at the Annual Section Meeting.

It was a great honor to work for you, for the Section and for the amazing organization Mathematical Association of America that brings all of us together, and allows us to work together to provide professional development and networking activities for Section members and mathematics community; and to promote discussion and action on issues affecting mathematics teaching, learning, and research in the Metropolitan New York region.

Elena Goloubeva, Webb Institute

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MESSAGE FROM THE SECTION CHAIR-ELECT

Warmest greetings to all the MAA Metro New York Section members!

According to the Bureau of Labor Statistics, mathematics occupations are projected to increase by 28 percent from 2016 to 2026 which will result in about 50,400 new jobs. The reality of preparing our students for the 21st century mathematical workforce centers on the understanding of globalization and the need for various skills and competencies. Essential skills such as critical thinking, inventive thinking, interpersonal skills, information processing, and effective communications are necessary for graduates to succeed in this high-tech digital age.

In this year's annual meeting at Hofstra University, we will have distinguished invited speakers, noteworthy presentations by faculty and students, and engaging partner discipline discussions. We hope the talks will expand your mathematical knowledge and challenge the way you think about teaching and learning as you prepare our students for the changing workforce climate. Moreover, we invite you to be part of the MAA Metro NY community so that your expertise can be shared and enjoyed by all. I look forward to greeting you at the May 13th meeting!

Janet Liou-Mark, New York City College of Technology (CUNY)

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MESSAGE FROM THE SECTION GOVERNOR

The August 2017 MathFest saw the initial meeting of the new MAA Congress which replaced the old Board of Governors. The responsibilities of the old Board of Governors have now been assumed by a new Board of Directors made up of the officers of the Association and the chair of the Congress. The problem with the old Board of Governors was that the Governors sat passively for a day hearing reports from various MAA officers and had little opportunity for discussion. The new Congress was meant to be all about discussion of topics brought to it by the Board of Governors.

At the beginning of the second Congress meeting at the Joint Math Meetings at San Diego in January 2018 it was announced that in the future the Congress will only meet at MathFest, and never again at the Joint Meetings, in order to save money. The MAA leadership seems to want to treat the winter Joint Meetings as a secondary activity of the Association, because the AMS runs this meeting and is viewed as not treating the MAA fairly in its planning and costs. This Governor thinks that it is a terrible state of affairs that the MAA and AMS are increasingly going their separate ways at a time when both are losing membership. Distancing itself from the AMS is not the solution.

The initial August meeting of the Congress was focused on a draft document about MAA Core Values. I, and most all in the Congress, saw this document as a marketing tool — for example, it never mentioned collegiate mathematics. A second draft in early 2018 had the following associated Goal of the MAA: Advancing the study, application, and love of mathematics by fostering *engagement* with high-quality mathematics, *advocacy* for the vital role of mathematics in society, and *inclusivity* in the teaching, learning, and practice of mathematics. The revised MAA Core Values at San Diego Congress meeting were:

a) Mathematics as a Vital Intellectual Discipline;
b) The Teaching and Learning of Mathematics, and
c) Community Centered on Interest in Mathematics.

(continued)

There are three short sentences for each of these Values. For a), they are:
"We encourage everyone to explore and learn mathematics as a fun, joyful, and a human endeavor. We communicate the heart of mathematics through high quality exposition. We advance creative discoveries in mathematics that move society forward."

There were still many criticisms of these revised Core Values. There were a number of procedural steps in setting up the Congress that took up time at MathFest and the Joint Meetings.

The MAA also is developing a strategic plan which again has a Washington office/marketing focus, in this Governor's view.

Alan Tucker, Stony Brook University (SUNY)

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TREASURER'S REPORT

(as of 3/01/18)

Business Checking	$ 8,782.80
Business Money Market	$15,081.98
Total	$23,864.78

All accounts are with J.P. Morgan Chase Bank. Further details will be provided at the annual meeting.

Armen Baderian, Nassau Community College (SUNY)

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25 and 50 Year Members

The following members will be recognized during the Awards Ceremony at our May meeting. The 25 year members are offered free registration, the 50 year members free registration *and* lunch (who said there's no such thing as a *free lunch*?!!).

25 Years: Nkechi M. Agwu (Borough of Manhattan Community College - CUNY), James E. Helmriech (Marist College), Paul Issack, Elliott Landowne, Richard Lipton, Yajun Yang (Farmingdale State College - SUNY)

50 Years: William Beckmann, Keith Harrow, Mahmoud Sayrafiezadeh (Medgar Evers College - CUNY)

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2018 ANNUAL MEETING PROGRAM
Sunday, May 13
Hofstra University, Hempstead, NY

8:30 - 12:00 PM Registration

8:30 - 11:30 AM Refreshments

8:30 - 3:30 PM Book exhibits

9:00 - 9:20 AM Welcome and Introductions
Dr. Benjamin Rifkin, Dean of the College of Liberal Arts and Sciences, Hofstra University
Dr. Daniel E. Seabold, Chairman, Department of Mathematics, Hofstra University
Dr. Elena Goloubeva, Chair of the Metro New York Section of the MAA, Webb Institute

9:20 - 10:20 AM Invited Speaker
Geometric Optimization Problems for Efficient Viewing: Finding Good Ways to See Things Well
Dr. Joe Mitchell, Stony Brook University

10:30 - 11:30 AM Invited Speaker
A Matter of Gravity
Dr. Steven G. Krantz, Washington University in St. Louis

11:30 - 12:30 PM Lunch

12:00 - 12:30 PM Contributed Poster Session

12:30 - 1:10 PM Business Meeting and Awards Ceremony

12:30 - 1:10 PM Math Bowl
Moderators: Dr. Dan Ismailescu and Dr. Eric Rowland, Hofstra University

1:15 - 2:15 PM Invited Speaker
The Future of Prediction
Dr. Lionel Levine, Cornell University

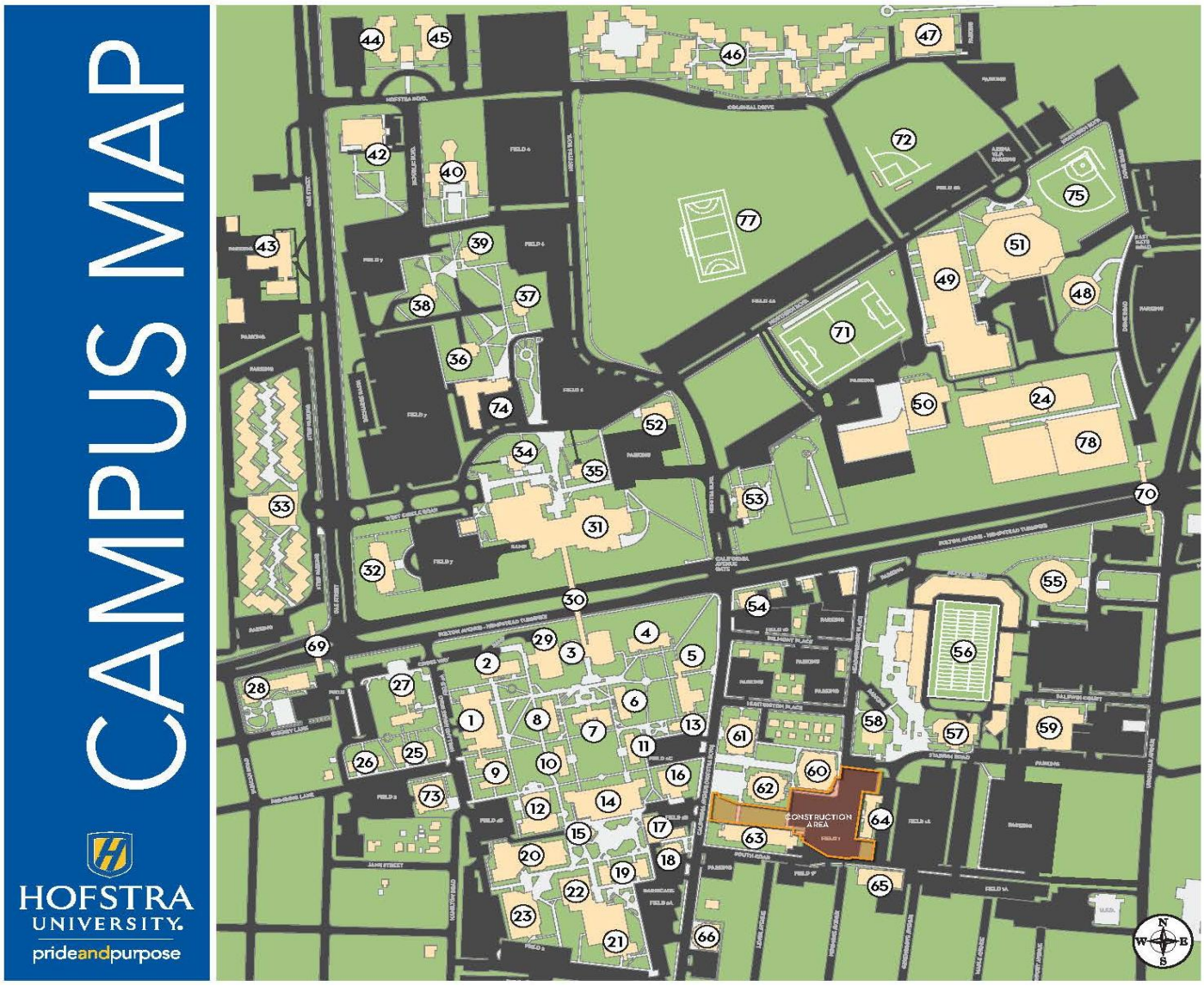
2:20 - 3:20 PM Invited Speaker
Learning to Personalize from Observational Data
Dr. Nathan Kallus, Cornell University

3:30 - 4:30 PM Panel: Partner Disciplines on Teaching Mathematics
Organizers: Dr. Mutiara Sondjaja, Dr. Johanna Franklin, Dr. Johann Thiel
Moderators: Dr. Mutiara Sondjaja, Dr. Johann Thiel
Panelists:
Dr. Elizabeth Bauer, Department of Psychology, New York University
Dr. Kevin Bisceglia, Department of Chemistry, Hofstra University
Dr. Peter Daniel, Department of Biology, Hofstra University
Dr. Ashwin Satyanarayana, Dept. of Comp. Systems Tech., NYC College of Tech.
Dr. Alan Tucker, Dept. of Applied Mathematics and Statistics, Stony Brook University

3:30 - 5:30 Contributed Paper Sessions
Research Session: Applied Mathematics & Pure Mathematics
Pedagogy Session
Modern Technology in Mathematics Education Session
Student Session

See pages 9-10 for Abstracts and brief Speaker Biographies

Hofstra University
Student Center & Davison Hall
Hempstead, NY 11549



NOTE: Most events, including registration, the plenaries and panel, and lunch, will be held in the Student Center (#31); three afternoon sessions will take place in Davison (#8).

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Presentation Abstracts and Speaker Biographies

INVITED SPEAKERS

A MATTER OF GRAVITY

DR. STEVEN G. KRANTZ, Washington University in St. Louis

Abstract: We take a new look at the concept of the center of gravity. In particular, we look at the stability of the center of gravity and also what geometric conditions guarantee that the centroid lies in the region. Matter become particularly interesting when we consider these questions in very high dimensions and asymptotically as the dimension tends to infinity. Some of this joint work is with Harold Parks, John McCarthy, and undergraduate Eric Hintikka.

Biography: Dr. Steven G. Krantz was born in San Francisco, California in 1951. He received a B.A. degree from the University of California at Santa Cruz in 1971 and a Ph.D. from Princeton University in 1974. His thesis advisor was E.M. Stein. Dr. Krantz has taught at UCLA, Princeton University, Penn State, and Washington University in St. Louis. He was Chair of the latter department for five years. Krantz has had nine Masters students and 20 Ph.D. students. He has written more than 110 books and more than 235 scholarly papers. He edits five journals and is Managing Editor of three. He is the founding editor of the Journal of Geometric Analysis and of Complex Analysis and its Synergies. Krantz has won the Chauvenet Prize, the Beckenbach Book Award, and the Kemper Prize. He was recently named to the Sequoia High School Hall of Fame. He is an AMS Fellow. Among Krantz's research interests are: several complex variables, harmonic analysis, partial differential equations, differential geometry, interpolation of operators, Lie theory, smoothness of functions, convexity theory, the corona problem, the inner functions problem, Fourier analysis, singular integrals, Lusin area integrals, Lipschitz spaces, finite difference operators, Hardy spaces, functions of bounded mean oscillation, geometric measure theory, sets of positive reach, the implicit function theorem, approximation theory, real analytic functions, analysis on the Heisenberg group, complex function theory, and real analysis. He has applied wavelet analysis to plastic surgery; creating software for facial recognition. Krantz has also written software for the pharmaceutical industry.

GEOMETRIC OPTIMIZATION PROBLEMS FOR EFFICIENT VIEWING: FINDING GOOD WAYS TO SEE THINGS WELL

DR. JOE MITCHELL, Stony Brook University (SUNY)

Abstract: A famous problem posed by Victor Klee in the early 1970's is the Art Gallery Problem: How many points ("guards") are sufficient to place within a simple polygon *P* having *n* vertices so that every point of *P* is "seen'" by at least one guard? This problem falls into a rich class of computational geometry problems that ask one to optimally cover a domain. We discuss several interesting mathematical and algorithmic questions that arise in this class, both in the case of stationary guards and mobile robotic guards. The problems are simple to state, easy to visualize, but often very challenging to solve.

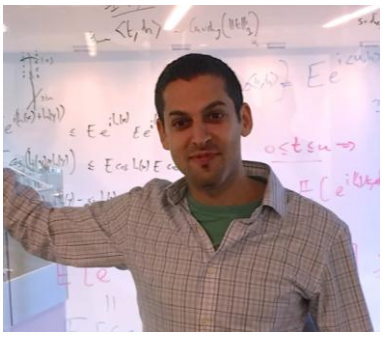
Biography: Dr. Joseph S. B. Mitchell received a BS (Physics and Applied Mathematics), and an MS (Mathematics) from Carnegie-Mellon University, and Ph.D. (Operations Research) from Stanford University (under advisorship of Christos Papadimitriou). Mitchell was with Hughes Research Labs and then on the faculty of Cornell University. He is now SUNY Distinguished Professor at Stony Brook University, where he serves as chair (since 2014) of the Applied Mathematics and Statistics Department and as research faculty in the Department of Computer Science. Mitchell has received various research awards (ACM Fellow, 2010 Godel Prize, NSF Presidential Young Investigator, Fulbright Scholar, President's Award for Excellence in Scholarship and Creative Activities) and numerous teaching awards. His primary research area is computational geometry, applied to problems in computer

(continued)

graphics, visualization, air traffic management, manufacturing, and geographic information systems. Mitchell has served for several years on the Computational Geometry Steering Committee, often as Chair. He is on the editorial board of the journals Algorithmica, Discrete and Computational Geometry, Computational Geometry: Theory and Applications, Journal of Computational Geometry, and the Journal of Graph Algorithms and Applications, and is an Editor-in-Chief of the International Journal of Computational Geometry and Applications. He has served on numerous program committees and was co-chair of the PC for the 21st ACM Symposium on Computational Geometry (2005).

THE FUTURE OF PREDICTION

DR. LIONEL LEVINE, Cornell University



Abstract: Can you predict the next term in this sequence?

0,1,3,4,9,10,12,13,27,28,30,31, . . .

I'll share my experience in a prediction tournament with thousands of players, focusing on the uses (and abuses!) of mathematics in predicting the future; why Bayes' rule is not the answer to everything; how to incentivize good predictions; and when to expect surprises. We'll see how randomness can be more predictable than you think, and determinism can be less predictable than you think! I'll hazard a few predictions with input from the audience: Will we ever know the 10^{100} th digit of pi? Will we discover life on Mars (and should we hope the answer is yes or no?)?

Biography: Lionel Levine is an associate professor at Cornell University. His research is on abelian networks. His hobby is inventing toy universes and studying their physics. You can usually find him thinking about why things are the way they are, or why they aren't the way they aren't.

LEARNING TO PERSONALIZE FROM OBSERVATIONAL DATA

DR. NATHAN KALLUS, Cornell University

Abstract: Personalization has long been central in machine learning, with successful applications in online news and product recommendation systems. A question of growing urgency is how to translate this success to emergent challenges such as personalized medicine, where personalization is key but experimentation can be prohibitively small-scale, costly, dangerous, and/or unethical in comparison to passive data collection. In this talk I will discuss recent advances in learning to personalize from purely observational data, such as hospitals' electronic medical records (EMR), where the isolated effect of a treatment is hidden by a myriad confounding factors. This question brings together machine learning, to handle individual-level targeting and very rich data, with causal inference, to handle the counterfactual nature of the question. I will present a particular application to personalizing pharmacological treatments for type-2 diabetes (T2D) management based on patient characteristics, disease progression, and treatment history by leveraging the EMR database of a large hospital. I will show how standard reductions of the problem to supervised learning, where predictive algorithms are used as a black box, can fail to achieve no-regret learning and also fail in practice. I will present instead a principled approach to learning to personalize that is based on mathematical optimization and demonstrate its success empirically and explain it theoretically.

Biography: Nathan Kallus is Assistant Professor in the School of Operations Research and Information Engineering and Cornell Tech at Cornell University. Nathan's research revolves around data-driven decision making, the interplay of optimization and statistics in decision making and in inference, and the analytical capacities and challenges of observational, large-scale, and web-driven data. He holds a PhD in Operations Research from MIT as well as a BA in Mathematics and a BS in Computer Science both from UC Berkeley. Before coming to Cornell, Nathan was a Visiting Scholar at USC's Department of Data Sciences and Operations and a Postdoctoral Associate at MIT's Operations Research and Statistics group.

PANEL: DISCUSSION WITH PARTNER DISCIPLINES ON TEACHING MATHEMATICS

Organizers: Dr. Johanna Franklin, Hofstra University
Dr. Tia (Mutiara) Sondjaja, New York University
Dr. Johann Thiel, New York City College of Technology

Panelists: Dr. Elizabeth Bauer, Department of Psychology, New York University
Dr. Kevin Bisceglia, Department of Chemistry, Hofstra University
Dr. Peter Daniel, Department of Biology, Hofstra University
Dr. Ashwin Satyanarayana, Dept. of Computer Systems Technology, NYC College of Tech.
Dr. Alan Tucker, Dept. of Applied Mathematics and Statistics, Stony Brook University (SUNY)

We teach a large number of non-math majors in our math classes; many of these students take our math classes to fulfill the requirements of their majors, or to fulfill a distribution requirement. Yet, we rarely have the chance, or time, to have a meaningful discussion with colleagues in other disciplines about how successful our mathematics courses really are in achieving the intended purpose of their mathematics requirements. What mathematical skills are important in other disciplines? Are our traditional approaches in teaching math -- for instance, one of them is teaching with an emphasis on algebraic manipulations -- effective in helping students gain skills relevant to their majors? The goal of this session is to provide an opportunity for lively conversations on these questions with some of our colleagues from other disciplines.

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FEATURED ARTICLE

www.simiode.org
SIMIODE
A SYSTEMIC INITIATIVE FOR MODELING INVESTIGATIONS & OPPORTUNITIES WITH DIFFERENTIAL EQUATIONS

Brian Winkel, Emeritus Professor of Mathematics,
United States Military Academy, West Point NY and Director of SIMIODE

The recent COMAP/SIAM report, GAIMME - Guidelines for Assessment and Instruction in Mathematical Modeling Education (GAIMME 2016) encourages us to do modeling throughout the mathematics curriculum and shows us how to do this in rich detail, including the tricky part of assessment.

The 2015 CUPM Curriculum Guide (CUPM 2015) recommends,
“There are major applications involving differential equations in all areas of science and engineering, and so many of these should be included in the ODE course to show students the relevance and importance of this topic.”

The report also does a reality check by admitting that many topics in traditional differential equations course have been de-emphasized while use of modeling and technology has increased.

We propose a serious paradigm shift to a modeling-based approach for teaching differential equations. To that end we are building a community of support, SIMIODE - Systemic Initiative for Modeling (continued) Investigations and Opportunities with Differential Equations, for teachers and students at www.simiode.org.

(continued)

SIMIODE is about teaching differential equations using modeling and technology upfront and throughout the learning process. We offer a community, in which colleagues can explore, communicate, collaborate, publish, teach, contribute, archive, etc. Access to this community is free. Teachers who register can gain access to double-blind, peer-reviewed materials with collegial comments on pedagogy and use in class.

The modeling-first approach closely parallels the underlying principles found in problem-based learning, inductive learning, and inquiry-based learning, which suggest that students learn best by doing and retain best when they construct their own paradigms. See Prince & Felder 2006, Cotic & Zuljan 2009, Brunning, et. al. 2004, and Sanders 2009. Additionally, putting the mathematics into the context of real world problems, makes the subject meaningful, applicable, interesting, and powerful in the eyes of the students. This can aid with student attitudes about mathematics, resulting in increased curiosity, persistence, and perceived usefulness according to research by Silvia 2008 and Rasmussen & Kwon 2007. Moreover, such an approach can enhance transferability of the mathematical knowledge as it is based in a reality with vivid imagery.

In a seminal study on inductive teaching and learning in the premier engineering education journal, the American Society for Engineering Education's (ASEE) Journal of Engineering Education, the authors conclude that "...inductive methods are consistently found to be at least equal to, and in general more effective than, traditional deductive methods for achieving a broad range of learning outcomes." Prince & Felder [page 1] 2006.

One of the authors, Prince [page 55] 2007, in a closing essay for PRISM, the magazine of ASEE,

"Another well-entrenched tenet of traditional instruction is the notion that students must first master the underlying principles and theories of a discipline before being asked to solve substantive problems in that discipline.

"An analysis of the literature as rendered in Prince & Felder (2006) suggests that there are sometimes good reason to `teach backwards' by introducing students to complex and realistic problems before exposing them to the relevant theory and equations."

Colleagues around the academic world believe in inductive methods that are in touch with the real world and are using this same approach. In a paper for teachers of American history, Lendol Calder forcefully supports an inductive approach (Calder 2007), by quoting the distinguished professor of history, Charles G. Sellers (UC Berkeley):

"The notion that students must first be given facts and then at some distant time in the future will 'think' about them is both a cover-up and a perversion of pedagogy... . One does not collect facts he does not need, hang on to them, and then stumble across the propitious moments to use them. One is first perplexed by a problem and then makes use of the facts to achieve a solution."

We know modeling reality motivates and creates mathematics. It has been a raison d'être for much of mathematics and occurs naturally. We can see it happening! Give elementary school students a collection of buttons and ask them to describe what they see. They categorize and sort them, on color, size, shape, mass, etc. Then they invent, ON THE SPOT, the notion of histogram to render their narrative. This is what happens when modeling comes first; mathematics is created and used by students. So it is at the level of differential equations.

What Does SIMIODE Offer?

SIMIODE is a supporting community at www.simiode.org with resources for teaching differential equations through modeling and real-world situations. SIMIODE advocates and supports an inductive approach to learning differential equations through context with the use of Modeling Scenarios.

Modeling Scenarios form the heart of the teaching materials found in SIMIODE in which a situation is presented which leads to model building using differential equations. Such scenarios often have data or the opportunity to collect data, in the latter case through the SIMIODE YouTube channel (SIMIODE 2016). These activities run the gamut from quick, in class activities, to long projects.

We list some of the modeling possibilities: dissipation of an intraocular gas bubble after retinal surgery, chemical kinetics of reactions, spread of an oil slick, feral cat control, tuned mass dampers to keep big buildings from swaying too much, LSD in the body, whiffle ball or shuttlecock falling, stadium design, pendulum motion, ascent rates in SCUBA diving, absorption of drugs like ibuprofen in the human body, and spread of the word JUMBO in literature. These can all be found in SIMIODE (SIMIODE 2016a) and are freely available. Each of these scenarios can motivate at least one (and often many more) differential equation concept.–They draw students into the study of these equations, because the content interests them and makes them curious. This is where the language and methods of the mathematics of differential equations stand ready to assist in discovery and exploration. Students are motivated to seek out and learn the tools of differential equations in order to address the context of the situation that piques their interest.

Currently there are over two dozen FREE on-line, curated, differential equations text books to support the traditional basics and save students money – lots of money. These are referenced and reviewed in SIMIODE (Winkel 2015a). SIMIODE enriches the study of differential equations with motivational Modeling Scenarios which draw students to the mathematics. More important, SIMIODE is a community. Teachers can form project areas and interest groups to support inquiry and material development with colleagues around the world. Students can work together with each other. A whole class or section of a course can be created as a group by a teacher for whatever purpose the teacher desires. Small groups and project teams in a class or across the globe can collaborate on writing, data analysis, videos, etc. and keep their results and writing in their own project area in SIMIODE. SIMIODE has many rich aspects – community, learning and teaching, resources, and modeling.

SIMIODE sponsors SCUDEM – Student Competition Using Differential Equation Modeling in some 96 sites around the United States and Beyond on 21 April 2018. For more details on this student competition and faculty development event see www.simiode.org/scudem.

SIMIODE offers two NSF funded workshops in the Bronx this summer. MINDE -- Model INstructors in Differential Equations Workshop, 22-28 July 2018 at Manhattan College, Riverdale NY USA. This is a Practitioner Workshop for applicants to participate in a challenging and invigorating faculty development opportunity to enhance their teaching of undergraduate differential equations in a modeling-first approach. DEMARC -- Differential Equations Model And Resource Creators Workshop, 15-21 July 2018 at Manhattan College, Riverdale NY USA. We invite qualified applicants to create new curricular Modeling Scenarios that enhance the teaching and learning of undergraduate differential equations using modeling. We still have openings. See simiode.org/nsfpracworkshop and simiode.org/nsfdevworkshop, respectively, for complete application procedures. These workshops will be annual events at different sites around the country.

Modeling Scenario Illustrations

We present details on three Modeling Scenarios from SIMIODE to illustrate the details of a typical approach to teaching differential equations through modeling.

Population Death and Immigration Modeling

The most used Modeling Scenario (Winkel 2015) of SIMIODE's many resources is a population model using m&m's as members of the population. On the first day of differential equations class the teacher says, "We are going to model death and immigration," and gives each student two cups, one paper plate, and a bag of m&m's with a sheet of instructions. Count out 50 m&m's, place in one cup, and toss onto the plate. If m side is up that m&m dies, remove from population, and once all dead are cleared out immigrate 10 m&m's back into the population. (continued)

Count and record the population. Keep doing this. “What happens?” the teacher asks after about 10 minutes. Discussion ensues, most importantly modeling begins, leading to the natural discovery of difference equation and differential equation mathematics and “inventing” concepts of iteration, change and rate of change, equilibrium value, long term behavior, parameter estimation, and solution strategies. What’s more, students will refer to this first day experience throughout the course for its approach, content, terms, use of data to motivate the study, power to illustrate modeling, methods, and excitement (Yagodich 2016).

“In my class evaluations, students were asked `What class assignment or activity did you find to be the most useful?’ *One student answered, `Believe it or not, the m&m activity on the first day of class really stood out to me. It helped show the real world applications of Differential Equations and I thought it was* amazing that we could build an equation using real world data.’ The fact that a student remembered this fairly short activity done the very first day of class all the way to the end of the semester made a big impact for me and planning for future semesters!”

Thousands of students have experienced this approach with great success. For a variation on this activity see (Winkel 2016) in which the immigration rate is a mystery number selected by each team of students and the resulting data is passed along to a different team to determine that immigration rate.

All this material is in the Student Version of the Modeling Scenario. There is also a Teacher Version in which the author offers details on uses, pitfalls, modifications, descriptions of what to do, etc. For example, in the Teacher Version of this Modeling Scenario there is material to help the teacher take students on the transition from a discrete differential equation model to a continuous differential equation model. Teacher Version materials are available only to teaching members of the community, which is freely offered through a registration process at https://simiode.org/register/ .

Torricelli’s Law for a Falling Column of Water

In a self-contained Modeling Scenario (Winkel 2015b) students are presented with a mathematical formulation of Torricelli’s Law for a Falling Column of Water. The goal is to build a differential equation model which describes the rate of change of the height of the column of water as the water exits through a small hole at the base of the column.

The material in the Modeling Scenario uses the Conservation of Energy Principle which says that the total energy (kinetic plus potential) of a drop of water in a column of water is conserved as it falls. This provides an expression for the exit velocity of the water from a small aperture in the container. Couple this with the cross sectional area of the aperture and one can model the rate at which the volume of water and hence the height of the constant cross-sectional column of water falls. With this principle, the very commonly used approach in modeling in which some quantity is computed in two ways and both computations are equated is employed to form a differential equation model.

The resulting model for the change in volume of the column of water at time t is

$$A(h(t)) \cdot h'(t) = -a\alpha\sqrt{2gh(t)}\,,$$

where $h(t)$ is the height of the column of water at time t; $A(h(t))$ is the cross sectional area of the column at time t; a is the constant cross sectional area of the exit hole; g is the acceleration due to gravity; and α is an empirical constant called the discharge or contraction coefficiens, which is an unknown parameter, indicating just what percentage of the water that could exit through the exit hole actually does leave, the difference being due to the radius and friction at the exit orifice.

Students can collect data from any one of a number of column and exit hole configuration videos at the SIMIODE YouTube channel (SIMIODE 2016) with information on the constant cross sectional area of the column, $A = A(h(t))$), and the exit hole, a. Students can stop the video, observe the time on the digital clock, and estimate the height of the column of water, from the images presented on the screen.

Sublimation Data

A simple experiment in which a small block of dry ice (frozen carbon dioxide) sublimates can prove to be a very interesting modeling scenario (Winkel 2015c) and serves as an introduction and reason for studying separation of variables techniques.

Warning: The first time we collected data we had placed the dry ice on the metal plate of a scientific lab scale and the mass went up as time progressed! Water was freezing and condensing on the plate faster than the dry ice was sublimating. We recommend that, with this and all experiments, one performs a "dry run."

Students can build a model of the rate at which the mass changes in terms of the geometry (in our case a cube of dry ice) and they will conjecture a differential equation model with initial conditions for the data of the sort:

$$m'(t) = -k\, m(t)^r, \quad m(0) = 7.57$$

Upon solving this differential equation and fitting the solution to the data, a best fit occurs when $r = 0.70$ which is close to what one might expect with $r = 2/3$. The latter is due to the fact that the mass is proportional to the volume and so the rate of decrease in mass or volume is proportional to surface area, i.e. volume (or mass) raised to the 2/3 power. A plot of the data and the model is very convincing (Figure 1).

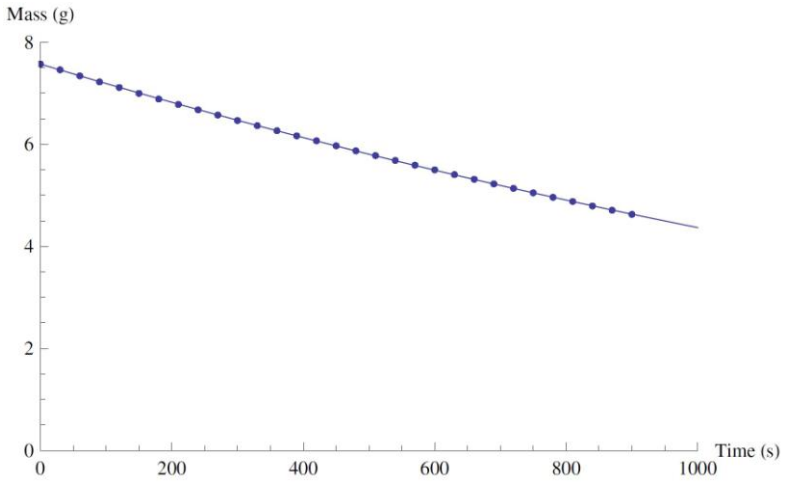

Figure 1. Data and model fitted to the data for sublimation of dry ice.

Conclusion

We have supported the notion that students learn mathematics best when it is in context and there is interest and curiosity present. We have presented details on a community of teachers and learners in SIMIODE who are interested in teaching and learning differential equations through modeling of realistic situations. Finally, we have given four examples of Modeling Scenario material available at SIMIODE. We invite readers to join our community at www.simiode.org.

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Go Back to School, Join *The Mathematics Speakers Bureau!!!*

Do you have a talk which would be suitable for local area students or their faculty? We are seeking mathematicians interested in sharing their knowledge, enthusiasm, and love of mathematics. Now in its 54th year, the Mathematics Speakers Bureau (MSB) is composed of dedicated mathematicians who volunteer to speak to students and faculty of regional middle schools, high schools, colleges and universities on topics reaching beyond the traditional mathematics curriculum.

The primary goals of the MSB are to stimulate the interests of local youth in mathematics, to provide opportunities for students to meet active and enthusiastic mathematicians, to motivate students towards careers in the mathematical sciences, and to encourage cooperation between corporate and academic institutions in the mathematical education of area youth. Volunteers provide information about talks they are willing to give and the Bureau, in turn, advertises these talks to the faculty of local area schools. Schools contact speaker volunteers directly to make specific arrangements for a visit. Volunteers determine the number of presentations they give in any given academic year and always maintain the right to decline any invitation to speak. The Bureau web-page (sections.maa.org/metrony/speakers.html) contains an up-to-date listing of available speakers and their

proposed talks. Additional information regarding the goals, history and operation of the Bureau can also be found at this site. If you wish to volunteer with the MSB, please contact Bureau Chair Dan King at dking@sarahlawrence.edu.

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Consider submitting a short announcement, commentary, article, study, experience, or other news-worthy item in the next issue of *MetroMath*. Contact the editor, Abe Mantell, via e-mail: mantell@ncc.edu.

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MATH IN THE NEWS FROM THE MAA

(much more can be found at: http://www.maa.org/news and http://mathdl.maa.org)

U.S. Students Take Top Honors at Romanian Master of Mathematics

A team of U.S. high school students, organized by the Mathematical Association of America, returned to 1st place at the Romanian Master of Mathematics competition after a top team finish in 2016. Held Feb. 21-26, 2018 in Bucharest, Romania, the Romanian Master of Mathematics is one of the most challenging international high school mathematics competitions in the world.

A total of 20 teams from around the world were invited to compete in the RMM. Contestants work through six problems over two days. The team score is based on the combined highest three individual scores. In addition to the team placement, students on the U.S. team took home the following honors:

- Mihir Singhal, gold medal
- Swapnil Garg, gold medal
- Colin Tang, silver medal
- Brandon Wang, silver medal

For this event, Po-Shen Loh, Carnegie Mellon University, was the U.S. Team Leader and Evan Chen served as U.S. Team Deputy Leader. Students who compete in the Romanian Master of Mathematics take part in the the Mathematical Association of America's training program, the Mathematical Olympiad Program, which focuses on the long term development of American mathematical talent. The Mathematical Olympiad Program draws from students who perform exceptionally well on the MAA American Mathematics Competitions (AMC) 10/12 for high school students. They are invited to continue participating in the AMC series of examinations that culminate with the International Mathematical Olympiad each summer.

U.S. Team Takes Second Place at European Girls' Mathematical Olympiad

The U.S. team took second place at the European Girls' Mathematical Olympiad (EGMO) held April 9-15, 2018 in Florence, Italy against teams from 52 countries. In addition to second place team honors, each member of the four person team was awarded a medal for their individual performance on the challenging mathematics exam.

The European Girls' Mathematical Olympiad is an international mathematics competition for female high school students. This year's competition had 192 students. The U.S. team is organized by the Mathematical Association of America and has consistently placed in the top four teams with a first place team finish in 2017.

(continued)

The 2018 EGMO U.S. team members are Megan Joshi (EGMO individual silver medal), Wanlin Li (EGMO individual gold medal), Emily Wen (EGMO individual bronze medal), and Catherine Wu (EGMO individual gold medal). Meghal Gupta served as team leader and Rachel Zhang as deputy leader.

The exam is made up of six proof-style problems given over two days. The U.S. team score was 129 out of a possible 168 points. Wu and returning U.S. team member Li were two of only five students to receive a perfect score of 42 points in the competition.

“The Mathematical Association of America is proud to sponsor the U.S. EGMO team as part of the MAA American Mathematics Competitions. On behalf of the mathematical community, we congratulate you on your second place finish in the European Girls’ Mathematical Olympiad. Your extraordinary performance is an inspiring example of hard work for the next generation of young mathematicians,” said Jennifer Barton, MAA director of competition operations. “We celebrate your achievements and are proud that you are part of America’s top math students.”

For complete scores, visit the EGMO.

MAA Announces $145,000 in Tensor Foundation Funding to Encourage Women and Historically Underrepresented Groups in Math

The Mathematical Association of America, on behalf of the Tensor Foundation, awarded $145,480 in funding to 28 institutions to encourage college and university women, pre-college girls and underrepresented groups to pursue mathematics.

“The Mathematical Association of America supports a portfolio of efforts to broaden participation in mathematics. We are grateful to the Tensor Foundation for their support. It is critical to society's future success that we have access to diverse perspectives to solve problems that impact our world,” said Michael Pearson, executive director of the Mathematical Association of America.

The funding was spread across two MAA grant programs. MAA Tensor Women and Mathematics grants funded 14 projects aimed at increasing women’s involvement, totaling $66,983. The MAA Tensor-SUMMA grants for students from historically underrepresented groups in mathematics funded 14 projects that total $78,497.

These projects, which range from math camps to mentored research, provide enrichment activities that increase interest in mathematics, foster a deeper appreciation, and encourage students to explore careers in a mathematical field.

The complete list of funded projects for the MAA Tensor-SUMMA program and MAA Tensor Women and Mathematics program can be found here.

MAA Funds 42 Campuses to Prepare Math Students for Careers in Industry

The Mathematical Association of America announces funding for 42 colleges and universities to offer a course that challenges students to use math to solve an industrial research problem as part of the MAA Preparation for Industrial Careers in Mathematical Sciences (PIC Math) program. The PIC Math program is supported by the National Science Foundation (DMS-1722275) and prepares mathematical sciences students for industrial careers by engaging them in research problems that come directly from industry.

“We are proud to support the preparation of future mathematicians for careers in business, industry, and government through the MAA PIC Math program. This National Science Foundation funding allows the MAA to increase awareness among mathematical sciences faculty and undergraduates about non-

academic career options. We know that the colleges and universities awarded will successfully prepare their students to make a positive impact on the world with their mathematical problem-solving skills," said Michael Pearson, executive director of the Mathematical Association of America.

In addition to a semester-long course that allows students to problem-solve and network with a local industrial partner, MAA also funds training to prepare faculty on each campus to facilitate the course in their community.

The PIC Math program has served 131 campuses and more than 2,000 students since it first began in 2014. As they tackle an industrial partner's real-world problem, students who participate in the PIC Math program learn problem solving, critical thinking, communications, and independent thinking skills that are valued by employers of STEM professionals.

This program supports underrepresented groups in the mathematical sciences, as well as first-generation and low socio-economic status college students. An estimated 534 students will participate in the program at 42 institutions that received funding in 2018.

The complete list of funded institutions for the MAA PIC Math program can be found here.

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EVENTS CALENDAR

Metropolitan New York Section Meeting • May 13, 2018, Hofstra University, Hempstead, NY
For more information see this newsletter, or visit: sections.maa.org/metrony/

Mathematics is a Long Conversation: A Celebration of Barry Mazur • June 4-8, 2018
Harvard University, Cambridge, MA
For more information visit: www.math.harvard.edu/conferences/mazur18/

SIAM Annual Meeting • July 9-13, 2018, Portland, OR
For more information visit: www.siam.org/meetings/an18/

NYS STEM Education Collaborative Summer Institute • July 29-31, 2018, SUNY Alfred, Alfred, NY
For more information visit: www.nysstemeducation.org/2018-institute/

MathFest • August 1-4, 2018, Denver, CO • For more information visit: www.maa.org/meetings/mathfest

Vladimir Voevodsky Memorial Conference • September 11-14, 2018
Institute for Advanced Study, Princeton, NJ • For more information visit: www.math.ias.edu/vvmc2018

AMS Fall Eastern Sectional Meeting • September 29-30, 2018, University of Delaware, Newark, DE
For more information visit: www.ams.org/meetings/sectional/2256_program.html

NCTM Regional Conference and Exposition • October 4-6, 2018, Hartford, CT
For more information visit: www.nctm.org/hartford

Seaway Section Meeting • October 12-13, 2018, University of Toronto, Mississauga, CAN
For more information visit: people.rit.edu/maacway/

New Jersey Section Meeting • October 27, 2018, Montclair State University, Montclair, NJ
For more information visit: sections.maa.org/newjersey/Main/index.html

AMTNYS 68th Annual Fall Conference • November 2-3, 2018, Saratoga Springs, NY
For more information visit: www.amtnys.org/pages/fall-conference.html

AMATYC 44th Annual Conference • November 15-18, 2018, Orlando, FL
For more information visit: www.amatyc.org/?2018ConfHome

MAA-AMS Joint Mathematics Meeting • January 16-19, 2019, Baltimore, MD
For more information visit: www.maa.org/meetings

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METROPOLITAN NEW YORK SECTION

OF THE

MATHEMATICAL ASSOCIATION OF AMERICA

ANNUAL MEETING
SUNDAY, 13 May 2018

HOFSTRA UNIVERSITY
Hempstead, NY

INVITED SPEAKERS

Joseph Mitchell, Stony Brook University
Geometric Optimization Problems for Efficient Viewing: Finding Good Ways to See Things Well

Steven Krantz, Washington University in St. Louis
A Matter of Gravity

Lionel Levine, Cornell University
The Future of Prediction

Nathan Kallus, Cornell University
Learning to Personalize from Observational Data

PARTNER DISCIPLINES ON TEACHING MATHEMATICS

Elizabeth Bauer, Department of Psychology, New York University
Kevin Bisceglia, Department of Chemistry, Hofstra University
Peter Daniel, Department of Biology, Hofstra University
Ashwin Satyanarayana, Department of Computer Systems Technology, New York City College of Technology
Alan Tucker, Department of Applied Mathematics and Statistics, Stony Brook University

CONTRIBUTED PAPER AND POSTER SESSIONS

Research, Pedagogical, and Student Presentations

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