CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT

2023 – 2024

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NJIT New Jersey Institute of Technology

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I. FROM THE DIRECTOR

The Center for Applied Mathematics and Statistics (CAMS) is entering its 38th year as a hub for research in applied mathematics and statistics at NJIT. CAMS supports faculty by organizing colloquia, seminars, and conferences, and by fostering collaborative and interdisciplinary research initiatives. We take particular pride in the accomplishments of our members, whose research has been highlighted in numerous features on the university news site and in external media outlets.

Over the past two years, CAMS has undertaken a strong initiative to broaden its membership by actively engaging faculty from other departments at NJIT, as well as mathematicians, scientists, and researchers from outside the university who have collaborative ties with our department. This outreach has fostered new interdisciplinary connections and enhanced the diversity of expertise within CAMS. As a result of these efforts, the center has experienced significant growth in both its membership and its research activities, positioning CAMS as a more vibrant research community.

We are looking forward to several significant events in the upcoming year:

- FACM 2025: CAMS will host its annual conference, *Frontiers in Applied and Computational Mathematics* (FACM '25), on June 5-6 at NJIT. The theme of this year's conference is *New trends in data- and physics- based modeling and simulation of fluids*. The event will feature 21 invited talks as well as numerous poster presentations given by participants from all over the world. CAMS thanks NSF for their generous support of the meeting.

- Launch of the Mathematical and Computational Biosciences Collective: This new research collective, supported by a major grant from NJIT's CRISP initiative, will bring together faculty, postdoctoral researchers, and graduate students to undertake collaborative work at the intersection of mathematics, computation, and the life sciences.

- Ongoing Research Support: CAMS receives substantial funding for graduate student and faculty research from sources such as the National Science Foundation, Simons Foundation, U.S. Navy, NASA, and other state and local agencies along with private industry, and we look forward to the continuing efforts of this funding.

As always, CAMS's accomplishments have been made possible through the support and dedication of many individuals. We are grateful to Provost John Pelesko, Senior Vice President for Research Atam Dhawan, and Eliza Michalopoulou, Chair of the Department of Mathematical Sciences, for their steadfast support of scientific research and encouragement of CAMS initiatives. We also extend our sincere thanks to President Teik Lim for his ongoing support of CAMS and its mission.

II. MISSION STATEMENT

The Center for Applied Mathematics and Statistics (CAMS) is an interdisciplinary research center dedicated to supporting applied research in the mathematical sciences at NJIT. CAMS was established in 1986 to promote research in the mathematical sciences at the New Jersey Institute of Technology. Members of the Department of Mathematical Sciences naturally form the core of CAMS membership, but the importance of mathematics for science and technology has made CAMS an interdisciplinary organization.

CAMS brings researchers from academia, industry, and government to NJIT by organizing interdisciplinary workshops and by bringing together researchers with common goals whose strengths are complementary. CAMS activities also include support for the submission of research proposals, which is done through dissemination of information, organization of group projects, collegial advice and assistance with application documents. Graduate student research is encouraged through the CAMS Summer Research Program and support for students to attend conferences. CAMS sponsors an annual conference, “Frontiers in Applied and Computational Mathematics,” which has become a leading forum for the presentation of new research in applied mathematics and the sciences.

In the future, CAMS hopes and expects to maintain its high standards of professionalism and scholarship and plans to extend its activities to include fostering more research by undergraduate students and developing long-term relationships with industry.

III. MEMBERS AND VISITORS

Department of Mathematical Sciences

Afkhami, Shahriar
Ahluwalia, Daljit S.
Askham, Travis
Bechtold, John
Booty, Michael
Bose, Amitabha
Boubendir, Yassine
Bukiet, Bruce
Bunker, Daniel
Choi, Wooyoung
Cirillo, Michelle
Cummings, Linda
Deek, Fadi
Dhar, Sunil
Diekman, Casey
Frederick, Christina
Golowasch, Jorge
Goodman, Roy
Guo, Wenge
Hamfeldt, Brittany
Horntrop, David
Horwitz, Kenneth
Jaquette, Jonathan
Johnson, Kenneth
Jin, Chong
Kapraff, Jay
Kondic, Lou
Loh, Ji Meng
Luke, Jonathan
Lushi, Enkeleida
Matveev, Victor
MacLaurin, James
Michalopoulou, Zoi-Heleni
Milojevic, Petronije
Nadim, Farzan
Nguyen, Thi-Phong
Oza, Anand
Petropoulos, Peter
Russell, Gareth
Shang, Zuofeng
Shi, Chenlu
Shirokoff, David
Siegel, Michael
Subramanian, Sundarraman
Turc, Catalin
Wang, Antai
Wei, Zhi
Wicke, Kristina
Young, Yuan-Nan
Zhao, Xinyu

CAMS External Faculty Members from New Jersey Institute of Technology

Ahmadpoor, Fatemeh	*Department of Mechanical & Industrial Engineering*
Bunker, Daniel	*Federated Department of Biological Sciences*
Deek, Fadi	*Department of Informatics*
Dias, Cristiano	*Department of Physics*
Dytso, Alex	*Department of Electrical & Computer Engineering*
Farokhirad, Samaneh	*Department of Mechanical & Industrial Engineering*
Flammang, Brooke	*Federated Department of Biological Sciences*
Garnier, Simon	*Federated Department of Biological Sciences*
Ghosh, Arnob	*Department of Electrical & Computer Engineering*
Golowasch, Jorge P.	*Federated Department of Biological Sciences*
Gor, Gennady	*Department of Chemical & Materials Engineering*
Holzapfel, Claus	*Federated Department of Biological Sciences (RU)*
Koutis, Yiannis	*Department of Computer Science*
Marras, Simone	*Department of Mechanical & Industrial Engineering*

Meegoda, Jay N.	*Department of Civil & Environmental Engineering*
Musialski, Przemyslaw	*Department of Computer Science*
Nadim, Farzan	*Federated Department of Biological Sciences*
Netto, Marcos	*Department of Electrical and Computer Engineering*
Park, SangWoo	*Department of Mechanical and Industrial Engineering*
Rosato, Anthony	*Department of Mechanical Engineering*
Rotstein, Horacio	*Federated Department of Biological Sciences*
Russell, Gareth	*Federated Department of Biological Sciences*
Shakib, Farnaz	*Department of Chemistry & Environmental Science*
Shen, Bo	*Department of Mechanical and Industrial Engineering*
Tafuni, Angelo	*School of Applied Engineering & Technology*
Voronov, Roman	*Department of Chemical & Materials Engineering*
Wang, Haimin	*Department of Physics*
Xu, Mengjia	*Department of Data Science*
Xu, Pan	*Department of Computer Science*

CAMS External Faculty Members

Booth, Victoria	*University of Michigan, Ann Arbor*
Diez, Javier	*University Nacional del Centro, Tandil, Argentina*
Erneux, Thomas	*Université Libre de Bruxelles, Belgium*
Huang, Huaxiong	*York University, Toronto, Canada*
Mema, Ensela	*Kean University*
Moore, Richard	*SIAM, Philadelphia*
Pak, On Shun	*Santa Clara University*
Papageorgiou, Demetrios	*Imperial College, London*
Pugnaloni, Luis	*University of La Pampa, Argentina*
Roychoudhury, Satrajit	*Pfizer*
Sachs, Jeffrey	*Merck*
Pejman, Sanaei	*Georgia State University*
Tao, Louis	*Peking University, China*
Vanden-Broeck, Jean-Marc	*University of East Anglia, Norwich, England*
Wang, Qiming	*Scotiabank, Canada*
Wylie, Jonathan	*City University of Hong Kong*

IV. COLLOQUIA AND SEMINARS

Applied Mathematics Colloquium/ Department of Mathematical Sciences Colloquium

September 8, **Victor Matveev**, NJIT
Accuracy of Deterministic vs. Stochastic Simulation of Neurotransmitter and Hormone Release

September 15, **Chun Liu**, IIT Chicago
Dynamic Boundary Conditions and Motion of Grain Boundaries

September 22, **Matthieu Labousse**, ESPCI Paris
Soft Violation of Bell's Inequality

September 29, **Shidong Jiang**, Flatiron Institute
A Dual-space Multilevel Kernel-splitting Framework for Discrete and Continuous Convolution

October 6, **Arnold Mathijssen**, University of Pennsylvania
Collective Functionalities Emerging in Microbial Active Matter

October 13, **Nick Trefethen**, Harvard University
Polynomials and Rational Functions

October 20, **Pavel Lushnikov**, University of New Mexico
Stokes Waves, Riemann Surface Sheets and Wavebreaking of Surface Dynamics

October 27, **Vu Thai Luan**, Mississippi State University
Advanced Time Integrators for Multiphysics Problems and Applications

November 3, **Lou Kondic**, NJIT
From Materials Science to Computational Topology: Interaction Networks in Particulate Matter

November 10, **Indranil SenGupta**, Florida International University
Risk Management, Data Science-based Improvements, and Financial Applications

November 17, **Niall Mangan**, Northwestern University
Identifying Models From Data

December 1, **Ian Tobasco**, Rutgers
Towards Homogenization of Mechanism-based Mechanical Metamaterials

December 8, **Paul Hand**, Northeastern University
Signal Recovery with Generative Priors

January 26, **Chen Liu**, Purdue University
Positivity-Preserving and Conservative High-Order Accurate Explicit-implicit Schemes for Compressible Flow Simulation

February 2, **Amir Sagiv**, Columbia University
Floquet Hamiltonians - Spectrum and Dynamics

February 9, **Paula Vasquez**, University of South Carolina
Coupling Macro-Micro Simulations in Complex Fluids

February 16, **Manas Rachh**, Flatiron Institute
Static Currents in Type-I Superconductors

February 23, **Eric Hester**, University of California, Los Angeles
Modeling Multiphase Matter: from Microparticles to Mega-Icebergs

March 1, **Joshua Taylor**, NJIT
Convex Optimization of Biochemical Processes

March 8, **David Ambrose**, Drexel University
Some Results for Non-Decaying, Non-Periodic Fluid Flows

March 22, **Yoichiro Mori**, University of Pennsylvania
Inextensible Interface Problem in 2D Stokes Fluid

April 5, **Charles Semple**, University of Canterbury, New Zealand
Tree Reconstruction from Multi-state Characters

April 12, **Steffen Hardt**, Technische Universität Darmstadt
Transport Processes in Nanochannels Induced by Electric and Temperature Fields

April 19, **Anna Balazs**, University of Pittsburgh
Chemically Controlled Shape-morphing of Elastic Sheets

April 26, **Oswald Knoth**, Leibniz Institute for Tropospheric Research
CGDycore.jl: A Testbed for Dynamical Cores (DyCore) for Numerical Weather Prediction in the Julia Language

May 3, **Igor Aronson**, Pennsylvania State University
Confined Bacterial Suspensions

Applied Statistics Seminar

October 26, **Zijian Guo**, Rutgers University
Robustness Against Weak or Invalid Instruments: Exploring Nonlinear Treatment Models with Machine Learning

November 9, **Min Zhang**, UC Irvine
Integrative Analyses for Genome-wide Gene Regulatory Network Construction

November 16, **Wodan Ling**, Biostatistics Division in the Population Health Sciences Department at Weill Cornell Medicine
Statistical analysis of large-scale microbiome-profiling studies: batch effect and robust testing

February 22, **Saonli Basu**, University of Minnesota
Efficient SNP-based Heritability Estimation in Multi-ethnic Large-scale Cohort Studies

February 29, **Ian W. McKeague**, Columbia University
Concurrent functional linear regression with application to wearable device data

Mathematical Biology Seminar

September 27, **Matthew Junge**, Baruch College, CUNY
Chase-escape

October 4, **Daniele Avitabile**, Vrije Universiteit Amsterdam
Bump Attractors and Waves in Networks of Integrate-and-Fire Neurons

October 11, **Celeste Vallejo**, DILIsym/Simulations Plus
An Introduction to Mathematical Modeling in Drug Development Using GastroPlus and DILIsym

October 25, **Victor Matveev**, NJIT
Parameter Estimation: Parameter Confidence Intervals Without Accurate Sampling

November 1, **Deren Eaton**, Columbia University
Linking Phylogenetic Inference at Genome-wide and Local Genealogical Scales

November 15, **John Nardini**, The College of New Jersey
Forecasting and Predicting Stochastic Agent-based Models of Cell Migration With Biologically-informed Neural Networks

November 29, **Jonathan Jaquette**, New Jersey Institute of Technology
Reliability and Robustness of Oscillations in Some Slow-Fast Chaotic Systems

January 24, **Fatemeh Ahmadpoor**, NJIT
Extreme mechanics of flexible biological and crystalline nanostructures

February 07, **Mengjia Xu**, NJIT
Hyperbolic graph embedding for MEG brain network analysis

February 14, **Sarah Strikwerda**, University of Pennsylvania
Well-posedness of PDE-ODE coupling with applications to tissue perfusion

February 21, **Yuchi Qiu**, University of California, Irvine
Multiscale modeling and topological data analysis in artificial intelligence-driven biology

March 06, **Puneeth Deraje**, University of Toronto
Spatial Inference from Ancestral Recombination Graphs using Brownian Motion

March 20, **Caterina Stamoulis**, Harvard Medical School
Human brain development from the lens of topological and dynamic optimization

March 27, **Sean Lawley**, University of Utah
Stochastics in Medicine: Delaying Menopause and Missing Drug Doses

April 03, **Majid Bani-Yaghoub**, University of Missouri-Kansas City
Understanding the Behaviors of Biological Waves Using Mathematical Models with Nonlocality

April 17, **Takuya Ito**, IBM Research
Multitask and compositional representations in human brains and neural networks

Fluid Mechanics and Waves Seminar

September 25, **Manas Rachh**, Flatiron Institute
Edge Effects at Insulator Interfaces

October 9, **Arnold D. Kim**, UC Merced
Quantitative SAR Imaging of Dispersive Targets

October 23, **Thi-Thao-Phuong Hoang,** Auburn University
Domain Decomposition Methods for Dimensionally Reduced Models of Flow and Transport in Fractured Porous Media

November 6, **Montanelli Hadrien**, INRIA and Institute Polytechnique de Paris (France)
The Linear Sampling Method for Random Sources

November 20, **Ruming Zhang**, TU Berlin
Monotonicity-based Shape Reconstruction for an Inverse Scattering Problem in a Waveguide

November 27, **Ianto Cannon**, Okinawa Institute of Science & Technology
Morphology of Droplets in Turbulent Flows

December 4, **Steven Roberts**, LLNL
The Order of Runge-Kutta Methods in Theory and Practice

February 19, **Xinyu Zhao**, McMaster University
Systemic Search for Singularities and Instabilities in Euler Flows

March 4, **Ross Parker**, Center for Communications Research, Princeton
Multi-modal solitary wave solutions to nonlinear wave equations

March 18, **Liet Vo**, University of Illinois at Chicago
Mixed finite element methods for the Stochastic Navier-Stokes equations

April 1, **Binan Gu**, Worcester Polytechnic Institute
Dynamic Pore Network Modeling of Nonlinear Species, Thermal and Surface Reactive Transport with Far-field Forcings

April 15, **Jay Meegoda**, NJIT Civil and Environmental Engineering
Mysteries of Nanobubbles

April 29, **Emad Masroor**, Swarthmore
Vortex Dynamics in the Wake

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

Journal Articles

Travis Askham

Random walks in frequency and the reconstruction of obstacles with cavities from multi-frequency data (with C. Borges, M. Rachh, J. Hoskins), *Journal of Scientific Computing*, Vol 98, Article 15, November 2023.

Michelle Cirillo

Undergraduate students' perceptions of features of active learning models for teaching and learning to teach mathematics (with D. Berk, R. LaRochelle, K. N. Bieda, F. Arbaugh), *International Journal of Research in Undergraduate Mathematics Education*, Vol 10, Issue 1, pp. 172-200, April 2024.

Eliciting cycles as pre-service teachers lead whole-class discussions: an investigation of moments of tension (with K. N. Bieda, B. Tyburski, R. Luczak), *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, Vol 1, October 2023.

Fadi Deek

Considerations for Decision-makers and Developers toward Adoption of Decentralized Key Management Systems Technology in Emerging Applications (with W. Yao, N. Gorlewski, G. Wang), *IEEE Computer*, Vol 57, pp. 27-38, June 2024.

SoK: A Taxonomy for Critical Analysis of Consensus Mechanisms in Consortium Blockchain (with W. Yao, R. Murimi and G. Wang), *IEEE Access,* Vol 11, pp. 79572-79587, July 2023.

Christina Frederick

Examples of Riesz bases of exponentials for multi-tiling domains and their duals' (with K. Yacoubou Djima), La Matematica, Vol 3, pp. 108-123, November 2023.

Roy Goodman

A new canonical reduction of three-vortex motion and its application to vortex-dipole scattering (with A. Anurag, E. K. O'Grady), *Physics of Fluids*, Vol 36, Issue 6, June 2024.

Brittany Hamfeldt

Numerical optimal transport from 1D to 2D using a non-local Monge-Ampère equation (with M. Cassini), *La Matematica*, Vol 3, Issue 2, 509-535, June 2024.

On the reduction in accuracy of finite difference schemes on manifolds without boundary (with A. Turnquist), I*MA Journal of Numerical Analysis*, Vol 44, Issue 3, pp. 1751-1784, May 2024.

Jonathan Jaquette

Quasiperiodicity and blowup in integrable subsystems of nonconservative nonlinear Schrödinger equations, *Journal of Dynamics and Differential Equations*, Vol 36, Issue 1, pp. 1-25, March 2024.

Validated numerical approximation of stable manifolds for parabolic partial differential equations (with J. van den Berg, J. D. Mireles James), *Journal of Dynamics and Differential Equations*, Vol 35, Issue 4, pp. 3589-3649, December 2023.

Reliability and robustness of oscillations in some slow-fast chaotic systems (with S. Kedia, E. Sander, J. D. Touboul), *Chaos: An Interdisciplinary Journal of Nonlinear Science,* Vol 33, Issue 10, October 2023.

Chong Jin

Sub-Cluster Identification through Semi-Supervised Optimization of Rare-Cell Silhouettes (SCISSORS) in single-cell RNA-sequencing (with J. R. Leary, Y. Xu, A. B. Morrison, E. C. Shen, P. C. Kuhlers, Y. Su, N. U. Rashid, J. J. Yeh, X. L. Peng), *Bioinformatics*, Vol 39, Issue 8, August 2023.

Lou Kondic

Properties of interaction networks in compressed two and three dimensional particulate systems (with L. Kovalcinova, A. Taranto), *Granular Matter*, Vol 26, Issue 1, February 2024.

Evolution of force networks during stick-slip motion of an intruder in a granular material: Topological measures extracted from experimental data (with R. Basak, R. Kozlowski, L. Pugnaloni, M. Kramar, J. Socolar, M. Carlevaro), *Physical Review E*, Vol 108, Issue 5, November 2023.

Ji Meng Loh

Learning optimal biomarker‐guided treatment policy for chronic disorders (with B. Yang, X. Guo, Q. Wang, Y. Wang), *Statistics in Medicine*, Vol 43, Issue 14, pp. 2765-2782, June 2024.

A latent state space model for estimating brain dynamics from electroencephalogram (EEG) data (with Q. Wang, X. He, and Y. Wang), *Biometrics*, Vol 79, Issue 3, pp. 2444-2457, September 2023.

Nonparametric inference for interval data using kernel methods (with H. Park and W. Jang). *Journal of Nonparametric Statistics*, Vol 35, Issue 3, July 2023.

Jay Meegoda

Sustainable Management of Rechargeable Batteries Used in Electric Vehicles (with G. Charbel, D. Watts), *Batteries*, Vol 10, Issue 5, May 2024.

Insights into PFAS environmental fate through computational chemistry: A review (with B. B. de Souza), *Science of the Total Environment*, Vol 926, May 2024.

Second Life of Used Lithium-Ion Batteries from Electric Vehicles in the USA (with G. Charbel, D. Watts), *Environments*, Vol 11, Issue 5, May 2024.

The use of a fluorine mass balance to demonstrate the mineralization of PFAS by high frequency and high power ultrasound (with R. W. Marsh, J. A. Kewalramani, B. B. de Souza), *Chemosphere*, Vol 352, March 2024.

Coupling grid nanoindentation and surface chemical analysis to infer the mechanical properties of shale mineral phases, Engineering Geology (with J. Du, A. J. Whittle, L. Hu, T. Divouxd), *Engineering Geology,* Vol 325, November 2023.

Microplastics in aquatic environments: a review of recent advances (with K. E., Fish, L. Clarizia), *Journal of Environmental Engineering and Science,* Vol 18, Issue 4, pp. 138-156, October 2023.

A review of theories to calculate pore pressures when fluids penetrate into rocks (with C. Baptista-Pereira, B. Gonçalves da Silva), *Mechanics Research Communications,* Vol 132, October 2023.

A ReaxFF-based Molecular Dynamics study of the Destruction of PFAS due to Ultrasound (with B. B. de Souza, S. A. Hewage, J. A. Kewalramani, A. van Duin), *Environmental Pollution*, Vol 333, September 2023.

Frequency on the Efficiency of Sonochemical Reactor, Ultrasonics Sonochemistry Contributions of Reactor Geometry and Ultrasound (with J. A. Kewalramani, B. B. de Souza, R. W. Marsh), *Ultrasonics Sonochemistry*, Vol 98, August 2023.

Microplastic Pollution Prevention: The Need for Robust Policy Interventions to Close the Loopholes in Current Waste Management Practices (with H. Hettiarachchi), *International Journal of Environmental Research and Public Health*, Vol 20, Issue 14, July 2023.

Kinetics Effects of the Power Density and Initial Concentration on the Sonochemical Degradation of PFOS and PFOA in Concentrated Waste (with J. A. Kewalramani, R. W. Marsh, D. Prajapat), *Journal of Water Process Engineering*, Vol 53, July 2023.

Zoi-Heleni Michalopoulou

A review of efficient applications of genetic algorithms to improve particle filtering optimization problems (with C. Kuptametee, N. Aunsri), *Measurement*, Vol 224, January 2024.

Petronije Milojevic

On the solvability and the dimension of the solution set of abstract linear boundary value problems and applications to ODE's, *Journal of Mathematical Analysis and Applications*, Vol 534, Issue 1, June 2024.

Thi Phong Nguyen

Fast imaging of local perturbations in a unknown bi-periodic layered medium (with F. Cakoni, H. Haddar), *Journal of Computational Physics*, Vol 501, March 2024.

A regularization method for Caputo fractional derivatives in the Banach space L^{\infty}[0, T] (with V. D. Nguyen), *Numerical Algorithms*, Vol 95, Issue 2, pp. 1033-1053, February 2024.

Anand Oza

Generalization of waving-plate theory to multiple interacting swimmers (with P. J. Baddoo, N. J. Moore, D. G. Crowdy), *Communications on Pure and Applied Mathematics*, Vol 76, Issue 12, pp. 3811-3851, December 2023.

Theoretical modeling of capillary surfer interactions on a vibrating fluid bath (with G. Pucci, I. Ho, D. M. Harris), *Physical Review Fluids*, Vol 8, Issue 11, November 2023.

Capillary surfers: wave-driven particles at a fluid interface (with I. Ho, G. Pucci, D. M. Harris), *Physical Review Fluids*, Vol 8, Issue 11, November 2023.

Anthony D. Rosato

Recurrent neural network model of tapped density relaxation (with V. Ratnaswamy, N. Ching, D. Blackmore, Y. Chung), *Computational Particle Mechanics*, Vol 11, pp. 1119 - 1132, November 2023.

Zuofeng Shang

Statistical Limits for Testing Correlation of Random Hypergraphs (with M. Yuan), *Latin American Journal of Probability and Mathematical Statistics*, Volume 21, pp. 465-489, March 2024.

Nonparametric inference under B-bits quantization (with K. Li, R. Liu, G. Xu), *Journal of Machine Learning Research*, Vol 25, Issue 19, pp. 1-68, January 2024.

Minimax nonparametric multi-sample test under smoothing (with X. Xing, P. Du, P. Ma, W. Zhong, J. S. Liu), *Statistica Sinica*, January 2024.

Deep neural network classifier for multi-dimensional functional data (with S. Wang, G. Cao), *Scandinavian Journal of Statistics*, Vol 50, Issue 4, pp. 1667-1686, December 2023.

Distributed adaptive nearest neighbor classifier: algorithm and theory (with R. Liu, G. Xu), *Statistics and Computing*, Vol 33, Issue 5, October 2023.

David Shirokoff

Spatial Manifestations of Order Reduction in Runge-Kutta Methods for Initial Boundary Value Problems (with D. Zhou, B. Seibold, R. Rosales), *Communications in Mathematical Sciences*, Vol 22, Issue 3, March 2024.

Algebraic structure of the weak stage order conditions for Runge-Kutta methods (with A. Biswas, D. Ketcheson, B. Seibold), *SIAM Journal on Numerical Analysis*, Vol 62, pp. 48-72, January 2024.

Michael Siegel

Global existence and singularity formation for the generalized Constantin-Lax-Mjjda equation with dissipation: The real line vs. periodic domains (with D. M. Ambrose, P. M. Lushnikov, D. A. Silantyev), *Nonlinearity*, Vol 37, Issue 2, February 2024.

Motion of a disk embedded in a nearly-inviscid Langmuir film. Part 1. Translation (with E. Yariv, R. Vrandao, H. Stone), *Journal of Fluid Mechanics*, Vol 977, December 2023.

Jeffery's paradox for the rotation of a single 'stick-slip' cylinder (with E. Yariv), *Mechanics Research Communications*, Vol 131, August 2023.

Sundarraman Subramanian

Model checks for two-sample location and scale (with A. Javidialsaadi, S. Mondal), *Journal of Nonparametric Statistics*, Vol 36, Issue 3, September 2024.

Kristina Wicke

Implications of gene tree heterogeneity on downstream phylogenetic analyses: A case study employing the Fair Proportion index (with R. Haque, L. Kubatko), *PLoS ONE*, Vol 19, Issue 4, April 2024.

Exploring spaces of semi-directed level-1 networks (with S. Linz), *Journal of Mathematical Biology*, Vol 87, Issue 5, November 2023.

How far is my network from being edge-based? Proximity measures for edge-basedness of unrooted phylogenetic networks (with M. Fischer, T. N. Hamann), *Discrete Applied Mathematics*, Vol 337, pp. 303-320, October 2023.

Mengjia Xu

TransformerG2G: Adaptive time-stepping for learning temporal graph embeddings using transformers (with A. J. Varghese, A. Bora, G. E. Karniadakis), *Neural Networks*, Vol 172, April 2024.

A framework of computer vision-enhanced microfluidic approach for automated assessment of the transient sickling kinetics in sickle red blood cells (with Y. Qiang, M. P. Pochron, M. Jupelli, M. Dao), *Frontiers in Physics*, Vol 12, March 2024.

DynG2G: An Efficient Stochastic Graph Embedding Method for Temporal Graphs (with A. V. Singh, G. E. Karniadakis), *IEEE Transactions on Neural Networks and Learning Systems*, Vol 35, Issue 1, January 2024.

Dynamics in Deep Classifiers Trained with the Square Loss: Normalization, Low Rank, Neural Collapse, and Generalization Bounds (with A. Rangamani, Q. Liao, T. Galanti, T. Poggio), *Research*, Vol 6, March 2023.

Yuan-Nan Young

Adaptive micro-locomotion in a dynamically changing environment via context detection (with Z. Zou, Y. Liu, A. Tsang, O. Pak), *Communications in Nonlinear Science and Numerical Simulations*, Vol 128, January 2024.

Hydrodynamics of multicomponent vesicle under strong confinement (with A. Gannon, B. Quaife), *Soft Matter*, Vol 20, Issue 3, pp. 599-608, December 2023.

Conference Publications and Abstracts

Linda Cummings

Network and Stochastic Modeling of Membrane Filtration with Multiple Fouling Modes (with G. Binan, P. Sanaei, L. Kondic), *ECCOMAS*, June 2024.

Topological data analysis applied to networks modeling porous media transport (with M. Illingworth, G. Binan, L. Kondic), *ECCOMAS*, June 2024.

Modeling Filtration through Random Pore Networks: Correlating Structure and Performance (with L. Kondic, G. Binan, P. Sanaei), *Complex Networks*, December 2023.

Extracting oil from an oil and water mixture by using their different wetting properties via the Acoustowetting phenomenon (with Y. Li, J. D'Addesa, M. Fasano, J. Diez, L. Kondic, O. Manor), *American Physical Society*, November 2023.

Forced Phase Separation in a Closed Cell (with M. Fasano, J. D'Addesa, O. Manor, J. Diez,, L. Kondic), *American Physical Society*, November 2023.

Network modeling of membrane filtration with multiple fouling modes (with B. Gu, P. Sanaei, Y. Li, L. Kondic), *American Physical Society*, November 2023.

On correlating topology and performance of pore networks in membrane filters (with M. Illingworth, B. Gu, Y. Li, L. Kondic), *American Physical Society*, November 2023.

Simulating Thermal Effects in the Dewetting of Liquid Metal Nanostructures (with R. Allaire, L. Kondic, L.), *American Physical Society*, November 2023.

Thin Films Under Action of Surface Acoustic Waves: Experiments, Modeling, and Simulations (with J. D'Addesa, M. Fasano, J. Diez, Y. Li, O. Manor, L. Kondic), *American Physical Society*, November 2023.

Laser heating and melting of metals on nanoscale: breakup of metal filaments (with R. Allaire, L. Kondic), *Proceedings of the 17th International Heat Transfer Conference*, August 2023.

Fadi Deek

iBCTrans: A Practical Blockchain-based Framework for Cellular Vehicular-to-Everything Networks (with W. Yao, Y. Liu, G. Wang), *IEEE International Conference on Blockchain,* Danzhou, China, December 2023.

AI Applications in Education for Working with Gifted Children: Current State, Future Uses, and Psychosocial Effects (with G. Krsmanovic), *The Sixth International Professional and Scientific Conference—Working with the Gifted: Methods and Programs*, Novi Sad, Serbia, October 2023.

Christina Frederick

Optimal sampling strategies for seabed classification and source localization with Gaussian processes and machine learning (with Z. Michalopoulou), *Journal of the Acoustical Society of America*, Vol 154, October 2023.

Arnob Ghosh

Towards Achieving Sub-linear Regret and Hard Constraint Violation in Model-free RL (with X. Zhou, N. Shroff), *Proceedings of The 27th International Conference on Artificial Intelligence and Statistics*, Vol 238, May 2024.

Achieving Fairness in Multi-Agent MDP Using Reinforcement Learning (with P. Ju, N. Shroff), *The Twelfth International Conference on Learning Representations*, May 2024.

Wenge Guo

Multi-label Classification under Uncertainty: A Tree-based Conformal Prediction Approach (with C. Tyagi), *COPA 2023: 12th Symposium on Conformal and Probabilistic Prediction with Applications*, September 2023.

Conformal Risk Control for Ordinal Classification (with Y. Xu, Z. Wei), P*roceedings of the 39th Conference on Uncertainty in Artificial Intelligence*, 2346-2355, July 2023.

Lou Kondic

Network and Stochastic Modeling of Membrane Filtration with Multiple Fouling Modes (with G. Binan, P. Sanaei, L. J. Cummings), *ECCOMAS*, June 2024.

Topological data analysis applied to networks modeling porous media transport (with M. Illingworth, G. Binan, L. J. Cummings), *ECCOMAS*, June 2024.

Modeling Filtration through Random Pore Networks: Correlating Structure and Performance (with G. Binan, P. Sanaei, L. J. Cummings), *Complex Networks*, December 2023.

Manufacturing of 3D colloidal crystals for infrared photonics in low-earth orbit (with Q. Lei, B. Khusid, A. Hollingsworth, P. M. Chaikin, W. Meyer, A. Reich), *American Society for Gravitational and Space Research (ASGSR)*, Issue 1, November 2023.

Extracting oil from an oil and water mixture by using their different wetting properties via the Acoustowetting phenomenon (with Y. Li, J. D'Addesa, M. Fasano, J. Diez, L. J. Cummings, O. Manor), *American Physical Society*, November 2023.

Forced Phase Separation in a Closed Cell (with M. Fasano, J. D'Addesa, O. Manor, J. Diez, L. J. Cummings), *American Physical Society*, November 2023.

Network modeling of membrane filtration with multiple fouling modes (with L. J. Cummings, B. Gu, P. Sanaei, Y. Li), *American Physical Society*, November 2023.

On correlating topology and performance of pore networks in membrane filters (with M. Illingworth, B. Gu, L. J. Cummings, Y. Li), *American Physical Society*, November 2023.

Simulating Thermal Effects in the Dewetting of Liquid Metal Nanostructures (with R. Allaire, L. J. Cummings), *American Physical Society*, November 2023.

Thin Films Under Action of Surface Acoustic Waves: Experiments, Modeling, and Simulations (with J. D'Addesa, M. Fasano, J. Diez, Y. Li, O. Manor, L. J. Cummings), *American Physical Society*, November 2023.

Understanding slow compression of frictional granular particles by network analysis (with R. Basak, K. Taghizadeh, S. Luding), *American Physical Society*, November 2023.

On slip predictability for sheared granular systems (with P. Bretz, M. Kramar), *Scipedia*, October 2023.

Wall effects in granular column: Revisiting Janssen's equation (with P. Jalali, S. Shah), *Institute for Mutiscale Simulation*, October 2023.

Forming colloidal crystals in microgravity (with Q. Lei, B. Khusid, A. D. Hollingsworth, P. Chaikin, W. V. Meyer), *American Society of Mechanical Engineers*, October 2023.

Laser heating and melting of metals on nanoscale: breakup of metal filaments (with R. Allaire, L. J. *Proceedings of the 17th International Heat Transfer Conference*, August 2023.

Zoi-Heleni Michalopoulou

Source localization and geoacoustic inversion with virtual arrays (with P. Gerstoft), *Book of Abstracts of ICUA 2024*, June 2024.

Augmenting sparse arrays in ocean acoustics: a Gaussian Process approach, *Journal of the Acoustical Society of America*, May 2024.

Blind Passive Signal Detection via Dictionary Learning in Unknown Multipath Time-Spreading Distortion Underwater Channels (with R. Rashid, A. Abdi, P. Gerstoft), Journal of the Acoustical Society of America, May 2024.

Performance evaluation of decision trees and multilayer perceptrons in seabed classification (with D. Rios, J. Tokuda), *Journal of the Acoustical Society of America*, May 2024.

Optimal sampling strategies for seabed classification and source localization with Gaussian processes and machine learning (with C. A. Frederick), *Journal of the Acoustical Society of America*, Vol 154, October 2023.

Seabed classification using acoustic signals: A decision tree approach (with D. Rios), *Journal of the Acoustical Society of America*, Vol 154, October 2023.

Anand Oza

On the stability of interacting flapping plates (with M. Nitsche, M. S. Siegel), *American Physical Society*, November 2023.

Zuofeng Shang

A Fast Non-Linear Coupled Tensor Completion Algorithm for Financial Data Integration and Imputation (with D. Zhou, A. Uddiin, C. Sylla, X. Tao, D. Yu), *4th ACM International Conference on AI in Finance: ICAIF'23*, November 2023.

Michael Siegel

On the stability of interacting flapping plates (with M. Nitsche, A. U. Oza), *American Physical Society,* November 2023.

Mengjia Xu

Norm-based generalization bounds for compositionally sparse neural networks (with T. Galanti, L. Galanti, T. Poggio), *37th Conference on Neural Information Processing Systems, NeurIPS 2023*, December 2023.

Essays, Books, and Manuscripts

Amitabha Bose

Lessons from our advisor Christopher K.R.T. Jones (with J. Rubin), *AMS Notices*, Vol 71, 632-634, May 2024.

Fadi Deek

F.P. Deek, R. Friedman, and N. Elliot (Editors), *Robert E. Lynch: A Life Celebrated*, Purple Breeze Press, Palm Harbor, Florida, Library of Congress Control Number: 2024905363, ISBN Paperback: 9798884267374, March 2024 (edited book).

Bob Lynch—A Four Decades of Distinction, in *Robert E. Lynch: A Life Celebrated, F.P. Deek, R. Friedman, and N. Elliot (Editors)*, pp. 1-18, Purple Breeze Press, Palm Harbor, Florida, March 2024 (book chapter).

Resolution, in *Robert E. Lynch: A Life Celebrated, F.P. Deek, R. Friedman, and N. Elliot (Editors)*, pp. 95-98, Purple Breeze Press, Palm Harbor, Florida, March 2024 (book chapter).

Lou Kondic

Editor's showcase 2023: Granular Matter, *Frontiers in Soft Matter*, Vol 4, 133970, April 2024 (edited collection).

Kristina Wicke

Tree Balance Indices - A Comprehensive Survey (1st Edition) (with M. Fischer, L. Herbst, S. Kersting, L. Kühn), Springer Nature Switzerland AG, Cham: Switzerland, November 2023.

Software

Victor Matveev

Calcium Calculator (CalC) modeling software, release 7.10.8, GitHub, June 2024.

Kristina Wicke

poweRbal: Phylogenetic Tree Models and the Power of Tree Shape Statistics (with S. Kersting, M. Fischer), The R Foundation, June 2024.

Patents

Jay Meegoda

Coupled High and Low-Frequency Ultrasound Systems and Methods for Remediation of Contaminated Solids (with J. Kewalramani), Patent No US11945014B2, April 2024.

B. PRESENTATIONS

Michael Booty

November 2023: 76th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Washington, D.C.
"Electrokinetic flow for a drop"

August 2023: 10th International Congress on Industrial and Applied Mathematics, Waseda University, Tokyo
"Hybrid asymptotic-numerical methods for two-phase flow with soluble surfactant"

Amitabha Bose

March 2024: Montana State University, Bozeman, MT
"Understanding entrainment of circadian oscillator models using one-dimensional maps"

November 2023: Brown University, Providence, RI
"Understanding entrainment of circadian systems using one-dimensional maps"

November 2023: ICERM, Providence, RI
"A neuromechanstic model for keeping a beat in the context of music"

July 2023: IIT Bombay, Mumbai, India
"Understanding entrainment of circadian systems using one-dimensional maps"

Yassine Boubendir

August 2023: The VI AMMCS International Conference, Waterloo, Ontario, Canada, August 14-18, 2023
"Asymptotic expansion of the scattering amplitude using local approximations of the Dirichlet to Neumann operator"

Bruce Bukiet

May 2024: 2024 Newark Photonics Forum, Newark, NJ
"Connecting the Photonics Community with the Newark STEM Ecosystem"

January 2024: NJIT Institute for Teaching Excellence - Donuts and Discussion, Newark, NJ
"Bridging the high school to college gap through active student engagement"

October 2023: SIAM-NPP 2023 Conference, Newark, NJ
"Utilizing Active Learning Methodologies to Prepare Urban High School Students for Success in College Mathematics"

October 2023: New England Community for Inquiry Learning in Mathematics (NE-COMMIT) Fall 2023 Conference, Westfield State University, Westfield, MA
"Turning Everyday Active: Utilizing Active Learning Methodologies to Prepare Urban High School Students for Success in College Mathematics"

Wooyoung Choi

June 2024: The SIAM conference on nonlinear waves and coherent structures, Baltimore, MD
"Modulation of short surface waves by long internal waves"

November 2023: Workshop on Nonlinear Water Waves and Related Topics, Hayama, Kanagawa, Japan
"On resonant triad interactions between surface and internal waves"

November 2023: Seminar, Pusan, Korea
"Fourier Series and their applications to ocean waves"

October 2023: Seminar, Pusan, Korea
"Long wave approximation and its applications"

Linda Cummings

June 2024: 9th European Congress on Computational Methods in Applied Sciences and Engineering, Lisbon, Portugal
"Network and Stochastic Modeling of Membrane Filtration with Multiple Fouling Modes"

June 2024: 9th European Congress on Computational Methods in Applied Sciences and Engineering, Lisbon, Portugal
"Topological data analysis applied to networks modeling porous media transport"

December 2023: 12th International Conference on Complex Networks and their Applications, Menton, France
"Modeling Filtration through Random Pore Networks: Correlating Structure and Performance"

August 2023: 17th International Heat Transfer Conference, Cape Town, South Africa
"Laser heating and melting of metals on nanoscale: breakup of metal filaments"

Fadi Deek
November 2023: NJIT's Institute for Teaching Excellence, NJIT, Newark, NJ
"AI: The Classroom and Beyond, Panel Moderator (with N Bosca, T Hunt, I Koutis, J Krawiec, H Phan, and J Young)"

Casey Diekman

March 2024: NJIT Prospective Graduate Student Recruitment Event, Newark, NJ
"Overview of my research"

December 2023: Biology Colloquium Series, Newark, NJ
"Data-driven conductance-based neuronal modeling with applications to circadian rhythms and Alzheimer's disease"

September 2023: Center for Mathematical Biology Seminar, Philadelphia, PA
"Data-driven conductance-based neuronal modeling with applications to circadian rhythms and Alzheimer's disease"

August 2023: ICIAM 2023, Tokyo, Japan
"Deep hybrid modeling of neuronal dynamics using generative adversarial networks"

July 2023: Dynamical Systems in the Life Sciences, Columbus, OH
"Deep hybrid modeling of neuronal dynamics"

Christina Frederick

April 2024: Women in Optimal Transport, Vancouver, Canada
"Multi-robot motion planning with intermittent diffusion"

December 2023: Acoustics 2023, Sydney, Australia
"Optimal sampling strategies for seabed classification and source localization with Gaussian processes and machine learning"

Roy Goodman

February 2024: Lehigh Math Colloquium, Bethlehem, PA
"Leapfrogging and scattering of point vortices"

Wenge Guo

June 2024: 2024 ICSA China Conference, Wuhan, Hubei, China
"A Tree-based Conformal Prediction Method for Multi-label Classification"

April 2024: The department of Biostatistics and Data Science Seminar Series, Limassol, Cyprus
"Tree-based Conformal Prediction Methods for Multi-label Classification"

September 2023: The 12th Symposium on Conformal and Probabilistic Prediction with Applications, Limassol, Cyprus
"Multi-label Classification under Uncertainty: A Tree-based Conformal Prediction Approach"

August 2023: The 39th Conference on Uncertainty in Artificial Intelligence, Pittsburgh, PA
"Conformal Risk Control for Ordinal Classification"

Kenneth Horwitz

October 2023: SIAM-NPP 2023 Conference, Newark, NJ
"Utilizing Active Learning Methodologies to Prepare Urban High School Students for Success in College Mathematics"

October 2023: New England Community for Inquiry Learning in Mathematics (NE-COMMIT) Fall 2023 Conference, Westfield State University, Westfield, MA
"Turning Everyday Active: Utilizing Active Learning Methodologies to Prepare Urban High School Students for Success in College Mathematics"

Jonathan Jaquette

March 2024: Applied & Computational Math Seminar, New Brunswick, NJ
"Reliability and robustness in slow-fast systems"

February 2024: Math Bio Seminar, Iowa City, IA (Online)
"Reliability and robustness in slow-fast systems"

October 2023: Dynamical Systems Seminar, New York City, NY
"Exploring global dynamics and blowup in some nonlinear PDEs"

September 2023: Mathematical Challenges in Neuronal Network Dynamics, Providence, RI
"Reliability and robustness in slow-fast systems"

August 2023: ICIAM, Tokyo, Japan
"Global dynamics and finite time blowup in some quadratic PDEs"

Chong Jin

December 2023: CMStatistics 2023
"Integrating Multi-omics Summary Data Using a Mendelian Randomization Framework"

Lou Kondic

June 2024: Seminar, Muenster, Germany
"Laser heating and melting of metals on nanoscale"

June 2024: Seminar, Enschede, The Netherlands
"Laser heating and melting of metals on nanoscale"

June 2024: 9th European Congress on Computational Methods in Applied Sciences and Engineering, Lisbon, Portugal
"Network and Stochastic Modeling of Membrane Filtration with Multiple Fouling Modes"

June 2024: 9th European Congress on Computational Methods in Applied Sciences and Engineering, Lisbon, Portugal
"Topological data analysis applied to networks modeling porous media transport"

June 2024: Seminar, Haifa, Israel
"Network modeling of porous media transport"

December 2023: 12th International Conference on Complex Networks and their Applications, Menton, France
"Modeling Filtration through Random Pore Networks: Correlating Structure and Performance"

November 2023: American Physical Society Division of Fluid Mechanics Annual Meeting, Washington, D.C.
"Understanding slow compression of frictional granular particles by network analysis"

November 2023: American Society for Gravitational and Space Research Meeting, Washington, D.C.
"Phase-field modeling of colloid-polymer mixtures in microgravity"

November 2023: American Society for Gravitational and Space Research (ASGSR) Annual Meeting, Washington, D.C.
"Manufacturing of 3D colloidal crystals for infrared photonics in low-earth orbit"

October 2023: Seminar, Cologne, Germany
"From materials science to computational topology: interaction networks in particulate systems"

October 2023: Particles 2023, Milano, Italy
"On slip predictability for sheared granular systems"

October 2023: ASME International Mechanical Engineering Congress and Exposition (IMECE2023), New Orleans, LA
"Forming colloidal crystals in microgravity"

August 2023: 17th International Heat Transfer Conference, Cape Town, South Africa
"Laser heating and melting of metals on nanoscale: breakup of metal filaments"

August 2023: Seminar, Rio de Janeiro, Brazil
"Modeling filtration through random pore networks: Correlating structure and performance"

July 2023: Workshop on Geometric Constraints: Materials, Graphs and Matroids, Rigidity and Packings, Toronto, CA
"Computing force networks in particulate systems"

Ji Meng Loh

August 2023: 25th International Conference on Computational Statistics, London, UK
"Inference of Spatial Autoregressive Model using Stochastic Gradient Descent"

August 2023: Brain Informatics 2023, Hoboken, NJ
"A Hierarchical Latent State-space Model for Modeling Brain Activities from Electroencephalogram Data"

August 2023: 6th International Conference on Econometrics and Statistics, Tokyo, Japan
"Inference of Spatial Autoregressive Model using Stochastic Gradient Descent"

James MacLaurin

October 2023: Boston University Statistics Seminar, Boston, MA
"Spherical Spin Glass Dynamics"

August 2023: Society for Mathematical Biology, Columbus, OH
"Stochastic calcium dynamics"

Victor Matveev

June 2024: International Conference for Mathematical Neuroscience (ICMNS-24), University College Dublin, Ireland
"Ca2+ buffers and sensors with two binding sites: interesting dynamics from simple reactions"

October 2023: SIAM-NNP Annual Meeting, Newark, NJ
"Accuracy of deterministic vs. stochastic modeling of calcium-dependent neurotransmitter release"

September 2023: NJIT DMS Applied Mathematics Colloquium, Newark, NJ
"Accuracy of deterministic vs. stochastic modeling of calcium-dependent neurotransmitter release"

July 2023: Society for Mathematical Biology (SMB) Annual Meeting, Ohio State University, Columbus, OH
"Accuracy of deterministic vs. stochastic modeling of calcium-dependent vesicle exocytosis"

Jay Meegoda

November 2023: US-Japan Geo-environmental Engineering Workshop, Kumamoto, Japan
“Nanobubbles - The State of the Art”

Zoi-Heleni Michalopoulou

June 2024: International Conference in Underwater Acoustics 2024, Bath, UK
"Source localization and geoacoustic inversion with virtual arrays"

May 2024: Meeting of the Acoustical Society of America, Ottawa, Canada
"Augmenting sparse arrays in ocean acoustics: A Gaussian Process approach"

May 2024: Meeting of the Acoustical Society of America, Ottawa, Canada
"Performance evaluation of decision trees and multilayer perceptrons in seabed classification"

May 2024: Meeting of SIAM - NNP, Newark, NJ
"Simplifying the inverse problem in ocean acoustics: sequential filtering and linearization"

March 2024: Workshop on the SBCEX 22 Experiment, Kingston, RI
"Geoacoustic inversion with virtual arrays"

February 2024: Invited seminar, Miami, FL
"Listening to the ocean: solving inverse problems in underwater acoustics"

December 2023: Acoustics 2023, Sydney, Australia
"Optimal sampling strategies for seabed classification and source localization with Gaussian processes and machine learning"

December 2023: Acoustics 2023 - Meeting of the Acoustical Society of America, Sydney, Australia
"Seabed classification using acoustic signals: A decision tree approach"

September 2023: ONR Peer Review Workshop, Monterey, CA
"Shallow Water Geoacoustic Inversion: Stochastic and Machine Learning Approaches"

Padma Natarajan

March 2024: ITE Donuts and Discussion, Newark, NJ
"Interactive tool(s) to engage students"

Thi Phong Nguyen

November 2023: The Southeastern-Atlantic Regional Conference on Differential Equations, Tallahassee, FL
"Transmission Eigenvalue Problems in Inverse Scattering and Adaptation to Locally Perturbed Periodic Media"

October 2023: SIAM New York-New Jersey-Pennsylvania Section, Newark, NJ
"Transmission eigenvalue problems in inverse scattering theory for locally perturbed periodic media"

October 2023: The 8th Annual Meeting of SIAM Central States Section, Lincoln, NE
"Sampling Methods for Inverse Scattering Problems in Locally Perturbed Periodic Media"

Anand Oza

June 2024: Self-organization in physics and biology, morphogenesis, turbulence, walking droplets and non-linear physics: International meeting in memory of Yves Couder, Paris, France
"Coarse-grained models for schooling wings in fast flows"

March 2024: American Mathematical Society (AMS) Spring Southeastern Sectional Meeting, Florida State University, Tallahassee, FL
"Vortex sheet interactions with flapping swimmers"

January 2024: Joint Mathematics Meeting (JMM), San Francisco, CA
"Vortex sheet interactions with flapping swimmers"

November 2023: American Society for Gravitational and Space Research Meeting, Washington, D.C.
"Phase-field modeling of colloid-polymer mixtures in microgravity"

October 2023: Physical Applied Math Seminar, Cambridge, MA
"Modeling the waves and interactions of capillary surfers"

August 2023: International Congress of Industrial and Applied Mathematics, Tokyo, Japan
"Phase-field modeling of colloid-polymer mixtures in microgravity"

Anthony D. Rosato

May 2023: Engineering Mechanics Institute Conference, Chicago, IL
“Density relaxation in tapped granular systems: Recurrent neural network model”

Zuofeng Shang

December 2023: CMStatistics2023, Berlin, Germany
"Graph and neural network models and related topics"

David Shirokoff

June 2024: Recent Progress on Optimal Point Distributions and Related Fields June 3-7, 2024, Providence, RI
"Linear programming bound solutions to the continuum pairwise particle interaction energy"

October 2023: SIAM NNP, Newark, NJ
"Certifying Stability of Runge-Kutta Methods via Semidefinite Programming"

October 2023: SIAM NNP, Newark, NJ
"Uniqueness and Convergence to Invariant Measures of Stochastic Gradient Descent Markov Operators"

September 2023: IMACS2023, Rome, Italy
"Explicit Runge-Kutta Schemes with Weak Stage Order and an Optimal Number of Stages"

Michael Siegel

April 2024: International Conference on Multiscale Modeling and Simulation based on Physics and Data, UCLA, Los Angeles, CA
"Finite-time singularity formation in the generalized Constantin-Lax-Majda equation with dissipation"

March 2024: American Mathematical Society (AMS) Spring Southeastern Sectional Meeting, Florida State University, Tallahassee, FL
"Vortex sheet interactions with flapping swimmers"

January 2024: Joint Mathematics Meeting (JMM), San Francisco, CA
"Vortex sheet interactions with flapping swimmers"

November 2023: 76th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Washington, D.C.
"Electrokinetic flow for a drop"

October 2023: American Mathematical Society Regional Meeting, Omaha, Omaha, NE
"Finite-time singularity formation in the generalized Constantin-Lax_majda equation"

September 2023: Numerical Analysis Seminar, College Park, MD
"Fast and accurate boundary integral methods for two-phase flow with surfactant"

August 2023: 10th International Congress on Industrial and Applied Mathematics, Waseda University, Tokyo, Japan
"Hybrid asymptotic-numerical methods for two-phase flow with soluble surfactant"

August 2023: International Conference on Industrial and Applied Mathematics (ICIAM), Tokyo, Japan
"Jeffery's paradox for the rotation of a stick-slip cylinder"

Kristina Wicke

March 2024: AMS 2024 Spring Southeastern Sectional Meeting - AMS Special Session on Diversity in Mathematical Biology, Tallahassee, FL
"The weighted total cophenetic index: A novel balance index for phylogenetic networks"

February 2024: CUNY Probability Seminar, New York City, NY
"Exploring tree balance indices: Curious results, current developments, and future directions"

November 2023: Phylomania 2023: 15th UTAS Theoretical Phylogenetics Meeting, Hobart, Australia (Virtual)
"The weighted total cophenetic index: A novel balance index for phylogenetic networks"

October 2023: SIAM-NNP 2023 Annual Meeting, Newark, NJ
"The weighted total cophenetic index: A novel balance index for phylogenetic networks"

September 2023: Foundation of Networks, Institute for Mathematical Sciences, National University of Singapore, Singapore
"Exploring spaces of semi-directed phylogenetic networks"

July 2023: Society for Mathematical Biology Annual Meeting 2023, The Ohio State University, Columbus, OH
"Exploring spaces of semi-directed phylogenetic networks"

Mengjia Xu

March 2024: Qognitive Inc., New York City, NY
“Time Series prediction with Mamba”

March 2024: LoG NYC meetup at the Jersey City campus of NJIT, Jersey City, NJ
“Exploring Neuroimaging Signatures via Hyperbolic Graph Representation Learning”

February 2024: NJ Big Data Alliance (NJBDA) Research Collaboration Forum, Rutgers University, New Brunswick, NJ
“Learning Hyperbolic Brain Network Representations for Healthy Aging Trajectories and Cognitive Decline Prediction”

February 2024: Mathematical Biology Seminar in the Department of Mathematical Sciences at NJIT, Newark, NJ
“Hyperbolic graph embedding for MEG brain network analysis”

January 2024: DOE - Applied Mathematics and MMICCs Principle Investigator Meeting

November 2023: "Machine Learning and Dynamical Systems” Seminar in the Alan Turing Institute, UK
“TransformerG2G: Adaptive time-stepping for learning temporal graph embeddings”

November 2023: Seminar at the Computing & Mathematical Sciences Department at Caltech, Pasadena, CA
"Hyperbolic graph embedding"

November 2023: NJIT IDS Data Science Summit, NJIT, Jersey City, NJ
"Hyperbolic graph embedding for MEG brain network analysis"

November 2023: FinTech seminar at the Martin Tuchman School of Management, NJIT, Newark, NJ
“A Generalization of ViT/MLP-Mixer to Graphs"

October 2023: SIAM-NNP 2023 Annual Meeting, Newark, NJ
"Adaptive time-stepping for learning temporal graph embeddings using transformers"

August 2023: ICIAM Workshop on "Mathematics of Geometric Deep Learning", Tokyo, Japan
"Learning temporal graph embeddings using transformers"

Yuan-Nan Young

June 2024: Workshop on Computational Tools for PDEs on complicated geometries and interfaces at Center for Computational Mathematics, Flatiron Institute, New York City, NY
"Modeling membranes and vesicles"

March 2024: American Physical Society March Meeting, Minneapolis, MN
"Interfacial properties required for net propulsion of a capsule encapsulating squirmer(s)"

March 2024: American Physical Society March Meeting
"Stoichiometric Model for the Microtubule-mediated dynamics of centrosome and nucleus"

January 2024: Workshop on "Mathematics of Living Systems", Taipei, Taiwan
"Active droplet: from its many behaviors to its necessary interfacial properties for propulsion"

December 2023: Department of Mathematics Colloquium, University of South Carolina, Columbia, SC
"A coarse-grained, stoichiometric model for centrosome and spindle dynamics"

November 2023: Biomechanical Engineering Seminar, UIC, University of Illinois at Chicago, IL
"A coarse-grained, stoichiometric model for centrosome and spindle dynamics"

November 2023: Scientific Computing Seminar, Florida State University, Tallahassee, FL
"A coarse-grained stoichiometric model for centrosome and spindle dynamics"

November 2023: American Physical Society Division of Fluid Dynamics Annual Meeting, Washington, D.C.
"Effects of Red Blood Cell Stiffness on Hemodynamics in a Model Microvessel"

October 2023: Math Bio Seminar, Penn State University, University Park, PA
"A coarse-grained stoichiometric model for centrosome and spindle dynamics"

October 2023: Math Bio Seminar, University of Pennsylvania, Philadelphia, PA
"A coarse-grained, stoichio- metric model for centrosome and spindle dynamic"

October 2023: Math Bio Seminar, University of Indiana-Purdue University Indianapolis, Indianapolis, IN
"From centrosome to primary cilium"

August 2023: Biophysics Seminar, Institute of Physics, Academia Sinica, Taipei, Taiwan
"From Centrosome to Primary Cilium"

August 2023: ICIAM (International Congress of Industrial and Applied Mathematics) 2023, Tokyo, Waseda University, Tokyo, Japan
"Squirmers in confinement"

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES

Linda J. Cummings

Fellow, American Physical Society

Associate Editor, IMA Journal of Applied Mathematics

Associate Editor, Proceedings of the Royal Society A

Associate Editor, SIAM Journal on Applied Mathematics

Roy Goodman

President, SIAM New York - New Jersey - Pennsylvania Section

Editorial Board, Frontiers in Photonics

Wenge Guo

Associate Editor, Statistics & Probability Letters

Editorial Board, Calcutta Statistical Association Bulletin

Editorial Board, PLOS ONE

Lou Kondic

Fellow, American Physical Society

Senior Editor, Frontiers in Soft Matter

Associate Editor, Crystals

Associate Editor, Nanomaterials

Associate Editor, Frontiers in Physics

Associate Editor, Journal of Engineering Mathematics

Associate Editor, Papers in Physics

Simone Marras

Associate Editor, Quarterly Journal of the Royal Meteorological Society

Topical Editor, Geoscientific Model Development, Copernicus EGU

Jay Meegoda

Editor, Journal of Environmental Engineering and Science

Associate Editor, Journal of Hazardous, Toxic, and Radioactive Waste Management

Editorial Board, Geotechnical Testing Journal

Editorial Board, International Journal of Environmental Research and Public Health

Editorial Board, Waste and Biomass Valorization

Zoi-Heleni Michalopoulou

Associate Editor, Journal of the Acoustical Society of America

Associate Editor, IEEE Journal of Oceanic Engineering

Luis Pugnaloni

Managing Editor, Papers in Physics

Anthony D. Rosato

Fellow, American Society of Mechanical Engineers

Fellow, American Academy of Mechanics

Editor-in-Chief, Mechanics Research Communications

Editorial Board, Vietnam Journal of Mechanics

Editorial Board of the Americas, Kona - Powder and Particle

Board Member, International Hoover Medal

Guest Editor, Virtual Special Issue in Honor of Prof. Denis L. Blackmore, Mechanics Research Communications

Michael Siegel

Associate Editor, Journal of Engineering Mathematics

Kristina Wicke

Associate Editor, Systematic Biology

B. FACULTY AWARDS

Linda J. Cummings

CSLA Distinguished Research Award, CSLA, NJIT, May 2024.

Fellow of the American Physical Society, November 2023.

Jay Meegoda

American Society of Civil Engineers (ASCE), New Jersey Section, Researcher of the Year Award, May 2024.

NJIT Foundation Excellence in Research & Innovation Medal, October 2023.

Sundar Subramanian

CSLA Excellence in Graduate Education Award, CSLA, NJIT, May 2024.

Peter Ward

CSLA Excellence in Teaching Award – University Lecturer, CSLA, NJIT, May 2024.

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

Continuing Funded Projects

Collaborative Research: Novel Microlocal-Analysis and Domain-Decomposition Based Fast Algorithms for Elastic Wave Modeling and Inversion in Variable Media
National Science Foundation: August 1, 2020 - March 31, 2024
Yassine Boubendir

Nonlinear Resonant Wave Interactions in Density-Stratified Flows
National Science Foundation: September 1, 2021 - August 31, 2024
Wooyoung Choi

Liquid Crystal Films Across Scales: Dewetting & Dielectrowetting
National Science Foundation: September 1, 2018 - August 31, 2023
Linda Cummings (PI), Lou Kondic (Co-PI)

GOALI: Network models for membrane filtration
National Science Foundation: August 15, 2022 - July 31, 2025
Linda Cummings (PI), Lou Kondic (Co-PI), Uwe Beuscher (Co-PI)

Strategies, algorithms, and analysis for autonomous mobile sensor deployment
US Dept. Of Navy: August 20, 2021 - August 19, 2024
Christina A. Frederick

CAREER: Generated Jacobian Equations in Geometric Optics and Optimal Transport
National Science Foundation: July 1, 2018 - June 30, 2024
Brittany Hamfeldt

Phase Separation of Two-Fluid Mixtures using Surface Acoustic Waves: Developing Basic Principles in a Quest for Enhanced Water Recovery
US- Israel Binational Science Foundation: October 1, 2021 - September 30, 2025
Lou Kondic

Active Oil-Water Separation Using Surface Chemistry and Acoustowetting
American Chemical Society: August 1, 2021 - August 31, 2023
Lou Kondic

Scalable Inference of quantile Regression for Large-Scale Health Care Data
National Institutes of Health: May 15, 2019 – April 30, 2024
Ji Meng Loh

Modeling and Simulations of Problems in Active Matter
The Simons Foundation: September 1, 2019 - August 31, 2024
Enkeleida Lushi

Collaboration in Mathematical Biology
The Simons Foundation: September 1, 2020 - August 31, 2025
James Maclaurin

Collaborative Research: Understanding the Turbulent Dynamics of Convective Bursts and Tropical Cyclone Intensification Using Large Eddy Simulation and High Order Numerics
National Science Foundation: August 1, 2021 - July 31, 2024
Simone Marras

Supplement Collaborative Research: Understanding the Turbulent Dynamics of Convective Bursts and Tropical Cyclone Intensification Using Large Eddy Simulation and High Order Numerics
National Science Foundation REU: August 1, 2021 - July 31, 2024
Simone Marras

Design and Fabrication of Recycled Glass Composite Construction Materials and Products
New Jersey Department Of Environmental Protection: January 18, 2022 to January 18, 2024
Jay Meegoda

Ultrasound Technology for the Mineralization of PFAS
US Department of Air Force, February 7, 2022 - January 21, 2025
Jay Meegoda

Geoacoustic Inversion in Shallow Water - Analytic and Optimization Methods
U.S. Navy: Office of Naval Research: March 1, 2020 - February 28, 2024
Zoi-Heleni Michalopoulou

Geoacoustic Inversion in Shallow Water - Stochastic and Machine Learning Approaches
U.S. Navy: Office of Naval Research: April 1, 2023 - March 31, 2026
Zoi-Heleni Michalopoulou

Modeling and Simulation of Interacting Wings: Collective Dynamics in Inertial Fluid Flows
National Science Foundation: July 15, 2021 - June 30, 2024
Anand U. Oza

Phase Transitions in Colloid-Polymer Mixtures in Microgravity
NASA: November 5, 2019 - November 3, 2023
Anand Oza

Wave-Coupled Active Matter
Simons Foundation: September 1, 2018 - August 31, 2023
Anand Oza

CDS&E: Collaborative Research: Scalable Nonparametric Learning for Massive Data with Statistical Guarantees
National Science Foundation: August 1, 2019 - July 31, 2023
Zuofeng Shang

Collaborative Research: Euler-Based Time-Stepping with Optimal Stability and Accuracy for Partial Differential Equations

National Science Foundation: August 15, 2020 - July 31, 2024
David Shirokoff

Flows about Grooved Superhydrophobic Surfaces
US- Israel Binational Science Foundation: October 1, 2021 - September 30, 2025
Michael Siegel

Numerical Methods and Analysis for Interfacial Flow with Ionic Fluids and Surfactants
National Science Foundation: August 1, 2019 - July 31, 2023
Michael Siegel

Collaborative Research: Mathematical, Numerical, and Experimental Investigation of Flow Sensing by the Primary Cilium
National Science Foundation: August 1, 2020 - July 31, 2024
Yuan-Nan Young

Projects Funded During the Present Academic/ Fiscal Year

Approximation of transport maps from local and non-local Monge-Ampere equations
National Science Foundation: July 01, 2023 - June 30, 2026
Yassine Boubendir

Optimal transport based strategies
US Dept. Of Navy: January 01, 2024 - December 31, 2028
Christina Frederick

Collaborative Research: New perspectives from applied and computational time-frequency analysis
National Science Foundation: July 01, 2023 - June 30, 2026
Christina Frederick

Collaborative Research: Convective Processes in the Tropics Across Scales
National Science Foundation: January 1, 2024 - December 31, 2026
Simone Marras

Waste Reduce and Reuse Demonstration at the New Jersey Institute of Technology
New Jersey Department Of Environmental Protection: November 1, 2023 to Friday, October 31, 2025
Jay Meegoda

Collaborative Research: Accuracy-Preserving Robust Time-Stepping Methods for Fluid Problems
National Science Foundation: August 01, 2023 - July 31, 2026
David Shirokoff

International Conference on Multiscale Modeling and Simulation Based on Physics and Data
US Dept. Of Air Force: April 01, 2024 - March 31, 2025
Michael Siegel

B. PROPOSED RESEARCH

Projects Proposed During Present Fiscal Year

Travis Askham

Collaborative Research: Math-DT Fast algorithms for high-fidelity digital twins of optical, electronic, and acoustic devices
National Science Foundation, June 19, 2024

Analysis and numerical methods for electrocoalescence of 3D drops
American Chemical Society, March 31, 2024

Yassine Boubendir

Robust Algorithms Based on Domain Decomposition and Microlocal-Analysis for Wave Propagation
National Science Foundation, December 15, 2023

Robust Algorithms Based on Domain Decomposition and Microlocal-Analysis for Wave Propagation
National Science Foundation, November 14, 2023

Casey Diekman

RTG: Transdisciplinary Training in Mathematical and Computational Biology at NJIT: From Data to Theory and Back
National Science Foundation, November 14, 2023

Christina Frederick

Focused research in time-frequency analysis and optimal transport
The Simons Foundation, September 15, 2023

Optimal transport based strategies in waves and dynamics
United States Navy, August 7, 2023

Jonathan Jaquette

Validated numerics for fluid dynamics in cylindrical geometries
The Simons Foundation, March 7, 2024

Validated numerics for fluid dynamics in cylindrical geometries
National Science Foundation, November 29, 2023

Chong Jin

Deep instrumental variables for inference on wearable device data
Merck & Co., May 16, 2024

Mendelian Randomization Analysis to Investigate Causal Relationships in Systemic Sclerosis
New Jersey Health Foundation, November 30, 2023

Lou Kondic

Collaborative Research: Analysis of dense suspension properties and dynamics by network methods
National Science Foundation, November 14, 2023

James MacLaurin

Noise Induced Patterns and Waves
National Science Foundation, November 14, 2023

Thi Phong Nguyen

Novel Imaging Methods for Inverse Scattering Problems in Complex Media
The Simons Foundation, January 30, 2024

Advances in Direct and Inverse Electromagnetic Scattering Theory for Locally Perturbed Periodic Media
National Science Foundation, September 26, 2023

Anand Oza

CAREER: Active matter systems interacting through waves and memory
National Science Foundation, July 25, 2023

Zuofeng Shang

Local and Global Online Inference for Nonparametric Regression
National Science Foundation, November 9, 2023

CDS&E: Quantization-Based Methods for Optimal Nonparametric Inference
National Science Foundation, September 29, 2023

Michael Siegel

International Conference on Multiscale Modeling and Simulation Based on Physics and Data
United States Air Force, October 24, 2023

Analysis and numerical methods for interfacial flows with multi-component fluids and electric field effects
National Science Foundation, October 5, 2023

Catalin Turc

A new class of high-order integral solvers for wave propagation problems in composite media
National Science Foundation, November 14, 2023

Kristina Wicke

Collaborative Research: Fast Combinatorial Approaches to Network Inference
National Science Foundation, October 11, 2023

Fellowship ICERM Kristina Wicke/ICERM's Fall 2024 Semester Program Theory, Methods, and Applications of Quantitative Phylogenomics Research Fellow ("Research Fellow")
Brown University, November 14, 2023

Yuan-Nan Young

Collaborative Research: Modeling, simulation and experimental investigations of collective dynamics of Janus particles
National Science Foundation, October 31, 2023

VII. COMMITTEE REPORTS AND ANNUAL LABORATORY REPORT

A. STATISTICAL CONSULTING LABORATORY REPORT (JULY 2023 - JUNE 2024)

The Statistical Consulting Lab serves the NJIT community and external organizations and aims to offer high quality statistical consulting for the purposes of promoting research, collaboration and statistical education. Below is a list of consulting activities that occurred over the past year.

Wenge Guo worked with Sarepta Therapeutics, a biotechnology company located in Cambridge, Massachusetts, to develop the Global Statistics Test and other multiple comparison procedures to enhance trial design and analysis efficiency. Dr Guo also collaborated with statisticians at Sarepta Therapeutics on joint statistical research, resulting in a paper titled “Multiple Comparisons Procedures for Analyses of Joint Primary Endpoints and Secondary Endpoints”, submitted to Pharmaceutical Statistics.

Ji Meng Loh worked with Professor Ali Mili (Computer Science) to derive expressions for the mean time to failure (MTTF) for faults in software programs, for the purpose of assessing the quality of fault detection systems. A paper “Failure based assessment of test suite effectiveness” is being prepared for submission.

Sunil Dhar worked with Professor Glen Mark Atlas, MD, of the Department of Anesthesiology in Rutgers New Jersey Medical School, on using variable selection methods to better understand how the relationship between the volume and surface area of aneurysms differ among patients with ruptured and unruptured aneurysms.

Sunil Dhar also worked with Professor Glen Mark Atlas, MD, on a mathematical proof involving matrices where the signs of finitely many rows (or columns) of the matrix were switched.

Ji Meng Loh met with PhD student Dahlia Musa (Information Systems) on a number of occasions to discuss statistical issues related to her dissertation research, involving measurements of simulated wound sizes over time by subjects with and without assistance from software developed by Musa. Topics discussed include regressions, t-tests, and multiple comparisons.

IX. CURRENT AND COLLABORATIVE RESEARCH

A. RESEARCH AREAS IN CAMS

Mathematical Biology

Researchers in CAMS working on problems related to Mathematical Biology: Booth, Bose, Bunker, Diekman, Flammang, Garnier, Golowasch, Holzapfel, Lushi, MacLaurin, Matveev, Nadim, Rotstein, Russell, Sachs, Wicke, and Young.

Mathematical Biology broadly refers to the branch of mathematics that is devoted to the theoretical study of biological processes and the development of novel mathematical tools to understand these processes. Recently, there has been quite a bit of emphasis on the intersection of mathematics with developmental biology, neurophysiology, systems biology, and genomics. Moreover, mathematicians are applying their modeling and analytical skills to the study of various diseases, such as diabetes, Parkinson's disease, schizophrenia, multiple sclerosis, Alzheimer's disease, and HIV-AIDS. The kinds of mathematics needed to describe and address problems in these areas of Mathematical Biology are quite vast and include dynamical systems, partial differential equations, stochastic differential equations, fluid dynamics, mechanics, parameter estimation, and statistics, to name only a few. Researchers in Mathematical Biology at NJIT have strong interdisciplinary research programs that involve, in most cases, active collaborations with experimentalists at the NJIT and Rutgers campuses, and other universities both in the US and abroad.

A primary focus of the Mathematical Biology group is in experimental, computational, and mathematical neuroscience. The experimental research in neuroscience within CAMS is headed up by Jorge Golowasch and Farzan Nadim. Both researchers run labs in which they conduct experiments on various aspects of the crustacean stomatogastric nervous system. Various aspects of Computational and Mathematical neuroscience are being studied by Victor Matveev, Horacio G. Rotstein, Casey Diekman, Amitabha Bose and James MacLaurin. Matveev uses analytical and computational techniques to study intracellular calcium signals controlling synaptic neurotransmitter release, endocrine hormone release and other physiological processes. He is particularly interested in the dynamics of calcium diffusion and buffering underlying changes in synaptic transmission strength termed synaptic plasticity. Rotstein is interested in understanding the mechanisms of generation of neuronal rhythmic oscillations in various areas of the brain (e.g., hippocampus, entorhinal cortex, neocortex, prefrontal cortex, striatum, olfactory bulb) and how this results from the cooperative activity of the dynamic and biophysical properties of the participating neurons, the synaptic connectivity and the network topology. A primary focus of this research is the study of the effects that single cell and network resonances (emergent properties resulting from the interaction between neurons/networks and oscillatory inputs) affect the generation of network oscillations. Diekman creates multiscale models of the circadian (~24-hour) clock to understand the interaction of membrane excitability and daily rhythms in gene expression and behavior. He is also developing data assimilation techniques for parameterizing conductance-based models, and new methods for analyzing how circadian oscillators entrain to environmental cycles. Bose is interested in developing mathematical and dynamical systems techniques to understand neuronal networks. In particular, he is interested in developing models for beat perception in the context of music and for circadian oscillations. James MacLaurin studies many aspects of neuroscience, including the effect of white noise on waves and patterns, derivation of population-density equations to describe the collective behavior of large ensembles of neurons, and techniques for the phase reduction of noisy irregular oscillations.

Another focus of CAMS members is in the area of computational and applied ecology as well as evolution. Dan Bunker is interested in how natural ecosystems cope with the ever increasing stresses placed on them by the forces of global change. Claus Holzapfel is interested in the creation of novel communities that consist of species that never occurred together, but are now being created through fast paced human impact. Gareth Russell studies complex ecological systems, including predictive models of wading bird species in the Everglades National Park. Kristina Wicke works in phylogenetics and is interested in the estimation and mathematical properties of evolutionary trees and networks.

In the area of biological fluid-structure interactions, Young has focused on the biomechanics of primary cilium, a cellular antenna that bends under a fluid flow around the cell. Young has also investigated the force from lipid (FFL) paradigm by constructing a continuum model for the activation of a non-selective mechanosensitive channel reconstituted in a vesicle under fluid stress. Lushi and other CAMS members work on the modeling and simulation of active matter.

Finally, external member Jeffrey Sachs uses pharmacometrics for vaccine discovery and development.

Fluid Dynamics and Material Science

Researchers in CAMS working on problems related to Fluid Dynamics and Material Science: Afkhami, Ahmadpoor, Askham, Bechtold, Booty, Bukiet, Choi, Cummings, Dias, Diez, Farokhirad, Gor, Huang, Jaquette, Jiang, Kondic, Luke, Lushi, Marras, Meegoda, Mema, Oza, Pak, Papageorgiou, Petropoulos, Rosato, Sanei, Shirokoff, Shakib, Siegel, Tafuni, Vanden-Broeck, Voronov, Wang H., Wang Q., Wylie, and Young.

A large group of members within the Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) have research interests in fluid dynamics and Material Science. This group of fluid dynamics scientists is one of the largest contained within a department of mathematics in the United States.

Fluid dynamics is concerned with the motion of fluids and gasses. Many beautiful and striking phenomena occur in fluid flows. Familiar examples include the giant vortices shed by airplane wings, the persistent red spot of Jupiter, and the formation of crystalline patterns in solidifying fluids (i.e., snowflakes).

The basic equations of inviscid fluid dynamics have been known for over 250 years and viscous flow equations were derived over 180 years ago. They are nonlinear partial differential equations and are simply written. However, analyzing the solutions to these equations is extremely challenging. Mathematicians have played a leading role in the development of analytical, asymptotic and numerical methods for solving the equations of fluid dynamics. Mathematical techniques originally developed to study fluid phenomena have found wide application in other areas of science and engineering. Examples include asymptotic methods, the inverse scattering transform, numerical methods such as boundary integral methods and level set methods, and theoretical techniques to study the qualitative nature of solutions to nonlinear differential equations. Mathematical research in fluid dynamics continues to drive broad advances in mathematical methods, numerical methods and mathematical analysis, including data science

The fluid dynamics group in the Department of Mathematical Sciences at NJIT has an active research program covering interfacial fluid dynamics, thin films, electrohydrodynamics, hydrodynamic stability theory, sedimentation, climate science, granular flow and combustion. A particular focus for several of the faculty members is the study of free and moving boundary problems. These are particularly challenging problems in that partial differential equations have to be solved in a region which is not known in advance, but must be determined as part of the solution. A famous example is the Stefan problem for melting ice or freezing water, but also the dynamics of bubbles, jets, shock waves, flames, tumor growth, crack propagation and contact problems all can be classified under this heading. CAMS fluid dynamics researchers are also pursuing applications of their work in Biology and Nanotechnology. In particular, there is an active research program in active matter. This and other topics in complex fluids is the focus of a complex flows and soft matter working group, headed by Linda J. Cummings, Jonathan Jaquette, Lou Kondic, and Anand Oza.

There are also various research activities in material science. This includes molecular dynamics, variational methods, thin film materials, gels and soft matter, and data science methods.

Wave Propagation

Researchers in CAMS working on problems related to Wave Propagation: Ahluwalia, Askham, Booty, Boubendir, Choi, Erneux, Frederick, Goodman, Jiang, Michalopoulou, Moore, Nguyen, Petropoulos, and Turc.

The analysis of wave propagation has a long and storied tradition in the history of applied mathematics, and the exploration of wave behavior has been a source of countless problems that have changed our understanding of acoustics, hydrodynamics, electromagnetics, optics, and even matter itself. These studies also have led to the development of powerful new mathematical and computational techniques, which have on occasion revolutionized entire fields of study. Several members of the CAMS faculty have research interests in the area of wave propagation; the following is a brief overview of the field and of their particular interests.

The treatment of transient electromagnetic signals such as those arising in signal analysis, spectroscopic applications, and the nondestructive testing of structures requires sophisticated numerical techniques that are stable, fast, and accurate, and that have reasonable memory requirements. Peter Petropoulos is conducting research on a variety of approaches that address these restrictions, including high-order finite difference schemes, boundary integral methods, and perfectly matched layers. Shidong Jiang employs fast algorithms, including the fast multipole method, iterative solvers, and integral equation formulation of boundary value problems for such problems and for related large-scale problems in physics and engineering. Yassine Boubendir and Catalin Turc develop multi-scale and efficient methods, including domain decomposition methods, for the study of wave scattering. Thi-Phong Nguyen studies inverse problems applied to the non-destructive testing of materials.

Even in cases where deterministic wave propagation is relatively well understood, the related inverse problem is far more challenging. The identification of certain characteristics of a source of acoustic waves, such as its location and intensity, is of obvious use in national defense, in environmental studies, in seismology, etc. In particular, Zoi-Heleni Michalopoulou and Christina Frederick work on developing powerful new algorithms for inverse problems in acoustics. Their research brings forward state-of-the-art techniques, including machine learning, to these challenging problems.

Numerical Methods

Researchers in CAMS working on problems related to Numerical Methods: Afkhami, Askham Boubendir, Bukiet, Choi, Dias, Dytso, Frederick, Goodman, Hamfeldt, Horntrop, Jiang, Kondic, Koutis, Luke, Lushi, Matveev, Michalopoulou, Moore, Musialski, Muratov, Nguyen, Papageorgiou, Petropoulos, Rosato, Shirokoff, Siegel, Shang, Tao, Turc, Xu and Young.

Given the rapidly increasing computing power and capacity in recent decades, the use of computation as a means of scientific inquiry has also greatly increased and now is ubiquitous in most areas of applied mathematics. CAMS researchers are actively involved in all aspects of this scientific revolution from the development of new, more efficient and accurate numerical algorithms to the creation of computational packages for use by researchers throughout the world. The computational work of CAMS researchers is supported by state of the art facilities including high-performance clusters..

Virtually every CAMS member uses computation in some aspect of their research. Some of the specific computational tools that are being used and developed by CAMS researchers are described below. Boundary integral methods are being used to study moving interfaces in materials science and fluid dynamics. Computational solutions of nonlinear partial differential equations are used in studies of the formation of finite-time singularities in aerodynamic and interfacial problems. A wide variety of finite difference methods for ordinary and partial differential equations, often in conjunction with iterative solvers and conjugate gradient methods, are used in studies of advection-diffusion problems, wave propagation, blood circulation, the visual cortex, as well as synaptic function and intracellular spatio-temporal calcium dynamics. Level set methods are used to study interfaces in materials. Novel techniques for differential difference equations are also used to better understand materials. Convergence of fast multipole methods is analyzed and these methods are used to study wave propagation. Novel techniques to remove spurious reflections of waves at computational boundaries are being developed. Signal detection and estimation techniques rely upon global optimization techniques used and developed by CAMS researchers. Finite element methods are used to study mechanical systems; hybrid methods are being developed and refined in order to achieve high order accuracy and efficiency near interfaces.

Stochastic computation also receives a great deal of attention by CAMS researchers. Monte Carlo methods based upon the principles of statistical mechanics are used in studies of granular materials. Efficient and consistent coarse-grain algorithms are designed to simulate the dynamics of DNA molecules and lipid bilayer membranes in viscous flows. Monte Carlo simulation is used to study molecular biology and bioinformatics.

Stochastic models of sedimentation are being developed and refined through a combination of analysis and simulation. Markov Chain Monte Carlo methods are used in studies in statistics and biostatistics. Simulations taking advantage of variance reduction techniques are being used to study the effects of stochastic perturbations on solitons. New computational techniques for stochastic partial differential equations based upon spectral methods are being developed and applied to multiscale models of surface processes. Recently, there has been significant research efforts by CAMS members on emergency methods in data science. Focus areas include statistical learning and applications of data science in acoustics, solar physics, and fluids.

Statistics

Researchers in CAMS working on problems in Applied Probability and Statistics: Dhar, Guo, Jin, Loh, Roychoudhury, Shang, Subramanian, and Wang.

Applied Probability and Statistics/Biostatistics is concerned with the study of processes in which uncertainty plays a significant role. In today's data driven environment, the utility and need for modeling and statistical analysis of uncertainty is assuming increasing importance in virtually every field of human interest. Typical examples are in the comparative study of DNA databases, evaluation of drug safety and effectiveness, design and analysis of modern communication protocols, stochastic models in finance, study of aging and performance analysis of components and complex systems.

While Applied Probability and Statistics/Biostatistics are driven by the need to solve applied problems, their progress and development comes from basic research and from their applications to solve specific problems arising in practice. This interplay of basic and applied research has benefited both. Real life applied problems have often posed new theoretical challenges which had to be solved by developing new methods (e.g., survival analysis and clinical trials). Conversely, theoretical ideas and methods which were developed in a specific applied context were later seen to be of much broader applicability (e.g., nonparametric aging ideas which owe their origins to research in stochastic modeling of reliability of physical systems were later seen as useful constructs in many other areas such as in the study of queuing systems, stochastic scheduling, branching processes as well as in modeling economic inequality). Biostatistics, an increasingly important area of statistics, focuses on developing new statistical methods, as well as applying existing techniques, to interpret data about the medical and life sciences. The importance of biostatistics stems from its wide use in the pharmaceutical and health-care industries, and in medical schools, e.g. in the area of cell biology and molecular medicine empirical survival distributions of mice in both placebo and treatment groups are typically compared to look for significant difference in new chemical treatments when compared with placebo.

The Statistical Consulting Laboratory (SCL), which operates under the umbrella of CAMS, provides data analysis and statistical modeling consulting services to the University community, as well as to external clients. Consulting on statistical and biostatistics problems channeled through the SCL, are provided by statistics faculty. The current coordinator of the SCL is Ji Meng Loh.

The current research interests of the Statistics faculty are in the following broad and overlapping areas: applied probability models (Dhar), bioinformatics and computational biology (Fang, Jin, Guo), bootstrap methods (Subramanian), censored time-to-event data analysis (Dhar and Subramanian), computational statistics (Fang, Guo and Subramanian), discrete multivariate distribution/reliability models and inverse sampling (Dhar), distribution theory and statistical inference (Dhar and Subramanian), empirical processes (Dhar, Subramanian), high dimensional inference (Fang, Guo, Loh, and Wang), machine learning and data mining (Fang), minimum distance estimation (Dhar), multiple imputations methods (Subramanian), multiple testing (Guo), semiparametric estimation and inference (Dhar and Subramanian), spatial statistics and spatial point patterns (Loh), statistical genomics/genetics and RNA-seq methods (Jin), statistical issues in clinical trials (Guo and Dhar), and statistical theory of reliability and survival analysis (Dhar, Subramanian, and Loh).

Several CAMS members have active research programs in Biostatistics. This includes the application of non- and semi-parametric statistical inference and computational methods, such as the bootstrap, in biostatistics.

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

Report on Undergraduate Studies
David J. Horntrop, Associate Chair for Undergraduate Studies

The undergraduate program of the Department of Mathematical Sciences continued to be very active during the past academic year.

In addition to their studies in our rigorous academic programs, many of our undergraduates also engaged in research or held industrial internships. In addition to participating in the Provost's Summer Undergraduate Research Program, many students engaged in research by working with individual professors and by participating in REU programs. Each summer a number of students have internships at MetLife, Chubb, and Prudential Financial while some students intern at consulting firms such as Mercer Consulting and Willis Towers Watson. Companies such as Movado Group, Aon, Google, Facebook, Guardian Life, SMBC, and BNY-Mellon also employ our students as summer interns.

Our students have also received many honors and awards during the past year and have also found success on their actuarial examinations with more than 14 passed during the year. The department itself was honored by having its Mathematics of Finance and Actuarial Science program ranked fifth nationally in a study commissioned by SafecoInsurance.com.

Many students who graduate from our program continue either to enter graduate programs at other prestigious institutions or find gainful employment. Examples of graduate schools recently attended by our undergraduates include UTexas-Austin, UCLA, CalTech, RPI, Columbia, Northwestern, and the University of Delaware. Examples of employers of our recent graduates include MetLife, Prudential Financial, Chubb, Guardian Life, NYLife, Aon, Buck Consultants, SMCB, and Willis Towers Watson.

Capstone Laboratory Projects on Nonlinear Water Waves

Instructor: *Wooyoung Choi* • Assistant: *Philip Zaleski*
Participating Students: *Ryan Kitson, Vincent LaStella, Vanessa Miller, Huu Nguyen, Vicky Ni, Ellison O'Grady, Shalom Salvi, Diego Sanchez*

This Capstone Lab is designed to study the excitation and their subsequent dynamics of nonlinear periodic and standing waves in water of finite depth in two different mechanisms (1) by an external pressure forcing applied periodically in time to the water surface and (2) by the parametric instability of standing waves in a tank oscillating vertically. The projects aim to provide the participating students opportunities to improve their mathematical and numerical modeling skills and to validate theoretical solutions through laboratory experiments. The students have developed numerical models using a pseudo-spectral method to solve the third- order nonlinear model (a system of two nonlinear integro-differential equations describing the motions of the free surface elevation and the free surface velocity potential) with different boundary conditions. Their numerical solutions have been compared with analytic solutions of the linear system and available experimental data.

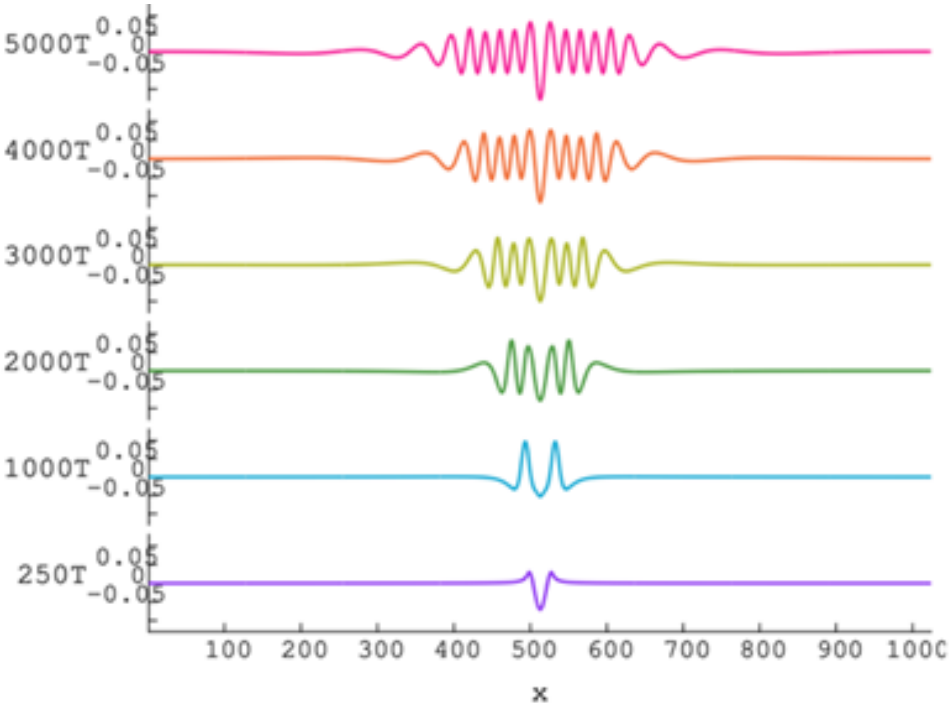

***Figure 1**:* Numerical solution of the third-order nonlinear water wave model for the generation of periodic waves by an oscillating pressure forcing at the center of the computational domain.

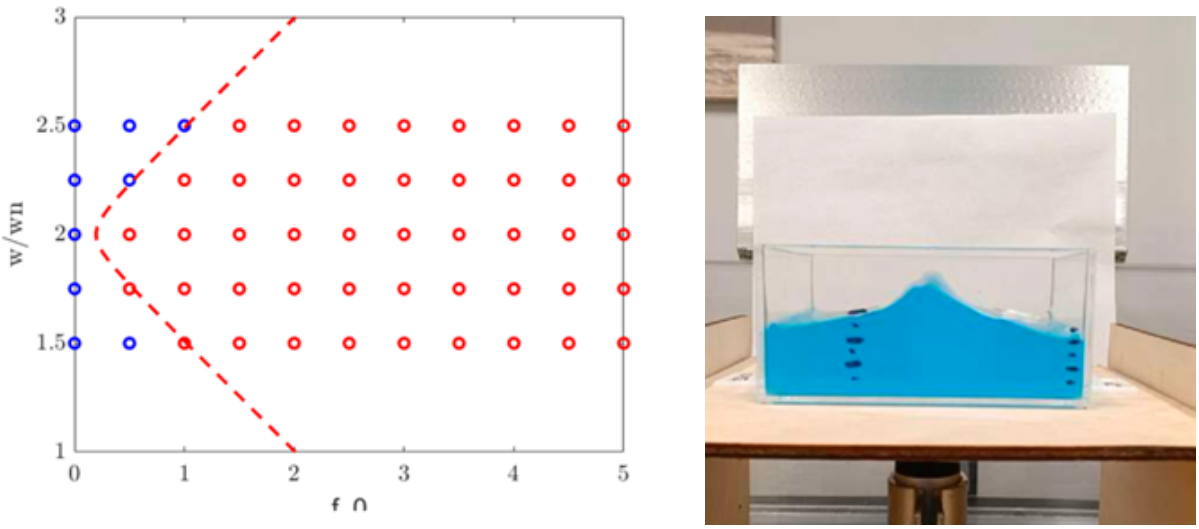

***Figure 2**:* Parametric instability of surface gravity waves in a vertically oscillating tank. Left panel: Comparison of numerical solutions of a third-order nonlinear system (red symbols: instability; blue symbols: stability) with the theoretical prediction (dashed line). Right panel: Experimental demonstration of the excitation of the second standing wave mode by the instability.

Capstone Laboratory Projects on Droplet Impact Dynamics

Instructor: *Shahriar Afkhami* • Participating Students:
(Group 1) *Arij Qureshi, Neel Patil, Meer Kenia, Manal Desai, Olivia Shpiruk, René Rajaram*
(Group 2) *Vignesh Nethrapalli, Anthony Siracusa, Gabriel Masarwa, Jack Tokuda, William Simkins*

This Capstone Lab focused on the study of droplet impact dynamics which involve complex interactions between the droplet and the surface, influenced by the droplet's velocity, viscosity, surface tension, and the surface's material properties and temperature.

Group 1 conducted a series of experiments to analyze the behaviors of different fluids impacting varying surfaces. They use two different materials for the droplets: first, water, a Newtonian fluid with a low melting point and viscosity, and second, wax, a non-Newtonian fluid with a high viscosity and melting points. Under controlled conditions, the group examined the impact of these fluids on different surfaces to shed light on the underlying physics governing droplet behavior, including spreading, recoiling, and solidification patterns.

The group demonstrated how both glass and Plaskolite alter droplet behavior upon impact, including the spreading, recoiling, and solidification of the droplets. The behavior of the wax droplet was also affected by the temperature of both the substrate and the droplet, as changes in the substrate temperature significantly affected how the droplets spread and solidified.

***Figure 1**: Experimental Setup*

Group 2 approached the study of droplet impact dynamics from a computational viewpoint with the goal of simulating the spread of a molten droplet freezing upon hitting a cold substrate. The group aimed to create a one-dimensional model to find a numerical approximation for the solidification of a droplet impacting a cold substrate. This is represented by a Stefan problem with:

1. A semi-infinite cold substrate at the bottom with spatially varying temperature.
2. A solid layer from $z = 0 \; to \; h(t)$ with spatially varying temperature.
3. A liquid later at constant melting temperature from $z = h(t)$ to z_{max}.

The group produced code for different versions of this problem and simulated the freezing problem. Results were compared to both the literature and Group 1, i.e., the experimental findings.

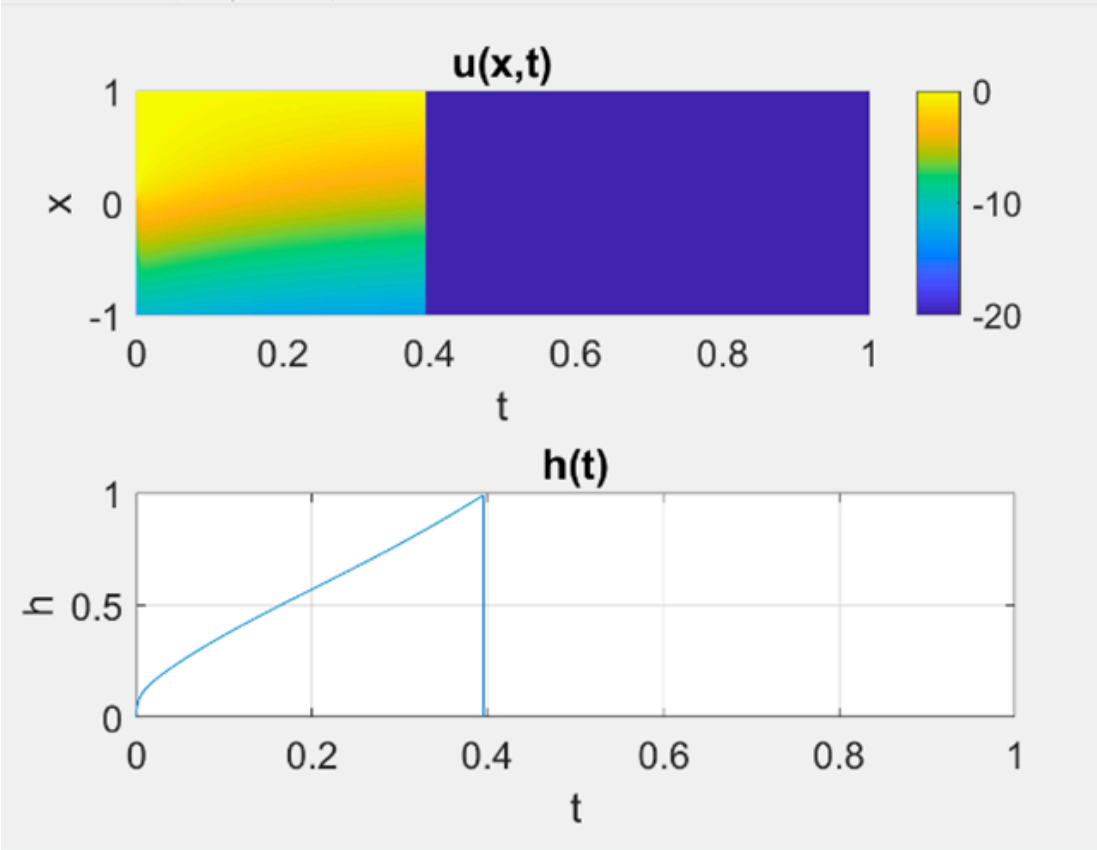

Figure 2*: Example of simulation results. The top graph is a heat map. It includes part of the substrate* [-1,0) *and the entirety of the water droplet* (0,1]*. Due to the large temperature difference between the substrate and water droplet, the substrate quickly heats up. Over time the substrate cools back down as the ice layer forms. The bottom graph is the height of the ice layer, h(t). After h(t) reaches 1, no more data is computed since the droplet is completely frozen by this point in time.*

B. GRADUATE PROGRAMS

Graduate Activities Report
Roy Goodman, Associate Chair for Graduate Studies

This was a banner year for the Department of Mathematical Sciences graduate program. We have an incoming class of 11 Ph.D. students in Applied Mathematics and Applied Statistics, plus two student in Data Science. The new students have diverse backgrounds from undergraduate and master's programs in mathematics (pure and applied), engineering, physics, and statistics. One student completed a summer internship at IBM. The Ph.D. program in Data Science (Statistics track) is up and running, with four students in the program and more accepted for the fall.

The Department of Mathematical Sciences takes great pride in the quality of its graduate programs. In addition to master's programs in Applied Mathematics, Applied Statistics, Biostatistics, and Data Science (Statistics track), our Ph.D. program continues to attract high-caliber students who work closely with faculty to conduct original research in applied and computational mathematics and statistics. We have recently introduced graduate certificates in Applied Statistics, Biostatistics, and Data Science. Each graduate certificate provides its students with a four-course set of specialized training that can be used to enhance an existing career or to explore advanced material before enrolling in a master's program.

Our doctoral students have an impressive collective record of presenting and publishing their research. Each year, they earn invaluable experience and recognition for their accomplishments at high-profile meetings organized by SIAM, the APS, and other international scientific organizations. Almost all our students also present posters at our annual Frontiers in Applied and Computational Mathematics conference. Most of our students have at least one high-quality publication accepted by graduation, essential for success in today's job market.

Our doctoral students are very engaged in departmental activities, and they regularly organize tea-time as well as academic, career-oriented, and social events under the banner of the NJIT SIAM Chapter, such as a student-organized seminar series in machine learning in addition to the usual graduate student seminar series that runs over the summer (see below). Our students have had much recent success finding internships in governmental research facilities such as the Johns Hopkins Applied Physics Laboratory and at private companies, including Emergent Holdings, Sage Therapeutics, and Biogen.

Ultimately, the offers our students receive after graduation best indicate our programs' health. New positions secured by our graduates in the past two years include a presidential postdoctoral fellowship at Arizona State University, postdocs at Emory University, Wayne State University, and Sandía National Laboratory, and a statistics and data science positions at Regeneron Pharmaceuticals, Caterpillar, and Johnson & Johnson, and ClinChoice.

PhDs Awarded in the Period Covered by the Report

Samantha Evans
A Fast Mesh-Free Boundary Integral Method for Two Phase Flow with Soluble Surfactant and a Study Of Electroconvective Flow
Advisors: Michael Siegel and Michael Booty

Nicholas Dubicki
A Micromagnetic Study of Skyrmions in Thin-Film Multilayered Ferromagnetic Materials
Advisors: Cyrill Muratov and Michael Siegel

Moshe Silverstein
Large Deviation Theory in Stochastic Processes: Applications to Biological Modeling
Advisor: James N. MacLaurin

Chhavi Tyagi
Multi-label Classification Using Conformal Prediction
Advisor: Wenge Guo

Austin Juhl
Certifying Stability in Runge-Kutta Schemes: Algebraic Conditions and Semidefinite Programming
Advisor: David Shirokoff

Sisi Gu
Analysis of Dependent Censored Data Using Copula Models
Advisor: Antai Wang

Publications, Presentations, & Conferences

***Not Including DMS Summer Student Talks**

Atul Anurag

Publications

A new canonical reduction of three-vortex motion and its application to vortex-dipole scattering (with R. H. Goodman and, E. K. O'Grady), Physics of Fluids, Vol 36, Issue 6, June 2024.

Talks and Posters

Point Vortex Dipole Scattering, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

The Phase Space of the Three-Vortex Problem, SIAM Conference on Nonlinear Waves and Coherent Structures, June 24, 2024, Baltimore, MD.

Prianka Bose

Talks and Posters

Study of Beat Perception Using Onset Detection Algorithm, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Son Clave Rythm: A Biophysical Model and Synchronization Study, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Jake Brusca

Talks and Posters

Efficient Monotone Discretization of the Monge-Ampère Equation Through Quadrature, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Matthew Cassini

Publications

Numerical Optimal Transport from 1D to 2D using a Non-local Monge-Ampere Equation (with B. Froese-Hamfeldt), La Matematica, Vol 3, pages 509-535, March 2024.

Bryan Currie

Talks and Posters

Some Effects of Behavior amid an Epidemic Disease, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Joseph D'Addesa

Talks and Posters

Thin Films Under Action of Surface Acoustic Waves: Experiments, Modeling, and Simulations, 76th Annual Meeting of the Division of Fluid Dynamics, November 19-21, 2023, Washington, DC.

Stability and Collapse of Holes in Liquid Layers with Vibrations, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Conference publications and abstracts

Extracting oil from an oil and water mixture by using their different wetting properties via the Acoustowetting phenomenon (with Y. Li, M. Fasano, J. Diez, L. J. Cummings, L. Kondic, O. Manor), *American Physical Society*, November 2023.

Forced Phase Separation in a Closed Cell (with M. Fasano, O. Manor, J. Diez, L. J. Cummings, L. Kondic), *American Physical Society*, November 2023.

Thin Films Under Action of Surface Acoustic Waves: Experiments, Modeling, and Simulations (with M. Fasano, J. Diez, Y. Li, O. Manor, L. J. Cummings, L. Kondic), *American Physical Society*, November 2023.

Nicholas Dubicki

Talks and Posters

Reevaluating the Stability of Stray Field Driven Magnetic Skyrmions in Thin-Film Ferromagnetic Materials, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Samantha Evans

Talks and Posters

A fast mesh-free boundary integral method for two phase flow with soluble surfactant, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Mark Fasano

Talks and Posters

Forced Phase Separation in a Closed Cell, 76th Annual Meeting of the Division of Fluid Dynamics, November 19-21, 2023, Washington, DC.

Phase Separation in Binary Mixture via Conservative Volume Force, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Conference publications and abstracts

Extracting oil from an oil and water mixture by using their different wetting properties via the Acoustowetting phenomenon (with Y. Li, J. D'Addesa, J. Diez, L. J. Cummings, L. Kondic, O. Manor), *American Physical Society*, November 2023.

Forced Phase Separation in a Closed Cell (with J. D'Addesa, O. Manor, J. Diez, L. J. Cummings, L. Kondic), *American Physical Society*, November 2023.

Thin Films Under Action of Surface Acoustic Waves: Experiments, Modeling, and Simulations (with J. D'Addesa, J. Diez, Y. Li, O. Manor, L. J. Cummings, L. Kondic), *American Physical Society*, November 2023.

Richard Greene

Talks and Posters

Efficient Polynomial Interpolation on the Square and Cube, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Matthew Illingworth

Talks and Posters

Correlating topology and performance of membrane pore network, 76th Annual Meeting of the Division of Fluid Dynamics, November 19-21, 2023, Washington, DC.

Correlating topology and performance of membrane pore networks, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Conference publications and abstracts

Topological data analysis applied to networks modeling porous media transport (with G. Binan, L. J. Cummings, L. Kondic), *ECCOMAS*, June 2024.

On correlating topology and performance of pore networks in membrane filters (with B. Gu, Y. Li, L. J. Cummings,L. Kondic), *American Physical Society*, November 2023.

Austin Juhl

Talks and Posters

Certifying Stability of Runge-Kutta Methods via Semidefinite Programming, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

José Pabón

Talks and Posters

Reduced order models of hydrodynamically interacting wings, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Nastaran Rezaei

Talks and Posters

Instability between the two-layer Poiseuille flow, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Instability of a two-layer flow, 3-Minute Research Presentation competition, February 28, 2024, NJIT, Newark, NJ.

Diego Rios

Talks and Posters

Seabed classification with decision trees, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Conference Publications and Abstracts

Performance evaluation of decision trees and multilayer perceptrons in seabed classification (with J. Tokuda, Z. H. Michalopoulou), *Journal of the Acoustical Society of America*, May 2024.

Moshe Silverstein

Talks and Posters

A Piecewise-Deterministic Markov Process Model for Calcium Signaling, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Michael Storm

Publications

The adjoint double layer potential on smooth surfaces in R^3 and the Neumann problem (with J. T. Beale and S. Tlupova), Advances in Computational Mathematics, Volume 50, Article 29, April 2024.

Talks and Posters

Computing the Adjoint Double Layer Potential, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Chhavi Tyagi

Conference Publications and Abstracts

Multi-label Classification under Uncertainty: A Tree-based Conformal Prediction Approach (with W. Guoi), *COPA 2023: 12th Symposium on Conformal and Probabilistic Prediction with Applications*, September 2023.

Zhiwen Wang

Talks and Posters

Deep learning in spatial analysis, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Zheng Zhang

Talks and Posters

Consistent Estimation of the Number of Communities in Nonuniform Hypergraph Model, SIAM-NNP Conference, October 20-22, 2023, NJIT, Newark, NJ.

Student Talks - Summer 2024

Monday, June 3 - **Atul Anurag**
The Phase Space of the Three-Vortex Problem and its Application to Vortex-Dipole Scattering

Thursday, June 6 - **Samantha Evans**
A Fast Mesh-Free Boundary Integral Method for Two Phase Flow with Soluble Surfactant and a Study of Electroconvective Flow

Monday, June 10 - **Jose Pabon**
Reduced Order Models of Hydrodynamically Interacting Flapping Wings

Monday, June 17 - **Nicholas Harty**
Towards the Numerical Homogenization of Time-Domain Multiple Scattering by Resonators, and Finite Wires and Strips

Monday, June 17 - **Patrick Grice**
The Inverse Elasto-Acoustic Problem

Thursday, June 20 - **Kristian Nestor**
Model checks for censored two-sample location-scale via estimated characteristic functions

Thursday, June 20 - **Tareq Aldirawi**
Conformal Risk Control and applications on Multi-label Classification

Thursday, June 27 - **Mark Fassano**
On Modeling a Thin Oil Film Covering Rigid and Deformable Objects

Monday, June 27 - **Philip Zaleski**
Iterated Function Systems and Stochastic Gradient Descent

Monday, July 1 - **Austin Juhl**
Certifying Stability in Runge-Kutta Schemes: Algebraic Conditions and Semidefinite Programming

Monday, July 8 - **Matthew Illingworth**
On Correlating Topology and Performance of Membrane Filter Pore Networks

Monday, July 8 - **Andrew White**
Role of Calcium Buffers in Synaptic Neurotransmitter Release and its short-term Modulation

Thursday, July 11 - **Bryan Currie**
On the maximum value of the stairs2 index

Thursday, July 11 - **Joseph D'Addesa**
Stability and Spreading of Sessile Drops on Vertically Vibrating Substrates

Monday, July 15 - **Prianka Bose**
Modeling Non-Isochronous Cyclic Rhythms: Relating Taal and Clave

Thursday, July 18 - **Connor Greene**
Optimal Polynomial Bases on the Square and Cube

Monday, July 22 - **Matthew Cassini**
Volume Integral Method for Electromagnetic Equations

Monday, July 22 - **Zhiwen (Esther) Wang**
1. Deep Learning Methods in Spatial Intensity Estimation
2. Block Bootstrap in Phylogenetic Tree Estimation

Monday, July 22 - **Nastaran Rezaei**
Instability between the two-layer Poiseuille Flow with the VOF Method

Thursday, July 25 - **David Mazowiecki**
Numerical Simulation of Multiple Particles Undergoing Quincke Rotation

Monday, July 29 - **Michael Storm**
Spectral Stability of Pulse Solutions of the Swift-Hohenberg Equation with Computer Assisted Proofs

Monday, July 29 - **Elizabeth Tootchen**
Modeling REM Sleep without Atonia

Monday, July 29 - **Souaad Lazergui**
Asymptotic Expansion of the Iterated Solutions for Multiple Scattering Configurations

Thursday, August 1 **- Nan Zhou, Xiaotian Mu, and Zhaoshu Cao**
Understanding Fluid Flux Through Porous Media Using Topological Data Analysis

Center for Applied Mathematics and Statistics
Department of Mathematical Sciences

606 Cullimore Hall
University Heights, Newark, NJ 07102
Phone: (973) 596-5782 • Fax: (973) 596-5591

http://math.njit.edu/
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