CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT
2017 – 2018

July 1, 2017 – June 30, 2018

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 32nd year as a vehicle for research in applied mathematics and statistics at NJIT. CAMS supports faculty research by organizing colloquia, seminars and conferences and by facilitating group and interdisciplinary research proposals. We take particular pride in the undergraduate research that is supported by CAMS. NJIT Provost Fadi Deek has encouraged increased efforts at undergraduate research university wide, and CAMS and the Department of Mathematical Sciences are happy to take a leading role in this endeavor. CAMS combined with faculty from the Department of Computer Science and researchers in industry to obtain a five year NSF 'EXTREEMS' grant, which began in September 2013 and is now in its fifth and final summer of engaging undergraduates in research. The grant has enabled us to significantly enhance the exposure of undergraduate mathematical science students to topics in computational and data-enabled science and engineering. On the graduate front, CAMS has this year for the first time organized a `Research Day' featuring short presentations by our advanced PhD students, and attended by CAMS members and visitors from other departments and nearby universities. We are also glad to report external recognitions of our PhD students, including NSF Fellowship (Axel Turnquist) and DOE Summer Fellowship (Ryan Allaire).

Some of the other highlights and significant achievements of this past year include:

- Eight new funded projects, including five by the National Science Foundation.

- The oversight of an additional twenty-five continuing grants, from various agencies. CAMS receives substantial funding for graduate student and faculty research from sources such as the National Science Foundation, the Office of Naval Research, the Air Force Office of Scientific Research, NASA, DARPA, and other state and local agencies such as the NJ Meadowlands Commission and private industry.

- Hosting of the 15th Frontiers in Applied and Computational Mathematics (FACM) conference. This three day workshop was attended by more than 70 participants, and focused on recent advances in computing methods of relevance to wave propagation, and included presentations on topics including boundary element methods, high frequency techniques, and domain decomposition algorithms.

As always, the accomplishments of CAMS have been built with the support and dedication of many individuals. We are grateful to Fadi Deek, Provost and Senior Vice President of Academic Affairs, Jonathan Luke, Department of Mathematical Sciences Chair, and Atam Dhawan, Senior Vice President for Research, for encouraging CAMS through their strong support of scientific research. Finally, we thank President Joel Bloom, who has been a constant source of support for CAMS and its mission. We look forward to continued fruitful interactions with these individuals in the upcoming year.

Lou Kondic, Director • Cyrill Muratov, Associate Director

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.

Department of Mathematical Sciences
Advisory Board 2017 - 2018

Dr. John S. Abbott	Corning Incorporated
Dr. James Cai	Roche Innovation Center New York
Dr. Ned J. Corron	U.S. Army AMCOM
Mr. Erik Gordon	Trillium Trading, LLC
Dr. Richard Silberglitt	Rand Corporation

III. MEMBERS AND VISITORS

Department of Mathematical Sciences

Afkhami, Shahriar
Ahluwalia, Daljit S.
Bechtold, John
Blackmore, Denis
Booty, Michael
Bose, Amitabha
Boubendir, Yassine
Bukiet, Bruce
Bunker, Daniel
Choi, Wooyoung
Cummings, Linda
Fang, Yixin
Frederick, Christina
Deek, Fadi
Dhar, Sunil
Diekman, Casey
Golowasch, Jorge
Goodman, Roy
Guo, Wenge
Hamfeldt, Brittany
Horntrop, David
Jiang, Shidong
Johnson, Kenneth
Kappraff, Jay
Kondic, Lou
Kriegsmann, Gregory A.
Loh, Ji Meng
Luke, Jonathan
Matveev, Victor
Michalopoulou, Zoi-Heleni
Milojevic, Petronije
Miura, Robert M.
Moore, Richard
Muratov, Cyrill
Nadim, Farzan
Oza, Anand
Perez, Manuel
Petropoulos, Peter
Rotstein, Horacio
Russell, Gareth
Shirokoff, David
Siegel, Michael
Subramanian, Sundarraman
Sverdlove, Ronald
Turc, Catalin
Wang, Antai
Young, Yuan-Nan

Department of Civil and Environmental Engineering: Meegoda, Jay
Department of Mechanical Engineering: Rosato, Anthony
Federated Department of Biological Sciences: Holzapfel, Claus (Rutgers University)

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
Papageorgiou, Demetrios	Imperial College, London
Tao, Louis	Peking University, China
Vanden-Broeck, Jean-Marc	University College London
Wylie, Jonathan	City University of Hong Kong

IV. COLLOQUIA AND SEMINARS

Applied Mathematics Colloquium/ Department of Mathematical Sciences Colloquium

September 8, **Allison Bishop,** Columbia University
In Pursuit of Obfuscation

September 15, **Maxence Cassier,** Columbia University
On the Limiting Amplitude Principle for Maxwell's Equations at the Interface of a Metamaterial

September 22, **Robert Pego,** Carnegie Mellon
Microdroplet Instability in a Least-Action Principle for Incompressible Fluids

September 29, **Alex Townsend,** Cornell University
Why are There so Many Matrices of Low Rank in Computational Math?

October 6, **Gennady Gor,** NJIT
How to Interpret Ultrasonic Experiments on Fluid-Saturated Nanoporous Media?

October 13, **Andrew Bernoff,** Harvey Mudd College
Energy Driven Pattern Formation in Thin Fluid Layers: The Good, the Bad and the Beautiful

October 20, **Daniel Szyld,** Temple University
Multiple Preconditioned GMRES for Shifted Systems, with Applications to Hydrology and Matrix Functions

October 27, **Peter Monk,** University of Delaware
Finite Element Methods for Maxwell's Equations

November 3, **Johannes Tausch,** Southern Methodist University
Fast Galerkin BEM for Parabolic Moving Boundary Problems

November 10, **Javier Diez,** UNICEN
Wettability Dynamics of Thin Liquid Films on Solid Substrates

November 17, **Mike O'Neil,** New York University
Fast Direct High-Order Methods for Electromagnetic Scattering from Bodies of Revolution

December 1, **Michael Shelley,** New York University / Flatiron Institute
Active Mechanics in the Cell

December 8, **Mette Olufsen,** North Carolina State University
Alterations in Cardiovascular Regulation in Disease – A Model Based Analysis

February 2, **Paulo Arratia,** University of Pennsylvania
Life in Complex Fluids

February 9, **Uwe Beuscher,** W.L. Gore & Associates
Investigation of the Correlation Between Gas/Liquid Porometry and Particle Filtration Using Simple Network Models

February 16, **Aleksandar Donev,** New York University
Large Scale Brownian Dynamics of Confined Suspensions of Rigid Particles

February 23, **Sue Ann Campbell,** University of Waterloo
Mean Field Analysis and the Dynamics of Large Networks of Neurons

March 2, **Gene Wayne,** Boston University
Dynamical Systems and the Two-Dimensional Navier- Stokes Equations

March 9, **Jerome Darbon,** Brown University
On Convex Finite-Dimensional Variational Methods in Imaging Sciences, and Hamilton-Jacobi Equations

March 23, **Sanjoy Mahajan,** Olin College (secondary affiliation: Massachusetts Institute of Technology)
Street-Fighting Mathematics for Better Teaching and Thinking

April 6, **Becca Thomases,** University of California, Davis
Microorganism Locomotion in Viscoelastic Fluids

April 13, **Michael Shelley,** New York University / Flatiron Institute
Active Mechanics in the Cell

April 20, **Maxim Olshanskii,** University of Houston
Finite Element Methods for PDEs Posed on Surfaces

April 27, **Yoichiro Mori,** University of Minnesota
Stability of Planar Fronts of the Bidomain Equation

Applied Statistics Seminar

September 28, **Wei Sun,** Department of Management Science, University of Miami
Personalized Advertising and Ad Clustering Via Sparse Tensor Methods

October 6, **Jing Qiu,** Department of Applied Economics and Statistics, University of Delaware
FDR Control of the High Dimensional TOST Tests

October 12, **Xin Yuan,** Bell Labs
Bayesian Deep Generative Deconvolutional

November 2, **Wenguang Sun,** Dept. of Data Sciences and Operations, University of Southern California
A General Framework for Information Pooling in Two-Sample Multiple Testing

November 16, **Weijie Su,** Department of Statistics, University of Pennsylvania
Statistical Inference for Stochastic Approximation and Online Learning via Hierarchical Incremental Gradient Descent

December 7, **Annie Qu,** Department of Mathematical Science, University of Illinois at Urbana Champaign
A Group-Specific Recommender System

March 1, **Thomas Mattew,** University of Maryland at Baltimore County
Statistical Methods for Cost-Effectiveness Analysis: A Selected Review

March 22, **Jiangtao Gou,** Fox Chase Cancer Center, Temple University Health System
Multiple Endpoints in Clinical Trials: P-Value Based Tests, Dependence Assumptions, and Group Sequential Procedures

March 29, **Yichao Wu,** University of Illinois at Chicago
Nonparametric Estimation of Multivariate Mixtures

April 5, **Dr. Xiaodong Luo,** Sanofi
Points of Considerations for Non-constant Hazard Ratios in Survival Analyses

April 19, **Yaqun Wang,** Rutgers School of Public Health
Inference of Gene Regulatory Network Through Adaptive Dynamic Bayesian Network Modeling

May 10, **Yuan Ao,** Georgetown University
Sub-Group Analysis with Nonparametric Unimodal Symmetric Error Distribution

Mathematical Biology Seminar

September 19, **Nirag Kadakia,** Yale University
Beyond the Kalman Filter: New Approaches for Optimal Estimation of Nonlinear and Chaotic Systems

October 3, **Noah Cowan,** Johns Hopkins
Closed-Loop Analysis of Sensorimotor Systems

October 10, **Elizabeth Cherry,** Rochester Institute of Technology
Reconstructing Cardiac Electrical Dynamics Using Data Assimilation

October 24, **Dan Wilson,** Rochester Institute of Technology
Model Reduction in the Era of Supercomputing: Applications to Cardiac Arrhythmia

November 28, **Áine Bynre**, New York University
Next Generation Neural Mass Modeling

December 5, **Eve Armstrong,** University of Pennsylvania
Crafting and Testing Functional Architectures for Pattern-Generating Networks

January 23, **Victoria Booth,** University of Michigan
Piecewise Smooth Maps for the Circadian Modulation of Sleep-Wake Dynamics

April 3, **Aminur Rahman,** Texas Tech University
Tumor Ablation Through Drug Diffusion

April 10, **Zahra Aminzare,** Princeton University
Gait Transitions in a Homogenous Phase Model of an Insect Central Pattern Generators

April 18, **Farshad Shirani,** Georgia Institute of Technology
Global Dynamics of a Mean Field Model of Electroencephalographic Activity in the Neocortex and its Application in the Study of Rhythmic Activity in the Brain

April 24, **David Saintillan,** University of California, San Diego
Active Hydrodynamics of Interphase Chromatin: Coarse-Grained Modeling and Simulations

May 8, **David Lipshutz,** Technion – Israel Institute of Technology
Delay Induced Oscillations in Genetic Circuits

Fluid Mechanics and Waves Seminars

September 18, **Colton Conroy,** Columbia University
Fractally Homogeneous Air-Sea Turbulence with Frequency-Integrated, Wind-Driven Gravity Waves

October 2, **Sharad Kapur,** Integrand Software
Large-Scale Electromagnetic Simulation for Radio Frequency Integrated Circuit Design

October 9, **Tore Magnus Taklo,** NJIT
On the Dispersion Relation and Spectral Properties of Surface Gravity Waves

October 16, **Bhabani Shankar Dandapat,** Sikkim Manipal Institute of Techology
Development of Modified Bingham Plastic Liquid Film Over an Unsteady Stretching Sheet

October 25, **Pablo Groisman,** Universidad de Buenos Aires
Hydrodynamic Limit and Shape Theorem for a Lattice-Free Random Growth Model

November 1, **Jens Eggers,** University of Bristol
Two Problems Involving Breakup of a Liquid Film

December 4, **Zhiliang Xu,** Univeristy of Notre Dame
Central and Central Discontinuous Galerkin (DG) Schemes on Overlapping Cells of Unstructured Grids for Solving Ideal MHD Equations with Globally Divergence-Free Magnetic Field

March 26, **Ashuwin Vaidya,** Montclair State University
Mechanics and Thermodynamics of Self-Organization in Fluid-Solid Systems

April 2, **Blaise Delmotte,** Courant Institute of Mathematical Sciences
Hydrodynamic Genesis of Colloidal Creatures

April 9, **Francis Seuffert,** University of Pennsylvania
The Hunt for the Sharp Constant and Extremals of Morrey's Inequality

April 16, **German Drazer,** Rutgers University
Periodic Arrays for Particle Separation in Microfluidic Systems

April 23, **Henry Shum,** University of Waterloo
Simulating Fluid Flow and Microparticle Motion Driven by Diffusioosmosis

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Shahriar Afkhami

Direct numerical simulation of variable surface tension flows using a Volume-of-Fluid method (with I. Seric, and L. Kondic), *Journal of Computional Physics,* Vol. 352, pp. 615-636, October 2017.

Exploiting the Marangoni effect to initiate instabilities and direct the assembly of liquid metal filaments (with C. Hartnett, I. Seric, K. Mahady, L. Kondic, J. Fowlkes, and P. Rack), *Langmuir,* Vol. 33, pp. 8123–8128, July 2017.

Ferrofluids and magnetically guided superparamagnetic particles in flows: A review of simulations and modeling, *Journal of Engineering Mathematics,* Vol. 107, pp. 231-251, August 2017.

Influence of thermal effects on stability of nanoscale films and filaments on thermally conductive substrates (with I. Seric and L. Kondic), *Physics of Fluids,* Vol. 30, pp. 12109-1—12109-23, January 2018.

Solutal-Marangoni flows of miscible liquids drive transport without surface contamination (with H. Kim, K. Muller, O. Shardt, and H. Stone), *Nature Physics,* Vol. 13, pp. 1105-1110, July 2017.

Denis L. Blackmore

Lie-algebraic structure of Lax—Sato integrable heavenly equations and the Lagrange—d'Alembert principle (with O. Hentosh, Y. Prykarpatsky, and A. Prykarpatski), *J. Geometry & Phys.,* Vol. 120, pp. 208-227, July 2017.

Sigma Map Dynamics and Bifurcations (with A. Rahman and Y. Joshi), *Regular & Chaotic Dynamics,* Vol. 22, pp. 740-749, December 2017.

Threshold voltage dynamics of chaotic RS flip-flops (with A. Rahman), *Chaos, Solitons & Fractals,* Vol. 103, pp. 555-566, October 2017.

A novel integrability analysis of a generalized Riemann type hydrodynamic hierarchy (with A. Samoilenko, Y. Prykarpatsky, and A. Prykarpatski), *Miskolc Math. Notes,* Vol. 27, pp. 555-567, October 2018.

Energy decay in tapped granular column: Can a one-dimensional toy model provide insight into fully three-dimensional systems? (with C. R. K. Windows-Yule, and A. D. Rosato), *Phys. Rev. E,* Vol. 96, pp. 04290201—042902-11, October 2017.

Examples of Lie and Balinsky-Novikov algebras related to Hamiltonian operators (with O. Artemovych, and A. Prykarpatski), *Topological Algebra and Its Applications/de Gruyter,* Vol. 6, pp. 43-52, March 2018.

Flow induced on a salt waterbody due to the impingement of a freshwater drop or a water source (with P. Singh, I. Benouaguef, N. Musunuri, E. Amah, and I. S. Fischer), *Mechanics Research Communications,* Vol. 85, pp. 89–95, August 2017.

Qualitative models and experimental investigation of chaotic NOR gates and set/reset flip-flops (with A. Rahman, and I. Jordan), *Proceeding of the Royal Society A,* Vol. 474, pp. 1-18, January 2018.

The Pfeiffer-Lax-Sato vector field equations and related integrable versal deformations (with A. Prykarpatski, M. Vovk, P. Pukach, and Y. Prykarpatsky), *Matematychni Studii,* Vol. 48, pp. 124-133, November 2017.

Amitabha K. Bose

Collective dynamics in heterogeneous networks of neuronal cellular automata (with K. Manchanda and R. Ramaswamy), *Physica A: Statistical Mechanics and its Applications,* Vol. 487, pp. 111-124, December 2017.

Phase-locking and bistability in neuronal networks with synaptic depression (with Z. Akcay, X. Huang, and F. Nadim), *Physica D: Nonlinear Phenomena,* Vol. 364, pp. 8-21, February 2018.

Reentrainment of the circadian pacemaker during jet lag: east-west asymmetry and the effects of north-south travel (with C.O. Diekman), *Journal of Theoretical Biology,* Vol. 437, pp. 261-285, January 2018.

Bruce G. Bukiet

Muscle Strength and Stiffness in Resistance Exercise: Force Transmission In Tissues (with H. R. Chaudry, E. Anderson, J. Burch, and T. Findley), *Journal of Bodywork and Movement Therapies,* Vol. 21, pp. 517-522, July 2017.

Mathematically Modeling Baseball, *Notices of the AMS,* Vol. 65, pp. 428-430, April 2018.

Linda J. Cummings

Director gliding in a nematic liquid crystal layer: Quantitative comparison with experiments (with E. Mema and L. Kondic), *Physical Review E,* Vol. 97, pp. 32704-1—32704-11, March 2018.

Mathematical Modeling of Ischemia-Reperfusion Injury and Postconditioning Therapy (with D. Fong), *Bulletin of Mathematical Biology,* Vol. 79, pp. 2474-2511, September 2017.

Stability of thin fluid films characterized by a complex form of effective disjoining pressure (with M. A. Lam and L. Kondic), *Journal of Fluid Mechanics,* Vol. 841, pp. 925-961, March 2018.

Casey O. Diekman

Computational neuroscience: mathematical and statistical perspectives (with R. Kass, S. Amari, K. Arai, E. Brown, M. Diesmann, B. Doiron, U. Eden, A. Fairhall, G. Fiddyment, T. Fukai, S. Grun, M. Harrison, M. Helias, H. Nakahara, J. Teramae, P. Thomas, M. Reimers, J. Rodu, H. G. Rotstein, E. Shea-Brown, H. Shimazaki), *Annual Review of Statistics and its Applications,* Vol. 5, pp. 183-214, March 2018.

Delayed Cryptochrome Degradation Asymmetrically Alters the Daily Rhythm in Suprachiasmatic Clock Neuron Excitability (with S. Wegner, M. Belle, A. Hughes, and H. Piggins), *Journal of Neuroscience,* Vol. 37, pp. 7824-7836, August 2017.

Eupnea, tachypnea, and autoresuscitation in a closed-loop respiratory control model (with P. J. Thomas and C. G. Wilson), *Journal of Neurophysiology,* Vol. 118 , pp. 2194-2215, October 2017.

Reentrainment of the circadian pacemaker during jet lag: east-west asymmetry and the effects of north-south travel (with A. K. Bose), *Journal of Theoretical Biology,* Vol. 437, pp. 261-285, January 2018.

Javier A. Diez

Drop pattern resulting from the breakup of a bidimensional liquid filaments grid (with I. Cuellar, P. D. Ravazzoli, and A. G. Gonzalez), Physics of Fluids, Vol 29, pp. 102103-1—102103-12, October 2017.

Yixin Fang

A generalized partially linear framework for variance functions (with H. Lian, and H. Liang), *Annals of the Institute of Statistical Mathematics,* Vol. 70, pp. 1147–1175, October 2018.

Changes in Peak Airflow Measurement During Maximal Cough After Vocal Fold Augmentation in Patients With Glottic Insufficiency (with G. R. Dion, E. Achlatis, S. Teng, M. Persky, R. C. Branski, and M. R. Amin), *JAMA Otolaryngology-Head & Neck Surgery,* Vol. 143, pp. 1141-1145, November 2017.

Efficacy of perioperative lumbar drainage following endonasal endoscopic cerebrospinal fluid leak repair: a meta-analysis (with O. H. Ahmed, S. Marcus, J. R. Tauber, B. Wang, and R. A. Lebowitz), *Otolaryngology--Head and Neck Surgery,* Vol. 156, pp. 52-60, January 2017.

Factors Associated With the Use of Postoperative Analgesics in Patients Undergoing Direct Microlaryngoscopy (with S. Taliercio, B. Sanders, S. Achlatis, R. Branski, and M. Amin), *Annals of Otology, Rhinology & Laryngology,* Vol. 126, pp. 375-381, February 2017.

False Vocal Fold Characteristics in Presbylarynges and Recurrent Laryngeal Neuropathy (with M. Persky, B. Sanders, C. A. Rosen, J. Kahane, M. R. Amin, and R. C. Branski), *Annals of Otology, Rhinology & Laryngology,* Vol. 126, pp. 42-46, January 2017.

Impact of diabetes on heart failure incidence in adults with ischemic heart disease (with N. Patel, O. Chen, C. Donahue, B. Wang, R. Donnino, and S. Natarajan), *Journal of diabetes and its complications,* Vol. 31, pp. 1597-1601, November 2017.

Impact of vocal fold augmentation and laryngoplasty on dyspnea in patients with glottal incompetence (with G. R. Dion, M. A. Fritz, S. E. Teng, S. Marcus, R. C. Branski, and M. R. Amin), *The Laryngoscope,* Vol. 128, pp. 427-429, February 2018.

Performance plateau in prelingually and postlingually deafened adult cochlear implant recipients (with C. Cusumano, D. R. Friedmann, B. Wang, J. T. Roland Jr, and S. B. Waltzman), *Otology & Neurotology,* Vol. 38, pp. 334-338, March 2017.

Protocol for the CHORD project (community health outreach to reduce diabetes): a cluster-randomized community health worker trial to prevent diabetes (with N. Islam, T. Gepts, I. Lief, R. Gore, N. Levy, M. Tanner, S. E. Sherman, Y. Fang, S. E. Sherman, and M. D. Schwartz), *BMC Public Health,* Vol. 18, pp. 1-11, April 2018.

Single-Index Model for Inhomogeneous Spatial Point Processes (with J. M. Loh), *Statistica Sinica,* Vol. 27, pp. 555-574, April 2017.

Sparse convex clustering (with B. Wang, Y. Zhang, and W. W. Sun), *Journal of Computational and Graphical Statistics,* Vol. 27, pp. 393-403, May 2018.

The value of intraoperative EABRs in auditory brainstem implantation (with A. Anwar, A. Singleton, Y. Fang, B. Wang, W. Shapiro, J. T. Roland, Jr, and S. B. Waltzman), *International Journal of Pediatric Otorhinolaryngology,* Vol. 101, pp. 158-163, October 2017.

Treatment of Neurogenic Cough with Tramadol: A Pilot Study (with G. R. Dion, S. E. Teng, E. Achlatis, and M. R. Amin), *Otolaryngology--Head and Neck Surgery,* Vol. 157, pp. 77-79, July 2017.

Variable selection for partially linear models via learning gradients (with L. Yang, J. Wang, and Y. Shao), *Electronic Journal of Statistics,* Vol. 11, pp. 2907-2930, August 2017.

What are the patterns between depression, smoking, unhealthy alcohol use, and other substance use among individuals receiving medical care? A longitudinal study of 5479 participants (with K. V. Ruggles, J. Tate, S. M. Mentor, K. J. Bryant, D. A. Fiellin, A. C. Justice, R. S. Braithwaite, A. C. Justice, and R. S. Braithwaite), *AIDS and Behavior,* Vol. 21, pp. 2014-2022, July 2017.

Christina A. Frederick

An L2-stability estimate for periodic nonuniform sampling in higher dimensions, *Linear Algebra and its Applications,* Vol. 555, pp. 361-372, October 2018.

Roy H. Goodman

Bifurcations of relative periodic orbits in NLS/GP with a triple-well potential, *Physica D,* Vol. 359, pp. 39-59, November 2017.

Wenge Guo

The control of the false discovery rate in fixed sequence multiple testing. (with G. Lynch, S. Sarkar, and H. Finner), *Electronic Journal of Statistics,* Vol. 11, pp. 4649-4673, November 2017.

Brittany Hamfeldt

A multigrid scheme for 3D Monge-Ampere equations (with J. Liu, A. Oberman, and M. Xiao), *International Journal of Computer Mathematics,* Vol. 94, pp. 1850-1866, September 2017.

Application of Optimal Transport and the Quadratic Wasserstein Metric to Full-Waveform Inversion (with Y. Yang, B. Engquist, and J. Sun), *Geophysics,* Vol. 83, pp. R43-R62, January 2018**.**

Convergent approximation of non-continuous surfaces of prescribed Gaussian curvature, *Communications on Pure and Applied Analysis,* Vol. 17, pp. 671-707, March 2018.

Higher-order adaptive finite difference methods for fully nonlinear elliptic equations (with T. Salvador), *Journal of Scientific Computing,* Vol. 75, pp. 1282-1306, June 2018.

Meshfree finite difference approximations for functions of the eigenvalues of the Hessian, Numerische Mathematik, Vol. 138, pp. 75-99, January 2018.

Simplified freeform optics design for complicated laser beam shaping (with Z. Feng, R. Liang, D. Cheng, and Y. Wang), Applied Optics, Vol. 56, pp. 9308-9314, November 2017.

Shidong Jiang

An efficient boundary integral scheme for the MBO threshold dynamics method via the NUFFT (with D. Wang, X.P. Wang,), *Journal of Scientific Computing,* Vol. 74, pp. 474-490, January 2018.

Fast evaluation of the Caputo fractional derivative and its applications to fractional diffusion equations (with J. Zhang, Q. Zhang, and Z. Zhang), *Communications in Computational Physics,* Vol. 21, pp. 650-678, March 2017.

Numerical solution to a linearized time fractional KdV equation on unbounded domains (with Q. Zhang, J. Zhang, and Z. Shang), *Mathematics of Computation,* Vol. 87, pp. 693-719, March 2018.

Second kind integral equation formulation for the mode calculation of optical waveguide (with J. Lai), *Applied and Computational Harmonic Analysis,* Vol. 44, pp. 645-664, May 2018.

Lou Kondic

Characterizing granular networks using topological metrics (with D. Joshua, L. Kovalcinova, J. Ren, R. Behringer, M. Kramar, and K. Mischaikow), *Physical Review E,* Vol. 97, pp. 42903-1—42903-8, April 2018.

Direct numerical simulation of variable surface tension flows using a Volume-of-Fluid method (with I. Seric and S. Afkhami), *Journal of Computional Physics,* Vol. 352, pp. 615-636, October 2017.

Director gliding in a nematic liquid crystal layer: Quantitative comparison with experiments (with E. Mema and L. J. Cummings), *Physical Review E,* Vol. 97, pp. 32704-1—32704-11, March 2018.

Exploiting the Marangoni Effect to Initiate Instabilities and Direct the Assembly of Liquid Metal Filaments (with C. Hartnett, I. Seric, K. Mahady, S. Afkhami, J. Fowlkes, and P. Rack), *Langmuir,* Vol. 33, pp. 8123, July 2017.

Granular response to impact: Topology of the force networks (with T. Tadanaga, A. Clark, and T. Majmudar), *Physical Review E,* Vol. 97, pp. 12906-1—12906-10, January 2018.

Influence of thermal effects on stability of nanoscale films and filaments on thermally conductive substrates (with I. Seric and S. Afkhami), *Physics of Fluids,* Vol. 30, pp. 12109-1—12109-23, January 2018.

Stability of thin fluid films characterized by a complex form of effective disjoining pressure (with M. A. Lam, L. J. Cummings), *Journal of Fluid Mechanics,* Vol. 841, pp. 925-961, March 2018.

Victor V. Matveev

Extension of Rapid Buffering Approximation to Ca2+ buffers with two binding sites, *Biophysical Journal,* Vol. 114, pp. 1204-1215, March 2018.

Zoi-Heleni Michalopoulou

Environmental inversion using dispersion tracking in a shallow water environment (with N. Aunsri), *Journal of the Acoustical Society of America,* Vol. 143, pp. EL188-EL193, March 2018.

Stochastic sediment property inversion in Shallow Water 06, *Journal of the Acoustical Society of America,* Vol. 142, pp. EL495-EL499, November 2017.

Cyrill B. Muratov

An old problem resurfaces nonlocally: Gamow's liquid drops inspire today's research and applications (with R. Choksi and I. Topaloglu), *Notices Amer. Math. Soc.,* Vol. 64, pp. 1275-1283, December 2017.

Layer solutions for one-dimensional nonlocal model of Ginzburg-Landau type (with K. Chen and X. Yan), *Mathematical Modeling of Natural Phenomena,* Vol. 12, pp. 68-90, January 2018.

On equilibrium shapes of charged flat drops (with M. Novaga, and R. Berardo), *Commun. Pure Appl. Math.,* Vol. 71, pp. 1049–1073, April 2018.

One-dimensional in-plane edge domain walls in ultrathin ferromagnetic films (with R. Lund and V. Slastikov), *Nonlinearity,* Vol. 31, pp. 728-754, January 2018.

Theory of the Dzyaloshinskii domain wall tilt in ferromagnetic nanostrips (with V. Slastikov, A. Kolesnikov, and O. Tretiakov), *Phys. Rev. B,* Vol. 96, pp. 134417-1—134417-10, October 2017.

Farzan Nadim

Phase-locking and bistability in neuronal networks with synaptic depression (with Z. Akcay, A. K. Bose, and X. Huang), *Physica D: Nonlinear Phenomena,* Vol. 364, pp. 8-21, February 2018.

Anand U. Oza

Promenading pairs of walking droplets: Dynamics and stability (with J. Arbelaiz, and J. Bush), *Physical Review Fluids,* Vol. 3, pp. 13604-1—13604-18, January 2018.

Simulations of pilot-wave dynamics in a simple harmonic potential (with K. M. Kurianski and J. Bush), *Physical Review Fluids,* Vol. 2, pp. 113602-1—113602-14, November 2017.

David G. Shirokoff

Approximate global minimizers to pairwise interaction problems via convex relaxation (with M. Bandegi), *SIAM Journal on Applied Dynamical Systems,* Vol. 17, pp. 417-456, February 2018.

Unconditional Stability for Multistep ImEx Schemes—Theory (with D. Zhou, B. Seibold, and R. Rosales), *SIAM Journal on Numerical Analysis,* Vol. 55, pp. 2336–2360, October 2017.

Michael S. Siegel

A local target specific quadrature by expansion method for evaluation of layer potentials in 3D (with A. Tornberg), *Journal of Computational Physics,* Vol. 364, pp. 365-392, March 2018.

Catalin C. Turc

Multitrace/singletrace formulations and Domain Decomposition Methods for the solution of Helmholtz transmission problems for bounded composite scatterers, *Journal of Computational Physics,* Vol. 350, pp. 343-360, December 2017.

Schur complement domain decomposition methods for the solution of multiple scattering problems, *IMA Journal Applied Mathematics,* Vol. 82, pp. 1104–1134, July 2017.

Well-conditioned boundary integral equation formulations and Nystrom discretizations for the solution of Helmholtz problems with impedance boundary conditions in two-dimensional Lipschitz domains, *Journal of Integral Equations and Applications,* Vol. 29, pp. 441-472, July 2017.

Antai Wang

On the likelihood of mixture cure models (with Y. Zhang and Y. Shao), *Statistics and Probability Letters,* Vol. 131, pp. 51-55, August 2017.

PROCEEDINGS PUBLICATIONS

Denis L. Blackmore

Studies of flow induced on a water surface due to the impingement of a drop or a water source (with N. Musunuri, I. Benouaguef, E. Amah, I. S. Fischer, and P. Singh), *American Society of Mechanical Engineer 2017 Fluids Engineering Division,* Vol. 1B, pp. V01BT06A013-V01BT06A018, August 2017.

Cyrill B. Muratov

Spectral mass gauging of unsettled liquid with acoustic waves (with J. Feller, A. Kashani, M. Khasin, C. B. Muratov, V. Osipov, and S. Sharma), *IOP Conf. Ser.: Mater. Sci. Eng.,* Vol. 278, pp. 12003-1—12003-8, December 2017.

B. PRESENTATIONS

Shahriar Afkhami

November 20, 2017: APS DFD Meeting, APS, Denver, CO

1. Large scale simulations of forced dewetting
2. On the influence of thermal effects on the dynamics of thin films and filaments

July 20, 2017: 14th U.S. National Congress on Computational Mechanics, USNCCM, Montreal

1. From mesoscopic to macroscopic computations of dynamic contact lines
2. Magnetophoretic interaction of a pair of ferrofluid droplets in a rotating magnetic field

Denis L. Blackmore

November 20, 2017: APS DFD Meeting, APS, Denver, CO
Flow induced on a salt waterbody due to the impingement of a freshwater drop

Michael R. Booty

June 21, 2018: Workshop in Applied Mathematics in Honor of Antonmaria Minzoni , Universidad Nacional Autonoma de Mexico, Mexico City, Mexico
Studies of time-dependent electrokinetic flow

October 30, 2017: 2017 AIChE Annual Meeting, American Institute of Chemical Engineers, Minneapolis, MN
A model for electrokinetic flow with deformable interfaces

Wooyoung Choi

September 5, 2017: IUTAM Symposium on Wind Waves, London, UK
On spectral formulations for nonlinear ocean waves

Linda J. Cummings

March 13, 2018: Courant Institute Applied Math Seminar, Courant Institute of Mathematical Sciences, NYU, New York, NY
Modeling thin liquid films: from liquid crystals to liquid metals

November 20, 2017: APS DFD Meeting, APS, Denver, CO
Instability of a liquid film non locally heated from below

October 27, 2017: Courant Institute Applied Math Seminar, Courant Institute of Mathematical Sciences, NYU, New York, NY
Modeling and large-scale simulation of thin film flows of nematic liquid crystal

September 6, 2017: Fields Institute Workshop on waves in neural media, Fields Institute, University of Toronto, Toronto, Canada
Curvature- and fluid-stress-driven tissue growth

Sunil K. Dhar

May 24, 2018: 2018 Annual Retreat on Cancer Research , Rutgers Cancer Institute of New Jersey and The New Jersey Commission on Cancer Research, New Brunswick, NJ
A role for resistance exercising in cancer: destruction of circulating tumor cells in contracting muscle (Poster)

April 23, 2018: Annual Meeting at Experimental Biology 2018, The American Association of Anatomists, San Diego, CA
A Role for Resistance Exercising in Cancer: Destruction of Circulating Tumor Cells in Contracting Muscle (Poster)

November 13, 2017: The 14th International Conference of the Society for Integrative Oncology, Northwestern Osher Center for Integrative Medicine, Chicago, IL
Resistance exercise and metastatic inefficiency

Casey O. Diekman

May 13, 2018: SRBR 2018, Society for Research on Biological Rhythms, Amelia Island, FL
Beyond the limits of circadian entrainment: computational modeling and analysis of shirt work, social jet lag, and non-24-hour sleep-wake disorder (Poster)

May 1, 2018: Computational Neuroscience Initiative Seminar, University of Pennsylvania, Philadelphia, PA
Computational modeling of circadian rhythms: gene expression, membrane excitability, and jet lag

October 25, 2017: Neuronal Oscillations & Computational Neuroscience Journal Club, NJIT, Newark, NJ
Circadian dynamics in measures of cortical excitation and inhibition balance

October 17, 2017: Biomathematics Seminar, North Carolina State University, Raleigh, NC
Circadian regulation of electrical activity in neurons and cardiomyocytes

September 15, 2017: Applied Mathematics Colloquium, University of Cincinnati, Cincinnati, OH
Circadian regulation of electrical activity in neurons and cardiomyocytes

September 11, 2017: MBI Workshop on Control and Modulation of Neuronal Systems, Ohio State University, Columbus, OH
Eupnea, tachypnea, and autoresuscitation in a closed-loop respiratory control model

July 17, 2017: Gordon Research Conference on Chronobiology, Stowe, VT
Reentrainment of the circadian pacemaker during jet lag (Poster)

Javier A. Diez

November 19-21, 2017: 70th Annual Meeting of Division of Fluids of the American Physical Society, APS, Denver, CO

1. Wettability dynamics of liquid filaments on horizontal substrates

2. Unstable bidimensional grids of liquid filaments: Drop pattern after breakups

May 30, 2018: XVIII Encuentro de Superficies y Materiales Nanoestructurados, Berisso, Argentina
Autoensamblado de gotas a partir de grillas nanométricas metálicas

Yixin Fang

June 25, 2018: AbbVie Short Course, AbbVie, Chicago, IL
Introduction to Statistical Learning

June 15, 2018: ICSA Applied Statistics Symposium 2018, ICSA, New Brunswick, NJ
Scalable inference via stochastic gradient descent

June 7, 2018: Statistical Learning and Data Science Conference, ASA , New York, NY
Scalable inference via stochastic gradient descent

April 20, 2018: Seminar, Boston University, Department of Biostatistics, Boston, MA
Joint screening of ultrahigh-dim genetic variables for survival outcomes

January 12, 2018: Seminar, Goergetown University, Department of Biostatistics, Georgetown University, DC
Scalable inference via stochastic gradient descent

December 18, 2017: CMStatistics 2017, London, UK
Scalable inference via stochastic gradient descent

July 31, 2017: Joint Statistical Meeting, American Statistical Association, Baltimore, MD
1. Single-index model for inhomogenous spatial point patterns (Presentation)
2. Single-index model for inhomogenous spatial point patterns (Poster)
3. Additive partially linear models for massive heterogeneous data

Christina A. Frederick

May 14, 2018: 7th International Conference on Computational Harmonic Analysis, Vanderbilt University, Nashville, TN
A simple iterative method for sampling functions bandlimited to a set of translated cubes

April 14, 2018: AMS Southeastern Section, Vanderbilt University, Nashville TN
Sampling and reconstruction in higher dimensions

November 16, 2017: Mathematics Department Colloquium, Spelman College, Atlanta Georgia
Sampling theory

July 24, 2017: Mathematical Congress of the Americas, Montreal, Canada
Multiscale methods for seafloor identification in sonar imagery

Roy H. Goodman

June 13, 2018: SIAM Conference on Nonlinear Waves, SIAM, Anaheim, CA
Bifurcations on quantum graphs

April 2018: University of Vermont Mathematics Department Colloquium, University of Vermont Math Dept, Burlington, VT
Bifurcations of periodic orbits in a nonlinear waveguide

August 22, 2017: Applied Mathematics, Modeling and Computational Science, AMMCS, Waterloo, ON
Bifurcations of relative periodic orbits in NLS/GP with a three-well potential

Wenge Guo

November 29, 2017: Applied Probability and Statistics Seminar, Hunter College of CUNY, New York, NY
Analysis of error control in large scale two-stage multiple hypothesis testing

September 27, 2017: 2017 ASA Biopharmaceutical Section Regulatory-Industry Statistics Workshop, ASA, Washington, DC
A selective inference-based two-stage procedure for clinical safety studies

August 2017: Joint Statistical Meetings, Baltimore, MD

1. A new graphical approach with generalized sequential rejection principle to control the familywise error rate
2. A selective inference-based two-stage procedure for clinical safety studies

Brittany Hamfeldt

June 5, 2018: CAIMS Annual Meeting, Canadian Applied and Industrial Mathematics Society, Toronto, Ontario, Canada
Meshfree finite difference methods for fully nonlinear elliptic equations

April 18, 2018: NJIT CSLA Board of Visitor's Meeting, CSLA, NJIT, Newark, NJ
Generated Jacobian Equations in geometric optics and optimal transport

March 2, 2018: Mathematics Colloquium, Southern Illinois University Edwardsville, Edwardsville, IL
Generalised finite difference methods for fully nonlinear elliptic equations

September 14, 2017: International Conference on Scientific Computation and Differential Equations, SciCADE, University of Bath, Bath, UK
Generalised finite difference methods for the Monge-Ampere equation

Kenneth A. Horwitz

February 7, 2018: AMTNJ State Conference, Association of Math Teachers of New Jersey, Monroe, NJ
Redesigning the PreCalc - Calc 3 Curriculum

Lou Kondic

April 1, 2018: IUTAM Symposium on Dynamics and Stability of Fluid Interfaces, U Florida, Gainesville, FL
Stability of liquid films of nanoscale thickness

March 25, 2018: IMA Workshop on Dynamic Contact Lines, IMA, Minneapolis, MN
Stability of fluid films of nanoscale thickness involving contact lines

March 13, 2018: Courant Institute Applied Math Seminar, Courant Institute of Mathematical Sciences, NYU, New York, NY
Modeling thin liquid films: from liquid crystals to liquid metals

March 10 -11, 2018: DPG Annual Meeting, TU Berlin, Berlin, Germany
1. Growth and interaction of colloid nuclei under microgravity
2. Loss of memory in dense sheared particulate systems

November 20, 2017: APS DFD Meeting, APS, Denver, CO
1. Growth and interaction of colloid nuclei
2. Instability of a liquid film non locally heated from below
3. On the influence of thermal effects on the dynamics of thin films and filaments

September 1, 2017: Particles 2017, V International Conference on Particle-based Methods, EPS, Hannover, Germany
Evolution of force networks in dense granular systems close to jamming

August 1, 2017: Seminar, UTN, La Plata, Argentina
Energy dissipation in particulate matter with cohesion

Ji Meng Loh

June 29, 2018: IMS Asia Pacific Rim Meeting, Institute of Mathematical Sciences, Singapore
Single-index model for inhomogeneous spatial point processes

June 14, 2018: International Chinese Statistical Association Applied Statistics Symposium, ICSA, New Brunswick, NJ
Single-index model for inhomogeneous spatial point processes

November 18, 2017: ICDM 2017 Sentire Workshop, IEEE, New Orleans, LA
Learning-based method with valence shifters for sentiment analysis

September 26, 2017: Dept of Mathematical Sciences, Binghamton University, Binghamton University
Single index model for inhomogeneous spatial point processes

July 31, 2017: Joint Statistical Meeting, American Statistical Association, Baltimore, USA
Single-index model for inhomogenous spatial point patterns

Victor V. Matveev

March 29, 2018: NJIT Institute for Brain and Neuroscience Research Showcase, NJIT, Newark, NJ
Stationary approximations to single-channel Ca2+ nanodomains

March 12, 2018: Dartmouth Department of Biology Seminar, Dartmouth College, Hanover, NH
Modeling presynaptic Ca2+ dynamics: approaches and applications

February 19, 2018: 62nd Annual Meeting of the Biophysical Society, Biophysical Society, San Francisco, CA
Comparison of deterministic and stochastic approaches for calcium dependent exocytosis

July 12, 2017: SIAM Annual Meeting, SIAM, Pittsburgh, PA
Stochasticity in vesicle exocytosis downstream of Ca2+ channel gating: a computational study

Zoi-Heleni Michalopoulou

May 7, 2018: Meeting of the Acoustical Society of America, ASA, Minneapolis, MN
Signal processing everywhere you look

May 30, 2018: Workshop on the Seabed Characterization Experiment, ONR, Seattle, WA
Time series analysis for SCE inversion

April 11, 2018: ONR Peer Review Workshop, ONR, Stennis Center, Starkville, MS
Shallow water inversion – Sequential and direct approaches

December 4-8, 2017: Meeting of the Acoustical Society of America, ASA, New Orleans, LA

1. Detection in an uncertain underwater waveguide
2. Sediment sound speed inversion at low frequencies in shallow water

August 1, 2017: International Conference on Theoretical and Computational Acoustics, Vienna University of Technology, Vienna, Austria
Shallow water geoacoustic inversion: a sequential filtering approach

Richard O. Moore

June 12, 2018: SIAM Conference on Nonlinear Waves and Coherent Structures, SIAM, Anaheim, CA
Stochastic ejection of droplet solitons in magnetic memory devices

April 30, 2018: Mathematics Colloquium, Department of Mathematical Sciences, Montclair State University, Montclair, NJ
Rare event techniques in stochastic nonlinear wave equations

October 27, 2017: Mathematics Colloquium, Department of Mathematics & Statistics, University of Vermont, Burlington, VT
Efficient sampling of stochastic nonlinear wave equations using low-dimensional reductions

September 17, 2017: AMS Fall Eastern Sectional Meeting, AMS, Buffalo, NY
Sampling switching dynamics in micromagnetic devices

August 16, 2017: Probability Seminar, Department of Mathematics, University of Buenos Aires, Buenos Aires, Argentina
Large deviation theory and sampling in micromagnetic memory

August 2, 2017: Seminarios en la interfase: entre la Matemática, la Informática, y las Ciencias Naturales y Humanas, Instituto de Calculo, University of Buenos Aires, Buenos Aires, Argentina
Optimal control of autonomous vehicles for velocity inference

July 11, 2017: SIAM Annual Meeting, Society for Industrial and Applied Mathematics, Pittsburgh, PA
Eulerian Versus Lagrangian Data Assimilation

Cyrill B. Muratov

May 25, 2018: Workshop on Topics in the Calculus of Variations: Recent Advances and New Trends, BIRS, Banff, Canada
The mathematics of charged drops

December 9-12, 2017: SIAM Conference on Analysis of PDEs, SIAM, Baltimore, MD
1. A universal thin film model for Ginzburg-Landau energy with dipolar interaction
2. A variational model for charged drop

November 20, 2017: Applied Mathematics Colloquium, Princeton University, Princeton, NJ
The mathematics of charged drops

October 2017: Materials Working Group, Courant Institute, New York, NY
A universal thin film model for Ginzburg-Landau energy with dipolar interaction

September 17, 2017: AMS Fall Eastern Sectional Meeting, American Mathematical Society, Buffalo, NY
Sampling switching dynamics in micromagnetic devices

July 25, 2017: 2nd Mathematical Congress of the Americas, Canadian Mathematical Society, Montreal, Canada
A universal thin film model for Ginzburg-Landau energy with dipolar interaction

July 2017: Mathematical Physics Seminar, Universita di Roma III, Rome, Italy
A universal thin film model for Ginzburg-Landau energy with dipolar interaction

Padma Natarajan

March 14, 2018: Pi Day Event, NJIT, Newark, NJ
Activity for elementary school students: Charades (STEM related)

December 19, 2017: STEAM Tank Event, NJIT, Newark, NJ
Activity for elementary school students: Bar graph of survey data collected using Plickers

November 29, 2017: Lunch at ITE Session, ITE, NJIT, Newark, NJ
Digital tools for your technology toolbox

Anand U. Oza

May 25, 2018: Northeast Complex Fluids and Soft Matter Workshop, University of Pennsylvania, Philadelphia, PA
Antipolar ordering of topological defects in active liquid crystals

March 8, 2018: APS March Meeting, American Physical Society, Los Angeles, CA
Traveling waves in a hydrodynamic model for schooling swimmers

February 13, 2018: Analysis, Dynamics and Applications Seminar, University of Arizona, Tucson, AZ
Antipolar ordering of topological defects in active liquid crystals

December 14, 2017: Institute for Computational & Engineering Sciences Seminar, UT Austin Institute for Computational & Engineering Sciences, Austin, TX
Coarse-grained models for interacting flapping swimmers

December 9, 2017: SIAM Conference on Analysis of Partial Differential Equations, SIAM, Baltimore, MD
A generalized Swift-Hohenberg model for active liquid crystal suspensions

November 28, 2017: Northeastern University Applied & Industrial Mathematics Seminar, Northeastern University, Boston, MA

1. Coarse-grained models for interacting flapping swimmers
2. Pilot-wave dynamics of walking droplets: single- and multi-particle phenomena

November 21, 2017: APS Division of Fluid Dynamics Meeting, APS, Denver, CO
Traveling waves in a continuum model of 1D schools

October 31, 2017: Brown University Fluids Seminar, Brown University, Providence, RI
Coarse-grained models for interacting flapping swimmers

David G. Shirokoff

May 5, 2018: DelMar Numerics Day, University of Delaware, Newark, DE
Unconditional stability for multistep IMEX schemes

April 21, 2018: AMS Sectional Meeting Program, Northeastern University, Boston, MA
Conic programming for a variational inequality modeling self-assembly

March 30, 2018: Analysis, Logic, and Physics Seminar, Virginia Commonwealth University, Richmond, VA
Conic programming for a variational inequality modeling self-assembly

October 25, 2017: Mechanical Engineering Seminar, NJIT, Newark, NJ
Unconditional stability for multistep IMEX schemes

July 28, 2017: Mathematical Congress of the Americas, Conference, Montreal, QC, Canada
Unconditional stability for multistep IMEX schemes

July 26, 2017: Mathematical Congress of the Americas, Conference, Montreal, QC, Canada
Conic programming of a variational inequality for self-assembly

July 21, 2017: Canadian Society of Applied and Industrial Mathematics, Dalhousie University, Halifax NS, Canada
Unconditional stability of multistep IMEX schemes

Michael S. Siegel

March 18, 2018: AMS Regional Meeting, American Mathematical Society, Columbus, OH
Analysis and numerics for interfacial electrokinetic flow

December 9, 2017: SIAM Conference on the Analysis of Partial Differential Equations, SIAM, Baltimore, MD
Analysis and numerics for interfacial electrokinetic flow

October 1, 2017: Complex Creeping Fluids: Numerical Methods and Theory, BIRS, Oaxaca, Mexico
A target specific QBX method for the accurate computation of boundary integrals for nearly touching interfaces

July 13, 2017: Colloquium, Department of Mathematics, Air Force Institute of Technology, Wright Patterson Air Force Base, OH
Accurate computation of boundary integrals for nearly touching interfaces

Sundarraman Subramanian

August 1, 2017: Joint Statistical Meetings, American Statistical Association, Baltimore, MD
Testing for model adequacy incensored location-scale families

Yuan-Nan Young

June 7, 2018: US NC TAM 2018, National Congress of Theoretical and Applied Mechanics, Chicago, IL, USA
A two-phase flow model for cytoplasm

January 3, 2018: Soft-matter Group Seminar, Academica Sinica, Taipei, Taiwan
A soft porous drop in linear flows

December 29, 2017: Center for Computation and Modeling Seminar, National Chiao Tung University, Hsinchu, Taiwan
A soft porous drop in linear flows

November 19-21, 2017: APS/DFD 2017, APS, Denver CO

1. A soft porous drop in linear flows
2. An Integral Equation Method Coupling with Variational Approach for Studying Coarse-Grained Lipid Dynamics
3. Dynamics of a surfactant-covered viscous drop under an electric field: Effects of surfactant diffusivity
4. Multiscale Modeling of Primary Cilium Deformations Under Local Forces and Shear Flows
5. Wetting and Adhesion mediated by Nanoscale Capillary Bridges
6. Rupture and Spreading Dynamics of Lipid Membranes on a Solid Surface
7. The Leaky Dielectric Model as a Weak Electrolyte Limit of an Electrodiffusion Model

October 3, 2017: Complex Creeping Fluids: Numerical Methods and Theory, BIRS, Oaxaca, Mexico
A soft porous drop in linear flows

August 31, 2017: Workshop on Wave Transport of Ionic Species, Fields Institute, Toronto, Canada
Deformation of a soft porous drop in a uniform streaming flow and a linear flow

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVIES AND AWARDS

Shahriar Afkhami

Member, Pi Mu Epsilon Honorary Society, November 2010 - Current

Member, Society for Industrial and Applied Mathematics, September 2009 - Current

Member, European Mechanics Society, January 2006 - Current

Member, American Physical Scociety, January 2005 - Current

Daljit S. Ahluwalia

Member, American Math Society, January 1972 - Current

Member, Society of Industrial and Applied Mathematics, January 1968 - Current

Denis L. Blackmore

Associate Editor, Mechanics Research Communications, 2007 - Current

Associate Editor, Mechanics Research Communications, 2007 - Current

Editorial Board, Universal Journal of Physics and Application, 2015 - Current

Editorial Board, Atlantis/Springer Advanced Book Series: Studies in Mathematical Physics: Theory and Applications, 2011 - Current

Editorial Board, Journal of Nonlinear Mathematical Physics, 2010 - Current

Editorial Board, Differential Equations and Applications, 2008 - Current

Editorial Board, Regular and Chaotic Dynamics, 2006 - Current

Editorial Board, Mathematical Bulletin of the Shevchenko Scientific Society, 2005 - Current

Member, Society for Industrial and Applied Mathematics, Current

Member, American Mathematical Society, Current

Member, Mathematical Association of America, Current

Member, International Association of Mathematical Physics, Current

Member, Society for Natural Philosophy, Current

Member, Gesellschaft für Agewandte Mathematik und Mechanik, Current

Member, Pi Mu Epsilon, Current

Member, Sigma Xi, Current

Michael R. Booty

Member, American Institute of Aeronautics and Astronautics, Current

Member, American Physical Society, Current

Member, Society for Industrial and Applied Mathematics, Current

Member, The Combustion Institute, Current

Bruce G. Bukiet

Member, National Council of Teachers of Mathematics, 2005 - Current

Member, Institute for Operations Research and Management Science, 2004 - Current

Backpage Problem Editor, Association of Math Teachers of New Jersey, 1999 - Current

Member, Mathematical Association of America, 1990 - Current

Member, Center for Applied Mathematics and Statistics, 1989 - Current

Member, American Physical Society, 1988 - Current

Member, Society for Industrial and Applied Mathematics, 1984 - Current

Member, Sigma Xi, 1980 - Current

Linda J. Cummings

Member, American Physical Society, September 2014 - Current

Associate Editor, Institute of Mathematics and its Applications, London, July 2011 - Current

Member, Biophysical Society, January 2010 - Current

Sunil K. Dhar

Statistician, Center for Injury Bio-Mechanics, Materials and Medicine, July 2015 - September 2017

Casey O. Diekman

Member, Society for Applied and Industrial Mathematics, July 2014 - Current

Member, Society for Mathematical Biology, July 2014 - Current

Member, Society for Neuroscience, July 2014 – Current

Javier A. Diez

Vicedirector, Centro de Investigaciones en Física e Ingeniería del Centro de la Provincia de Buenos Aires (CIFICEN), Current

Director, Instituto de Física Arroyo Seco (IFAS), Current

Yixin Fang

Member, Institute of Mathematical Statistics, January 2013 - Current

Member, International Chinese Statistical Association, April 2011 - Current

Member, American Statistical Association, July 2004 - Current

Roy H. Goodman

Member, American Mathematical Society, Current

Wenge Guo

Member, International Indian Statistical Association, 2011 - Current

Member, International Chinese Statistical Association, 2010 - Current

Member, Institute of Mathematical Statistics, 2006 - Current

Member, American Statistical Association, 2005 – Current

Brittany Hamfeldt

Member, Society for Industrial and Applied Mathematics, 2014 - Current

Member, Association for Women in Mathematics, 2013 - Current

David J. Horntrop

Member, American Mathematical Society, June 1988 - Current

Member, Society for Industrial and Applied Mathematics, June 1988 - Current

Kenneth A. Horwitz

Member, Association of Math Teachers of New Jersey, February 2018 - Current

Member, Association for Supervision and Curriculum Development, September 2013 - Current

Member, National Council of Teachers of Mathematics, September 2013 - Current

Shidong Jiang

Member, Society for Industrial and Applied Mathematics, October 2012 - Current

Member, American Mathematical Society, January 1999 - Current

Jay M. Kappraff

Member, Mathematics Association of America, Current

President of NJIT chapter, Sigma Xi, September 2007 - Current

Member of the Editorial Board, ISIS Symmetry, September 2003 - Current

Lou Kondic

Member, European Mechanics Society, September 2005 - Current

Member, Society for Industrial and Applied Mathematics, September 2000 - Current

Fellow, American Physical Society, November 2017 - Current

Awards

November 16, 2017: Leloir Award for International Cooperation in Science, Technology and Innovation by Argentine Ministry of Science and Technology

Ji Meng Loh

Member, International Chinese Statistical Association, November 2012 - Current

Member, Institute of Mathematical Statistics, October 2009 – Current

May 2, 2018: Award for Excellence in Graduate Education, CSLA, NJIT

Jonathan H. Luke

Member, Society for Applied and Industrial Mathematics, 1986 - Current

Member, American Mathematical Society, 1981 - Current

Member, American Physical Society, 1980 - Current

Victor V. Matveev

Member, Society for Industrial and Applied Mathematics, October 2014 - Current

Member, American Association for the Advancement of Science, January 2011 - Current

Member, Society for Mathematical Biology, August 2004 - Current

Member, Biophysical Society, September 2003 - Current

Member, Society for Neuroscience, September 1996 - Current

Richard O. Moore

Member, American Mathematical Society, January 2004 - Current

Member, Optical Society of America, February 1999 - Current

Member, Society for Industrial and Applied Mathematics, January 1999 - Current

Cyrill B. Muratov

Member, Society for Industrial and Applied Mathematics, January 2000 - Current

Farzan Nadim

Member, American Physiological Society, September 2005 - Current

Member, Society for Industrial and Applied Mathematics, September 1999 - Current

Member, Society for Neuroscience, September 1994 - Current

Padma Natarajan

Member, American Statistical Association, October 2017 - Current

Anand U. Oza

Member, American Physical Society, October 2012 - Current

Member, Society for Industrial and Applied Mathematics, December 2009 - Current

Roy A. Plastock

Member, Mathematical Association of America, Current

David G. Shirokoff

Member, Society for Industrial and Applied Mathematics, January 2015 - Current

Sundarraman Subramanian

Member, American Statistical Association, Current

Member, Institute of Mathematical Statistics, Current

Life Member, International Indian Statistical Association, Current

Ronald Sverdlove

Member, Econometric Society, 2006 - Current

Member, American Finance Association, 2004 - Current

Member, Financial Management Association, 2004 - Current

Member, American Mathematical Society, 1970 - Current

Member, Mathematical Association of America, 1970 - Current

Former Secretary of New Jersey Section, Society for Industrial and Applied Mathematics, 1970 - Current

Antai Wang

Member, American Statistical Association, August 1999 - Current

B. FACM 2018 CONFERENCE: FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS

The fifteenth conference on Frontiers in Applied and Computational Mathematics, under the abbreviated title FACM 2018, was held at the New Jersey Institute of Technology on August 24-26. This year's conference has focused on recent advances in numerical wave propagation problems.

Wave scattering problems are important in a variety of engineering and industrial applications such as the design of antennas and stealth aircraft; imaging and tomography; electromagnetic compatibility; and many others in particular in the aeronautic industry. This workshop was a great occasion for researchers in this field to present their most recent and effective work on industrial applications. The diversity of the methods presented in this meeting and its medium size provided a unique opportunity to discuss limitations and advantages of each technique. Substantial funds were devoted to support the participation of graduate students, postdoctoral fellows, beginning faculty, and under-represented minorities.

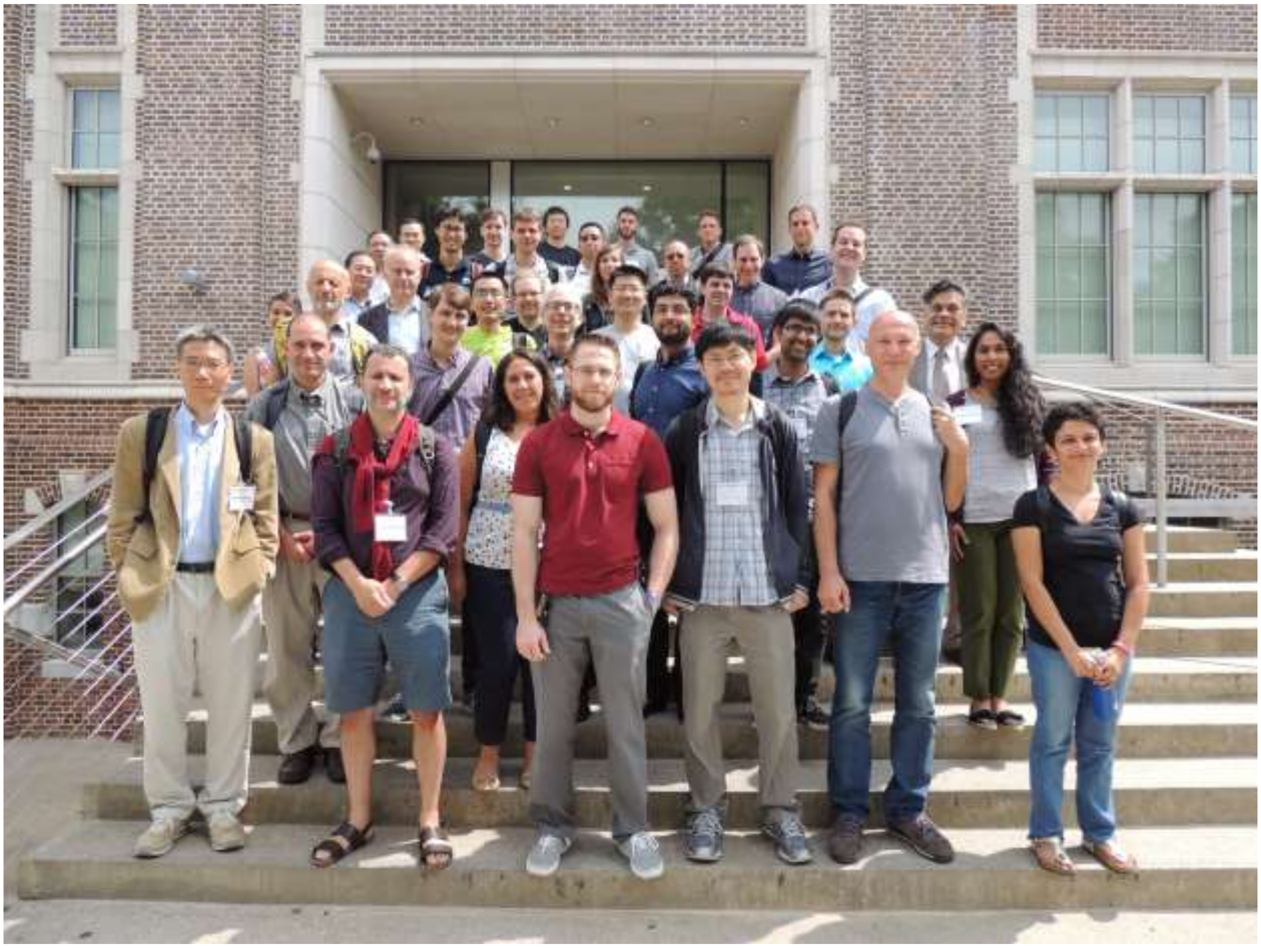
The FACM 2018 conference was proposed as a two and a half day single-track session comprised of plenary lectures and standard workshop presentations. The conference had 70 total participants, of whom 40 visited from universities other than NJIT. Some talks were given by postdocs, thereby giving these young researchers a chance to showcase their research results alongside more established colleagues. In addition to the talks, there were 13 posters.

The plenary speakers and titles of their talks were as follows:

- Peter Monk, University of Delaware, on " Optimal Design of Thin Film Solar Cells"
- Vladimir Druskin, Schlumberger-Doll Research, on " Reduced Order Models, Networks and Applications to Modeling and Imaging with Waves"
- Fioralba Cakoni, Rutgers University, on " Eigenvalue Problems in Inverse Scattering Theory"
- Hongkai Zhao, University of California, Irvine, on " Why is High Frequency Helmholtz Equation Difficult to Solve"

The organizing committee for this year's conference was: Yassine Boubendir (Chair), with Cyrill Muratov, Lou Kondic, Shidong Jian, Christina Frederick, Jonathan Luke and Michael Siegel, all of the Department of Mathematical Sciences at NJIT, and with the following external committee member: Alexander Barnett (Flatiron Institute).

Photos from FACM 2018



Group Photo from FACM 2018

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

Colaborative Research: Nonlinear Interactions between Surface and Internal Gravity Waves in the Ocean
National Science Foundation: September 15, 2016 - August 31, 2019
Wooyoung Choi

Modeling Steep Surface Waves Evolving Under Wind Forcing and Energy Dissipation Due to Wave Breaking
National Science Foundation: September 1, 2015 - August 31, 2018
Wooyoung Choi

GOALI: Predicting Performance & Fouling of Membrane Filters
National Science Foundation: September 15, 2016 - August 31, 2019
Linda Cummings (PI), Lou Kondic (Co-PI)

Collaborative Research: Expanding Links with Industry through Collaborative Research and Education in Applied Mathematics
National Science Foundation: April 1, 2013 - March 31, 2018
Linda Cummings (PI), Richard Moore (Co-PI)

Modeling and Analysis of Nematic Films
National Science Foundation: August 1, 2012 - July 31, 2017
Linda Cummings (PI), Lou Kondic (Co-PI)

CAREER: Neuronal Data Assimilation Tools and Models for Understanding Circadian Rhythms
National Science Foundation: July 01, 2016 - June 30, 2021
Casey Diekman

Multisensory Integration by Circadian Clocks
US ARMY: October 01, 2016 - January 31, 2018
Casey Diekman

Testing the Efficacy of a Technology-Assited Weight Management Interevention within Patient-Centered Medical Homes: The GEM Study
US/NIH/NYU: September 20, 2016 - August 31, 2017
Yixin Fang

Meshfree Finite Difference Methods for Nonlinear Elliptic Equations
National Science Foundation: September 01, 2016 - August 31, 2019
Brittany Hamfeldt

Numerical Methods for Optimal Transportation
Simons Foundation: September 01, 2016 - August 31, 2017
Brittany Hamfeldt

Collaborative Research: Efficient High-Order Parallel Algorithms for Large-Scale Photonics Simulation
National Science Foundation: August 15, 2014 - July 31, 2018
Shidong Jiang

NASA Shared Services Center (NSSC): Structure Evolution During Phase Separation in Colloids Under Microgravity
NASA: August 16, 2016 - August 15, 2018
Lou Kondic (PI), Boris Khusid (NCE, Co-PI)

Quantifying Complex Spatio Temporal Systems
DARPA: August 01, 2016 - July 31, 2018
Lou Kondic

Collaborative Research: Computations, Modeling and Experiments of Self and Directed Assembly for Nanoscale Liquid Metal Systems
National Science Foundation: July 01, 2016 - June 30, 2019
Lou Kondic (PI), Shahriar Afkhami (Co-PI)

Collaborative Research: Computational and Data-Enabled Science and Engineering
National Science Foundation: September 15, 2015 - October 31, 2018
Lou Kondic

Cell Calcium Dynamics
National Science Foundation: July 1, 2015 – June 30, 2019
Victor Matveev

Shallow Water Inversion with Optimization and Direct Methods
Office of Naval Research: April 1, 2016 - September 30, 2019
Zoi-Heleni Michalopoulou

Magnetization Dynamics at Nanoscale
National Science Foundation SF: July 01, 2016 - June 30, 2019
Cyrill Muratov

US-Israel Research Proposal: Network Resonance: Spiking Mechanisms and Behavioral Implications
National Science Foundation: September 15, 2016 - August 31, 2020
Horacio Rotstein

Penalty Methods and Computational Material Science
Simons Foundation: September 1, 2015 - August 31, 2020
David Shirokoff

Numerical Methods and Analysis for Induced-Charge Electrokinetic Flow with Deformable Interface
National Science Foundation: August 1, 2014 - July 31, 2018
Michael Siegel (PI), Michael Booty and Yuan-Nan Young (Co-PIs)

Efficient Solutions of Wave Propagation Problems in Multi-Layered, Multiple Scattering Media
National Science Foundation: September 01, 2016 - August 31, 2019
Catalin Turc

STTR PH II/Innovative Physics-based Modeling Tool for Application to Passive Radio Frequency Identification System on Rotorcraft
US Dept. of Navy: January 04, 2017 - January 03, 2019
Catalin Turc

Predictive Models for Financial and Commercial Data
Shanghai SuperV: February 27, 2017 - March 31, 2018
Antai Wang

Collaborative Research: Theoretical, Computational and Experimental Investigations on the Interaction Between a Lipid Bilayer Memebraneand a Solid Substrate or Particle
National Science Foundation: September 01, 2016 - August 31, 2019
Yuan-Nan Young

CONTINUING FUNDED TRAINING PROGRAMS

EXTREEMS-QED: Research and Training in Computational and Data-Enabled Science and Engineering for Undergraduates in the Mathematical Sciences at NJIT
National Science Foundation: September 1, 2013 - August 31, 2018
Michael Siegel, David Horntrop, Ji Meng Loh, Zoi-Heleni Michalopoulou, and Marvin Nakayama

PROJECTS FUNDED DURING THE PRESENT ACADEMIC/FISCAL YEAR

Efficient High Frequency Integral Equations and Iterative Methods
National Science Foundation: August 01, 2017 - July 31, 2020
Yassine Boubendir

NSF INCLUDES DDLP: Leadership and iSTEAM for Females in Elementary school (LiFE): An Integrated Approach to Increase the Number of Women Pursuing Careers in STEM
National Science Foundation: April 01, 2018 - March 31, 2020
Bruce Bukiet

Liquid Crystal Films Across Scales: Dewetting & Dielectrowetting
National Science Foundation: September 01, 2018 - August 31, 2021
Linda Cummings (PI), Lou Kondic (Co-PI)

Dinámica de la Formación de Estructuras Líquidas en Escalas Micro y Nanométricas
Agencia Nacional de Promoción de la Ciencia y la Tecnología: July 2017 – July 2020
Javier Diez

Stability, Breakup, and Self-Assembly on Nanoscale Thin Films
American Physical Society, November 2017
Javier Diez

Testing the Efficacy of a Technology-Assisted Intervention to Improve Weight Management of Obese Patients within Patient Aligned Care Teams at the VA
VA Medical Center/ US DVA: August 11, 2017 – August 31, 2017 and August 31, 2018
Yixin Fang

Prevention of Foot Complications in Diabetes
VA Medical Center: August 01, 2017 - August 31, 2017
Yixin Fang

Numerical Methods for Multiscale Inverse Problems and Applications to Sonar Imaging
National Science Foundation: September 01, 2017 - August 31, 2020
Christina Frederick

Collaborative Research: Efficient High-Order Algorithms for Nonequilibrium Microflows over the Entire Range of Knudsen Number
National Science Foundation: July 01, 2017 - June 30, 2020
Shidong Jiang

Collaborative Agreement with Meadowlands Environmental Research Institute - Benthic Project
Rutgers: January 01, 2018 - September 30, 2018
Ji Meng Loh

Geoacoustic Inversion in Shallow Water
US NAVY ONR: March 01, 2018 - February 28, 2021
Zoi-Heleni Michalopoulou

Collaborative Research: Overcoming Order Reduction and Stability Restrictions in High-Order Time-Stepping
National Science Foundation: August 01, 2017 - July 31, 2020
David Shirokoff

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

The Study of Hele-Shaw Viscoelastic Two-Phase Flows
American Chemical Society
Shahriar Afkhami

Algorithm Development for the Computation of Surface Active Agents (Surfactants) at Fluid Interfaces and the Applications
National Science Foundation
Shahriar Afkhami

Collaborative Research: Dynamics of Magnetic Chains and Beyond
National Science Foundation
Denis L. Blackmore

Resent Advances on Numerical Wave Propagation
National Science Foundation
Yassine Boubendir

Liquid Crystal Films Across Scales: Dewetting & Dielectrowetting
National Science Foundation
Linda J. Cummings

GOALI supplement: CAREER: Neuronal Data Assimilation Tools and Models for Understanding Circadian Rhythms
National Science Foundation
Casey O. Diekman

Arthur C. Guyton Awards for Excellence in Integrative Physiology
American Physiological Society
Casey O. Diekman

Simons Investigators in the MMLS
The Simons Foundation
Casey O. Diekman

Prevention of Foot Complications in Diabetes [IPA with VA based VA grant]
New York University
Yixin Fang

Testing the Efficacy of a Technology-Assisted Intervention to Improve Weight Management of Obese Patients within Patient Aligned Care Teams at the VA
New York University
Yixin Fang

Optimization of Post-Operative Triage After Major Surgery
New York University
Yixin Fang

Testing the Efficacy of a Technology-Assisted Weight Management Intervention within Patient-Centered Medical Homes: The GEM Study
New York University
Yixin Fang

Scalable Inference of Quantile Regression for Large-Scale Health Care Data
US NIH
Yixin Fang

Joint Screening of Ultra-High Dimensional Variables for Time-To-Event Outcome
US NIH
Yixin Fang

Dimension Reduction of Big Data with Composite Diffusion Wavelets and Optimal Sampling
National Science Foundation
Christina A. Frederick

Numerical Methods for Multiscale Inverse Problems and Applications to Sonar Imaging
National Science Foundation
Christina A. Frederick

Nonlinear Waves and Quantum Graphs
The Simons Foundation
Roy H. Goodman

Four Problems in Nonlinear Dynamics
National Science Foundation
Roy H. Goodman

Collaborative Research: Theory and Methods for Large Scale Multiple Testing and Inference
National Science Foundation
Wenge Guo

CAREER: Generated Jacobian Equations in Geometric Optics and Optimal Transport
National Science Foundation
Brittany Froese Hamfeldt

Sloan Research Fellowship in Mathematics
A.P. Sloan Foundation
Brittany Froese Hamfeldt

Phase Transitions in Colloid-Polymer Mixtures in Microgravity
NASA
Lou Kondic

Statistical Analysis of Data Collected by Meadowlands Environmental Research Institute
Rutgers, The State University
Ji Meng Loh

Tensors, Topology and Dimension Reduction for Analysis of Large Multi-Year NYC Stop-and-Frisk Space-Time Point Data
National Science Foundation
Ji Meng Loh

Collaborative Agreement with Meadowlands Environmental Research Institute - Benthic Project
Rutgers, The State University
Ji Meng Loh

Geoacoustic Inversion in Shallow Water
Office of Naval Research
Zoi-Heleni Michalopoulou

EDT: Enriched Doctoral Training in the Mathematical Sciences at NJIT
National Science Foundation
Zoi-Heleni Michalopoulou

CDS&E: Data-Enabled Deployment, Control, and Inference in Flow Fields
National Science Foundation
Richard O. Moore

Collaborative Research: OP: Developing Computational and Analytical Tools for the Next Generation of Mode-Locked Lasers
National Science Foundation
Richard O. Moore

Wave-Coupled Active Matter
The Simons Foundation
Anand U. Oza

Collaborative Research: Active Surfers on a Vibrating Bath -- Flow, Self-Propulsion and Collective Motion
National Science Foundation
Anand U. Oza

Spiking network Mechanisms Underlying Gamma Oscillations
US- Israel Binational Science Foundation
Horacio G. Rotstein

NSF Graduate Research Fellowship for Axel Turnquist
National Science Foundation
Horacio G. Rotstein

Mechanical Stimulation of UAW Muscles for Treatment of Obstructive Sleep Apnea
US NIH
Mesut Sahin and Sunil Dhar

Testing Adequacy OF Single-Index Location-Scale and Quantile Regression Models
National Science Foundation
Sundarraman Subramanian

Innovative Strategies to Analyze Survival Data Using Frailty Models
The Simons Foundation
Antai Wang

Analysis of Dependent Censored Data using Nonparametric and Semiparametric Methods
National Science Foundation
Antai Wang

Collaborative Research: Experimental, Computational and Theoretical Investigations on Activation of Mechanosensitive Channels
National Science Foundation
Yuan-Nan Young

Collaborative Research: Mathematical, Numerical and Experimental Investigations of Mechanotransduction of External Hydrodynamic Stresses by Ciliated Vertebrate Cells
National Science Foundation
Yuan-Nan Young

Collaborative Research: Osmophoresis: Propulsion of Semipermeable Vesicles Driven by Chemical Gradients
National Science Foundation
Yuan-Nan Young

VIII. COMMITTEE REPORTS AND ANNUAL LABORATORY REPORT

A. COMPUTER FACILITIES

Computing Equipment

High quality facilities supporting numerical computation are essential for the Department of Mathematical Sciences (DMS) and the Center for Applied Mathematics and Statistics (CAMS) at NJIT to fulfill their educational and research missions. Thus DMS and CAMS, with the help of SCREMS, CSUMS, UBM, and MRI grants from NSF, together with the generous support of NJIT, have maintained the CAMS Math Computation Laboratory (CMCL) for the research needs of their members since 1989.

Computational support provided by CMCL for the proposers consists of the workstations and desktop PC's that are networked and available to investigators in their offices, plus other more major, shared facilities of the CMCL (see Table 1).

Table 1: Main CAMS Math Computation Laboratory facility, Stheno cluster

Model	Cores	Processor & speed/GPU & max flops	Storage / RAM
Intel multi-core	392	Intel Xeon, 2.2 to 2.53 GHz	9872 GB
Nvidia multi-GPU	15,320	NVIDIA Tesla K20(m), 1.17 Tflops	32 GB

The DMS has expanded its "Stheno" cluster in stages since its first server became operational in 2011. The cluster is intended to be used to test, debug, and run message-passing interface (MPI) codes. It now has 32 nodes and 392 cores, 3,840 GB of RAM, and 9,872 GB of local disk storage. Two servers of the cluster contain GPU's, which now total 6, with a total of 32 GB of GPU RAM. The GPU's are currently CUDA capable and are intended for general purpose computation on GPU-accelerated computing nodes.

The DMS also has its "Gorgon" cluster, which has been expanded sequentially since it became operational in 2010. This cluster is intended for jobs that require large memory, and for parallel computations that use the OpenMP application programming interface. It is now a 32 core system, with AMD Opteron 6134 processors running at 2.3 GHz, and a total of 64 GB of shared memory.

All computational facilities are maintained by the Academic and Research Computing Systems (ARCS) group, headed by its director, David Perel.

Recognizing the need to support the scientific and engineering computing that is essential to research efforts across the campus, NJIT provides all faculty, postdocs, and graduate students access to centralized computing servers for research purposes. These recently received a significant upgrade as part of a substantial donation by Linode, which is a Linux-based cloud hosting company based in New Jersey. The NJIT cluster, "Kong", now has a total of 348 nodes, 3,128 CPU's, 27,008 GB of RAM, and a disk storage of 342,770 GB. Processors are all AMD Opteron or Intel Xeon models, with speeds from 2.2 GHz to 2.8 GHz. It also features total of 18 GPU's (NVIDIA Tesla K20X and NVIDIA Tesla P100), amounting to 60,928 GPU cores and 248 GB of RAM. Stheno and Kong nominally aggregate of approximately 55 TFLOPS computing power.

Office

The DMS assigns an individual office to faculty and postdoctoral associates, and assigns common offices with networked computers and other equipment to graduate students. In addition, a conference room and the CAMS Reading Room are available for formal and informal research meetings. Academic visitors are welcome and are assigned the same facilities.

Other

CAMS: The DMS is the base of the Center for Applied Mathematics and Statistics (CAMS) to which all investigators belong. CAMS supports research in the mathematical sciences at NJIT by preparing a CAMS Annual Report, a series of CAMS Technical Reports (available in electronic form at the CAMS website http://math.njit.edu/research/index.php). CAMS maintains a weekly colloquium on Applied Mathematics and Statistics, and in most weeks there is a seminar in each of mathematical biology, fluid mechanics and waves, and statistics. DMS and CAMS also sponsor a major conference on “Frontiers in Applied and Computational Mathematics,” which has been held annually at NJIT since 2004.

B. STATISTICAL CONSULTING LABORATORY REPORT

July 2017 – June 2018

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.

The following collaborative paper was published:

> C. Garg, J. H. Seo, J. Ramachandran, J. M. Loh, F. Calderon, and J. E. Contreras. Trovafloxacin attenuates neuroinflammation and improves outcome after traumatic brain injury in mice, *Journal of Neuroinflammation*, Vol. 15, pp. 1-15, February 2018.

We completed the project studying the effect of organic and metallic pollutants on biodiversity in New Jersey:

> **Client**: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
> **Description**: Benthic Biodiversity and Benthic Pollutant Loads in Emergent Marshes of the NJ
> **Meadowlands Consultant**: Ji Meng Loh Loh presented analysis results to a team of scientists at the Environmental Research Institute, and submitted a final report.

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, Golowasch, Holzapfel, Nadim, Matveev, Rotstein, Russell, 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, 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 and Amitabha Bose. 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 techniques to understand the role of short-term synaptic plasticity in producing multi-stable periodic solutions within neuronal networks. He is also interested in developing models that involve central pattern generating networks.

Another focus of CAMS members is in the area of computational and applied ecology. 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.

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.

Fluid Dynamics

Researchers in CAMS working on problems related to Fluid Dynamics: Afkhami, Bechtold, Booty, Bukiet, Choi, Cummings, Diez, Huang, Jiang, Kondic, Luke, Oza, Papageorgiou, Petropoulos, Rosato, Shirokoff, Siegel, Vanden-Broeck, Wang, Wylie, and Young.

There are thirteen faculty members within the Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) whose research is in fluid dynamics or the closely related area of combustion. 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 gases. 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.

The fluid dynamics group in the Department of Mathematical Sciences at NJIT has an active research program covering interfacial fluid dynamics (Afkhami, Booty, Cummings, Huang, Kondic, Papageorgiou, Siegel, and Vanden-Broeck), thin films (Cummings, Diez, and Kondic), electrohydrodynamics (Papageorgiou, Petropoulos, and Vanden-Broeck), hydrodynamic stability theory (Papageorgiou), sedimentation (Luke), granular flow (Kondic and Rosato) and combustion (Bechtold, Booty, and Bukiet). A particular focus for several of the faculty members (Afkhami, Booty, Choi, Cummings, Huang, Kondic, Papageorgiou, Siegel, Vanden-Broeck, Wang, Wylie, and Young) 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.

Wave Propagation

Researchers in CAMS working on problems related to Wave Propagation: Ahluwalia, Booty, Boubendir, Choi, Erneux, Frederick, Goodman, Jiang, Kriegsmann, Michalopoulou, Miura, Moore, 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.

One field that has been affected very profoundly by the relatively new science of nonlinear waves is optical communications. Richard Moore is currently using perturbation theory and statistical techniques to develop efficient ways to characterize the effect of perturbations on solitons used for optical communications. Roy Goodman uses Hamiltonian mechanics and asymptotic methods to explore how light can be slowed, delayed, or "trapped"' by engineering defects in nonlinear periodic structures.

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 investigates nonreflecting boundary conditions and scattering problems for acoustic and electromagnetic waves by open surfaces. He 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.

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. Zoi-Heleni Michalopoulou has developed a localization-deconvolution approach based on Gibbs sampling that explores the space of allowable configurations with improved speed and accuracy over conventional approaches.

Finally, the propagation of waves through materials is often influenced by parameters that depend on the waves in a way that requires fundamentally different physics. The microwave heating of ceramics or the passage of optical fields through photorefractive crystals, for instance, couples hyperbolic equations to parabolic equations governing the evolution of thermal profiles and chemical species. Gregory Kriegsmann and Richard Moore are investigating asymptotic and numerical methods to treat such coupled hyperbolic-parabolic systems.

Dynamical Systems

Researchers in CAMS working on problems related to Dynamical Systems: Blackmore, Bose, Golowasch, Jiang, Kappraff, Kriegsmann, Matveev, Miura, Moore, Nadim, Oza, Papageorgiou, Rotstein, Siegel, Tao, and Young.

Today's research in the theory and applications of dynamical systems all have their roots in the work of early innovators in differential equations and mathematical modeling.

A major revolution in dynamical systems research took place during the late nineteenth and early twentieth century characterized by innovations in the study of integrability such as those of Kovalevskaya, and culminating in the ground-breaking work of Poincare on nonintegrable Hamiltonian systems. Poincare brought a new infusion of topological methods to dynamical systems research that has illuminated and served as a source of inspiration for virtually all subsequent investigations. In the process, he introduced a new perspective on nonlinearity and complex motion that predated chaos theory. This new topological trend continued and was greatly advanced by such notables as Birkhoff, Kolmogorov, Arnold, and Moser.

Then in the 1960's, the face of dynamical systems research was dramatically altered by Smale and others with the introduction of a variety of techniques from differential topology that provided amazing new insights into the nature of chaotic dynamics. At about the same time, a dramatic advance in research on infinite-dimensional Hamiltonian systems was occurring as a result of several extraordinary discoveries concerning integrability, solitons, and the inverse scattering transform made by the likes of Gardner, Greene, Kruskal, Lax, and our own Robert Miura. These remarkable breakthroughs established the foundations of what has come to be known as the modern theory of dynamical systems, and catalyzed an explosion of applied and fundamental research in nonlinear dynamics.

Dynamical systems research in CAMS has a decidedly applied focus, and is extremely active in a wide and diverse range of areas including mathematical biology, fluid dynamics, wave propagation, computational topology, nonlinear optics, and quantum field theory and its applications to such things as quantum computing. There are a significant number of researchers who employ techniques from nonlinear dynamics in their work, and a smaller but sizeable core group whose interests are centered around dynamical systems and their applications. This includes Denis Blackmore, who applies nonlinear dynamics to study the motion of vortices and vortex filaments in fluids and particles in granular flows, the chaotic evolution of biological populations, the computational topological nature of certain geometric objects, and quantum computing. He also does fundamental research in bifurcation theory, chaos theory, and algebraic and differential integrability analysis of infinite-dimensional Hamiltonian dynamical systems. Dynamical systems methods applied to nonlinear waves and optics is the focus of Roy Goodman's research. A key ingredient in his work is the development of methods for obtaining insights from finite-dimensional reductions of infinite-dimensional systems such as the nonlinear Schrodinger equation.

Numerical Methods

Researchers in CAMS working on problems related to Numerical Methods: Afkhami, Boubendir, Bukiet, Choi, Frederick, Goodman, Hamfeldt, Horntrop, Jiang, Kondic, Luke, Matveev, Michalopoulou, Moore, Muratov, Papageorgiou, Petropoulos, Rosato, Shirokoff, Siegel, Tao, Turc, 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 numerous workstations and a 134 processor cluster.

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; the hybrid immersed boundary/immersed interface method is being developed and refined in order to 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.

Statistics

Researchers in CAMS working on problems in Applied Probability and Statistics: Dhar, Fang, Guo, Loh, 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, 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 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.

B. RESEARCH DESCRIPTIONS

Shahriar Afkhami

Shahriar Afkhami's research focuses on computational and mathematical modeling of real-life engineering phenomena including biomedical systems, polymers and plastics, microfluidics, and nanomaterials. His current research thrusts include studies of existence of solutions, flow stability, asymptotic behavior, and singularities of complex flow problems. Currently, he is working on 3D computations of drop dynamics and breakup in polymer processing, microfluidics, and electrowetting. Motivated by biomedical and pharmaceutical applications, Shahriar Afkhami has been studying the dynamics of magnetic particles in a blood flow for drug delivery applications. His current materials related projects involve directed assembly of metallic nanostructures.

Daljit S. Ahluwalia

The research of Daljit S. Ahluwalia is in the field of applied mathematics, mainly in the areas of asymptotics and wave propagation. Using analytic and asymptotic methods, he has addressed a wide range of phenomena including scattering, diffraction, reflection, guided waves, dispersion and shock waves. Applications of this work include ocean acoustics, water waves, electromagnetics, and elastic waves.

John Bechtold

The research of John K. Bechtold has focused on the modeling and analysis of physical problems, primarily in the area of theoretical combustion. His studies cover a wide range of topics in both premixed and nonpremixed combustion, including stability, ignition, extinction, and complex flame/flow interactions. His current projects include the development of new generalized models of near-stoichiometric flames, stability of expanding and converging flames, and radiation-driven flows in microgravity.

Denis Blackmore

Dynamical systems (nonlinear dynamics) theory is a rich amalgam of techniques from algebra, analysis, chaos theory, differential equations, differential geometry, differential topology, fractals, geometry, singularity theory, and topology, and has important applications in every branch of science and engineering. Denis Blackmore's research is primarily in the theory and applications of dynamical systems and closely related fields. He has studied a plethora of applications in such areas as acoustics, automated assembly, biological populations, computer aided geometric design, fluid mechanics, granular flows, plant growth (phyllotaxis), relativistic and quantum physics, and rough surface analysis. His theoretical work includes fundamental results on solution properties and integrability of differential equations, and analysis of hypersurface singularities. His current projects include particle dynamics, pilot-wave dynamics, strange chaotic attractors, exotic bifurcation theory, integrability of infinite-dimensional dynamical systems (PDEs), mathematical physics and vortex dynamics, and competing species dynamics

Victoria Booth

Victoria Booth is interested in applying mathematical modeling techniques to further our understanding of the brain. Her research focuses on different spatial and temporal scales of brain function, from single neuron spiking, to activity of large-scale spiking neuron networks, to networks of interacting neuronal populations. The consistent theme of her research is to utilize mathematical modeling to understand the physiological mechanisms generating experimentally observed neural activity, thus providing the neuroscience community with quantitative support of experimental hypotheses and a rigorous theoretical framework for exploring and developing experimentally-testable predictions. Mathematically, understanding the mechanisms generating specific model behaviors requires complete analysis of stable and unstable solutions to the nonlinear ordinary differential equations of the model system. For this analysis, she utilizes numerical simulations and analysis techniques from dynamical systems, singular perturbation theory and bifurcation theory.

Currently, her research activities are primarily concentrated in two major directions: construction and analysis of mathematical models of the sleep-wake regulatory network and investigation of the interactions of single neuron properties and network structure on spatio-temporal activity patterns in large-scale spiking neuron network models.

Michael Booty

Michael Booty's research interests are in mathematical modeling and analysis, by approximate or exact analytical techniques or by numerical methods. Much of his work is motivated by applications in fluid mechanics, including heat transfer, chemical, and electromagnetic effects. His studies on combustion have focused on time-dependent and multidimensional dynamics of reaction waves in mixed and multiphase systems, prototype reaction-diffusion models, dynamics of fast reaction waves, and droplet burning. He has studied conditions that minimize pollutant formation in the thermal oxidation of common materials, in collaboration with faculty of the Department of Chemistry and Environmental Science at NJIT. Current research interests include: studies on interfacial flows with surfactants, elastic membranes, and electrostatic fields (with Michael Siegel and Yuan-Nan Young), thermal waves in microwave heating and processing (with Greg Kriegsmann), and in fluid-structure interaction.

Amitabha Bose

The research of Amitabha Bose focuses on development and application of dynamical systems techniques to address problems arising in mathematical and computational neurophysiology. A major focus of his work has been on uncovering the role of synaptic plasticity in neuronal networks. This has led to a better understanding of how multistability of periodic solutions arise within a neuronal network as well as how some networks maintain phase relationships across a range of frequencies. These findings have been applied, for example, to circuits that are involved with REM sleep, to the crustacean pyloric and gastric mill networks, and other central pattern generating networks. More recent studies have focused on circadian rhythms and sustained activity in random graphs. Underlying much of this work is the rigorous analysis of one-dimensional, discontinuous maps that often arise as a result of model reduction.

Yassine Boubendir

Yassine Boubendir's general interests are in the numerical and the mathematical analysis of Partial Differential Equations. More specifically, he is interested in the design, implementation and analysis of numerical algorithms for problems of electromagnetic, acoustic and elastic wave propagation. In recent years, he introduced a new non-overlapping domain decomposition algorithm that combines a boundary element and finite element methods. In addition, he developed an appropriate Krylov subspace method, at high frequency regime, in the context of multiple scattering situations. Currently, his research is devoted to the acceleration of the iterative methods corresponding to these two algorithms.

Daniel Bunker

Global change poses a strong challenge to ecologists, environmental scientists, and conservation biologists: even as our natural and managed ecosystems become more stressed by the forces of global change, humans require that these ecosystems produce both a greater quantity and a greater variety of ecosystem services. for instance, we may expect a forested ecosystem to produce timber, provide clean water, sequester carbon, support wildlife, and provide recreational opportunities, yet at the same time the forest community is being buffeted by climate change, invasive species, and land-use change. In order to ensure that our ecosystems provide the services society demands, we must be able to predict how ecological communities will respond to these global forces, and in turn how changes in community composition will affect ecosystem services. To develop this predictive framework, I employ a mix of observation, experimentation, modeling and synthesis, within a diverse array of biological communities.

Bruce Bukiet

Bruce Bukiet's research concerns mathematical modeling of physical phenomena and issues in improving education, both at the K-12 level and post-secondary. He has studied the dynamics of detonation waves, including curved detonations and detonation models of discrete mixtures and he currently researches questions involving biological systems relating to balance and cancer. In the area of education, he is extensively involved in NJIT’s Collaborative for Leadership, Education and Assessment Research (CLEAR) and its projects involving enhancing digital learning through the Future Ready Schools – New Jersey effort, its online educational resource repository and in research concerning connecting math classes to the real world. Finally, he continues to work on understanding and optimizing aspects of baseball from a mathematical modeling perspective.

Wooyoung Choi

Wooyoung Choi's research interest lies mainly in fluid mechanics and nonlinear waves, in particular, with applications to geophysical flow problems. His recent research focuses on the development of simple but accurate mathematical models to describe various physical processes in the ocean and, in collaboration with physical oceanographers, their validation with field and laboratory measurements. His current research projects include the development of new asymptotic models and efficient numerical methods to study the short-term evolution of nonlinear ocean surface waves with enhanced physical parameterizations of wave breaking and wind forcing, and the dynamics of large amplitude internal waves in density stratified oceans and their surface signatures.

Linda Cummings

Linda Cummings works on a variety of physically-motivated free boundary problems, mostly fluid-dynamical in nature, many of which arise in industrial or biological applications. On the biological side her current work includes studies of fluid flow, nutrient transport and cell growth in tissue engineering applications; flow dynamics and bacterial biofilm formation in prosthetic devices such as urethral catheters and ureteric stents; and dynamics of lipids in cell membranes. Her current industrially-relevant projects include modeling and analysis of "bistable" nematic liquid crystal display devices; modeling of bubble dynamics in the manufacture of glass fibers; and the flow of thin liquid films (both Newtonian and non-Newtonian). She also works on classical low Reynolds number free boundary flows, such as Stokes flows and Hele-Shaw flows. Her mathematical approaches are wide-ranging, encompassing skills of mathematical modeling, discrete and continuum mechanics, complex analysis, and asymptotic and numerical methods.

Fadi P. Deek

Fadi Deek's primary research interest is in learning systems and collaborative technologies, with applications to software engineering, and in computer science education. His approach to research involves a mixture of theoretical development, software system implementation, controlled experimental evaluation, and ultimately deployment of the systems developed. His interest in learning systems revolves around the development of new technologies that take into consideration the cognitive behavior and needs of end-users. The specific types of learning systems that he is interested in are related to computing which has motivated his work in software engineering. Because both learning and software engineering are highly collaborative activities, he has also become interested in understanding how collaboration works, ranging from the dynamics of collaborative groups to the technologies required for computer-supported work. His original interest in learning systems was sparked by a long standing interest in computer science education which continues to engage him. These underlying interests in learning systems and collaboration are the unifying theme for his publications, dissertation advisement, system development and professional involvement. Most of this research has been supported by grants where he has been the principal or co-PI.

Sunil K. Dhar

The research focus of Sunil Dhar has been on model building and inference. His ongoing research involves proving existence, computing and developing robust and efficient minimum distance estimators such as L2-distance type, under the following models: linear, AR [k], the additive effects outliers, and the two-sample location model. He also developed functional least squares estimators under the additive effects outliers model. An optimization technique for the general class of sums of absolute multivariate linear functionals has been developed by him. He extended the negative multinomial distribution; this new model has many applications. His ongoing research in multivariate lifetime reliability models involves deriving new multivariate geometric and generalized discrete analogs of Freund's models, with demonstrated applications. Other discrete models developed by him are in the area of models of order k. He has wide and varied experience in statistical consulting.

Casey Diekman

Casey Diekman uses a combination of mathematical modeling, numerical simulation, and dynamical systems analysis to gain insight into biological systems. He is currently focused on creating a mathematical framework to understand how dynamic changes in gene expression affect the electrical properties of neurons and ultimately animal behavior. Circadian (~24-hour) rhythms offer one of the clearest examples of the interplay between these different levels of organization, with rhythmic gene expression leading to daily rhythms in neural activity, physiology and behavior. Diekman develops mathematical models of the master circadian clock in the mammalian brain. These models and the mathematical theory associated with them have led to counterintuitive predictions that have since been validated experimentally by his collaborators. The primary goal of his research program in mathematical biology is to uncover mechanisms underlying biological timekeeping, neuronal rhythm generation, and the disruption of rhythmicity associated with certain pathological conditions including sleep disorders, Alzheimer's disease, breathing problems, and ischemic stroke.

Javier Diez

Javier Diez's research focuses on free surface flows and interface phenomena. He is particularly interested in coating flows and the dynamics of the contact line, where the liquid, the solid substrate and the surrounding environment (gas or liquid) intersect. Current projects include using a combination of experimental measurements (usually by means of optical techniques) and numerical simulations of the fluid dynamic equations, with particular emphasis on the inclusion of intermolecular forces to account for hydrodynamical effects in nanoscale phenomena.

Thomas Erneux

The research of Thomas Erneux is mainly concerned with laser dynamical instabilities and their practical use in applications. More recently, he became interested in delay differential equations appearing in different areas of science and engineering. The response of lasers can be described by ordinary, partial, or delay differential equations. He uses a combination of numerical and singular perturbation techniques to investigate their solutions. A large part of his research is motivated by specific collaborations with experimental groups.

Yixin Fang

Yixin Fang’s primary research interest is in high-dimensional-data analysis. He is interested in developing efficient supervised-learning and unsupervised-learning methods for analyzing big data. He is also interested in applying existing statistical methods for analyzing complex data from different fields such as genetics, medical studies, and econometrics.

Christina Frederick

The research of Christina Frederick has encompassed multiscale computation and numerical homogenization for inverse problems based on elliptic PDEs, as well as sampling strategies that exploit special microstructures of functions to reduce the computation cost, and retain theoretical optimality in terms of efficiency and stability. Her recent work includes multiscale methods for sonar imaging, as well as robotics and stochastic differential equations.

Jorge Golowasch

The research of Jorge Golowasch focuses mainly on the cellular and network mechanisms of long-term regulation of electrical activity in a simple model neural network, the pyloric network of the stomatogastric ganglion of crustaceans. An undesirable consequence of plasticity is the potential instability of the system. In the nervous system, the activity of neurons and neural networks remains quite stable over very long periods of time. Conductances, however, also express plasticity. How this plasticity contributes to stability, however, is a question largely unexplored. Using both electrophysiological and computational tools, he and his students in the laboratory study mechanisms of neuronal plasticity and homeostasis of the ionic currents that determine the excitability and electric activity of neurons and simple neural networks. He is also interested in how neurons interact to form rhythmic pattern generating networks.

Roy Goodman

Roy Goodman's research focuses, broadly, on nonlinear wave phenomena. The tools he uses consist mainly of asymptotic methods, dynamical systems analysis, and numerical simulation. Physical applications he has studied include storm propagation in the atmosphere at middle latitudes and the interaction of light pulses in telecommunications optical fibers. Recently, he has been investigating the interaction of nonlinear waves with localized changes to the media through which they propagate. This includes the enticing possibility of "light trapping" at specified locations in optical fibers, as well as more abstract studies of classical nonlinear wave equations. Another area of application is the interaction of vortices in Bose-Einstein condensates.

Wenge Guo

Wenge Guo's research interests include large-scale multiple testing, high-dimensional inference, bioinformatics, machine learning, and statistical methods for clinical trials. The new theories and methods he derived are mainly used for controlling the false discovery rate (FDR) and other generalized error rates in large-scale multiple testing. Their main applications are on bioinformatics and computational biology. His current research projects include estimate and control of the FDR under dependence and development of new multiple testing methodologies for different biomedical areas such as microarray data analysis, design and analysis of clinical trials, and high throughput screening assay.

Brittany Hamfeldt

Brittany Hamfeldt's research focuses on the development of numerical methods for solving nonlinear partial differential equations. A particular focus of her work is the solution of fully nonlinear elliptic equations and related applications to optimal mass transportation. She has introduced new formulations of the associated equations, which have led to the first PDE based methods for optimal mass transportation. These methods have enabled the development of new techniques for solving seismic inverse problems and for reshaping beams of light. She has also introduced a new framework for solving a large class of fully nonlinear elliptic equations on unstructured meshes.

Claus Holzapfel

As a community ecologist Claus Holzapfel is fascinated by the intriguing ways of how species interact with each other. Within that topic his research addresses ecological and evolutionary processes and their outcome in plant populations and communities. The leading question is whether communities are more than simple chance assemblies. Perturbed systems - systems that are altered from their pristine state - are ideal study objects to address such a question, since here possible coevolved interactions are likely disrupted. Good examples are plant communities that are invaded by non-native organisms or systems otherwise heavily impacted by human activity (climate change, land-use change).

David J. Horntrop

The research of David J. Horntrop has focused on the development and numerical simulation of stochastic models of physical phenomena for problems ranging from materials science to fluid dynamics. His studies of turbulent diffusion were based on random field models for the advection of passive scalars and involved asymptotics, stochastic analysis, and the creation of novel wavelet-based Monte Carlo numerical schemes for the simulation of random fields. His current studies of materials involve the development and use of mesoscopic models to describe surface processes in order to gain insight on the importance of small scale phenomena on the creation of large scale patterns. He is presently developing and validating new spectral methods for the numerical solution of stochastic partial differential equations for these studies.

Huaxiong Huang

Huaxiong Huang's research interests include Fluid Mechanics, Scientific Computing, Mathematical Modeling and Industrial Mathematics. Recently, he has been working on problems on stress/defects reduction of InSb crystals, ruin probability and asset allocation related to personal finance, multiphase mass and heat transport problems in cloth assemblies, bread baking, and multiphase bubbly flow related to water purification; extensional viscous flow related to optical fiber drawing and pulling of microelectrodes; and finally in biologically related problems such as the spatial buffering and viral membrane fusion.

Shidong Jiang

Shidong Jiang's main research interests lie in the field of numerical analysis and scientific computing with particular emphasis on fast numerical algorithms and integral equation methods for solving initial/boundary value problems for various partial differential equations (PDEs). He has constructed second kind integral equation formulations for various problems including the open surface problems, the fourth order PDEs such as biharmonic and modified biharmonic equations, the unsteady Stokes equations, the dislocation climb in two dimensions, and the electromagnetic mode propagation of optical waveguides. He has also worked on the construction of sum-of-exponentials and sum-of-poles approximations and their applications including nonreflecting boundary condition for the Schrodinger equation, the Havriliak-Negami dielectric model, the Caputo fractional derivative, efficient separated sum-of-exponentials approximation of the heat kernel in arbitrary dimension, and the continuous time random walk transport equation. He is currently working on the efficient algorithms for large-scale photonics simulation.

Lou Kondic

Research of Lou Kondic has concentrated on modeling and numerical simulations of various problems in fluid mechanics and material science, in particular granular materials. His focus is on modeling, asymptotic methods, and scientific computing. The problems arising from fluid mechanics that he has worked on include interfacial flows for Newtonian and complex fluids (liquid crystals in particular), thin film instabilities, contact line dynamics, and pattern formation on the scales ranging from nano to macro. He has also worked in the field of compressible fluid mechanics, in particular bubble dynamics and sonoluminescence. In the field of granular matter, he has developed molecular dynamics/discrete element simulations for two and three dimensional granular systems. These simulations have been used to address granular statics and dynamics in various settings including microgravity environment, dense granular flows, silo discharge, to name a few. Recent focus has been on development of topological methods for describing structure of granular systems on mesoscale. His research is carried out in close collaboration with experimental researchers in the field.

Gregory A. Kriegsmann

The research of Gregory A. Kriegsmann has focused on the modeling, analysis, and numerical simulations of physical problems arising in industrial and technological settings. His studies in microwave heating of materials describe the nonlinear interaction between electromagnetic waves and materials, and the effect of cavity geometry. His research on acoustic and electromagnetic scattering theory includes applications to radar, structural acoustics, and acoustics in flows. His studies in circuit theory cover the design and analysis of oscillators and power supplies. His current work is focused on microwave assisted chemical vapor infiltration, thermal patterns in microwave heating experiments, and microwave assisted ceramic sintering.

Ji Meng Loh

Ji Meng Loh's primary research interest is in spatial statistics, in particular the analysis of spatial point patterns. He has developed methods for bootstrap of spatial data, anomaly detection and assessing data quality. Ji Meng has worked on statistical applications in many fields including cosmology, public health, fMRI analysis and telecommunication.

Jonathan H. C. Luke

The research of Jonathan H. C. Luke has focused on the modeling and analysis of physical problems primarily in the areas of low-Reynolds-number fluid dynamics and wave propagation in complex media. His studies in sedimentation theory cover the topics of velocity fluctuations, renormalization, the method of reflections, cluster dynamics, and variational and numerical methods. His studies of electromagnetic waves in highly dispersive media mainly concern energy deposition and numerical methods. His current projects include analysis of the stability of numerical implementations of no-slip boundary conditions for the Navier-Stokes equations in streamfunction-vorticity form, simulation and analysis of energy deposition from electromagnetic waves in dispersive materials, and effective boundary conditions for heating and scattering problems in microwave cavities.

Victor Matveev

The research of Victor Matveev is in the area of computational neuroscience, and is focused primarily on biophysical modeling and numerical simulations of synaptic function and its mechanisms. In his work, Victor Matveev employs analytical methods as well as a variety of computational techniques, from stochastic modeling to numerical solution of partial and ordinary differential equations. Victor Matveev performs most of his work in collaboration with experimental neurophysiologists, and develops models to explain and fit the experimental data. His current projects include the study of the mechanisms of short-term synaptic facilitation and other calcium-dependent processes involved in neurotransmitter secretion, and the modeling of presynaptic calcium diffusion and buffering. To facilitate his research, Victor Matveev also has been working on the development of a software application designed for solving the reaction-diffusion equation arising in the study of intracellular calcium dynamics ("Calcium Calculator").

Jay Meegoda

Jay Meegoda's research can be best described as mechanics of geo-environmental engineering where he utilizes scientific concepts and engineering technologies in real world applications. Under the heading of mechanics of geo-environmental engineering, his research can be further subdivided into five main trust areas: engineering properties of contaminated soils; centrifugal modeling of contaminant transport; micro-mechanics of civil engineering materials; reuse of contaminated soils; and ultrasound research. Micromechanic models were used to explain the mechanical behavior of civil engineering materials. He received the best practice paper award in 2001 from the Environmental Multimedia Council of the Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE) for a publication resulting from the above research. Currently, his research is focused on use of a laser to detect segregation in asphalt pavements and development of smart pipes for drinking and waste water distributions.

Zoi-Heleni Michalopoulou

The research of Zoi-Heleni Michalopoulou focuses on inverse problems in ocean acoustics. The goal is to understand the properties of the propagation medium and detect and localize sound-emitting sources. To this end, methods are developed that combine ocean acoustic modeling and signal processing. Efforts are made to design direct (or exact) methodologies that return ocean medium property values using a set of measurements and the solution of an integral equation. In parallel, sound propagation modeling is combined with Bayesian models to provide a concurrent description of the water column and sediment and location of the source.

Petronije Milojevic

The research of P.S. Milojevic is focused on studying semilinear and (strongly) nonlinear operator equations using a combination of topological, approximation, and variational methods and applications to ordinary and partial differential equations. He has developed various fixed point results for condensing and A-proper maps. His studies of semilinear operator equations with monotone and (pseudo) A-proper maps involve nonresonance and resonance problems with Fredholm and hyperbolic-like perturbations of single valued and multivalued nonlinear maps, and Hammerstein equations. He has widely applied these abstract theories to BVPs for (contingent) ordinary and elliptic PDEs, to periodic and BVPs for semilinear hyperbolic and parabolic equations and to nonlinear integral equations. His study of nonlinear and strongly nonlinear operator equations is concerned with the existence and the number of solutions of such equations involving condensing, monotone, and various types of approximation maps. His current research deals with Hammerstein equations and weakly inward A-proper and pseudo A-proper maps and applications to differential and integral equations.

Robert M. Miura

The research of Robert M. Miura covers several areas in mathematical physiology, especially in neuroscience. The techniques used are mathematical modelling, mathematical analysis, approximation methods, and numerical simulations. His research on excitable biological cells, including neurons, cardiac cells, and pancreatic beta-cells, is aimed at understanding ionic electrical effects on cell function and signaling. These studies involve detailed investigations of membrane electrical properties, subthreshold resonance, stochastic resonance, signal propagation on dendrites, and mechanisms leading to bursting electrical activity. His recent studies on spreading cortical depression, and more generally, on intercellular communication via ion flows, include analysis and simulations of partial differential equation models of wave propagation in the brain, of spatially coupled discrete neurons, and of restricted diffusion.

Richard O. Moore

Richard Moore's research focuses on wave phenomena in optical communication systems and optical devices. He is particularly interested in how such systems and devices are disturbed by a variety of influences relevant to their operating environments. Current projects include using a combination of perturbation methods and importance sampling to simulate rare events in optical communication lines, and using dynamical systems techniques and rigorous reduction methods to analyze the impact of heating due to optical field absorption in devices that convert optical frequencies using parametric gain media. More recent work explores the intersection between data assimilation and optimal control, including the development of efficient algorithms to compute optimal paths for autonomous vehicles navigating in noisy environments.

Cyrill B. Muratov

Cyrill Muratov's research is mainly in the area of applied analysis and calculus of variations. The problems under consideration arise from a variety of applications from materials science, fluid mechanics and biology and give rise to systems of nonlinear partial differential equations exhibiting self-organizing behavior. These difficult mathematical problems can be approached by the direct method of calculus of variations and singular perturbation techniques. Currently, the ongoing projects include the asymptotic analysis of energy-driven pattern formation problems in the presence of non-local effects, with major applications to ultrathin ferromagnetic films and nanotechnology. Other projects involve modeling, analysis and simulations of rare events in noise-driven systems and studies of multiscale, multiphysics problems, with particular applications to NASA's space exploration systems.

Farzan Nadim

Farzan Nadim studies rhythmic motor activity generated in the central nervous system by combining experiments and computational techniques. Nadim has a joint appointment with the Federated Department of Biological Sciences and runs a laboratory that conducts experiments on isolated nervous systems of crustacea. These experiments involve electrophysiological recordings from multiple nerves and neurons, pharmacological manipulations of the system, and immunohistology. The neuronal circuits studied all produce oscillatory output of various frequencies. The lab also models these systems both at the detailed biophysical level and using analytic mathematical techniques. His current focus is on contribution of synaptic dynamics to network output and the interaction between multiple oscillatory systems.

Anand Oza

Anand Oza's primary research interests are fluid mechanics and physical applied mathematics, with applications to soft matter physics and biological systems. He uses a combination of modeling, analysis and numerical simulation, and typically works in collaboration with experimentalists in the field. His research has recently been directed towards understanding hydrodynamic interactions in active matter systems, in which collections of objects both generate and interact with fluid flows. Specifically, he has developed and analyzed mathematical models for the pilot-wave dynamics of droplets bouncing on a vibrating fluid bath, a system that offers a visualization of wave-particle coupling on a macroscopic scale. He has also developed a PDE model for liquid crystal-like assemblies comprised of microtubules and motor proteins in a fluid, a model system for studying the self-organization principles that underlie complex cellular structures. He is currently developing models for the interactions between flapping swimmers, with a view to understanding how hydrodynamics mediates schooling and flocking behavior in animal collectives.

Demetrios T. Papageorgiou

The research of Demetrios T. Papageorgiou focuses on the modeling, analysis, and computation of physical and technological problems that involve fluid dynamics and aerodynamics. His studies in surface tension driven flows cover the stability, dynamics, and breakup of single and compound liquid jets, both in the presence and absence of surface active agents, which affect interfacial tension. Analysis of finite-time-singularities has been used to motivate experiments for rheological measurements. His studies in bubble dynamics are a theoretical and experimental collaborative research effort to control the drag on rising bubbles using surfactants. Current projects include jet and bubble dynamics, nonlinear stability of core-annular flows when surfactants are present, nonlinear stability of electrified liquid films, and study of viscous flows in pulsating channels or tubes by construction of Navier-Stokes solutions both numerically and analytically with particular emphasis on chaotic regimes and their influence on applications.

Manuel Perez

The research of Manuel Perez is in the areas of heat transfer, drying of porous media, expert systems, medical diagnosis by computer, and mechanical properties of fibrous webs. He is now working on survival studies of prostate cancer patients, and on evaluating the efficacy of surgical procedures and radiation treatment for various stages of the disease.

Peter G. Petropoulos

The research of Peter G. Petropoulos has focused on the numerical modeling and asymptotic analysis of physical problems in the areas of transient electromagnetic wave propagation in complex media. His studies of pulsed electromagnetic waves in dispersive media mainly concern the asymptotic and numerical methods for studying the response of relaxing (Debye) and fractionally-relaxing (Cole-Cole) dielectrics, as well as the development fourth-order accurate finite difference methods for the time-domain Maxwell equations with discontinuous coefficients. His current projects include analysis of the error in problems where impedance boundary conditions are employed, development of numerical techniques to simulate pulse propagation in Cole-Cole dielectrics, analysis of perfectly matched absorbing boundary conditions in relation to exact absorbing boundary conditions, and the development of fourth-order accurate schemes in the presence of curved boundaries.

Anthony D. Rosato

Anthony Rosato's research is concerned with granular flows as related to the solids handling and processing industries. The flows are modeled using dissipative molecular dynamics simulations to identify governing mechanisms that affect observable behavior. Currently, he is studying the development of velocity field structures in boundary-driven flows, and how they may influence segregation behavior in polydisperse systems. He is also interested in the application of dynamical systems modeling to these systems.

Horacio G. Rotstein

The research of Horacio G. Rotstein focuses mainly on the study of the biophysical and dynamic mechanisms underlying the generation of rhythmic oscillatory activity in the brain, particularly in the hippocampus and entorhinal cortex. Rhythmic oscillations at theta (8 - 12 Hz) and gamma (30 - 80 Hz) frequencies in these areas of the brain have been correlated with various forms of learning and memory. In addition, alteration in particular sorts of brain rhythmic oscillations have been shown to correlate with the existence and progression of a variety of neuropsychiatric conditions, including schizophrenia and dementia. Rhythms differ not only in their frequency range, but also in the underlying biophysical mechanisms by which they are generated. These mechanisms usually vary in different brain areas, and may operate at a single cell level or may involve the coherent activity of many cells and cell types in a network. The primary goal of my research is to uncover and understand the underlying biophysical and dynamic principles that govern the generation of rhythmic activity in the brain. As secondary goals I hope to understand the functional implications for brain functioning of the previous results, the relation between disruption of rhythmic activity and diseases of the nervous system, and the effects that changes at a subcellular level have on rhythms observed at the single cell and network levels.

David Shirokoff

David Shirokoff's research focuses on two main areas. (i) Numerical methods for fluid dynamics in the presence of irregular boundaries and interfaces, and (ii) Numerical methods for the simulation and characterization of materials governed by energy driven pattern formation. In the first area, his developments include reformulations of the Navier-Stokes equations as pressure-Poisson systems for improved accuracy and efficiency in fluid dynamics computations, and active high order penalty methods as a means to improve the accuracy and efficiency of Fourier based methods that are used to solve PDEs on irregular geometries. In the second area, of computational materials science, his interests focus on designing new numerical techniques to characterize the underlying energy landscape. The techniques rely on replacing a complicated energy with a simpler, convex one, which can then be minimized using tools from optimization theory to systematically obtain low energy states for use in thermodynamic simulations.

Michael Siegel

The research of Michael Siegel is focused on the analysis and numerical computation of moving boundary problems that arise in fluid mechanics, materials science, and physiology. His research in fluid dynamics covers singularity formation on interfaces for inviscid and low Reynolds number (Stokes) flow, the dynamics of drops and bubbles (including the influence of surfactant), and effect of small regularization--such as surface tension--on mathematically ill-posed interfacial flow problems. His studies in materials science primarily involve crystal growth and diffusion controlled moving boundary problems. in physiology, he has studied optimal suturing patterns for skin wounds and formulated models for determining the stress and strain distribution in the heart wall that occur due to changes in heart geometry.

Sundar Subramanian

The research of Sundar Subramanian focuses on non- and semi-parametric statistical inference for censored time-to-event-data analysis. His investigations involve study of the large sample behavior of estimators using techniques from counting processes and martingales, empirical processes, kernel estimation, and information bound theory. His interests on the computational side include bootstrap methods for model selection and bandwidth computation, and mis-specification studies using simulation. The procedures have strong theoretical basis and find applications in Biostatistics.

Ronald Sverdlove

Ronald Sverdlove's research interests are in the areas of corporate finance, fixed income securities, and the overlap of the two. In the fixed income area, he studies the Credit Default Swap (CDS) market and its relations to the bond and stock markets. He uses price data in all three markets to determine the effectiveness of models for predicting future prices. In corporate finance, he studies how corporations make decisions about various aspects of their financing, in particular the seniority level of newly issued bonds. A second corporate decision is the relative importance of using "soft" or "hard" information in deciding on investments to be made. Hard information consists of those things that can be objectively measured in a reproducible way, while soft information is more subjective and often based on personal relationships. Different kinds of institutions make different choices between the two. Current work considers contracts that corporations offer to creators of intellectual property for the purchase of that property and the reasons for the existence of contingent payments in those contracts. A third type of corporate decision is particularly relevant in the financial industry, where institutions must decide how to structure themselves according to the regulations that will apply to each possible structure. Current work involves modeling the process by which a financial institution makes the decision whether or not to become a regulated bank, trading off the ability to offer deposit insurance to customers against the reduced amount of risk and leverage that can be used by an unregulated institution. Techniques of game theory are used to analyze many of these decisions involving negotiations between two or more institutions.

Louis Tao

The research of Louis Tao focuses on large-scale scientific computation, through a combination of numerical simulations, bifurcation theory, and asymptotics. He is mainly interested in the modeling and analysis of the dynamics of networks, with applications to specific problems in neuroscience and mathematical biology. His work in computational neuroscience has been in two distinct areas: a) how neurons in the visual cortex process elementary features of the visual scene and b) how recurrent networks perform computations. His current projects include the modeling of orientation selectivity in cortex and the analysis of the network dynamics that arises.

Catalin Turc

Catalin Turc's research interests belong to the broad area of computational electromagnetics and acoustics. The main goal is the design and implementation of numerical methods that can be used for efficient simulation of electromagnetic and acoustic wave interactions with complex material structures. During the past few years, he has worked on a variety of problems related to fast, high-order frequency domain integral equation methods for acoustic and electromagnetic scattering problems in domains with complex material and geometrical features. He has developed analytical and computational tools that enable solutions for problems of fundamental significance involving applications such as electromagnetic interference and compatibility (electronic circuits), dielectric/magnetic coated conductors, composite metamaterials (photonic crystals and negative index materials), and solar cells.

Jean-Marc Vanden-Broeck

Jean-Marc Vanden-Broeck's research is concerned with fluid mechanics and the theory of free boundary problems. He uses a combination of numerical and asymptotic methods to investigate new properties of nonlinear solutions. A large part of his research focuses on the effects of surface tension and on the computations of waves of large amplitude. Interfacial flows generated by moving disturbances, three dimensional solitary waves, waves on electrified fluid sheets, and the stability of Stokes flows in the presence of electric fields are among his recent interests.

Antai Wang

Antai Wang's research mainly focuses on survival data analysis, high dimensional data analysis and cancer data analysis. Currently his research goal is to develop new strategies to model dependent censored data or multivariate survival data using frailty models, copula models and nonparametric methods. For high dimensional data, Antai develops new methodologies to conduct variable selections for longitudinal data based on a Procrustes criterion which is used to extract data information while keeping the original data structure. The new research strategies are important and useful for correlated survival data analysis and microarray data analysis in medical research.

Yuan-Nan Young

The research of Yuan-Nan Young focuses on the multiphase flows in computational fluid dynamics (CFD), and relevant issues in numerical treatment of moving boundary problems. In particular he has numerically investigated how surfactants, both soluble and insoluble, can affect the pinch-off of bubbles in viscous fluids. He also investigates numerical schemes to optimize the accuracy of regularization of surface tension force in CFD codes. His current projects also include an investigation on the hysteretic behavior of drop deformation in highly viscous straining flows.

C. COLLABORATIVE RESEARCH

Shahriar Afkhami

Numerical Investigation of Marangoni Flows in Mixing of Miscible Liquids with I. Seric (NJIT DMS Graduate Student)

Numerical Simulation of Microlayer Formation in Nucleate Boiling with Jacopo Buongiorno (MIT)

A New Computational Method for Viscoelastic Two-Phase Flow with V. Barra (NJIT DMS Graduate Student)

Micorfluidics Flow Focusing with A. Leshansky

Cavitation in Insects: Mechanisms for Switching on the Embryonic Tracheal System with A. Woods (UMontana)

Magnetophoretic Interaction of Ferrofluid Droplets in a Rotating Magnetic Field with James Feng (UBC)

Liquid Metals on Nanoscale: Modeling and Computation with L. Kondic

John K. Bechtold

Theoretical Combustion with C. K. Law (Princeton University) , H. G. Im (University of Michigan), and M. Matalon (Univesity of Illinois)

Denis L. Blackmore

Dynamical Systems Modeling of Dilating/Contracting Granular Systems with A. D. Rosato, L. Zuo NJIT (Graduate Student), N. Ching (NJIT Graduate Student), A. Harlow (NJIT Graduate Student), X. Tricoche (Purdue University), and K. Urban (NJIT Graduate Student)

Density Relaxation in Granular Systems with A. D. Rosato and D. J. Horntrop

Integrability Analysis of Nonlinear Equations of Mathematical Physics with A. Prykarpatski (AGH, Krakow, Poland)

Discrete Dynamical Modeling of Logical Circuits with A. Rahman (NJIT Graduate Student)

Analysis and Simulation of Infinite-Dimensional Dynamical Systems with H. Wu (NJIT DMS Graduate Student)

Perturbations of the Forced van der Pol equation with J. Tavantzis (NJIT)

A Gauge-Theoretical Analysis of Magnetic Reconnection with K. Urban (NJIT Applied Physics Graduate Student)

Innovations in Strange Attractor Theory and Applications with Y. Joshi (Kingsborough Community College)

New Techniques for Analyzing Strange Attractors with Y. Joshi (Kingsborough Community College) and A. Rahman (NJIT Graduate Student)

Solutocapillary Flows with P. Singh and I. A. Fischer

Dynamical Systems Foundations of Entropy with J. Tavantzis (NJIT (Emeritus)) and R. Addabbo (Vaughn College)

Axial and Radial Pressure in Cylindrical Silos with A. D. Rosato and X. Tricoche

Local Periodic Pertubations of Limit Cycles with J. Tavantzis (Rutgers-Newark)

Dynamical Modeling and Analysis of Walking Droplets with A. Rahman (NJIT DMS Graduate Student)

Dynamical Systems, Differential Topology and Analysis: Theory and Applications with A. Rosato, A. Prykarpatsky, A. Rahman, M. Brons, B. Shashikanth, J. Lee

Michael R. Booty

Novel Approaches to Semiconductor Device Integration Using Magnetic Fields with N. M. Ravindra and A. Fiory

Surfactant Effects in Low Reynolds Number Flows with Y.-N. Young and M. S. Siegel

Amitabha K. Bose

Linear Conductance-Based Mechanisms Underlying Oscillations in Neuronal Networks with J. P. Golowasch and F. Nadim

Yassine Boubendir

A Preconditioner for Wave Problems Based on the Perfectly Matched Layer with P. G. Petropoulos and D. Midura (NJIT Graduate Student)

A Preconditioner for Wave Problems Based on the Perfectly Matched Layer with P. G. Petropoulos and D. Midura (NJIT Graduate Student)

Acceleration of an Iterative Method for the Evaluation of High-Frequency Multiples Scattering Effects with R. Fernando and F. Ecevit

Coupling Finite and Boundary Element Methods Using Localized Adaptive Radiation Condition for Maxwell's Equations with A. Bendali and N. Zerbib

Well-Conditioned Integral Equations for Acoustic Transmission Problems with C. Turc

Bruce G. Bukiet

Math Modeling of Prostate Cancer Treatment with H. Chaudhry (NJIT) , T. Findley (VA Hospital East Orange), Nan Gao (Rutgers-Newark), Z. Ji, and S. K. Dhar
Education Research with J. M. Lipuma

Daniel E. Bunker

Effects of Generalist Herbivores on Plant Communities with L. Rohleder (Graduate Student) , T. Blockus (Undergraduate Student), D. Evangelista (Undergraduate Student), D. Waller, A. Royo, B. McShea, S. Cote, C. DeVan (Graduate Student), and B. Traw

Life History Tradeoffs and Species Abundance with B. Mitchell, T. Blockus , and A. Madala

Cascading Effects of Urbanization on Pollinator and Plant Communities with C. DeVan (Graduate Student) , T. Blockus (Undergraduate Student), and D. Evangelista (Undergraduate Student)

Augmented Reality for Ecological Data and Processes with G. J. Russell and D. E. Bunker

Spontaneous Dispersion of Particles in Liquid Surfaces with P. Singh

Wooyoung Choi

Unconditional Stability for DAEs: with Applications to Non-Local PDEs with D. G. Shirokoff and L. Feng (NJIT Graduate Student)

Linda J. Cummings

Mathematical Models Related to the Drawing of Glass Sheets and Optical Fibers with C. Breward (University of Oxford) , J. Abbott (Corning, Inc.), T. Witelski (Duke University), I. Griffiths (University of Oxford), and M. Taroni (University of Oxford)

Free Surface Instability of a Thin Film of Nematic Liquid Crystal with L. Kondic, M. Lam (NJIT Graduate Student), T.-S. Lin (University of Loughborough), and U. Thiele (University of Loughborough)

Bistability and "Gliding" in a Nematic Liquid Crystal Display Device with L. Kondic, C. Cai (NJIT Graduate Student), and E. Mema (NJIT Graduate Student)

Oscillatory Instability of Liquid films Nonlocally Heated From Below with D. G. Shirokoff, W. Batson (NJIT), and L. Kondic

Mathematical Model for Determining the Binding Constants between Immunoglobulins, Bivalent Ligands, and Monovalent Ligands with R. Perez-Castillejos and E. Mack (BP)

Mathematical Models for Filtration with P. Sanaei (NJIT DMS Graduate Student) and G. Richardson (University of Southampton)

Extensional Dynamics of a Nematic Liquid Crystal Sheet with T. Myers (CRM, Barcelona) and J. Low (CRM, Barcelona)

Mathematical Models for Tissue Engineering with Jeffrey Pohlmeyer (NJIT DMS Graduate Student) and S. Waters (University of Oxford)

Two-dimensional Stokes Flow in Doubly-Connected Domains with J. King (University of Nottingham, UK)
Sunil K. Dhar

Math Modeling of Prostate Cancer Treatment with B. G. Bukiet, H. Chaudhry (NJIT) , T. Findley (VA Hospital East Orange), Nan Gao (Rutgers-Newark), Z. Ji, and S. K. Dhar

Assessment and Comparison of the Slippage and Unintentional Opening of Epidural Catheters and Their Connectors with C. Anthony (Rutgers, New Jersey Medical School), R. Horvath (B.Horvath, LLC) , S. K. Dhar (NJIT), and A. Gonzalez Fiol

Sunil K. Dhar: *Robust spatial release from masking for spectrally degraded vocoded speech* with A. Ihlefeld (NJIT) and S. K. Dhar (New Jersey Institute of Technology)

Sunil K. Dhar: *Multivariate Logistic-Type Models Based on an Inverse Sampling Scheme* with Y. Zhu (NJIT DMS Graduate Student)

Casey O. Diekman

The Various Effects of the Light/Dark Signals on the Biological Metabolite Signals for the Entrainment of the Cyanobacterial Circadian Clock with Y. Jeong (NJIT), M. Kaur (NJIT Graduate Student) , P. Patel (Graduate Student), A. Shah (Undergraduate Student), A. Ng (Undergraduate Student), and E. Khan (NJIT Graduate Student)

Magnesium regulates the circadian oscillator in cyanobacteria with Y. I. Kim, C. O. Diekman, C. L. Dias , Y. Jeong (NJIT), and M. Kaur (NJIT Graduate Student)

Involvement of Neural Oscillators and Proprioception in Locomotion of C. Elegans with G. Haspel, C. O. Diekman (NJIT) , J. Storm (NJIT Graduate Student), and A. J. Jurko (NJIT Graduate Student)

Correlated Expression of Ion Channel in Circadian Neurons with J. P. Golowasch and C. O. Diekman

Global Coupling of Genetic Oscillators with A. K. Bose and H. G. Rotstein

Daylength Encoding by Circadian Clock Neurons with M. Belle (University of Manchester) and H. Piggins (University of Manchester)

Ion Channel Expression in SCN2.2 Cell Line with J. P. Golowasch and R. Deek (Undergraduate Student)

Christina A. Frederick

Sampling, Frame Theory, Stability Estimates with K. Djima (Amherst College)

Inverse Problems for Medical Imaging with S. Valellian (NC State) and K. Ren (UT Austin)

Robotics with H. Zhou (Georgia Tech) and M. Egerstadt (Georgia Tech)

Roy H. Goodman

Numerical Methods for Invariant Manifolds with Jacek Wrobel (NJIT DMS Graduate Student) , C. Basarab (NJIT Graduate Student), and P. Shah (NJIT Undergraduate Student)

Instabilities of Localized Solutions to Nonlinear Wave Equations with Defects with M. Weinstein (Columbia University) and J. Marzuola (University of North Carolina)

Interactions of Vortex Interactions in Bose-Einstein Condensates with P. Kevrekidis (University of Massachusetts) and R. Carretero (San Diego State University)

Wenge Guo

Analysis of Longitudinal Microarray Data with A. Wang, J. M. Loh (NJIT) , X. Zhang (NJIT Graduate Student), and X. (James) Li (Georgetown University)

New Directions for Research on Some Large-Scale Multiple Testing Problems with S. K. Sarkar (Temple University)

Analysis of Error Control in Large Scale Two-Stage Multiple Hypothesis Testing with J. P. Romano (Stanford University)

Brittany Hamfeldt

Eigenvalue Problems for Nonlinear PDEs with J. Lesniewski (NJIT Graduate Student)

Optimal Transport on the Sphere with A. Turnquist (NJIT Graduate Student)

Beam Shaping Following an Optimal Transportation Map with Z. Feng (Beijing Institute of Technology)

Viscosity Solutions of Elliptic Dirichlet Boundary Control Problems with J. Liu (S. Illinois University Edwardsville)

David J. Horntrop

Density Relaxation in Granular Systems with A. D. Rosato and D. L. Blackmore

Variance Reduction for Stochastic Differential Equations with M. Billamoria (NJIT Undergraduate Student) and S. Singh (NJIT Undergraduate Student)

Modeling and Simulation of Credit Risk with B. Ren (NJIT Graduate Student) and W. Morokoff (Standard & Poors)

Lou Kondic

Oscillatory Instability of Liquid films Nonlocally Heated From Below with D. G. Shirokoff, W. Batson (NJIT), L. J. Cummings , and L. Kondic

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Ji Meng Loh

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Estimating the Survival Rate of Mutants with A. Mili

Victor V. Matveev

Dynamics of Calcium-Dependent Insulin Secretion in Pancreatic Beta Cells with M. Gram Pedersen, A. Sherman , and M. Riz (Graduate Student)

Properties of Synaptic Calcium Channels with E. Stanley (Graduate Student)

Calcium Nanodomains in Neurotransmitter and Hormone Release with A. Sherman (NIH) and R. Bertram (Florida State University)

Zoi-Heleni Michalopoulou

Contaminant Behavior and Impacts to Environmental Systems with L. B. Axe, L. Wei (NJIT), K. Jahan (Rowan University), J. Dyksen (United Water), B. Wang (NJIT Graduate Student), N. Sandhu (NJIT Graduate Student), Z. Shu (NJIT Graduate Student), S. Zhang (NJIT Graduate Student), and S. Gitungo (NJIT/ Hatch Mott Graduat

Sequential Particle Filtering with C. Yardim and P. Gerstoft

Statistical Modeling of the Invariance Principle for Tracking with L. Zurk

Sediment Layer Identification with Ambient Noise with P. Gerstoft

Detection of Weak Sources in Underwater Environments with A. Abdi

Richard O. Moore

Noise and Rare Events in Optical Systems with D. Cargill (Brown University) , C. M. Alcatel-Lucent , and T. Shaefer (The College of Staten Island)

Localized Patterns in Thermally Active Parametric Gain Media with K. Promislow (Michigan State University)

Heating of Thin Ceramic Slabs in Microwave Cavities with S. Agrawal (Mathematical Sciences, NJIT)

Optimal Control in Data Assimilation with D. McDougall and A. Hsieh

Transitions and Soft Error Rates in Micromagnetic Devices with Y. Yu. (NJIT DMS Graduate Student) and C. M. Muratov

Importance Sampling in Data Assimilation with C. Jones (UNC-Chapel Hill) and D. McDougall (Institute for Computational Engineering and Sciences, U. Texas-Austin)

Effects of Thermal Perturbations on Magnetic Droplet Solitons with M. Hoefer and P. Wills (Graduate Student)

Cyrill B. Muratov

Domain Walls in Thin Film Ferromagnets with R. Lund (NJIT) , A. Capella-Kort (UNAM), H. Knuepfer (University of Heidelberg), G. Chaves-O'Flynn (NYU), and V. Slastikov (Bristol University)

Front Propagation in Geometric and Phase Field Models of Stratified Media with M. Novaga (University of Pisa), A. Cesaroni (University of Padua), and P. Gordon (University of Akron)

Transitions and Soft Error Rates in Micromagnetic Devices with Y. Yu. (NJIT DMS Graduate Student)

Gyroid Structures in Material Science with D. G. Shirokoff and C. B. Muratov

Density Functional Theory for Massless Fermions in Graphene with V. Moroz (University of Swansea) and J. Lu (Duke University)

Gamma-Convergence for Nonlocal Variational Problems with M. Novaga (University of Pisa)

Non-Local Geometric Variational Problems with M. Novaga (University of Pisa)

Nonlinear PDEs Involving Fractional Operators with X. Yan (University of Connecticut)

Farzan Nadim

Linear Conductance-Based Mechanisms Underlying Oscillations in Neuronal Networks with J. P. Golowasch, A. K. Bose, and F. Nadim

Role of Linear Currents on Slow Oscillation with J. P. Golowasch, A. K. Bose (NJIT) , and Y. Guan (NJIT Graduate Student)

Temporal Fidelity of Axonal Action Potential Conduction and Its Neuromodulation with D. M. Bucher

Anand U. Oza

Reduced Models of the Pilot-Wave Dynamics of Walking Droplets, with L. Barnes (NJIT Graduate Student)

Active Surfers on a Vibrating Bath: Self-Propulsion and Collective Motion, with D. Harris (Brown University)

Interacting Lattices of Flapping Swimmers, with M. Shelley (Courant Institute/Flatiron Institute) and L. Ristroph (Courant Institute)

Free Streamline Theory of Flows Past an Inflated Film, with M. Shelley (Courant Institute/Flatiron Institute) and L. Ristroph (Courant Institute)

Peter G. Petropoulos

A Preconditioner for Wave Problems Based on the Perfectly Matched Layer with Y. Boubendir and D. Midura (NJIT Graduate Student)

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Electrohydrodynamics and Interfacial Fluid Dynamics with L. Barannyk and D. Papageorgiou

Electrohydrodynamics and Interfacial Fluid Dynamics with T. Anderson (NJIT Undergraduate Student) and D. Papageorgiou

Numerical Simulation of Pattern Formation in Systems with Global Feedback with H. G. Rotstein

Algorithms for the Computation of Fractional Derivatives with M. Causley

Horacio G. Rotstein

Global Coupling of Genetic Oscillators with C. O. Diekman and A. K. Bose

Subthreshold and Superthreshold Frequency Preferences (Resonance) in Nonlinear Neural Models with D. Kim (NJIT DMS Graduate Student) , F. Nadim , and N. Sheikholeslami

Dynamics of Medial Entorhinal Cortex Layer II Stellate Cells and Related Networks with D. Kim (NJIT DMS Graduate Student) , J. White , and T. Kispersky

Pattern Formation in Relaxation Oscillators with Inhibitory Global Feedback with H. Wu (NJIT DMS Graduate Student)

Coregulation of Conductances in Neuronal Models with J. P. Golowasch and M. Olarinre (NJIT Graduate Student)

Dynamic Compensation Mechanism Give Rise to Period and Duty Cycle Level Sets in Oscillatory Neuronal Models with J. P. Golowasch and M. Olarinre (NJIT Graduate Student)

The Canard Phenomenon in Piece-Wise Linear Systems with S. Coombes

Dynamics of Fronts in Bistable Systems with Delayed Global Feedback with Y. Boubendir

Numerical Simulation of Pattern Formation in Systems with Global Feedback with P. G. Petropoulos

David G. Shirokoff

Oscillatory Instability of Liquid films Nonlocally Heated From Below with W. Batson (NJIT) , L. J. Cummings , and L. Kondic

High-Order Methods for a Pressure Poisson Equation Reformulation of the Navier-Stokes Equations with Electric Boundary Conditions with D. Zhou (Temple) , B. Seibold (Temple University), and R. Rosales (MIT)

Resolving Order-Loss in Runge-Kutta Methods for Boundary Value Problems with B. Seibold (Temple University) , D. Zhou (Temple University), and R. Rosales (MIT)

FFT Based Optimization for Variational Problems with Fourier Constraints with M. Bandegi (NJIT DMS Graduate Student)

Unconditional Stability for DAEs: with Applications to Non-Local PDEs with W Choi and L. Feng (NJIT Graduate Student)

Gyroid Structures in Material Science with C. B. Muratov

Michael S. Siegel

Surfactant Effects in Low Reynolds Number Flows with Y.-N. Young and M. R. Booty

Efficient Surface-Based Numerical Methods for 3D Interfacial Flow with Surface Tension with D. Ambrose (Drexel)

Mechanics of Retinal Detachment with T. Chou

Sundarraman Subramanian

Analysis of Doubly Truncated Survival Data Using Nonparametric Methods with A. Wang and J. Qin (NIH)

Ronald Sverdlove

Financial Bubble Project with W. V. Rapp, M. Somers, M. A. Ehrlich , P. B. Chou, Z. Yan, and R. Mehta

The Central Bank and the Risk Sharing Network for Financial Institutions with M. A. Ehrlich and P. B. Chou

Relations between Prices in the Stock Market and the CDS Market with R.-R. Chen (Fordham University)

A Critical Study of the Concept of a Collective with G. Shafer and V. Vovk

Catalin C. Turc

Reduced Bases Simulation of Wave Propagation in Urban Environments with O. Bruno (Caltech) and M. Lyon (U New Hampshire)

High-Order Solutions of Integral Equation Formulations of Helmholtz Transmission Problems in Two-Dimensional Domains with Corners with V. Dominguez (U Navarra Spain) and M. Lyon (U New Hampshire)

Antai Wang

Analysis of Longitudinal Microarray Data with J. M. Loh (NJIT) , W. Guo (NJIT), X. Zhang (NJIT Graduate Student), and X. (James) Li (Georgetown University)

The Analysis of Left Truncated Bivariate Data Using Archimedean Copula Models with K. Chandra (Columbia University Graduate Student)

Analysis of Clustered Survival Data Using Frailty Models with Xieyang Jia (NJIT DMS Graduate Student)

Analysis of Doubly Truncated Survival Data Using Nonparametric Methods with J. Qin (NIH) and S. Subramanian (NJIT)

Yuan-Nan Young

Dynamics and Rheology of a Compound Vesicle in Shear Flow with J. Blazdziewicz, P. Vlahovska , and S. Veerapaneni

Dynamics of Primary Cilium with C. Jacobs (Columbia University)

Poration of a Lipid Bi-Layer Membrane with H. Nganguia (NJIT DMS Graduate Student)

Electrodeformation of a Surfactant-Laden Viscous Drop with H. Nganguia (NJIT DMS Graduate Student)

Surfactant Effects in Low Reynolds Number Flows with M. B. Booty and M. S. Siegel

Elastic Filament and Viscous Drop in Stokes Flow and Rheology of Soft-Particle Suspensions with M. Shelley

Swimming of Bacteria with Two Flagella with N. Patel (Northwestern University Graduate Student)

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. One of the main focuses of this research activity has been the NSF-funded EXTREEMS-QED program, which began in Fall 2013 and has now entered its fourth year. The PI is Michael Siegel and the Program Director is David Horntrop. Students in each year's cohort begin their research projects in January and complete them in December of the same year. The 2016 cohort consisted of nine students: Ester Calderon, Elizabeth Daudelin, Jacob Dresher, Christian Granier, Alina Mohit-Tabatabai, Roman Passaro, Andrew Pennock, Diego Rios, and Tadanaga Takahashi. Their research mentors were Ji Meng Loh, Eliza Michalopoulou, and Richard Moore. The 2017 cohort consisted of six students: Patricia Bobila, Salvatore Cordaro, Matthew Illingworth, Ivan Mitevski, Paulo Paz, and David Youssif. Their research mentors were Brittany Hamfeldt and Michael Siegel. The 2018 cohort consists of nine students: Amina Bendaoud, Joshua Colditz, Kyle D'Souza, George Haramuniz, William McCann, Chiara Milla, Daniel Newton, Jacob Piccolo, and Thomas Slawinski. Their research mentors are Shahriar Afkhami, Casey Diekman, and Eliza Michalopoulou. EXTREEMS-QED students presented their research at a number of conferences during the past year including the MIT IEEE Undergraduate Research Technology Conference and the MBI Undergraduate Research conference. Many students have been engaged in research outside the EXTREEMS-QED program and have presented and published their work at various conferences including the NJIT Undergraduate Summer Research Symposium. Research completed by Andrew Dziedzic, Mohit Nakrani, Bina Ezra, and Musa Syed as part of their senior capstone project has been submitted for publication.

Many of our students have industrial internships during the summer, particularly, but not exclusively, students in the Mathematics of Finance and Actuarial Science concentration. Each summer a number of students have internships at MetLife and Prudential Financial while some students intern at consulting firms such as Mercer Consulting and Oliver Wyman Actuarial Consulting. Companies such as Chubb and Panasonic also employ our students as summer interns. In addition, this year a group of our math majors working on a joint Capstone project was invited for a month-long visit to Oxford University, UK to work on filtration related problems with Prof. Ian Griffiths (Ivan Mitevski, Michael Illingworth, Ines Vujkovac).

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 12 passed during the year. This year's Pi Mu Epsilon Mathematics Honor Society Induction Ceremony took place in April with Patricia Bobila, Ester Calderon, Denis Hallulli, George Haramuniz, Elie Samaha, and Philip Zaleski being inducted into membership. The department itself was honored recently 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, NYLife, Buck Consultants, and Trillium Management.

Capstone Laboratory Projects on Modeling of Porous Media Flow

Instructor: Lou Kondic, Lab Assistant: Binan Gu

(Supported in part by the NSF Grant No. DMS-1615719, PI: Cummings, Co-PI: Kondic)

Report 1: Modeling filtration via Monte-Carlo simulations

Participating Students: Paulo Paz, Mehtab Siu, Catherine Sousa

This project focuses on the modeling of filtration mechanism via stochastic Monte-Carlo type of simulations. Here, filtration process is modeled via random walkers which stick to the membrane walls if their random motion brings them to the vicinity of the membrane walls. Random walks continue until clogging of the pore. The particular aspect of the problem that the project focused on was the influence of the pore shape on throughput (how many particles managed to pass through a pore) and on time of clogging. Figure 1 shows an example of the simulations. The students have found out that a large number of simulations is needed to reduce statistical effects and have therefore put together scripts that allowed them to carry out thousands of simulations of clogging progress. The outcome was then compared to the continuum model results that had been developed previously by Sanai and Cummings (2017). While direct quantitative comparison is not possible due to different nature of the input parameters, quantitative agreement has been found, with the Monte-Carlo simulations consistently finding existence of an optimum angle that minimizes the throughput.

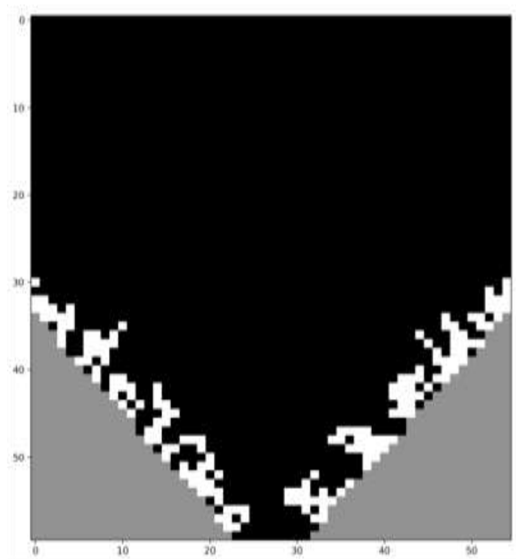


Figure 1: Geometry of Monte-Carlo simulations showing pore walls (grey) and the random walkers (white). In simulations the pore angle was modified with the goal of finding the optimum angle.

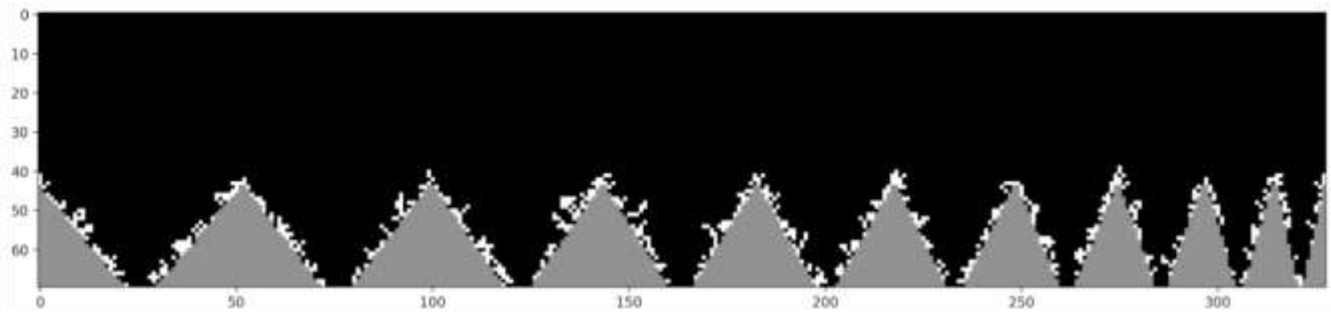


Figure 2 caption: Multiple pore geometry with the pore aspect ratio changing along the horizontal axis.

The next step is extension of the simulations to multiple pores. This direction has been carried out as a summer project for Catherine Souza, NJIT undergraduate, and has been supported by NJIT Undergraduate Provost Fellowship. The project is focusing on answering the following question: is it preferable to have a gradient of pore sizes along the filter axis (the horizontal direction in Fig. 2), with respect to filter performance (throughput and clogging time)? To answer this question, Catherine has been carrying out extensive simulations where the walkers (particles) are exposed to cross-flow, modeled by biased probability distributions describing their motion.

Report 2: Modeling of Connected Branched Membrane Filters

Participating Student: Dylan Renaud

The previous work (Sanaei and Cummings (2017, 2018) has focused on unconnected membrane morphology, as illustrated in Fig. 1c. The current project has focused on computing the performance of filters characterized by different membrane structures, as shown in Figs. 1a and 1b, and comparing them with the performance of the membranes characterized by unconnected membrane structure. To carry out this comparison, an elaborate branching model has been developed, and simulations have been formulated and carried out. The focus of these simulations has been on computing throughput for the membrane structures shown in Fig. 1 and discussing which of the configurations is optimal. Furthermore, the project involves considering asymmetric membranes, where pores are perturbed by random noise. The question here is how random perturbations, which are expected in applications, influence membrane performance.

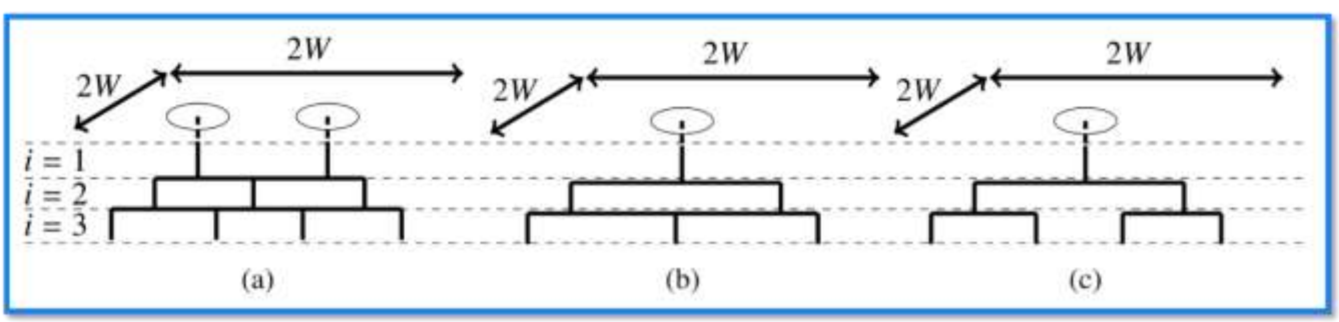


Figure 1: Illustration of three different branched pore membranes. (a) Two-inlet connected membrane. (b) Single-inlet connected membrane. (c) Non-connected membrane.

Report 3: Asymmetric Multilayered Membrane Filters with Improved Performance
Participating Students: Ivan Mitevski, Michael Illingworth, Ines Vujkovac

This project focuses on reproducing and improving the model of multilayered membrane filters, developed by Ian Griffiths (J. Membrane Sci. 511, 108 (2016)). The model focuses on creating an innovative method of membrane filtration by carrying out stochastic simulation of the particles transport through the multilayered filter and entrapment of particles within. Here, the filters are composed of a number of membrane layers stacked on top of each other. Each membrane layer is characterized by a two dimensional array of pores with given initial radii and a taper angle which prescribes a difference in pore radii between successive layers. Figure 1, from the reference above, illustrates the membrane geometry. The participating students have developed their own simulations of the flow through a multilayered filter, and have been successful in reproducing the results from the Griffiths work. This project is being continued in direct collaboration with Dr. Griffiths (Oxford University, UK) in the direction of carrying out simulations of filters characterized by random pore structure, as illustrated in Fig. 2. To this effect, the participating students are spending part of their summer 2018 working with Dr. Griffiths at Oxford.

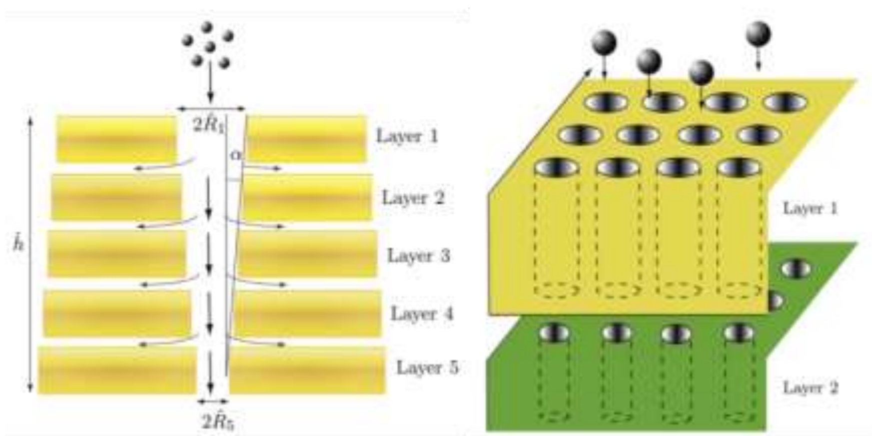


Figure 1: Schematic diagram of multilayer filter.

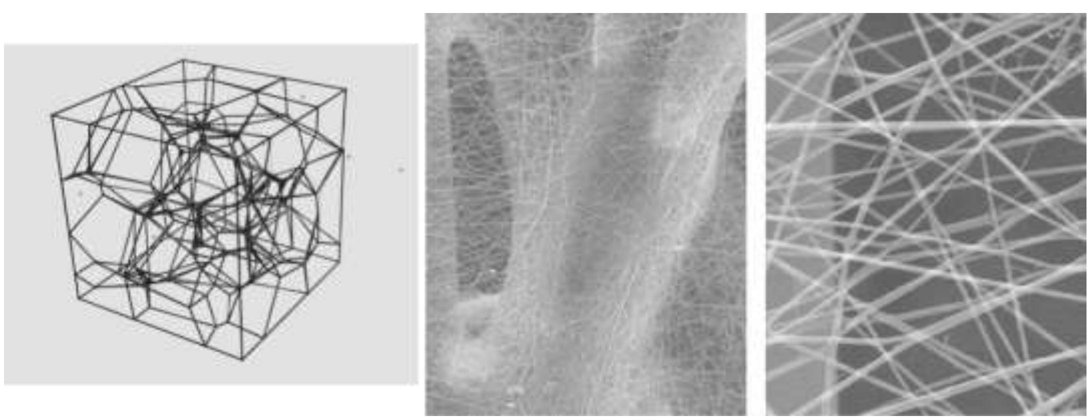


Figure 2: Irregular filter structure with random connections.

Report 4: Safsafi Modeling Filtration using Parallel Pores
Participating Students: Matthew Belanger, Elizabeth Castro, Yahira Mendoza, Achraf Safsafi

This projects is based on modeling filtration by considering flow of particles through multiple layers of parallel pores as developed by Dr. Bauscher, the industrial collaborator from Gore Pharmaceuticals. Baucher's publication (Chem. Eng. Technology, 33, 1377 (2010)), considers propagation of a particle in the geometry illustrated in Fig. 1. Filtration itself is modeled by a size exclusion mechanism, based on the idea that if a particle attempts to travel through a pore that is smaller than itself, it will be captured by the pore, otherwise the particle passes through to the next pore level. Two models were used: the Complete Mixing Model and Restricted Lateral Flow Model, with the difference between them defined by the freedom of particles to move from a given lateral position in one layer to another one in the consecutive layer, as illustrated by the arrows in Fig. 1, that shows the Restricted Lateral Flow case. The students have been successful in reproducing the main features from Baucher's work and furthermore have extended the findings in the direction of considering filters whose properties change from layer to layer.

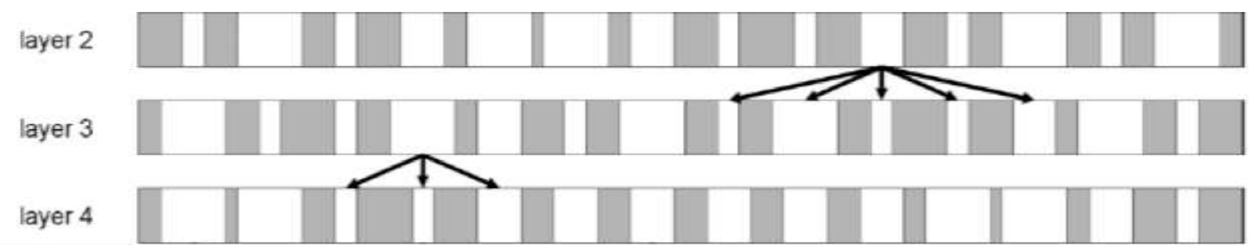


Figure 1: Restricted Lateral Flow model. The particles are allowed to move only by a specified number of pores when transversing from one layer to the next.

Capstone Laboratory Projects on the Numerical Study of the Instability of Miscible and Immiscible Thin Fluid Layers on Substrates

Instructor: Shahriar Afkhami

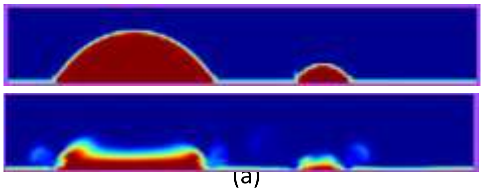
Participating Students: Ester J. Calderon, Jacob Dresher, Lauren J. Faber, Darren Gomez, Peter G. Lehrer, Jimmy Lu, Colin E. Pope, Taylor K. Tu, Ryan L. Van Treuren, Ines Vujkovac

This capstone project involves the study of the fluid dynamical problem of thin bilayer films. There has been a recent experimental study on the Ag-Au bimetallic nanoparticles produced by the laser dewetting of Ag/Au bilayer films on a substrate. The aim of this activity here is to develop a physical understanding of final properties of bimetallic systems, and to enhance the knowledge of the structure and morphology of the nanoparticles. Of particular focus of this study here is to analyze the differences in the composition and the final size distribution of the nanoparticles using direct numerical simulations. While there are many parameters involve in the problem setting, here we only focus on changing the relative thickness of each layer, changing the relative viscosity of each layer, as well as relative viscosity of the surrounding, and finally varying the equilibrium contact angle.

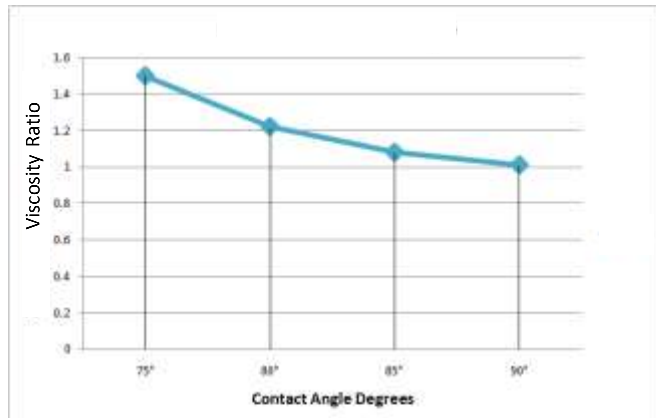
Numerical study of the instability of miscible and immiscible thin fluid layers on substrates: This part involves a numerical study of the evolution of thin layers of miscible liquids, in contact with the immiscible surrounding fluid, toward equilibrium shapes. The understanding of competing forces for such systems is currently poor. This study aims at unraveling such mechanisms using direct numerical simulations. The final goal is to study the structural evolution and final morphology of nanometric bilayers consisted of miscible liquids. This findings will help us understand how to control the synthesis of alloy metallic nanoparticles. The specific goal is to study the fluids dewetting process when there are two layers of various thicknesses, with different viscosity components, and see the how changing these properties may affect the profile of the fluid as it dewets. We have implemented our state-of-the-art numerical framework that solves the full Navier–Stokes equations and tracks the interface based on the Volume-of-Fluid method, to study the compositional structure of thin bilayer films. Our preliminary numerical results reveal some novel and controllable mechanisms of the dynamics of bilayer thin films, that are unstable due to the presence of destabilizing van der Waals forces. Specifically:

- In the absence of a second layer, the instability of the thin film follows closely the predictions of the linear stability analysis.
- By making the second (bottom) layer slightly more viscous than the top layer, while the bilayer still remains unstable, the nonlinear instability leads to the formation of a secondary droplet, suggesting that even a small spatial variation of the viscosity can significantly alter the instability characteristic length scales (see Fig. 1(a)).
- For moderate thicknesses of the bottom layers, the formation of the secondary droplet is independent of the thickness ratio.
- There appears to be a correlation between the viscosity ratio and contact angle defining the threshold for the formation of a secondary droplet (see Fig. 1(c)).

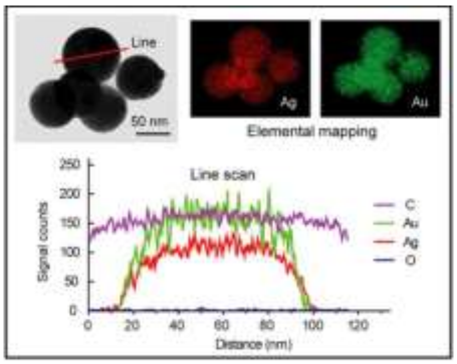
We will perform further numerical simulations to reach definite answers in particular regarding the above findings when comparing various film lengths, layer sequence, and the surrounding viscosity. We have also achieved some very interesting results regarding the compositional structure of the bilayer system. Our preliminary numerical results reveal that the obtained final droplets have a composition of the two layers over the whole volume of the droplets (see Fig. 1(a) bottom panel), showing qualitatively similar distribution illustrated by the experimental results from [Applied Surface Science 434 (2018) 1293–1299].



(a)



(c)



(b)

Figure 1: (a) Final drop formation as a results of the instability of a bilayer liquid film; the bottom layer is only slightly more viscous than the top layer. The top panel show the whole droplet, as well as the secondary droplet, and the bottom panel shows the compositional structure of the final drop distribution. (b) Experimental results from [Applied Surface Science 434 (2018) 1293–1299], showing similar findings regarding the drop formation of an Ag 5 nm/Au 5 nm film observed after irradiation by a single pulse laser. (c) The threshold for the formation of the secondary droplet (symbols), showing the viscosity ratio of the bottom layer to the top layer as a function of the contact angle.

Future Work

To numerically illustrate the fabrication of particles with varying com- positional distribution. We will continue this direction by the involved undergrad students who are currently working on the project. This re- search direction is expected to lead soon to a preparation of a manuscript.

B. GRADUATE PROGRAMS

Graduate Activities Report
Richard Moore, Associate Chair for Graduate Studies

The Department of Mathematical Sciences takes great pride in the quality of its graduate programs. In addition to four Master's programs in Applied Mathematics, Applied Statistics, Biostatistics, and Mathematical & Computational Finance, our PhD program continues to attract high-caliber students who work closely with faculty to conduct original research at the cutting edge of applied mathematics and statistics. We have recently introduced four Graduate Certificates in Applied Statistics, Biostatistics, Financial Mathematics, and Quantitative Tools for Finance. 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 prior to 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 international meetings such as those organized by SIAM and the APS. Almost all of our students also present posters at our annual Frontiers in Applied and Computational Mathematics conference, which is described in Section VIB of this report. Most of our students have at least one high-quality publication accepted by the time of their graduation, which is essential for success in today's job market.

Our doctoral students are very engaged in departmental activities, and they regularly organize academic, career-oriented, and social events under the banner of the NJIT SIAM Chapter. Many of them take advantage of training opportunities such as the annual Workshop on Mathematical Problems in Industry, which will be hosted by NJIT in June of 2019. Our students have had much recent success in finding internships, in governmental research facilities such as NASA, Oak Ridge National Laboratory, and Argonne National Laboratory or in private industries such as Pixar Animation Studios.

It is ultimately the offers our students receive after graduation that indicate the health of our programs. Our recent graduates have been very successful, receiving offers to postdoctoral positions at elite universities such as New York University, to governmental research laboratories such as the US Army Coastal and Hydraulics Laboratory, and to industrial positions at companies including Merck Pharmaceuticals, Sanofi, and the Philadelphia 76ers.

CAMS Research Day 2018

1. Andrew DeStefan
   Advisor: Richard Moore
   Optimal Sampling Paths for Autonomous Vehicles in Uncertain Ocean Flows

2. Thilo Simon
   Advisor: Cyrill Muratov
   A nonlocal isoperimetric problem with dipolar repulsion

3. Yiming Yu
   Co-Advisors: Richard Moore and Cyrill Muratov
   Sampling of thermally induced switching in spin-torque magnetic nanodevices

4. Yinbo Chen
   Advisor: Victor Matveev
   Stationary Approximations to Single-Channel Ca2+ Nanodomains

5. Matthew Moye
   Advisor: Casey Diekman
   Data Assimilation Methods for Neuronal State and Parameter Estimation

6. William Batson
   Co-Advisors: Linda Cummings, David Shirokoff, and Lou Kondic
   Models and applications of liquid film thermocapillary instabilities

7. Michael Lam
   Co-Advisors: Linda Cummings and Lou Kondic
   Instability in Nematic Liquid Crystal Films and GPU computing

8. Binan Gu
   Co-Advisors: Linda Cummings and Lou Kondic
   Stochastic Modeling of Membrane Filtration with Complex Morphology

9. Zhongcheng Lin
   Advisor: Antai Wang
   A simple test for dependent censoring

PhDs Awarded in the Period Covered by the Report

Valeria Barra
Thesis: Numerical Simulations of Thin Viscoelastic Films
Advisors: Shahriar Afkhami, Lou Kondic, and Shawn Chester

Rui Cao
Thesis: Numerical Methods and Simulation for Time Dependent Electrokinetic Flow
Advisors: Michael Booty and Michael Siegel

Szu-Pei Fu
Thesis: Efficient Coarse-Grained Brownian Dynamics Simulations for DNA and Lipid Bilayer Membrane with Hydrodynamic Interactions
Advisors: Yuan-nan Young and Shidong Jiang

Xieyang Jia
Thesis: Survival Analysis Using Archimedean Copula
Advisor: Antai Wang

Michael Lam
Thesis: Instabilities in Nematic Liquid Crystal Films and Droplets
Advisors: Linda J. Cummings and Lou Kondic

Randolph J. Leiser
Thesis: Effects of Heterogeneity on Oscillatory Network Dynamics
Advisor: Horacio Rotstein

Haiyang Qi
Thesis: Boundary Integral Equation Based Numerical Solutions of Helmholtz Transmission Problems for Composite Scatters
Advisor: Catalin Turc

Pejman Sanaei
Thesis: Mathematical Modeling of Membrane Filtration
Advisor: Linda J. Cummings

Yalin Zhu
Thesis: Topics on Multiple Hypotheses Testing and Generalized Linear Model
Advisors: Sunil Dhar and Wenge Guo

Publications, Presentations, & Conferences
***Not Including FACM Participation**

Mahdi Bandegi

Publications

Approximate global minimizers to pairwise interaction problems via convex relaxation, (with D. Shirokoff), *SIAM Journal on Applied Dynamical Systems*, Vol. 17, pp. 417-456, January 2018.

Posters

April 18, 2018: 2018 Dana Knox Student Research Showcase, NJIT, Newark NJ
Conic programming of a variational inequality motivated from self-assembly

Presentations

June 8, 2018: NJIT Graduate Student Summer Seminar, NJIT, Newark, NJ
Efficient solvers for some conic variational problems

Valeria Barra

Presentations

July 7, 2017: Student Talk, NJIT, Newark, NJ
Numerical study of thin viscoelastic films

January 12, 2018: American Mathematical Society Joint Mathematics Meeting 2018, San Diego, CA
Numerical simulations of thin viscoelastic films

Conferences and Workshop Attendance

January 10-13, 2018: AMS JMM 2018 Judge for Research Poster Showcase, San Diego, CA

April 13-15, 2018: Scientista Symposium Judge for Research Poster Showcase, Microsoft, New York, NY

June 25-29, 2018: MPI 2018, Claremont, CA

Chao Cheng

Presentations

June 8, 2018: 16th Annual Northeastern Granular Materials Workshop, Yale University, New Haven, CT
The precursors to stick-slip events in sheared granular systems

Conferences and Workshop Attendance

May 25, 2018: 9th Northeastern Complex Fluids & Soft Matter Workshop, University of Pennsylvania, Philadelphia, PA

Yinbo Chen

Posters

March 2018: IBNR Graduate Student/Post-Doctoral Research Showcase, NJIT, Newark NJ
Stationary approximations to single-channel CA2+ nanodomains

Presentations

April 25, 2018: CAMS Research Day, NJIT, Newark, NJ
Stationary approximations to single-channel CA2+ nanodomains

Linwan Feng

Presentations

July 2017: NJIT Graduate Student Summer Workshop Seminar, NJIT, Newark, NJ
Penalty methods and the numerical solutions of shallow water wave equations

Binan Gu

Presentations

April 25, 2018: CAMS Research Day, NJIT, Newark, NJ
Stochastic Modeling of membrane filtration with complex morphology

May 25, 2018: Northeastern Complex Fluids & Soft Matter Workshop, U. of Pennsylvania, Philadelphia, PA
Modeling asymmetry of membrane filters with complex morphology

Conferences and Workshop Attendance

June 4-15, 2018: Intensive Program on Fluids and Waves, GSSI, L'Aquila, Italy

Lenka Kovalcinova (Postdoctoral Associate)

Presentation

March 7, 2018: APS March Meeting, UCLA, Los Angeles, CA
Comparison of the force network topology of the 2D and 3D granular systems

Michael Lam

Publications

Stability of thin fluid films characterised by a complex form of effective disjoining pressure, (with L.J. Cummings and L. Kondic), *Journal of Fluid Mechanics,* Vol. 841, pp. 925-961, April 2018.

Posters

April 2018: 2018 Dana Knox Student Research Showcase, NJIT, Newark NJ
The growth of colloid nuclei under microgravity (with B. Khusid, L. Kondic, and W. Meyer)

Presentations

November 19, 2017: APS 70^{th} Annual Division of Fluid Dynamics Meeting, Denver, CO
Growth and interaction of colloid nuclei (with B. Khusid, L. Kondic, and W. Meyers)

July 25-27, 2017: FUNWAVE-TVD Workshop, University of Delaware, Newark, DE
Optimization in FUNWAVE-TVD with parallel I/O (with M. Malej)

April 25, 2018: CAMS Research Day, NJIT, Newark, NJ
Instabilities in nematic liquid crystal films and GPU computing (with L.J. Cummings and L. Kondic)

Conferences and Workshop Attendance

2017: APS 70^{th} Annual Division of Fluid Dynamics Meeting, Denver, CO

2017: FUNWAVE-TVD Workshop, University of Delaware, Newark, DE

Zhongcheng Lin

Conferences and Workshops

July 29 – August 3, 2017: Joint Statistical Meetings, Baltimore, MD

Yixuan Sun

Presentations

April 7, 2018: Applied Math Days, Rensselaer Polytechnic Institute, Troy, NY
Optimizing the design of pleated membrane filters

May 25, 2018: NCS9, University of Pennsylvania, Philadelphia, PA
Optimizing the design of pleated membrane filters

Conferences and Workshop Attendance

June 6-July 27, 2018: HPC Workshop, NJIT, Newark, NJ

Axel Turnquist

Publications

Quadratization: From Conductance-Based Models to Caricature Models with Parabolic Nonlinearities (with H. Rotstein), in Encyclopedia of Computational Neuroscience, ed. D. Jaeger and R.Jung, Springer, New York, NY, November 2017.

Li Yu

Presentations

August 1, 2017: Joint Statistical Meeting, Baltimore, MD
A generalized graphical approach to sequentially rejective multiple testing procedures

Yalin Zhu

Presentations

September 27, 2017: 2017 ASA Biopharmaceutical Section Regulatory-Industry Statistics Workshop, Washington, DC
A selective inference-based two-stage procedure for clinical safety studies

August 1, 2017: Joint Statistical Meetings, Baltimore, MD
A selective inference-based two-stage procedure for clinical safety studies

AWARDS

Valeria Barra

Fall 2017: Ahluwalia Doctoral Fellowship Award

Michael Lam

Fall 2017: Ahluwalia Doctoral Fellowship Award

Axel Turnquist

Fall 2018: NSF Graduate Research Fellowship

PhD Summer Program Activities

Student Talks - Summer 2018

Friday, June 08, **Mahdi Bandegi**
Efficient solvers for some conic variational problems

Wednesday, June 13, **Chao Cheng**
Intermittent dynamics of dense particulate matter

Friday, June 15, **Keyang Zhang**
Convergence of a boundary integral method for interfacial Stokes flow

Wednesday, June 20, **Yan Zhang**
Some topics on modern statistical inference

Friday, June 22, **Ryan Atwater**
Studies of two-phase flow with soluble surfactant

Wednesday, June 27, **Subha Datta**
WPSVM for spatial point processes directed by Gaussian random fields

Friday, June 29, **Jacob Lesniewski**
Eigenvalue problems for nonlinear partial differential equations

Friday, June 29, **Soheil Saghafi**
Numerical methods for dispersive shallow water wave equations

Friday, July 06, **Binan Gu**
Stochastic modeling of membrane filtration with complex morphology

Wednesday, July 11, **Malik Chabane**
On resonant interactions of gravity-capillary waves

Friday, July 13, **Yinbo Chen**
Stationary approximations to single-channel Ca2+ nanodomains

Wednesday, July 18, **Matthew Moye**
Data assimilation methods for neuronal state and parameter estimation

Wednesday, July 25, **Linwan Feng**
Numerical methods for dispersive shallow water wave equations

Friday, July 27, **Guangyuan Liao**
Modeling for pleated filter and optimization for filter design

Wednesday, August 01, **Brandon Behring**
Dynamics near the leapfrogging vortex quartet

Friday, August 03, **Jimmie Adriazola**
Optimizing beam matching in waveguides

Friday, August 03, **Erli Wind-Andersen**
A brief introduction to integral equations and singular kernel evaluation

Wednesday, August 08, **Yixuan Sun**
Modeling for pleated filter and optimization for filter design

Friday, August 10, **Gan Luan**
Analysis of racial disparities in New York City's 'Stop-and-Frisk' policy by spatial point process

Friday, August 10, **Axel Turnquist**
Monge-Ampere PDE on a sphere

Wednesday, August 15, **Tadanaga Takahashi**
Non-overlapping domain decomposition method applied to the scattering problem

Friday, August 17, **Lauren Barnes**
Trajectory of a walking droplet

Friday, August 17, **Yuexin Liu**
Deep learning in self-assembly colloids

Wednesday, August 22, **Beibei Li**

Wednesday, August 22, **Atefeh Javidi**
Analysis of binary data based on semiparametric approach

Friday, August 24, **Rituparna Basak**
Application of machine learning to stick-slip dynamics of a particulate media

Friday, August 24, **Ruqi Pei**
A fast algorithm for particle simulations

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