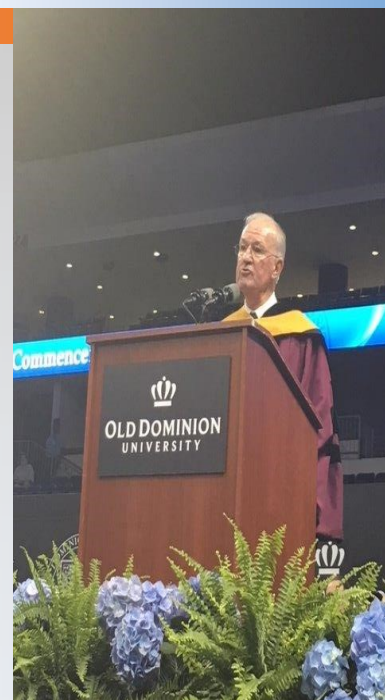


Mathematics & Statistics Newsletter



Chair's Message:

Dr. Hideaki Kaneko

Hello Faculty, Staff, Students and Alumni

We have concluded an exciting and productive spring 2018 semester. At the undergraduate level, the department is piloting a number of programs aimed at improving students' performance in their mathematics and statistics classes. Bob Strozak, Blair Swoope and Andrea Jones are restructuring the Math 162 course in order to introduce a number of problem solving sessions as part of the course. Robin Flanagan will pilot an ALEKS based Math 103 class in fall 2018. The department continues to be actively engaged in online course development. Online courses are very popular among students. Also, instructors who teach online courses are finding the online mode of instruction to be quite effective. Recently, Lee Land developed an online version of Math 163. She is teaching it for the first time this summer. Przemek Bogacki, Gordon Melrose and Bob Strozak are developing on-line courses for Math 211 and Math 212. The department's Big Data Analytics program is off to a great start. Katie Smith taught BDA 411/511 – Introduction to Machine Learning I to a group of enthusiastic students. I believe that this major, Big Data Analytics, will attract more and more students in the years to come. At the graduate level, during the AY 17-18, the faculty published or have articles accepted for publication totaling more than 50 papers. The department is being visited by a number of post-doctoral research associates and visiting graduate students. Their biographies can be found on subsequent pages of this newsletter.

Nail Yamaleev secured a large grant from the Army Research Office with a project title "Physics-based Spectral Collocation Methods for Large Eddy Simulation on Adaptive Grids". Yan Peng, Li-Shi Luo and Ruhai Zhou, each, are currently supported by NSF grants. Fang Hu as well as John Tweed are both working on projects with NASA Langley, with Fang's research being on jet noise abatement and John's research being on radiation shielding studies and improved transport method. We have listed below the current grant activities in the department. Our statistics group, Rao Chaganty, Norou Diawara and Kayoung Park, are providing statistical consultation to other faculty members on campus. Yuesheng Xu has been spearheading the effort to advance the departmental initiative in Data Science. He is leading a very active weekly seminar on the subject which is attended by a number of our faculty members. Yuesheng's work on Medical Imaging in collaboration with the Memorial Sloan Kettering Cancer Center is drawing much attention throughout the country. In summary, I am delighted to report that the level of research productivity is rising and will continue to increase.

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John Adam

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Special points of interest

- Student Organizations
- Julia Robinson Festival
- Grants
- New Faculty

Featured Faculty Members:



Heather Kunkel :

Heather received her B.S. degree in Interdisciplinary Studies in May 1995 and M.S. degree in Education in December 1995, both from Old Dominion University. After teaching several years at Hickory Middle School and Indian River Middle School in Chesapeake, she joined the department in 2002 as Instructor of Mathematics. She was promoted to the current rank of Senior Lecturer in 2010. Heather completed an additional 18 credit hours of graduate mathematics courses at ODU. Heather attended a Math Awareness Conference in 2017 as well as in 2018. She is actively involved in teaching a recently created course, Math 205 – Calculus for Life Sciences. She plans to develop an ONLINE version of this course in the spring of 2019. One of her passions is flying; she received Private Pilot Certificate in 2006.



Przemek Bogacki::

Dr. Bogacki is Associate Professor and University Professor of Mathematics. He received Ph.D. in mathematical sciences from Southern Methodist University in 1990. Przemek has been conducting his research in the area of Mathematical Education. His book on Linear Algebra is scheduled to be published by the American Mathematical Society. Recently, Przemek became a fourth author of the popular textbook, University Calculus: Early Transcendentals, which is published by the Pearson Publishing Company. His excellent teaching skills were recognized twice by the college of Sciences as the Distinguished Teacher. Among numerous service activities, Przemek serves as Editor and Managing Editor of the Electronic Proceedings of the Annual International Conference on Technology in Collegiate Mathematics (ICTCM). He is also a Member of the MyMathLab (Pearson) Advisory Board.



Course Coordinators:

Math 101– Shari Davis
Math 102– Eunice Pepper
Math 103M– R. Flanagan
Math 162– E. Swoope
Math 163– R. Stowe
Math 200–T. Grant
Math 211/212/312– P. Bogacki & Gordon Melrose
Stat 130M– J. Russell

Grants:

Catherine Chamberlayne: Implementation of Modified Flipped Classroom, PI, Faculty Innovator Grant CLT ODU, Amount \$1,500.

Rao Chaganty: (1) Chesapeake Bay Monitoring Program, Co-PI, Department of Environmental Quality, Virginia, July 2017 to June 2018. Amount \$20,364

Shari Davis: Supplemental Critical Thinking Explorations to Promote Discovery and Deeper Comprehension, Co-PI, Faculty Innovator Grant CLT ODU, Amount \$1,500

Norou Diawara: (1) DMV Virginia Seat Belt and Core Survey, Co-PI, November 2017 to September 2018, Virginia Department of Motor Vehicles pass-through funds from the U.S. Department of Transportation Virginia. Amount \$19,980. (2) Improving Integrated Behavioral Health Care Training across the lifespan for Masters Level Counselors and Clinical Supervisors through Technology and Experiential Training. Co-PI, U.S. Department of Health and Human Services (HRSA), September 2017-August 2021, Amount \$192,000 (3) Quantitative Image Modeling for Brain Tumor Analysis and Tracking, Co-PI, NIH, through 2019, Amount \$187,200.

Fang Hu: TDFAST: Time Domain Fast Acoustic Scattering Toolkit, National Institute of Aerospace, PI, May 2017 - March 2018, Amount \$82,400.

Sookyoung Joo: Mathematical studies of smectic A and bent-core liquid crystals, PI, Simons Foundation Grant, September 2016 – August 2021, Amount \$40,000.

Li-Shi Luo: (1) Funding for Teaching Time Release, PI, Beijing Computational Science Research Center, China, January 2018–May 2018, Amount \$14,000. (2) Funding to Support Post-Doctoral Research, Jefferson Science Associates, LLC (JLab/DOE), September 2017–August 2018, Amount \$38,154. (3) Collaborative Research: Efficient High-Order Algorithms for Nonequilibrium Microflows Over the Entire Range of Knudsen Number, PI, National Science Foundation, August 2017 – July 2020, Amount \$162,500.

Ke Shi: IMA Workshop for Recent Advances and Challenges in Discontinuous Galerkin Methods and Related Approaches, Co-PI, NSF \$15,000.

Grants Continued:

Kayoung Park: Food Assistance, Diet and Body Weight Status among WIC Eligible Children, Co-PI, National Institutes of Health/Eunice Kennedy Shriver National Institute of Child Health & Human Development, December 2016 – December 2018, Amount \$155,000.

Yan Peng: Numerical study of electrokinetic bioparticle transport through fluid-structure-electric interaction, PI, National Science Foundation, September 2013 – August 2018, Amount \$213,903.

Katherine Smith: (1) Stern2STEM: A Pilot Program to Increase Veteran Retention and Success in STEM Degree Programs, Senior Personnel, the Office of Naval Research STEM, (2) Supplemental Critical Thinking Explorations to Promote Discovery and Deeper Comprehension, Co-PI, Faculty Innovator Grant CLT ODU, Amount \$1,500, (3) Program Management Support, Co-PI, CACI (U.S. Navy), Amount 15% of \$194,793.

Robert Strozak: Open Resources Mini Grant, PI, Faculty Innovator Grant CLT ODU, Amount \$1,500 (2) Addressing Common Math Errors Using Specialized Online Tutorials, Faculty Innovator Grant CLT ODU, Amount \$1,500.

John Tweed: Radiation Shielding Studies and Improved Transport Methods, PI, NASA Langley, September 2014 – August 2019, Amount \$ 876,907.

Nail Yamaleev: Physics-based spectral Collocation Methods for LARGE Eddy Simulation on Adaptive Grids, PI, August 2017 – January 2020, Amount \$328,601.

Post- Doctoral Associates and Visiting Graduate Students



Dr. Yun Chen received his PhD in mathematics from Sun Yat-sen University. He is spending two years AY2017-2019 under the supervision of Prof. Yuesheng Xu. His research interest covers optimization methods and image processing. More specifically, Dr. Chen is working on tomographic reconstruction on adaptive unstructured grids.



Dr. Jialin Lou earned his B.S. degree in Engineering Mechanics at Beijing Institute of Technology and M.S. and Ph.D. degrees in Aerospace Engineering with a minor in Mathematics from North Carolina State University. Dr. Hong Luo was his thesis advisor. He recently joined the Department of Mathematics and Statistics as a post-doctoral research associate working with Dr. Nail Yamaleev on the project funded by the Army Research Office. Jialin's current research focuses on the development of new high-order nonlinearly stable spectral collocation schemes for the 3-D Navier-Stokes equations on adaptive unstructured grids. One of the key aspects of his research is to construct a novel grid adaptation strategy based on the minimization of spurious entropy production that enables large eddy simulation of unsteady turbulent flows in complex geometries and efficient implementation on massive parallel platforms.



Mr. Jin Ren is a PhD student at Sun Yat-sen University. Jin is studying under the guidance of Prof. Yuesheng Xu. Jin's research interest is in the area of the application of optimization problem based on Fixed-Point Proximity Algorithm. His current project is entitled, "Prediction of lncRNA-disease associations by inductive matrix completion".



Mr. Yizun Lin is also a PhD student from Sun Yat-sen University working under the guidance of Professor Yuesheng Xu. Yizun's research interests are theory of deep learning and support vector machine, medical imaging and optimization algorithms. He is writing two articles entitled, "Fast fixed-point proximity algorithm for PET image reconstruction" and "Approximation power of deep learning".



Jizhou Liu is a Ph.D. candidate from the Beijing University of Aeronautics and Astronautics (BUAA). He is visiting our department for one year hosted by Prof. Fang Hu through the support of the China Scholarship Council. His research is on the study of gas-kinetic schemes for two- and three-dimensional problems with unstructured grids.

Student Awards & Recognitions

Graduate Students:

Tony Haines received a scholarship from SREB (Southern Regional Education Board) Scholarship.

Michelle Pizzo received Virginia Space Grant Consortium Graduate Research Fellowship.

Anthony Williams was selected as recipient of the Philip R. Wohl Scholarship.

Undergraduate Students BS in Mathematics:

Sabrina Huffman (spring 18) is the best student in Applied Math major.

Cheryl Ngo (Fall 17) is the best student in Statistics/Biostatistics major.

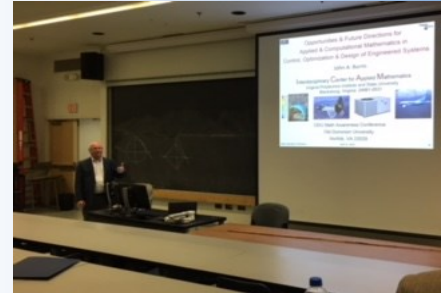
Edward Griffith (Fall 17) is the best student in Math for Secondary School Teachers major.

Meghan Rover (Spring 18) is the best student in Actuarial Mathematics major.

Student Organizations:

Charles Armstrong is President of Math/Stat Club. **Katelin J. Ashley** is President of the Student Chapter of SIAM. **Kristine Gierz** is the president of the Student Chapter of the Association of Women in Mathematics (AWM).

Students organized the annual **Math Awareness Conference** on Saturday, April 21. The event was attended by more than 60 students and the faculty from all across the Tidewater region. Four plenary speakers were invited. Names and abstracts of their talks follow:



- **Dr. John Burns, Virginia Tech**

In his famous 1986 Bell Communications Research Lecture titled "You and Your Research", Richard Hamming said, "If you do not work on an important problem, it's unlikely you'll do important work. It's perfectly obvious".

What is not so obvious is how to determine what problems are important and why they are important. What is clear, but not often recognized, is that applied & computational mathematics has become the enabling science for most modern breakthroughs and advances in scientific discoveries and technology developments. Mathematical algorithms enable the development of computational engineering software required for model based development and provide the engines that drive data analytics and machine learning. The mathematics of shape derivatives make it possible to optimize additive manufacturing systems. Applications can and should play a key role in deciding the importance of research in mathematics. In this talk I will discuss some past mistakes and present some emerging applications in design, optimization and control of energy systems. I will close with advice for young researchers and some predictions about future directions.

- **Dr. Karen Kafadar, University of Virginia**

As David Donoho emphasizes in his article, "50 years of data science," statisticians have been analyzing data sets for decades - even those deemed "huge" by the times. Today's computational power enables the possibilities to collect and store huge amounts of data. Massive data bring new challenges, not only for computer scientists who can develop tools for accessing and managing huge data sets, but more importantly for statisticians who know how to sample intelligently such data and recognize the need to draw valid inferences from them. Historically, the emergence of large data sets has prompted the development of sub-disciplines in our profession such as statistical graphics, statistical computing, and computer-intensive methods, and it continues to be true as one encounters data from fMRI experiments, Internet traffic, genomics, and high-energy physics. In this talk, I will describe some "huge" data sets that prompted both the interaction with domain scientists and the development of novel statistical methods to derive valid inferences. The examples emphasize that data without inference are useless, and that the need for statisticians continues to grow.

- **Dr. Yuesheng Xu, Old Dominion University**

We shall discuss several crucial mathematical issues in data science. They include representation of data sets, information extraction from raw data, mathematical foundation of machine learning and solutions of non-smooth non-convex optimization arising in data science.

- **Dr. James Warner, NASA Langley**

Scientific computing has undergone extraordinary growth in sophistication in recent years, enabling the simulation of a wide range of complex multiphysics and multiscale phenomena. Along with this increase in computational capability is the growing recognition that uncertainty quantification must go hand-in-hand with numerical simulation in order to generate meaningful and reliable predictions for engineering applications. If not rigorously considered, uncertainties due to manufacturing defects, material variability, modeling assumptions, etc. can cause a substantial disconnect between simulation and reality. Packaging these complex computational models within an uncertainty quantification framework, however, can be a significant challenge due to the need to repeatedly evaluate the model when even a single evaluation is time-consuming. Therefore, there is a growing need for methods to accelerate this process.

Student Organization Con't.

Kristen Gierz commented on the establishment of the new student chapter of Association of Women in Mathematics, "As a new organization, the Association of Women in Mathematics is excited to start activities this semester, including seminars from invited speakers, a panel discussion for graduates and undergraduates, and perhaps a picnic at the end of the semester. We invited Dr Henry Mwambi and his talk was entitled 'A nonlinear mixed-effects model for multivariate longitudinal data with partially observed outcomes with application to HIV disease dynamics.' We also invited Dr Gaff from the Department of Biology and her talk was entitled 'Climate Change and tick-borne Diseases.' "

Charles Armstrong with help of Cecilia Stevaux, one of our undergrads, helped Math/Stat Club's table at Activity Fair in Webb Center. We got many potential new members.

Finally, on Tuesday, March 27, the Math/Stat Club went on a field trip to the NASA Langley Research Center in Hampton, Virginia. There, the visitors enjoyed presentations by NASA scientists and engineers, representing the thermal, structural, systems and control aspects of their projects. This included a presentation by ODU graduate Dr. Robert Wagner. The presenters explained the kinds of mathematics that they use in their everyday work. The group was then treated to a tour of a couple of robotics labs. One of them featured an enormous robotic arm to be used for building structures in space. The event was organized by first-year graduate student Lacey Schenk, and NASA project manager Charles Taylor.

New Faculty: Dr. Yet Nguyen will be joining the department in the fall of 2018. Yet received his MS and PhD in Statistics from Iowa State University in 2013 and 2018 respectively. While at Iowa State, Yet received a prestigious George W. Snedecor Award, which is given to the most outstanding PhD candidate in Statistics. His research interests are in the area of Data Science and Yet wrote a PhD dissertation entitled "Accounting for Dependence and Relevant Covariates in RNA-seq Data Analysis". He is the author of 5 research Articles and is currently preparing additional articles for publications. Welcome aboard!

A Visit to William & Mary:

On February 3, 2018, Katherine Smith travelled to the **Center for Gifted Education at William & Mary's School of Education**, to present at the **Focusing on the Future** event. This event is a career and academic planning experience for middle and high school students. Ms. Smith offered a forty-five minute presentation first to high school students and then to middle school students. Both presentations included an overview of Ms. Smith's background, including education and work experiences, as well as an overview of research interests. Additionally, an overview of the department was provided that included all five concentrations with additional focus on the newest major in Big Data Analytics.

Next, the presentation shifted to a discussion of how mathematics is used to solve interesting problems. First, Ms. Smith presented an overview of why we teach computers to play board games. Focusing on the success of AlphaGo, which is a machine learning model that combined neural networks and tree search to beat 18 time world Go champion, Lee Sedol, in 2016. This work, which is detailed in Silver, D., et al. (2016). "Mastering the game of Go with deep neural networks and tree search." Nature 529: 484, was presented at a level that students could understand by focusing on how the researchers designed the model to learn to mimic how people play games. Middle school students were given more background to support their understanding.

Then, Ms. Smith presented the mathematics of Super Mario Bros. For the middle school students, this included a description of collision detection using simple bounding boxes to detect collisions. The high school students saw a presentation of how physics in games are computed using computational mathematics techniques in addition to the discussion on collision detection

Finally, Ms. Smith presented information about how three-dimensional objects in games are represented using triangular meshes. After providing information about why triangles are the best polygon for this use, other applications for meshing were discussed including three-dimensional scanning, object recognition, and three-dimensional printing.

Overall, both talks were well received with students staying engaged and asking questions throughout.

Richard F. Barry Seminars

Spring 2018

We've invited a number of prominent speakers to the department. They are

Jan.22-Zhilin Li, N.C. State University
Feb.15-Abbie Basile, ODU Library
Feb. 22-Bruce Torrence, Randolph M.
March 15, Ciprian Crainiceanu, J. Hopkings U.
April 3, Alex Misiats, VCU
April 6, Guohui Song, Clarkson U.
April 12, Jialin Lou, ODU
April 19, Ana-Maria Staicu, N.C.State U.

Please contact Yan Peng
ypeng@odu.edu for future speakers.

JULIA ROBINSON MATHEMATICS FESTIVAL

The Old Dominion University Mathematics & Statistics Department hosted the Julia Robinson Mathematics Festival on Saturday, May 19, 2018. The event was coordinated by organizer Katie Smith and co-organizer Blair Swoope. Additionally, Catherine Chamberlayne, Norou Diawara, Sidy Diawara, Robin Flanagan, Vickie Herzog, Sookyung Joo, Lee Land, Eunice Pepper, Maria Rich, Randy Stowe, Julia Varbalow, and Anthony Williams volunteered. The festival attracted approximately 60 students in 4th through 6th grades from the Hampton Roads area. The event was a success as students enjoyed problem and puzzle solving activities including The Three Jugs Problem, Who Gets the Last Chip, Tiling Torment, Candy Conundrum, A Little Bit of Aggression, and ConHex. Organizers received positive feedback from parents and are looking forward to coordinating the Second Annual Julia Robinson Mathematics Festival in Spring 2019.



Department of Mathematics & Statistics

Mathematical & Statistical Department

4700 Elkhorn Avenue
ECSB/2nd Fl. Suite 2300
Norfolk, Va. 23529

- Chair: Hideaki Kaneko
- Associate Chair of Research: Fang Hu
- Assistant Chair of Instruction: Gordon Melrose
- GPD: Raymond Cheng
- CDA: Robert Strozak
- Director of Data Science: Yuesheng Xu
- Statistics Program Director: Rao Chaganty
- Financial: Sheila Hegwood
- Faculty Advisor of Student Chapter of SIAM: Raymond Cheng
- RFB Colloquium: Yang Peng
- Faculty Advisor of Student Chapter of Association for Women in Mathematics (AWM): Sookyung Joo.
- Director of Online instruction: P. Bagacki
- Office Managers: Sheila Hegwood, Miriam Venable (ECSB)
Barbara Jeffrey (VAB)