The Mathematical Association of America New Jersey Section Meeting

held in conjunction with MATYCNJ (Mathematics Association of Two-Year Colleges of New Jersey)

and

Garden State Undergraduate Mathematics Conference

Opening doors through Mathematics AMATYC

Raritan Valley Community College Branchburg, NJ

Saturday, April 13, 2019

Abstracts and Biographies of Speakers
Techniques to Enhance Stereographic Imaging
Michelle Craddock Guinn, Belmont Unversity

The objective of my research is to design an algorithm to enhance stereoscopic imagery so that it adapts to the viewing distance of the observer, with seamless transitions among stereo and hyperstereo levels. The goal of this research is to develop an algorithm to provide hyperstereo in conjunction to stereo enhancing the depth information needed to improve performance and judgment. A technique to augment the benefits of stereo and hyperstereo will be the focus of this research. The algorithm will use image smoothing, blending and edge detection techniques to provide this enhancement.

Dr. Michelle Craddock Guinn is an Associate Professor of Mathematics at Belmont University. She recently gave the J. Ernest Wilkins Lecture at the National Association of Mathematicians, Inc. Undergraduate MATHFest. She graduated from Spelman College in Atlanta, GA where she majored in mathematics. Michelle received both masters and doctoral degrees in mathematics from the University of Mississippi in Oxford, MS in the area of Functional Analysis. After graduation, she accepted a post-doctoral position at the United States Military Academy in West Point, NY and later awarded the Davies Fellowship which allowed her the time to research Image Processing at the United States Army Research Laboratory (ARL) in Adelphi, MD. She joined the Department of Mathematics and Computer Science at Belmont University in the fall of 2013, and she was recently the first African American to be granted tenure and promotion in the Mathematics and Computer Science Department at Belmont University, and she is the second in the College of Science and Mathematics. She has two daughters that make this journey of life meaningful.

Teaching Mindset Mathematics Through Open, Creative Mathematics and Brain Science Messages
Jo Boaler, Stanford University

We are in the midst of a revolution, in the science of the brain and learning. New knowledge from brain science is showing a clear path for mathematics learning, that is both exciting and inspiring for teachers. In recent years scientific studies have also demonstrated that student and teacher 'mindsets' have a profound impact on learning. So what does mathematics teaching look like when it takes account of brain science and mindset research? It is open, creative, visual and it encourages brain connections through multi-modal representations of knowledge. In this session we will think about ways to teach mindset mathematics, K-16, and look at videos of students who have learned in these ways. We will consider what mathematics can be and look like when it is open, creative and beautiful.

Dr Jo Boaler is a Professor of Mathematics Education at Stanford University, and the faculty director of youcubed. She is the author of the first MOOC on mathematics teaching and learning. Former roles have included being the Marie Curie Professor of Mathematics Education in England, a mathematics teacher in London comprehensive schools and a lecturer and researcher at King's College, London. Her PhD won the national award for educational research in the UK. She is an elected fellow of the Royal Society of Arts (Great Britain), and a former president of the International Organization for Women and Mathematics Education (IOWME). She is the recipient of a National Science Foundation 'Early Career Award', the NCSM Kay Gilliland Equity Award (2014) and the CMC Walter Denham Mathematics Leadership award (2015). She is the author of nine books and numerous research articles. She recently formed www.youcubed.org to give teachers, parents and students the resources and ideas they need to inspire and excite students about mathematics. Her work has been published in the New York Times, TIME magazine, The Telegraph, The Atlantic, The Wall Street Journal and many other news outlets. She was recently named one of the 8 educators "changing the face of education" by the BBC.

Bingo Paradoxes
Arthur Benjamin, Harvey Mudd College

Imagine you are walking past a crowded Bingo parlor with hundreds of people playing. Suddenly you hear one person excitedly call out "Bingo!". Is it more likely that they have 5 in a row or 5 in a column (or are they the same)? Or is the most probable outcome diagonal? The answers will surprise you.

Dr. Arthur Benjamin earned his B.S. in Applied Mathematics from Carnegie Mellon U and his PhD in Mathematical Sciences from Johns Hopkins University. Since 1989, he has taught at Harvey Mudd College, where he is the Smallwood Family Professor of Mathematics. He has served as co-Editor (with Jennifer Quinn) of Math Horizons for MAA, he is a Fellow of the AMS, and has received numerous awards, including the MAA Haimo Prize for distinguished teaching, the MAA Beckenbach Book prize forProofs That Really Count, the Communications Award from the Joint Policy Board for Mathematics. He has given 3 TED Talks, which have been viewed over 20 million times. His newest book, a New York Times Bestseller in Education, is called The Magic of Math: Solving for X and Figuring out Why. Aside from his research interests in combinatorics and game theory, he enjoys tournament backgammon, writing parodies, racing calculators, and performing magic.

Panel: PIC Math in New Jersey
Presented by Dr. Aihua Li, Montclair State University
and Dr. Thanh Nguyen, Rowan University
Moderator Hieu Nguyen, Rowan University

Preparation of Industrial Careers in the Mathematical Sciences (PIC Math) is an MAA program that prepares mathematics students for industrial careers by engaging them in research problems that come directly from industry. The program includes faculty development opportunities to learn strategies to connect with industry partners, prepare students mathematically, and offer a

research course. This panel features NJ Section members that have participated in the PIC Math program. They will share more details of the program and their experiences implementing these strategies in New Jersey.

Dr. Aihua Li is a professor of Mathematics at Montclair State University. She received her Ph. D. in mathematics from the University of Nebraska-Lincoln. Her primary research is in commutative algebra, specialized in ring theory and ideal theory. In recent years, she has done research in number theory, matrix theory, discrete dynamical systems, and graph theory. Dr. Li is currently the chair of the Mathematical Association of America New Jersey Section (MAA-NJ). She received the PIC Math funding from MAA (through an NSF grant) and taught a PIC Math class in spring 2017 at MSU. She is the recipient of a Distinguished Scholar Award by Montclair State University and a Faculty Mentoring Award by the Division of Mathematics and Computer Science of CUR.

Dr Thanh Nguyen is an Assistant Professor of Applied Mathematics at Rowan University. He received a Bachelor and Master degrees in Mathematics from Vietnam National University, Hanoi and a PhD in Engineering from Vrije Universiteit Brussel (Free University of Brussels), Belgium. Before joining Rowan University, he have worked at Austrian Academy of Sciences, University of North Carolina at Charlotte, and Iowa State University. Thanh's research interests are in inverse problems for partial differential equations and engineering applications. Some application projects he has worked on include the detection of buried landmines using ground penetrating radar and infrared camera; through-wall imaging; and through-dress imaging. He joined the PIC Math project in 2018-2019 and is teaching the PIC Math course in spring 2019.

Abstracts of MAA-NJ Contributed Paper Sessions

Organizer: Theresa C. Michnowicz, New Jersey City University
Session 1: Recreational Mathematics
ATCC 101. Organizer and Presider: David Nacin, nacind@wpunj.edu

2:00–2:15: **Padovan, Pascal, and Proofs without Words**
David Nacin, William Paterson University

Abstract: The image of the golden spiral is perhaps the most famous picture in all of Mathematics. It is constructed simply by placing squares in such a way that the next one has no overlap. The side lengths in this construction are simply the Fibonacci numbers. If we repeat this same process with equilateral triangles, the side lengths give us a new sequence, one called the Padovan Numbers and identities are now based around the plastic number instead of the golden ratio.

We briefly discuss the history of this sequence and how the architect Hans van der Laan first stumbled upon these numbers. We then move on by showing how this same sequence arises again and again in a number of counting problems involving dominoes, perfect matchings, compositions, and more. We present each of these through pictures alone and show how each one provides a method for finding the initial recurrence relation, as well as proving several identities.

Our main result is a collection of new proofs without words that involve nothing more than a pyramid of dots in two different colors. It is possible to prove several of the most famous identities without either words or numbers, simply by associating each Padovan number with the correct diagonals of Pascal's triangle. We can strip the numbers off the triangle completely, and simply lets the dots dance and do the rest.

2:15–2:30: **Limit Points of Folding Sequences**
Matt Sequin, Saint Peters University
Abstract: Imagine a thin strip of paper labeled with the interval [0, 1], where 0 is on the very left edge of the paper and 1 is on the right edge. If this strip of paper is folded in a certain way, the creases from the folds will correspond to different numbers in the interval. Folding the paper an infinite number of times will yield a sequence, called a folding sequence. In this talk, we will focus on the limit points of these sequences, and briefly discuss how folding sequences can be used as an example to introduce key concepts in an undergraduate point-set topology or analysis course.

2:30–2:45: **Exploring a Fascinating Prime Magic Square**
Jay L. Shiffman, Rowan University

Abstract: There are a number of prime magic squares including Rudolph Ordrejka's (1928-2001) consisting of the nine entries 17, 89, 71, 113, 59, 5, 47, 29 and 101:

17	89	71
113	59	5
47	29	101

This paper considers a companion prime magic square whose entries are as follows:

1480028159	1480028153	1480028201
1480028213	1480028171	1480028129
1480028141	1480028189	1480028183

We explore a number of interesting properties possessed by this magic square and determine the smallest constant required to add to each of the entries to obtain a new magic square consisting of from 1-9 primes respectively if this is possible. In addition, we determine the case where constants are added to obtain no prime entries. The latter problem takes on two flavors, which will be discussed.

Session 2: Graph Theory and Combinatorics

ATCC 102. Organizers and Presiders: Amanda Beecher, Ramapo College of New Jersey; abeecher@ramapo.edu; Lei Cao, Georgian Court University, lcao@georgian.edu

2:00–2:15: **The Maximization of Neighbor-Component Order Connectivity**
Kristi Luttrell, Seton Hall University; joint with Daniel Gross, John T. Saccoman, Seton Hall University; L. William Kazmierczak, Charles Suffel, Monika Heinig; Stevens Institute of Technology

Abstract: The vulnerability parameter neighbor-component order connectivity is defined as the minimum number of closed neighborhoods that must be removed from a graph in order to ensure that all remaining components have order less than some given threshold value, k. Consider a network modeled by a graph G on n nodes and e edges. We denote neighbor-component order connectivity as $\kappa_{nc}^{(k)}(G)$ or simply $\kappa_{nc}^{(k)}$. We observe that the problem of computing the neighbor-component order connectivity of a network modeled by an arbitrary

graph G for arbitrary k is NP-hard since $\kappa_{nc}^{(1)}(G)$ = γ(G), where γ(G) is the domination number of G. In this talk, we will look at a result that ensures maximum neighbor-component order connectivity over all graphs having the same number of nodes and maximum degree.

2:15–2:30: **Integral Regular Split Multigraphs**
John Saccoman, Seton Hall University; joint with Elizabeth Newman, Bianca Reilly, Seton Hall University

Abstract: A split graph is a graph in which the nodes can be partitioned into a clique and an independent set (whose nodes are called cones). A split graph G is proper if every cone has the same degree. Past results in spectral graph theory address multigraph concerns in cases which are underlying threshold, whose neighborhoods are nested in a multiset way and all multiple edges are confined to the clique. We present formulas for the eigenvalues of regular split multigraphs in which all multiple edges occur between the clique nodes and cone nodes, multiplicity of multiple edges μ > 1 fixed, and whose adjacency matrix eigenvalues are integral.

2:30–2:45: **Using Single-Elimination Tournaments as a Voting Method**
Christian Hellings, Gwynedd Mercy University; joint with David DiMarco and Ryan Savitz, Neumann University

Abstract: Various methods of voting have been proposed as alternatives to the widely used plurality voting system. We investigate a new method based on using single-elimination tournaments to decide the winner of an election. In this approach, candidates face off against each other in all possible bracket-style tournaments (as in the NCAA basketball tournament). We describe the method, compare it to other existing methods, and discuss its properties.

2:45–3:00: **The Extreme Points of Certain Convex Polytopes**
Lei Cao, Georgian Court University; joint with Richard Brualdi, University of Wisconsin at Madison

Abstract: We investigate convex polytopes of doubly stochastic matrices having special structures: symmetric, Hankel symmetric, centrosymmetric, and both symmetric and Hankel symmetric. We determine dimensions of these polytopes

and classify their extreme points. As a continuation, we characterized the extreme points of the convex polytopes of doubly substochastic matrices with those symmetries and the classical transportation polytope with these symmetries.

3:00—3:15: **A Graphical Forest**
Grace Cook, Bloomfield College
Abstract: I will discuss an undergraduate mathematics project conducted by non-math majors in a discrete mathematics course. The course consisted of computer science, elementary mathematics education, and game programming majors. The project required students to create a graphic organizer to connect the key concepts of graph theory as related in Oscar Levin's Discrete Mathematics: An Open Introduction, 2nd edition, an open educational resource for discrete mathematics. Students spent several course sessions creating a list of key vocabulary terms, techniques, and theories related to graph theory then discussing ways that the elements of the list related to each other and how they were connected in a physical sense (i.e. paths connect to math graphs). Students then created a graphic organizer in an effort to relate the topics visually. I will share their successes and failures in the endeavor and how they attempted to integrate graph theory into the actual graphic organizer.

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Lunch Discussion Tables
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Organized by Theresa C. Michnowicz, New Jersey City University.
There will be seven discussion tables at lunch:
1. *My favorite proofs*, led by Arthur Benjamiin, benjamin@hmu.edu
2. *Changing college students' relationships with mathematics*, led by Jo Boaler, joboaler@stanford.edu
3. *Encouraging, supporting and mentoring students from underrepresented groups*, led by Michell Guinn, michelle.guinn@belmont.edu
4. *Non-academic careers for mathematics students*, led by Aihua Li, lia@montclair.edu, and Thanh Nguyen, nguyent@rowan.edu
5. *Undergraduate research in combinatorics and graph theory,* led by Lei Cao, lcao@georgian.edu, and Amanda Beecher, abeecher@ramapo.edu
6. *The mathematics of paper puzzles: Sudoku, KenKen, Kakuro, Maysu and more*, led by David Nacin, nacind@wpunj.edu

7. *Teaching mathematics to non-majors*, led by Jonathan Weisbrod, jweisbrod@rcbc.edu

GSUMC Career Panel: How to Get Your First Job?

Moderator: Angel Pineda, Associate Professor and Graduate Director of Mathematics, Manhattan College

Recent mathematics graduates share their career path and how they got their first job. They will also share their experiences in the workplace to help prepare students for the transition from academia to industry. There will be presentations followed by a question and answer session with the audience. Come and learn what recent graduates wished they knew when they were students!
Panelists:

- Katherine Encarnacion, Data Scientist, United Parcel Service (UPS)
- Stewart Hengeveld, Analytics Analyst III at Horizon Blue Cross Blue Shield (BCBS) of NJ
- Alyssa Parker, Actuarial Assistant, ProSight Specialty Insurance

Announcements

Call for Contributed Papers and Lunch Discussion Leaders for the Fall MAA-NJ 2019 Meeting

There will be one general contributed paper session at the Fall 2019 meeting. Please submit title, 3-4 line summary, and a one-paragraph abstract in Word to Kathy Turrisi, Centenary University, Kathy.Turrisi@CentenaryUniversity.edu, by September 6, 2019.

MAA members interested in leading a lunch table discussion at the Fall 2019 meeting are asked to submit their proposed topic to Amanda Beecher, Ramapo College of New Jersey, abeecher@ramapo.edu, by September 6, 2019.

Call for Special Contributed Paper Session Organizers for the Spring 2020 MAA-NJ Meeting

Those interested in organizing a special contributed paper session for the Spring 2020 meeting should submit the proposed topic to Amanda Beecher, Ramapo College of New Jersey, abeecher@ramapo.edu, by September 6, 2019.

Book Sales at the Meeting

There is a 40% discount for MAA and AMS members and a 25% discount for non-members. We have new books on display but you are not able to order books at the meeting. If you are not an AMS member, call (800) 321-4267 with code MT262, before May 13. If you are a member of AMS, use code MT262 either when you call or when you order through the online bookstore.

Future MAA Meetings

MAA-NJ. The Fall 2019 MAA-NJ meeting will be held at Essex County Community College on Saturday, October 26, 2019. The Spring 2020 MAA-NJ meeting will be held at Rowan University on a date to be announced.

MathFest. The MAA will hold its annual MathFest in Cincinnati July 31 – August 3, 2019. For further information, refer to http://www.maa.org/mathfest/

Joint Mathematics Meeting. The 2020 JMM will be in Denver, January 15 – 18.

Future AMATYC Meetings

AMATYC. The 2019 AMATYC annual meeting will be held in Milwaukee, WI, on November 14 – 17, 2019. For further information, refer to http://www.amatyc.org

NJAMTE Annual Meeting

The New Jersey Association of Mathematics Teacher Educators will hold its 13th annual conference at The College of New Jersey on Friday, May 31, 2019. Anyone involved in the mathematical education of teachers is encouraged to join NJAMTE. For further information, contact Maria DeLucia at mariadelucia@comcast.net.

25/50/75-year Members of the MAA: The section congratulates Karen E. Clark, Mark J. Karol, and Katherine Safford Ramus for their 25 years of MAA membership. We congratulate Vaclav E. Benes, Frank L. DiMeglio, Lionel B. Garrison, Gary S. Itzkowitz, Samuel Kohn, Gerald A. Reisner, William J. Rickert, and Kenneth H. Rosen for 50 years of membership. And special recognition to Hyman J. Zimmerberg, who has been a member of MAA for 75 years!

MAA-NJ Committees

Awards Committee: Thomas Hagedorn (chair), The College of New Jersey; Aihua Li (ex-officio), Montclair State University; Theresa Michnowicz, New Jersey City University; Jonathan Weisbrod, Rowan College at Burlington County.

Nominating Committee: Zhixiong Chen, New Jersey City University; Karen Clark, The College of New Jersey; Thomas Hagedorn (chair), The College of New Jersey; Aihua Li (ex-officio), Montclair State University; Hieu Nguyen, Rowan University.

Teaching Award Committee: Denis L. Blackmore, NJIT; Karen Clark (chair), The College of New Jersey; Aihua Li (ex-officio), Montclair State University; Dirck Uptegrove, Nokia.

Committee for Contributed Papers: Lei Cao, Georgian Court University; Grace Cook, Bloomfield College; Aihua Li (ex-officio), Montclair State University; Theresa Michnowicz (ex-officio), New Jersey City University; Kathy Turrisi (chair), Centenary University.

Organizing Committee: Deepak Bal, Montclair State University; Amanda Beecher, Ramapo College of New Jersey; Lei Cao, Georgian Court University; Zhixiong Chen, New Jersey City University; Grace Cook, Bloomfield College; Jana Gevertz, The College of New Jersey; Thomas Hagedorn, The College of New Jersey; Ik Jae Lee, Rowan University; Aihua Li, Montclair State University; Theresa C. Michnowicz, New Jersey City University; Sarita Nemani, Georgian Court University; Linda Ritchie, Centenary University; Kathy Turrisi, Centenary University; Dirck Uptegrove, Nokia; Elizabeth Uptegrove, Felician University; Paul von Dohlen, William Paterson University; Jonathan Weisbrod, Rowan College at Burlington County.

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Hosting Committee: Rosemarie Gorini (chair), Nemanja Nikitovic, Nora Thornber, Aditi Patel and Ashlee Pieris, Raritan Valley Community College.

GSUMC Committees

Organizing Committee: Deepak Bal (co-director), Montclair State University; Lee Collins (co-director), Rowan University; Katarzyna Kowal, Ramapo College of New Jersey; Giancarlo Labruna, Montclair State University; Ik Jae Lee (co-director), Rowan University; Marek Slaby, Fairleigh Dickinson University at Florham Campus.

New Jersey Undergraduate Mathematics Competition Organizing Committee: Katarzyna Kowal (Co-Director), Ramapo College of New Jersey; Tom Leong, University of Scranton; David Molnar, Rutgers University at New Brunswick; Emanuel Palsu-Andriescu, Monmouth University; Marek Slaby (Co-Director), Fairleigh Dickinson University at Florham Campus.

New Jersey Undergraduate Mathematics Competition Proctors and Graders: Nicholas Battista, The College of New Jersey; Michael Beals, Rutgers University; Crystal Bourne, Rowan College at Burlington County; Carlos Castillo, Essex County College; Tao Chen, LaGuardia Community College; Andrew Clifford, The College of New Jersey; Benjamin Daniels, Rowan University; Joseph DeGaetani, Montclair State University; Tom Leong, University of Scranton; Robert Mayans, Fairleigh Dickinson University at Florham Campus; Priti Mihalik, Rowan College at Burlington County; David Molnar, Rutgers University; Ken Monks, University of Scranton; Emanuel Palsu-Andriescu, Monmouth University; Vasil Skenderi, Saint Joseph's Colllege; Jonathan Weisbrod, Rowan College at Burlington County; Chia-Lin Wu, Stockton University.

Student Presentations: Lee Collins (Coordinator), Rowan University; Eric Jones, Rowan College at Gloucester County.

Acknowledgments

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The New Jersey Section offers congratulations to the GSUMC for sixteen years of successful undergraduate math conferences.

The 2019 GSUMC is supported by Nokia Bell Labs and the NJ section of the MAA. The GSUMC thanks Raritan Valley Community College for their kind hospitality in hosting the meeting.

Social Media Information

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MAA-NJ and MATYCNJ
Spring 2019 Meeting Program

8:30 – 9:30	**Registration and Coffee;** Conference Center Lobby
8:30 – 1:30	**Book Exhibits;** Conference Center Lobby
9:30 – 9:40	**Welcome by Dr. Audrey Loera, Dean of Academic Support and Education Partnerships;** ATCC room ABC
9:40 – 10:30	**Techniques to Enhance Stereographic Imaging**; Michelle Craddock Guinn, Belmont University**.** Presider: Amanda Beecher, Ramapo College of New Jersey; ATCC room ABC
	MATYCNJ Panel Discussion: New 60-Credit Degree Requirement; Somerset Hall room S-122
10:30 – 10:45	**MAA-NJ Business Meeting**; ATCC room ABC
10:30 – 11:10	**Intermission**; Book exhibits; Conference Center Lobby
	MATYCNJ Business meeting; Somerset Hall room S-122
11:10 – 12:00	**Teaching Mindset Mathematics through Open, Creative Mathematics and Brain Science Messages;** Jo Boaler, Stanford University**.** Presider: Thomas Hagedorn, The College of New Jersey; ATCC room ABC
12:00 – 1:30	**Lunch**; ATCC room ABC
1:00 – 2:00	**Student Poster Session**; College Center, Student Lounge
2:00 – 2:50	**Panel: PIC Math** Aihua Li and Thanh Nguyen; ATCC ABC
2:00 – 3:15	**Contributed Paper Sessions**; ATCC 101 and ATCC 102
	Student Talks; Somerset Hall Rooms S-013, S-014, S-015, S-016
3:20 – 3:50	**Break;** Conference Center Lobby 3:30 is the deadline for door prize/silent auction entries
3:50 – 4:40	**Bingo Paradoxes,** Arthur Benjamin, Harvey Mudd College. Presider: Deepak Bal, Montclair State University; ATCC room ABC
4:40 – 5:00	**Prizes and Awards**; GSUMC awards, door prizes, and silent auction winners (must be present to win); ATCC room ABC
5:30	**Dinner Honoring Speakers**; Stoney Brook Grille

Garden State Undergraduate Math Conference
Spring 2019 Program

8:30 – 9:15	**Team Registration, Student Check-in, and Breakfast;** College Center, Student Lounge
9:20 – 9:30	**Announcements** regarding Math Competition; College Center, room C-008/C-010
9:30 – 10:30	**New Jersey Undergraduate Math Competition**; Individual Part; College Center, room C-008/C-010
10:30 – 12:00	**New Jersey Undergraduate Math Competition**; Team part, rooms to be announced during the individual part
12:00 – 1:00	**Lunch**; Student Lounge
1:00 – 2:00	**Student Poster Session**; Student Lounge
2:00 – 3:10	**Student Talks**; Somerset Hall, rooms S-013, S-014, S-015, S-016
3:10 – 3:50	**Career Panel**; College Center, room C-008/C-010
3:50 – 4:40	**Bingo Paradoxes,** Arthur Benjamin, Harvey Mudd College. Presider: Deepak Bal, Montclair State University; AT Conference Center, room ABC.
4:40 – 5:00	**Prizes and Awards**; GSUMC awards, door prizes, and silent auction winners (must be present to win); AT Conference Center, room ABC.

Dinner Honoring the Invited Speakers and Award Recipients

The Section will honor the invited speakers and award recipients at dinner at Stoney Brook Grille following the meeting. Everyone is cordially invited.