CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT
2016 – 2017

July 1, 2016 – June 30, 2017

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 32st 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 fourth summer of engaging undergraduates in research. The grant enables us to significantly enhance the exposure of undergraduate mathematical science students to topics in computational and data-enabled science and engineering.

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

- Fourteen new funded projects, including ten by the National Science Foundation – a substantial increase from the previous years.

- The oversight of additional seventeen 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, the Department of Defense, and other state and local agencies such as the NJ Meadowlands Commission and private industry.

- Hosting of the 14th Frontiers in Applied and Computational Mathematics (FACM) conference. The two day meeting was attended by more than 130 participants, and focused on mathematics in industry, including porous media flow, computational electromagnetics, pharmaceutical statistics, and various aspects of data science, among others. FACM conference was scheduled to follow the 33rd Mathematical Problems in Industry Workshop (MPI), also held at NJIT and organized by the CAMS members.

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 2016-2017

Dr. John S. Abbott	Corning Incorporated
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
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
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 9, **Rolf Ryham**, Fordham University
Explicit Stokes Flows for a Moving Internal Boundary with Applications to Pore Dynamics in Liposomes

September 16, **Stephen Wiggins**, University of Bristol
Roaming: Dynamical Reaction Pathways in Phase Space

September 23, **Shawn Walker**, Louisiana State University
A Structure Preserving Discretization for the Ericksen Model with Colloidal Effects and External Fields

September 30, **Ehud Yariv**, Technion - Israel Institute of Technology
Electrohydrodynamic Flows under Strong Electric Fields

October 7, **Chi-Wang Shu**, Brown University
Discontinuous Galerkin Method for Convection Dominated Partial Differential Equations

October 14, **Georg Stadler**, New York University
Computational Methods for Bayesian Inverse Problems Governed

October 21, **Eva A. Kanso**, USC
Active and Driven Crystals in Confined Microfluidic Channels

October 28, **Mike Siegel**, NJIT
A Local Target-Specific QBX Method for Laplace's Equation in 3D Multiply-Connected Domains

November 4, **Tim Sauer**, George Mason University
Density Estimation and Topology from Data

November 11, **Vianey Villamizar**, Brigham Young University
Exact Local Absorbing Boundary Conditions in Terms of Farfield Expansions

November 18, **Horacio Rotstein**, NJIT
Inhibition-Based Resonance in a Hippocampal CA1 Network: A Modeling Study

December 2, **Shuwang Li**, IIT
An Efficient Rescaling Scheme for Computing Moving Interface Problems

January 20, **Brittany Froese**, NJIT
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

January 27, **Andrew Comech**, Texas A&M University
Stability of Solitary Waves in the Nonlinear Dirac Equation

February 3**, Douglas Wright**, Drexel University
Traveling Waves in Diatomic Fermi-Pasta-Ulam-Tsingou Lattices

February 10, **Mark Hoefer**, University of Colorado at Boulder
Dispersive Hydrodynamics

February 17, **Sean Sun**, Johns Hopkins University
Water Dynamics in Cell Mechanics

February 24, **Ruben Rosales**, MIT
The Correction Function Method [CFM] for Interfaces/Boundaries Embedded in Regular Grids

March 3, **Yuriko Renardy**, Virginia Tech
A Viscoelastic Model for Thixotropic Yield Stress Fluids: Shear, Elongation, and Shear Banding

March 10, **Diane Henderson**, Pennsylvania State University
A Method to Recover Water-Wave Profiles from Bottom Pressure Measurements

March 24**, Linda Cummings**, NJIT
Modeling and Simulation of Thin Film Flows of Nematic Liquid Crystal

March 31, **Steven G. Johnson**, MIT
Bounds on Light-Matter Interactions

April 7, **Kresimir Josic**, University of Houston
Spatio-temporal Dynamics of Synthetic Microbial Consortia

April 21, **Robert Krasny**, University of Michigan at Ann Arbor
Particle Simulations for Protein/Solvent Electrostatics and Fluid Flow on a Sphere

April 28, **He Xiaoming**, Missouri University of Science & Technology
Dual-Porosity Stokes Model and Finite Element Method for Coupling Dual-Porosity Flow and Free Flow

Applied Statistics Seminar

September 29, **Han Liu**, Princeton University
Combinatorial Inference

October 6, **Dan Yang**, Department of Statistics, Rutgers University
Bilinear Regression with Matrix Covariates in High Dimensions

October 13, **Xi Cheng**, NYU, Leonard N. Stern School of Business
Statistical Inference for Model Parameters with Stochastic Gradient Descent

October 20, **Larry Tang**, Department of Statistics, George Mason University
ROC Curve and Likelihood Ratio in Diagnostic Medicine and Forensics

November 17, **Zhiliang Ying**, Department of Statistics, Columbia University
Latent Class and Latent Factor Models for Item Response Data

December 1, **Dai Feng**, Merck & Co., Inc.
Using the Latent Correlations to Measure the Association between Continuous and Binary Markers with Repeated Measurements

February 23, **Rong Chen**, Dept. of Statistics, Rutgers University
Factor Model for High Dimensional Matrix Valued Time Series

March 9, **Pierre C. Bellec**, Dept. of Statistics, Rutgers University
Optimistic Lower Bounds for Convex Regularized Least-Squares

March 22, **Zhezhen Jin**, Dept. of Biostatistics, Columbia University
Statistical Issues and Challenges in Biomedical Studies

March 30, **Wei Biao Wu**, Dept. of Statistics, University of Chicago
Asymptotic Theory for Quadratic Forms of High-Dimensional Data

April 6, **Peter X. K. Song**, Dept. of Biostatistics, University of Michigan
Regression Analysis of Networked Data

April 7, **Yichuan Zhao**, Dept. of Mathematics and Statistics, Georgia State U.
A Nonparametric Approach for Partial Areas under ROC Curves

April 13, **Haiyan Su**, Dept. of Mathematical Sciences, Montclair State University
Generalized P-Values for Testing Zero-Variance Components in Linear Mixed-Effects Models

April 20, **Hui Zhang**, Dept. of Biostatistics, St. Jude Children's Research Hospital
Major Statistical Challenges in Count Data Analysis

April 27, **Hongyuan Cao**, Dept. of Statistics, University of Missouri
Analysis of Asynchronous Longitudinal Data with Partially Linear Models

Mathematical Biology Seminar

September 13, **Oreste Piro**, University of the Balearic Islands
Can Dynamical Criticality Lead to Statistical Criticality?: An Affirmative Answer from a Model of Neural Tissue

September 27, **Bipin Rajendran**, NJIT
Bio-inspired Algorithms for Learning & Adaptation

October 11, **Ashok Litwin-Kumar**, Columbia University
Optimal Connectivity for Random and Learned Neural Representations

October 25, **Arjun Yadaw**, Mount Sinai
A Comprehensive, Multi-Scale Dynamical Model of Cannabionoid (CB1) Receptor Regulated Neurite Outgrowth

November 22, **Elad Schneidman**, Weizmann Institute of Science
A Thesaurus for Neural Population Codes and a Neural Metric for Stimulus Space

December 5, **Edward J. Banigan**, Northwestern University
Emergent Length Scales of the Cell Nucleus

December 6, **Christina Weaver**, Franklin and Marshall College
Cortical Diversity and Brain Aging: Insights from Computational Modeling

February 21, **Theodore Vo**, Boston University
Canard Phenomena in Mathematical Neuroscience

February 28, **Tyrus Berry**, George Mason University
Data Assimilation with and Without a Model

March 7, **Toni Guillamon**, Universitat Politècnica de Catalunya
Quasiperiodic Forcing in Models of Bistable Perception

March 21, **Daniel Santa Cruz Damineli**, University of Maryland
Biological Functions of Oscillatory Systems: Specific Signatures Underlie Distinct Growth Regimes in Pollen Tubes

March 28, **Karim Azer**, Sanofi
Mathematical Biology and Pharmacology Models in Pharma: Challenges and Applications

April 11, **Lucy Spardy**, Skidmore College
Limb Coordination in Crayfish Swimming: Understanding the Role of Long Range Connections

April 18, **Shy Shoham**, The Technion – Israel Institute of Technology
'Exciting' Biophysics for Interfacing with Large-Scale Neuronal Networks

Fluid Mechanics and Waves Seminars

September 12, **William Batson**, NJIT
Oscillatory Excitations in Interfacial Fluid Dynamics

September 26, **Enkeleida Lushi**, Brown University/ CIMS
Self-organization in Confined Swimmer Suspensions

October 17, **Kyongmin Yeo**, IBM Research
Collective Motions in Active Suspensions of Micro-Rotors

November 7, **Anand Oza**, CIMS
Coarse-grained Models for Interacting Flapping Swimmers

November 14, **Valery Slastikov**, Bristol
The Structure of Two Dimensional Liquid Crystal Point Defects in the Landau-de Gennes Model

March 27, **Tiago Salvador**, McGill University
Building Accurate Convergent Finite Difference Schemes for Elliptic Partial Differential Equations

April 3, **Ricardo Barros**, Loughborough University
Large Amplitude Internal Waves in Three-Layer Flows

April 10, **Luiz Faria**, MIT
Towards an Asymptotic Theory of Weak Heat Release Combustion

April 17, **Ian Griffiths**, University of Oxford
Wrinkly Smoothie

April 24, **Luc Deike**, Princeton University
Air Entrainment and Bubble Statistics under Breaking Waves

May 1, **Michael Mueller**, Princeton University
Physics-Based Approaches to Model Form Uncertainty Quantification for Large Eddy Simulation of Turbulent Combustion

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Shahriar Afkhami

Substrate Melting During Laser Heating of Nanoscale Metal Films (with F. Font and L. Kondic), *Int. J. Heat Mass Transfer*, Vol. 113, pp. 237, May 2017.

Interfacial Dynamics of Thin Viscoelastic Films and Drops (with V. Barra and L. Kondic), *Journal of Non-Newtonian Fluid Mechanics*, Vol. 237, pp. 26-38, October 2016.

Denis L. Blackmore

Long-Time Behavior of Solutions and Chaos in Reaction-Diffusion Equations (with K. Soltanov, and A. Prykarpatski), *Chaos, Solitons & Fractals*, Vol. 99, pp. 91-100, May 2017.

Hamiltonian Operators and Related Integrable Differential-Algebraic Novikov—Leibniz Type Structures (with O. Artemovych, and A. Prykarpatski), *Asian Journal of Mathematical and Computational Research*, Vol. 17, pp. 184-203, April 2017.

Simulation, Modeling and Dynamical Analysis of Multibody Flows (with A. D. Rosato, S. Sen, and H. Wu), *International Journal of Modern Physics B*, Vol. 31, pp. 1742004, April 2017.

Poisson Brackets, Novikov—Leibniz Structures and Integrable Riemann Hydrodynamic Systems (with O. Artemovych, and A. Prykarpatski), *Journal of Nonlinear Mathematical Physics*, Vol. 24, pp. 41-72, January 2017.

Neimark—Sacker Bifurcations and Evidence of Chaos in a Discrete Dynamical System Model of Walkers (with A. Rahman), *Chaos, Solitons & Fractals*, Vol. 91, pp. 339-349, October 2016.

Amitabha K. Bose

Entrainment Maps: A New Tool for Understanding Circadian Oscillator Models (with C. O. Diekman), *Journal of Biological Rhythms*, Vol. 31, pp. 598-616, October 2016.

Wooyoung Choi

Internal Solitary Waves in a Two-Fluid System with a Free Surface (with T. Kodaira, T. Waseda, and M. Miyata), Vol 84, pp. 201-223, October 2016.

Linda J. Cummings

Flow and Fouling in Membrane Filters: Effects of Membrane Morphology (with P. Sanaei), *Journal of Fluid Mechanics*, Vol. 818, pp. 744-771, April 2017.

Effects of Flexoelectricity and Weak Anchoring on a Freedericksz Transition Cell (with E. Mema and L. Kondic), *Physical Review E*, Vol. 95, pp. 12701, March 2017.

Casey O. Diekman

Entrainment Maps: a New Tool for Understanding Circadian Oscillator Models (with A. K. Bose), *Journal of Biological Rhythms*, Vol. 31, pp. 598-616, October 2016.

Yixin Fang

Smoking-Cessation Interventions for Urban Hospital Patients: a Randomized Comparative Effectiveness Trial (with S. E. Sherman, A. R. Link, E. S. Rogers, P. Krebs, J. A. Ladapo, D. R. Shelley, B. Wang, and E. Grossman), *American Journal of Preventive Medicine*, Vol. 51, pp. 566–577, October 2016.

End Tidal Carbon Dioxide As a Screening Tool for Computed Tomography Angiogram in Postoperative Orthopaedic Patients Suspected of Pulmonary Embolism (with A. J. Ramme, E. Iturrate, E. Dweck, D. J. Steiger, L. H. Hutzler, B. Wang, J. A. Bosco, and A. E. Sigmund), *The Journal of arthroplasty*, Vol. 31, pp. 2348–2352, October 2016.

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, September 2016.

A Taxonomy of Seven-Day Readmissions to an Urban Teaching Hospital (with D. Burke, N. Link, D. Bails, and M. P. Janjigian), *Journal of hospital medicine*, Vol. 11, pp. 33–38, 2016.

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.

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.

Single-Index Model for Inhomogeneous Spatial Point Processes (with J. M. Loh), *Statistica Sinica*, Vol. 27, pp. 555-574, 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 26, pp. 375-381, May 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), *AIDS and Behavior*, Vol 21, pp. 2014–2022, July 2017.

Association between End-Of-Rotation Resident Transition in Care and Mortality among Hospitalized Patients (with J. L. Denson, A. Jensen, H. S. Saag, B. Wang, L. I. Horwitz, L. Evans, S. E. Sherman), *JAMA*, Vol. 316, pp. 2204–2213, December 2016.

The Accuracy of the Laryngopharyngeal Reflux Diagnosis: Utility of the Stroboscopic Exam (with M. A Fritz, M. J. Persky, C. B. Simpson, M. R. Amin, L. M. Akst, and G. N. Postma), *Otolaryngology–Head and Neck Surgery*, Vol. 155, pp. 629–634, October 2016.

Brittany D. Hamfeldt

Numerical Methods for the 2-Hessian Elliptic Partial Differential Equation (with A. M. Oberman, and T. Salvador), *IMA Journal of Numerical Analysis*, Vol. 37, pp. 209-236, January 2017.

Optimal Transport for Seismic Full Waveform Inversion (with B. Engquist and Y. Yang), *Communications in Mathematical Sciences*, Vol. 14, pp. 2309-2330, October 2016.

Shidong Jiang

A Quantitative Study of the Effect of Cladding Thickness on Modal Confinement Loss in Photonic Waveguides (with J. Lai), *Optics Express*, Vol. 24, pp. 24872-24882, October 2016.

Lou Kondic

Interfacial Dynamics of Thin Viscoelastic Films and Drops (with V. Barra and S. Afkhami), *Journal of Non-Newtonian Fluid Mechanics*, Vol. 237, pp. 26-38, October 2016.

Effects of Flexoelectricity and Weak Anchoring on a Freedericksz Transition Cell (with E. Mema and L. J. Cummings), *Physical Review E*, Vol. 95, pp. 12701, March 2017.

Evolution of Force Networks in Dense Granular Systems Close to Jamming (with L. Kondic, M. Kramar, L. Kovalcinova, and K. Mischaikow), *European Physical Journal Web of Conferences*, Vol. 140, pp. 15014, June 2017.

Substrate Melting During Laser Heating of Nanoscale Metal Films (with F. Font and S. Afkhami), *Int. J. Heat Mass Transfer*, Vol. 113, pp. 237, May 2017.

Ji Meng Loh

Baseline and Distribution of Organic Pollutants and Heavy Metals in Tidal Creek Sediments after Hurricane Sandy in the Meadowlands of New Jersey, *Environmental Earth Science*, Vol. 76, pp. 293, April 2017.

Quantitative Comparison of Two-Point Correlation Functions from Real and Mock SDSS Galaxy Catalog (with W. Jang), *Astrophysical Journal*, Vol. 839, p. 62, April 2017.

Single-Index Model for Inhomogeneous Spatial Point Processes (with Y. Fang), *Statistica Sinica*, Vol. 27, pp. 555-574, January 2017.

Victor V. Matveev

Ca2+ Channel Clustering with Insulin-Containing Granules Is Disturbed in Type 2 Diabetes (with N. R. Gandasi, P. Yin, M. Riz, M. V. Chibalina, G. Cortese, P.-E. Lund, P. Rorsman, A. Sherman, M. G. Pedersen, and S. Barg), *Journal of Clinical Investigation*, Vol. 127, pp. 2353–2364, June 2017.

Padé Approximation of a Stationary Single-Channel Calcium Nanodomain, *Biophysical Journal*, Vol. 111, pp. 2062-2074, November 2016.

Zoi-Heleni Michalopoulou

A Direct Method for the Estimation of Sediment Sound Speed with a Horizontal Array in Shallow Water (with T. Lin), *IEEE Journal of Oceanic Engineering*, Vol. 42, pp. 208-218, January 2017.

Sediment Sound Speed Inversion with Time-Frequency Analysis and Modal Arrival Time Probability Density Functions (with A. Pole), *Journal of the Acoustical Society of America*, Vol. 140, pp. EL131-EL136, July 2016.

Passive Fathometer Reflector Identification with Phase Shift Modeling (with P. Gerstoft), *Journal of the Acoustical Society of America*, Vol. 140, pp. EL125-EL130, July 2016.

Petronije Milojevic

On the Dimension of the Set of (Positive) Solutions of Nonlinear Equations with Applications, *Electronic Journal of Differential Equations*, Vol. 2016, pp. 12055, August 2016.

Richard O. Moore

Modal Analysis of Spatial Pattern Formation in Fused Silica under Ultraviolet Irradiation (with D. A. Edwards), *Journal of the Optical Society of America B*, Vol. 33, pp. 1709-1715, July 2016.

Cyrill B. Muratov

Threshold Phenomena for Symmetric-Decreasing Radial Solutions of Reaction-Diffusion Equations (with X. Zhong), *Discrete Cont. Dyn. Syst. A*, Vol. 37, pp. 915-944, February 2017.

Domain Structure of Ultrathin Ferromagnetic Elements in the Presence of Dzyaloshinskii-Moriya Interaction (with V. Slastikov), *Proc. Roy. Soc. Lond. A*, Vol. 473, pp. 20160666, January 2017.

A Reduced Model for Precessional Switching of Thin-Film Nanomagnets under the Influence of Spin-Torque (with R. G. Lund, G. D. Chaves-O'Flynn, and A. D. Kent), *Phys. Rev. B*, Vol. 94, pp. 144425, October 2016.

Farzan Nadim

Membrane Potential Resonance Frequency Directly Influences Network Frequency through Gap Junctions (with Y. Chen, X. Li, and H. G. Rotstein), *Journal of Neurophysiology*, Vol. 116, pp. 1554-1563, July 2016.

Peter G. Petropolous

Electric field stabilization of viscous liquid layers coating the underside of a surface (with T. Anderson, R. Cimpeanu, and D. Papageorgiou), *Physical Review Fluids*, Vol. 2, pp . 054001, May 2017.

Horacio G. Rotstein

Dynamic Compensation Mechanism Give Rise to Period and Duty Cycle Level Sets in Oscillatory Neuronal Models (with M. Olarinre, and J. P. Golowasch), *Journal of Neurophysiology*, Vol. 116, pp. 2431-2452, November 2016.

Membrane Potential Resonance Frequency Directly Influences Network Frequency through Gap Junctions (with Y. Chen, X. Li, and F. Nadim), *Journal of Neurophysiology*, Vol. 116, pp. 1554-1563, July 2016.

David G. Shirokoff

On the Spectral Gap of a Square Distance Matrix (with X. Cheng, D. Li, and B. Wetton), *Journal of Statistical Physics*, Vol. 166, pp. 1029–1035, December 2016.

Michael S. Siegel

Convergence of a Boundary Integral Method for 3D Interfacial Darcy Flow with Surface Tension (with D. M. Ambrose, and Y. Liu), *Mathematics of Computation*, Vol. 86, pp. 2745-2775, March 2017.

Well-Posedness of Two-Dimensional Hydroelastic Waves (with D. M. Ambrose), *Proceedings of the Royal Society of Edinburgh*, Vol. 147, pp. 529-570, March 2017.

Sundarraman Subramanian

Semiparametric Simultaneous Confidence Bands for the Difference of Survival Functions (with N. Ahmed), *Lifetime Data Analysis/Springer*, Vol. 22, pp. 504-530, October 2016.

Catalin C. Turc

Well-Posed Boundary Integral Equation Formulations and Nyström Discretizations for the Solution of Helmholtz Transmission Problems in Two-Dimensional Lipschitz Domains, *Journal Integral Equations and Applications*, Vol. 28, pp. 395-440, September 2016.

Windowed Green Function Method for Layered-Media Scattering, *SIAM J. Applied Mathematics*, Vol. 75, pp. 1871–1898, September 2016.

Superalgebraically Convergent Smoothly Windowed Lattice Sums for Doubly Periodic Green Functions in Three-Dimensional Space, *Proceedings of The Royal Society A Mathematical Physical and Engineering Sciences*, Vol. 472, pp. 20160255, July 2016.

Yuan-Nan Young

Long-Wave Dynamics of an Elastic Sheet Lubricated By a Thin Liquid Film on a Wetting Substrate (with H. A. Stone), *Physical Review Fluids*, Vol. 2, pp. 64001, June 2017.

PROCEEDINGS PUBLICATIONS

Daniel E. Bunker

Fluid dynamics of hydrophilous pollination in Ruppia (widgeon grass) (with Musunuri, N., Fischer, I., Singh, P., and Pell, S.), *ASME 2016 Fluids Engineering Division Summer Meeting*, pp. V01AT04A009-V01AT04A009, July 2016.

Fluid Dynamics of Hydrophilous Pollination in Ruppia (widgeon grass) (with N. Musunuri, S. Pell, I. Fischer, and P. Singh), *Procedia IUTAM*, Vol. 20, pp. 152-158, 2017.

Yixin Fang

Postoperative Tachycardia: Clinically Meaningful or Benign Consequence of Orthopedic Surgery? (with A. E. Sigmund, M. Chin, H. R. Reynolds, L. I. Horwitz, E. Dweck, and E. Iturrate), *Mayo Clinic Proceedings*, Vol. 92, pp. 98–105, January 2017.

Brittany D. Hamfeldt

Generalised Finite Difference Methods for Monge-Ampere Equations, *Applications of Optimal Transportation in the Natural Sciences: Oberwolfach Report*, Vol. 2017, pp. 45-48, February 2017.

Richard O. Moore

Quasi-Stable Dynamics of a Mode-Locked Laser (with Y. Yu), *13th International Conference on Mathematical and Numerical Aspects of Wave Propagation*, pp. 397-398, May 2017.

B. PRESENTATIONS

Shahriar Afkhami

November 1, 2016: APS DFD Meeting, APS, Portland, OR
Explicit Demonstration of the Role of Marangoni Effect in the Breakup of Nanoscale Liquid Filaments

August 20, 2016: XXIV ICTAM, Montreal, Canada
1. On the computation of viscous forces near the moving contact line
2. Mesh Convergence of Moving Contact Lines in VOF Simulations (Poster)

July 17, 2016: SIAM Annual Meeting, Boston, MA
Wetting and Dewetting of Thin Viscoelastic Drops

November 1, 2016: APS DFD Meeting, APS, Portland, OR
Breakup of Liquid Metal Filaments

Denis L. Blackmore

May 21 & 22, 2017: SIAM Conference on Applications of Dynamical Systems, Snowbird Resort, Utah
1. Bifurcations in Walking Droplet Dynamics
2. Analysis of New Walking Droplet Bifurcations

January 4, 2017: Joint Mathematics Meeting, American Mathematical Society & Mathematical Association of America, Atlanta, GA
1. Discrete Dynamical Modeling and Experimental Investigation of Chaotic NOR Gates and Set/Reset Flip-Flops
2. The Chaotic Ballet of Walking Droplets

November 13, 2016: American Mathematical Society Sectional Conference, Greenboro, NC
New Chaotic Strange Attractors and Their Applications

October 3, 2016: 53rd Annual Meeting of the Society of Engineering Science, College Park, MD
Evolving Dynamics of a Tapped Column of Inelastic Spheres

September 24, 2016: American Mathematical Society Sectional Conference, Brunswick, ME
Neimark-Sacker Bifurcations and Evidence of Chaos in a Discrete Dynamical Model of Walkers

September 15, 2016: Mathematics Forum, Olsztyn, Poland
1. A New Generalized Exactly Solvable Super-Radiance Model
2. Hamiltonian Operators and Related Integrable Differential-Algebraic Novikov—Leibniz Structures

August 26, 2016: International Conference of Theoretical & Applied Mechanics, Montreal, Canada
Magnetic Point Vortex Dynamics in the Plane

July 25, 2016: World Congress on Computational Mechanics XII, Seoul, S. Korea
Investigation of Energetic Granular Flows Via Simulations, Experiments and Theory

Yassine Boubendir

September 30, 2016: SIAM Central States Section Annual Meeting, Little Rock, AR
Asymptotic Expansions of the Helmholtz Equation Solutions in the Case of Convex Obstacles

July 12, 2016: SIAM Annual Meeting, Boston, MA
Asymptotic Expansions of the Helmholtz Equation Solutions in the Case of Convex Obstacles

Bruce G. Bukiet

March 15, 2017: NJEDge Faculty Showcase, Monmouth University, West Long Branch, NJ
Real-Time Assessment of Student Learning Using Tech Tools in Teaching

September 1, 2016: Insitute for Teaching Excellence Workshop, NJIT, Newark, NJ
Your Course Is More than Just the Material: Connecting Your Course to the World

May 18, 2017: Insitute for Teaching Excellence May 2017 Workshop, NJIT, Newark, NJ
Real-Time Assessment of Student Learning Using Tech Tools in Teaching

March 10, 2017: NJIT Guidance Counselor Appreciation Day, NJIT, Newark, NJ
Skills Gained in Earning a Degree in NJIT's College of Science and Liberal Arts and Related Career Opportunities

Daniel E. Bunker

November 1, 2016: APS Division of Fluid Dynamics Annual Meeting, Portland, OR
Fluid Dynamics of Two-Dimensional Pollination in Ruppia Maritima

Wooyoung Choi

August 10, 2016: National Institute of Mathematical Sciences, Daejeon, Korea
On Predicting Strongly Nonlinear Ocean Waves with Wave Breaking

July 29, 2016: Pusan National University, Pusan
Interaction of Internal Waves with Surface Waves

July 27, 2016: Shanghai Jiao Tong University, Shanghai
Highly Nonlinear Wave Phenomena in the Ocean

Linda J. Cummings

May 1, 2017: 9th International Conference on Porous Media, Rotterdam, The Netherlands
Modeling Filtration through Pleated Membrane Filters
November 1, 2016: APS Division of Fluid Dynamics Annual Meeting, Portland, OR

1. Nucleation Type Instabilities in Partially Wetting Nanoscale Nematic Liquid Films
2. Large Scale GPU Simulations of the Generalized Thin Film Equation

Sunil K. Dhar

August 31, 2016: Joint Statistical Meeting, Chicago, Illinois
Multivariate Discrete Distributions and Goodness-Of-Fit

June 24, 2017: Frontiers in Applied and Computational Mathematics (FACM), NJIT, Newark, NJ
Multivariate Logistic Type Models Based on Inverse Sampling Scheme (Poster)

Casey O. Diekman

May 22, 2017: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
Reentrainment of the Circadian Pacemaker during Jet Lag

January 19, 2017: Center for Sleep and Circadian Biology Seminar, Northwestern University, Evanston, IL
Entrainment Maps

July 13, 2016: SIAM Life Sciences Meeting, Boston, MA
Intra- and Intercellular Roles of Hyperexcitation in Circadian Clock Neurons

June 24, 2017: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Modeling Circadian Rhythmicity of Cardiac Arrhythmias (Poster)

June 1, 2017: International Conference on Mathematical Neuroscience, Boulder, CO
Eupnea, Tachypnea, and Autoresuscitation in a Closed-Loop Respiratory Control Model (Poster)

April 21, 2017: Experimental Biology, Chicago, IL
Eupnea, Tachypnea, and Autoresuscitation in a Closed-Loop Respiratory Control Model (Poster)

October 17, 2016: Dynamical Systems and Data Analysis in Neuroscience: Bridging the Gap, Columus, OH
Data Assimilation in Circadian Cells (Poster)

Yixin Fang

June 16, 2017: International Conference on Econometrics and Statistics, Hong Kong
Additive Partially Linear Models for Massive Heterogeneous Data

June 12, 2017: Department of Statistics and Finance, University of Science and Technology of China, Hefei, China
Variable selection in population health research

March 20, 2017: Bell Labs NAACS Guest Speaker, Murray Hill, NJ
Tuning Parameter Selection Based on Stability

October 15, 2016: International Conference on Statistical Distributions and Applications, Niagara Falls, Canada
Variable Selection for Partially Linear Models via Learning Gradients

Wenge Guo

August 1, 2016: Joint Statistical Meetings, Chicago, IL
FDR-Controlling Procedures for Testing a Priori--Ordered Hypotheses

Brittany D. Hamfeldt

June 14, 2017: Chinese Academy of Sciences, Beijing, China
Applications of Optimal Transport and the Wasserstein Metric

June 8 & 13, 2017: Tsinghua University, Beijing, China
1. Applications of Optimal Transport and the Wasserstein Metric
2. Generalised Finite Difference Methods for the Monge-Ampere Equation

May 30, 2017: Numerical methods for PDEs and their applications, Institut Mittag-Leffler, Sweden
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

April 10, 2017: Generated Jacobian Equations: from Geometric Optics to Economics, Banff International Research Station, Banff, Canada
Generalised Finite Difference Methods for Monge-Ampere Equations

March 1, 2017: SIAM Computational Science & Engineering Meeting, SIAM, Atlanta, GA
Numerical Approximation of Optimal Transport Maps Via Monge-Ampere Equations

February 1, 2017: Applications of Optimal Transportation in the Natural Sciences, Mathematisches Forschungsinstitut Oberwolfach, Germany
Generalised Finite Difference Methods for Monge-Ampere Equations

January 20, 2017: Applied Mathematics Colloquium, NJIT, Newark, NJ
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

October 7, 2016: Scientific Computing Seminar, Brown University, Providence, RI
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

September 26, 2016: Applied Math and Analysis Seminar, Duke University, Durham, NC
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

September 23, 2016: Numerical Analysis and Scientific Computing Seminar, Courant Institute of Mathematical Sciences, New York, NY
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

July 18, 2016: Computational Optimal Transportation, Centre de Recherches Mathematiques, Montreal, Canada
Meshfree Finite Difference Methods for the Monge-Ampere Equation

David J. Horntrop

September 1, 2016: SIAM Meeting on Applied Mathematics Education, Philadelphia, PA
Undergraduate Research and Curriculum Development in EXTREEMS-QED at NJIT

Shidong Jiang

August 1, 2016: 7th International Congress of Chinese Mathematicians, Beijing, China
On the Construction and Applications of Sum-Of-Exponentials Approximations

July 1, 2016: SIAM Annual Meetin, Boston, MA, USA
Second Kind Integral Equation Formulation for Mode Calculation of Optical Waveguides

Lou Kondic

October 20, 2016: Seminar, University of Arizona, Tucson, AZ
Films, Rings and Rivulets: Instabilities of Liquid Metals on Nanoscale

June 1, 2017: 7th Northeast Complex Fluids and Soft Matter Workshop, Princeton University, Princeton, NJ
On Connection between Topology and Memory Loss in Sheared Granular Materials

May 1, 2017: 9th International Conference on Porous Media, Rotterdam, The Netherlands
Modeling Filtration through Pleated Membrane Filters

March 13 & 14, 2017: APS March Meeting, New Orleans, LA

1. Energy Dissipation in Sheared Wet Granular Systems
2. On Connection between Topology and Memory Loss in Sheared Granular Materials

March 1, 2017: DARPA MoDyl Workshop, Washington, DC
Topological Properties of Force Networks in Dense Particulate Systems

November 1, 2016: APS Division of Fluid Dynamics Annual Meeting, Portland, OR

1. Explicit Demonstration of the Role of Marangoni Effect in the Breakup of Nanoscale Liquid Filaments
2. Instabilities of Nanometric Fluid Films on a Thermally Conductive Substrate
3. Nucleation Type Instabilities in Partially Wetting Nanoscale Nematic Liquid Films
4. Breakup of Liquid Metal Filaments
5. Large Scale GPU Simulations of the Generalized Thin Film Equation

September 15, 2016: Non-equilibrium dynamics of thin films, CECAM, Lausanne, Switzerland
Films, Rings and Rivulets: Instabilities of Liquid Metals on Nanoscale

June 20, 2017: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Force Chains in Granular Materials (Poster)

May 26, 2017: Conference on Lifetime Data Science, American Statistical Association, Storrs, CT
A Single-Index Model for Inhomogeneous Spatial Point Processes

Victor V. Matveev

June 1, 2017: International Conference on Mathematical Neuroscience, Boulder, CO
Rapid Buffer Approximation for Ca2+ Buffers with Two Binding Sites

October 9, 2016: C.N. Yang Institute for Theoretical Physics 50th Anniversary Conference, Simons Foundation, Stony Brook, NY
From Ising Model to Synaptic Transmission: Adventures in Biophysics and Neuroscience

February 14, 2017: 61st Annual Meeting of the Biophysical Society, New Orleans, LA, USA
Novel Approximation of Equilibrium Single-Channel Ca2+ Nanodomain (Poster)

July 12, 2016: SIAM Life Sciences Meeting, SIAM, Boston, MA
A Novel Approximation Method for Equilibrium Single-Channel Ca2+ Domains (Poster)

Zoi-Heleni Michalopoulou

October 22, 2016: Meeting of the Acoustical Society of America, Kansas City, MO
Tracking in Ocean Acoustics for Geoacoustic Inversion

June 25, 2017: Meeting of the Acoustical Society of America, Boston, MA
Bayesian Modal Identification with Particle Filtering for Sediment Property Inversion

November 28, 2016: Meeting of the Acoustical Society of America, Honolulu, HI
Phase shifts in passive fathometer processing

Richard O. Moore

August 11, 2016: SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA
Numerical Exploration of a Coupled Nonlinear Schroedinger Equation

August 8, 2016: SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA
Biased Monte Carlo Simulations to Compute Phase Slip Probabilities in a Mode-Locked Laser Model

Cyrill B. Muratov

June 1, 2017: Curves and Networks in Geometric Analysis, Centro della Ricerca Matematica, Scuola Normale di Pisa, Pisa, Italy
A Universal Thin Film Model for Ginzburg-Landau Energy with Dipolar Interaction

June 1, 2017: Sol-skyMag: International Conference on Ferromagnetisms and Spintronics, University of the Basque Country, San Sebastian, Spain
Theory of Chiral Domain Walls in Ultrathin Ferromagnetic Films with Perpendicular Magnetic Anisotropy

March 1, 2017: PDE Seminar, University of Pisa, Pisa, Italy
A Universal Thin Film Model for Ginzburg-Landau Energy with Dipolar Interaction

October 1, 2016: Applied Math Seminar, University of Maryland, College Park, MD
A Non-Local Variational Problem Arising From Studies of Nonlinear Charge Screening in Graphene

July 1, 2016: Applied Math Seminar, Swansea University, Swansea, UK
A Non-Local Variational Problem Arising From Studies of Nonlinear Charge Screening in Graphene

Farzan Nadim

November 12, 2016: Annual Meeting of the Society for Neuroscience, San Diego, CA
Neuromodulation Produces Complex Changes in Resonance Profiles of Neurons in an Oscillatory Network (Poster)

Padma Natarajan

March 15, 2017: NJEDge Faculty Showcase, Monmouth University, West Long Branch, NJ
Real-Time Assessment of Student Learning Using Tech Tools in Teaching

May 18, 2017: Institute for Teaching Excellence Workshop, NJIT, Newark, NJ
Real-Time Assessment of Student Learning Using Tech Tools in Teaching

Horacio G. Rotstein

November 18, 2016: Math Colloquium, NJIT, Newark, NJ
Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study

October 3, 2016: Math Graduate Students Seminar, NJIT, Newark, NJ
Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study

September 28, 2016: Seminar Data Science, Networks and Math Biology Seminar, City College of New York, New York, NJ
Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study

July 14, 2016: Boston University, Boston, MA
A Framework for the Study of Neuronal Resonance - Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study

July 5, 2016: Mena Lab - Rutgers University, Newark, NJ
Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study

July 5, 2016: Math Graduate Students Seminar, NJIT, Newark, NJ
Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study

September 20, 2016: Annual Meeting of the Unión Matemática Argentina
Multiple Resonances in Neuronal Networks Connected with Gap Junctions and Delay

November 12, 2016: 2016 Annual Meeting of the Society for Neuroscience, San Diego, CA
Neuromodulation Produces Complex Changes in Resonance Profiles of Neurons in an Oscillatory Network (Poster)

October 17, 2016: Dynamical Systems and Data Analysis in Neuroscience: Bridging the Gap, Columbus, OH

1. Effects of Connectivity Delay on the Subthreshold Resonance in Neural Networks (Poster)
2. Frequency Response Alternating Map (FRAM): a Mutually Forced Approach to Resonant Networks (Poster)
3. Inhibition-Based Theta Resonance in a Hippocampal Network: a Modeling Study (Poster)

July 12, 2016: SIAM Conference on the Life Sciences, Boston, MA
Pancreatic Beta Cells - Synchronization and Intrinsic Heterogeneity (Poster)

David G. Shirokoff

June 24, 2017: Frontiers in Applied and Computational Mathematics, NJIT, Newark NJ
Unconditional Stability for Multistep IMEX Schemes (Poster)

April 7, 2017: Numerical Analysis Seminar, Brown University, Providence, RI
Approximate Global Minimizers to Pairwise Interaction Problems through a Convex/Non-Convex Energy Decomposition: with Applications to Self-Assembly

February 28, 2017: SIAM Conference on Computational Science and Engineering, Atlanta, GA
Unconditional Stability for Multistep IMEX Schemes

February 13, 2017: Applied Analysis Seminar, Louisiana State University, Baton Rouge, LA
Minimizing Pairwise Interactions via a Convex/Non-Convex Decomposition

January 25, 2017: Applied Mathematics and Computing Seminar, Temple University, Philadelphia, PA
Approximate Global Minimizers to Pairwise Interaction Problems through a Convex/Non-Convex Energy Decomposition: with Applications to Self-Assembly.

October 24, 2016: Mathematics Department Colloquium, Montclair State University, Montclair, NJ
Approximate Global Minimizers for Pairwise Interacting Systems

October 20, 2016: Partial Differential Equations Seminar, Drexel University, Philadelphia, PA
Approximate Global Minimizers for Pairwise Interacting Systems

July 15, 2016: SIAM Annual Meeting 2016, Boston, MA
Approximate Global Minimizers for Pairwise Interactions

January 4, 2017: 60th Birthday Conference in Honor of Professor Chi-Wang Shu, Brown University, Providence, RI
Unconditional Stability for Multistep IMEX Schemes (Poster)

Michael S. Siegel

April 1, 2017: Colloquium, Department of Mathematics, Drexel University, Philadelphia, PA
Accurate Computation of Boundary Integrals for Nearly Touching Interfaces

March 22, 2017: Making a Splash - Droplets, Jets and Other Singularities, Computational and Experimental Research in Mathematics, Providence, RI
Accurate Computation of Boundary Integrals for Nearly Touching Interfaces

March 2, 2017: SIAM Conference on Computational Science and Engineering, Atlanta, GA
A Local Target-Specific QBX Method for Laplace's Equation in 3D Multiply- Connected Domains

October 1, 2016: Colloquium, Department of Mathematics Sciences, NJIT, Newark, NJ
A Local Target-Specific QBX Method for Laplace's Equation in 3D Multiply Connected Domains

Sundarraman Subramanian

May 26, 2017: Conference on Lifetime Data Science, American Statistical Association and University of Connecticut, Storrs, CT
Function-Based Hypothesis Testing Via Plug-In Empirical Likelihood in Censored Location-Scale Families

Catalin C. Turc

July 01, 2016: SIAM Annual Meeting, Boston, MA

1. Domain Decomposition Methods for the Solution of Multiple Scattering Problems
2. Efficient Algorithms for the Simulation of Wave Propagation in Periodic Media
3. Well-Posed Boundary Integral Equation Formulations and Nyström Discretizations for the Solution of Helmholtz Transmission Problems in Lipschitz Domains

Yuan-Nan Young

January 1, 2017: University of Grenoble, Grenoble, France
On the Gating of a Mechanosensitive Channel by Fluid Shear Stress

October 17, 2016: Illinois Institute of Technology, Chicago, Il
Mathematical Modeling of Lipid Bilayer Membranes in Biological Fluid-Structure Interactions
March 3, 2017: 2017 SIAM Conference on Computational Sciences and Engineering, Atlanta Georgia
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

March 1, 2017: APS March Meeting, New Orleans, LA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

November 1, 2016: 69th Annual Meeting of the APS-DFD, San Francisco, CA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

July 1, 2016: 2016 SIAM Annual Meeting, Boston, MA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

July 14, 2016: SIAM Life Sciences Meeting, Boston, MA

1. Electrohydrodynamics of a Planar Lipid Bilayer Membrane
2. On the Gating of a Mechanosensitive Channel by Fluid Shear Stress

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES 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

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

Member, American Mathematical Society

Member, Mathematical Association of America

Member, International Association of Mathematical Physics

Member, Society for Natural Philosophy

Member, Gesellschaft für Agewandte Mathematik und Mechanik

Member, Pi Mu Epsilon

Member, Sigma Xi

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, January 2005 - Current

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

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

Member, Mathematical Association of America, January 1990 - Current

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

Member, American Physical Society, January 1988 - Current

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

Member, Sigma Xi, January 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

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

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, January 2011 - Current

Member, International Chinese Statistical Association, January 2010 - Current

Member, Institute of Mathematical Statistics, January 2006 - Current

Member, American Statistical Association, January 2005 – Current

Brittany D. Hamfeldt

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

Member, Association for Women in Mathematics, January 2013 – Current

Award

May 2, 2017: Rising Star Research Award from CSLA, NJIT

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 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

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

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

Member, Mathematics association of America, Current

Lou Kondic

Member, European Mechanics Society, September 2005 - September 2020

Member, Society for Industrial and Applied Mathematics, September 2000 - September 2020

Member, American Physical Society, September 1994 - September 2020

Ji Meng Loh

Member, International Chinese Statistical Association, November 2012 - Current

Member, Institute of Mathematical Statistics, October 2009 - Current

Jonathan H. Luke

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

Member, American Mathematical Society, January 1981 - Current

Member, American Physical Society, January 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

Zoi-Heleni Michalopoulou

Associate Editor, Journal of the Acoustical Society of America, 2011 - Current

Associate Editor, IEEE Journal of Oceanic Engineering, 2015 - Current

Fellow, Acoustical Society of America

Senior Member, IEEE

Member, SIAM

Richard O. Moore

Member, SPIE, June 2010 - Current

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

Roy A. Plastock

Member, mathematical association of america, Current

Anthony D. Rosato

Fellow, American Academy of Mechanics, December 2016 - Current

Horacio G. Rotstein

Member, Organization for Computational Neuroscience, May 2011 - Current

Member, American Mathematical Society, January 2001 - Current

Member, Society for Industrial and Applied Mathematics, January 2001 - Current

Member, Society for Mathematical Biology, January 2001 - Current

Member, Society for Neuroscience, January 2001 - Current

Award

December 6, 2016: "Raices" Prize from Ministry of Science, Technology and Innovation, Argentina

David G. Shirokoff

Member, Society for Industrial and Applied Mathematics, February 2013 - Current

Michael S. Siegel

Associate Editor, Journal of Engineering Mathematics, September 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, January 2006 - Current

Member, American Finance Association, January 2004 - Current

Member, Financial Management Association, January 2004 - Current

Member, American Mathematical Society, January 1970 - Current

Member, Mathematical Association of America, January 1970 - Current

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

Antai Wang

Member, American Statistical Association, August 1999 - Current

B. FACM 2017 CONFERENCE: FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS

The fourteen conference on Frontiers in Applied and Computational Mathematics, under the abbreviated title FACM 2017, was held at the New Jersey Institute of Technology on June 23-24. This year's conference has focused broadly on the mathematics in industry, and was scheduled to follow the 33rd Mathematical Problems in Industry Workshop (MPI) which was held at NJIT immediately prior to the FACM 2017 conference.

Following its focus, the conference has included a number of topics of relevance to industrial applications. These include fluid dynamics with symposia on filtration as well as on more classical fluid dynamics problems, computational electromagnetics, computational mathematical biology, and stochastic modeling of physical systems, among others. The symposia that focused on data science considered a variety of industrial problems involving large quantities of data, and in particular on applications related to pharmaceutical statistics.

The conference had 136 total participants, of whom 81 visited from 55 universities other than NJIT, and 35 visited from either a government laboratory or industry. 8 participants visited from 4 countries outside the USA. The conference featured 64 minisymposium talks, many of which were given by junior faculty who are among the best young researchers in the mathematical sciences in the USA. Contributed talks by postdocs and graduate students were also selected from a large number of applications, and were presented in the same sessions as the invited minisymposium talks, thereby giving these young researchers a chance to showcase their research results alongside more established colleagues. In addition to the talks, there were 23 posters on a variety of research topics.

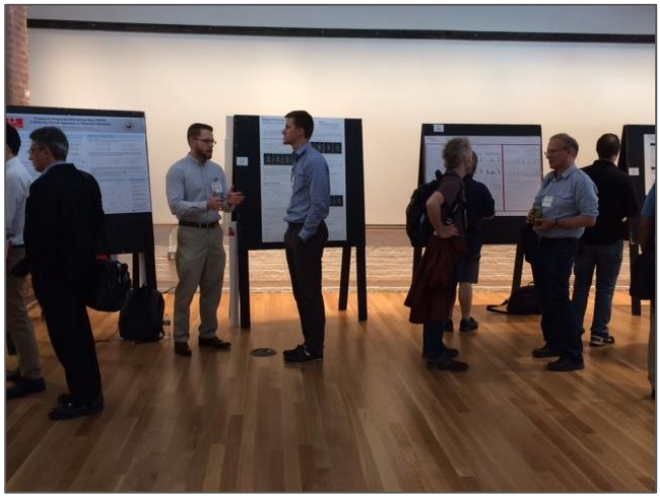
The plenary speakers and talks for the conference were given by:

- Jon Chapman, Oxford University, on "Mathematical Modelling of Lithium Ion Batteries"
- Jianying Hu, IBM T. J. Watson Research Center, on "Computational Health Methods for Next Generation Healthcare"
- Greg Luther, Adaptive Optics Associates and Northrop Grumman, on "Business-Driven R&D: Leveraging Mathematical and Optical Science"
- Cleve Moler, MathWorks, on "The Evolution of MATLAB"

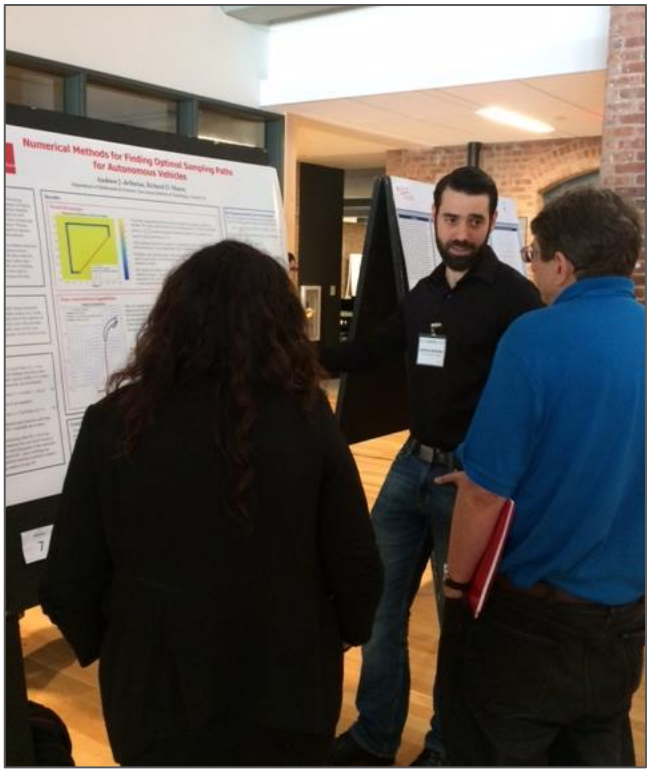
The organizing committee for this year's conference was: Lou Kondic (Chair), with Michael Booty, Linda Cummings, Casey Diekman, Yixin Fang, Brittany Froese, Shidong Jiang, Ji Meng Loh, Jonathan Luke, Richard Moore, and Michael Siegel, all of the Department of Mathematical Sciences at NJIT, with the following external committee members: Ruth Abrams (Sanofi), Karim Azer (Sanofi), Uwe Beuscher (Gore), Zydrunas Gimbutas (NIST), Tuan M. Hoang-Trong (IBM), Anna Georgieva Kondic (Merck), James Kozloski (IBM), Demetrios Papageorgiou (Imperial College), and Kyongmin Yeo (IBM).

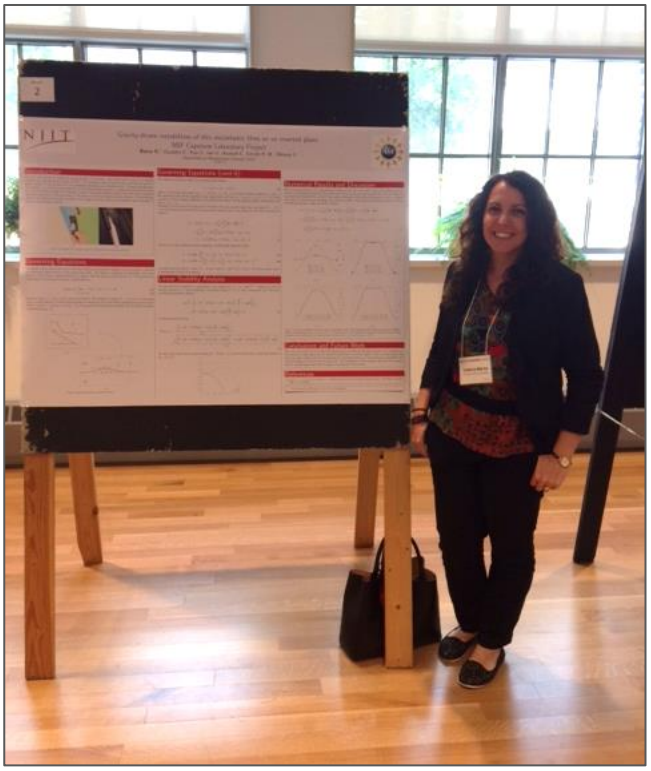
Photos from FACM 2017

Group Photo at FACM 17



Poster Session





DMS Ph.D. students Andrew deStefan (L) and Valeria Barra (R) presenting their posters during FACM 17

Greg Luther's Plenary Session

Jianying Hu's Plenary Session

Minisymposa

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

A New Computational Method for Viscoelastic Two-phase Flows
National Science Foundation: September 1, 2013 - August 31, 2016
Shahriar Afkhami

Conference on Frontiers in Applied and Computational Mathematics 2016
National Science Foundation: June 1, 2016 - May 31, 2017
Michael Booty

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

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

Modeling Circadian Clock Mechanisms from Synapse to Gene
National Science Foundation: July 1, 2014 - June 30, 2017
Casey Diekman

Collaborative Research: New Directions for Research on Some Large-Scale Multiple Testing Problems
National Science Foundation: July 15, 2013 - June 30, 2017
Wenge Guo

Collaborative Research: Efficient High-Order Parallel Algorithms for Large-Scale Photonics Simulation
National Science Foundation: August 15, 2014 - July 31, 2017
Shidong Jiang

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

Collaborative Research: Experimental and Computational Study of the Instabilities, Transport, and Self-Assembly of Nanoscale Metallic Thin Films and Nanostructures
National Science Foundation: September 1, 2012 - August 31, 2016
Lou Kondic

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

Deterministic and Stochastic Magnetization Dynamics in Thin Ferromagnetic Films and Devices
National Science Foundation: July 1, 2013 - June 30, 2017
Cyrill Muratov

Mechanisms of Frequency Preference in Neurons and Networks: Biophysics and Dynamics
National Science Foundation: September 1, 2013 - August 31, 2016
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, 2017
Michael Siegel (PI), Michael Booty and Yuan-Nan Young (Co-PIs)

Efficient Integral Equation Solvers for Large-Scale Frequency Domain Electromagnetic Scattering Problems
National Science Foundation: September 1, 2013 - August 31, 2016
Catalin Turc

Innovative Physics-based Modeling Tool for Application to Passive Radio Frequency Identification System on Rotocraft
Air Force Office Scientific Research: May 30, 2015 - September 29, 2016
Catalin Turc

Mathematical and Experimental Study of Lipid Bilayer Shape and Dynamics Mediated by Surfactants and Proteins
National Science Foundation: September 15, 2012 - August 31, 2016
Yuan-Nan Young (PI)

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

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

Predicting Performance & Fouling of Membrane Filters
National Science Foundation: September 15, 2016 - August 31, 2019
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, 2017
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: 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)

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

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

Computational and Data-Enabled Science and Engineering: Characterizing Dynamics of Particle-based Systems: REU Supplement
National Science Foundation: May 1 - Aug 1, 2017
Lou Kondic

Magnetization Dynamics at Nanoscale
National Science Foundation: 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

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

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

FSG: Cavitation in Insects: Computational and Experimental Study of Physical Mechanisms for Switching on the Embryonic Tracheal System
New Jersey Institute of Technology
Shahriar Afkhami

Efficient Solvers for Multiple Scattering Configurations and Eddy Currents
National Science Foundation
Yassine Boubendir

Efficient Solvers for High Frequency and Iterative Solvers
National Science Foundation
Yassine Boubendir

FSG: High Frequency Integral Equation Solvers Based on New Asymptotic Expansions Obtained Using Approximations of the Dirichlet to Neumann Operator
New Jersey Institute of Technology
Yassine Boubendir

National Science Foundation INCLUDES. Leadership and iSTEAM for Females in Elementary School (LiFE): An Integrated Approach to Increase the Number of Women Pursuing Careers in STEM in Elementary School (LiFE): An Integrated Approach to Increase the Number of Women Pursuing Careers in STEM
National Science Foundation
Bruce G. Bukiet (PI) with J.M. Lipuma and N.L. Steffen (Co-PIs)

Intercellular Signaling in the Circadian Clock
National Institutes of Health
Casey O. Diekman

Joint Screening of Ultra-high Dimensional Variables for Censored Survival Data
National Science Foundation
Yixin Fang

Joint Screening of Ultra-High Dimensional Variables for Time-to-Event Outcome
National Institutes of Health
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

The Cluster-Randomized Trial of CHW Coaches on Preventing DM Among Prediabetics at BH and VA
U.S. Department of Veterans Affairs
Yixin Fang

Prevention of Foot Complications in Diabetes [IPA with VA based VA grant]
U.S. Department of Veterans Affairs
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 (IPA)
U.S. Department of Veterans Affairs
Yixin Fang

Dynamics of Nonlinear Waves
Simons Foundation
Roy H. Goodman

FSG: Selective Inference: A New Approach to Large Scale Multiple Testing
New Jersey Institute of Technology
Wenge Guo

Collaborative Research: Systematic Development of Large Scale Multiple Testing Methodology
National Science Foundation
Wenge Guo

Mathematics and Optics
National Science Foundation
Gal Haspel

Fast High-Order Algorithms for Nonequilibrium Microflows in Complex Geometries
National Science Foundation
Shidong Jiang

Stick-Slip Dynamics and Failure in Granular Materials
United States Army
Lou Kondic

Stop and Frisk Policing: Health Risks and Socioeconomic Outcomes in African American Communities
National Institutes of Health
Ji Meng Loh

Spatial Temporal Point Analysis of Large Multi-Year Inhomogeneous NYC Stop-and-Frisk Data
National Science Foundation
Ji Meng Loh

ATD: Modeling of Spatial-Temporal Data Streams for Prediction and Anomaly Detection
National Science Foundation
Ji Meng Loh (PI) with Y. Fang and W. Guo (Co-PIs)

Statistical and Machine Learning Methods for Spatio-Temporal Stream Mining
Bloomberg Grant Program
Ji Meng Loh

Collaborative Agreement with Meadowlands Environmental Research Institute - Benthic Project
Ji Meng Loh

FSG: Statistical Modeling of Cab Data GPS for Demand Prediction and Supply Optimization
New Jersey Institute of Technology
Ji Meng Loh

EDT: Enriched Doctoral Training at New Jersey Institute of Technology for Students in the Mathematical Sciences
National Science Foundation
Zoi-Heleni Michalopoulou (PI) with L.J. Cumming, J.M. Loh, R.O. Moore, and M.S. Siegel (Co-PIs)

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

Global Optimization in Continuum Models by Conic Programming and Dimensional Reduction, with Applications to Self-Assembly
National Science Foundation
David G. Shirokoff

Collaborative Research: Overcoming Order Reduction and Stability Restrictions in High-Order Time-Stepping
National Science Foundation
David G. Shirokoff

Conference on Frontiers in Applied and Computational Mathematics 2017
National Science Foundation
Michael S. Siegel (PI) with L.J. Cummings and M.R. Booty (Co-PIs)

AGEP-GRS Supplement to: Numerical Methods and Analysis for Induced-Charge Electrokinetic Flow with Deformable Interfaces
National Science Foundation
Michael S. Siegel (PI) with M.R. Booty (Co-PI)

Enhancement of Gas Transport Across Air-Water Interface by Raindrops
National Science Foundation
Pushpendra Singh (PI) with D.L. Blackmore and I.S. Fischer (Co-PIs)

Bootstrap Function-Based Hypothesis Testing in Censored Location-Scale Models
National Science Foundation
Sundarraman Subramanian

Analysis of Dependent Censored Data Using Novel Nonparametric or Semiparametric Approaches
National Science Foundation
Antai Wang

Statistical Analysis for Medical Research
St. Joseph Health (Private Organization)
Antai Wang

Predictive Models for Financial and Commercial Data
Shanghai SuperV System Integration Co. Ltd (Private Organization)
Antai Wang

New Strategies to Analyze Survival Data Using Frailty Models
National Institutes of Health
Antai Wang

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

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

VIII. COMMITTEE REPORTS AND ANNUAL LABORATORY REPORT

A. COMPUTER FACILITIES

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: CAMS/Math Computational Laboratory Facilities

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 current major computational facilities of the CMCL consist of two clusters, "Gorgon" and "Stheno".

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.

Specific details of this year's expansion of the Stheno cluster, for the technically-minded, are as follows:

* Server 1, Stheno-5, has: 1 node with 2 NVIDIA Tesla K20 GPUs. The node has 2 CPUs (Intel Xeon E5-2660 processors, 2.2 GHz, 25 MB cache, 1866MH), each with 10 cores, making a total of 20 CPU cores. RAM total is 128 GB (DDR3, 1866MHz, LP RDIMM). Each of the two GPUs has 2668 cores, with a maximum rate of 3950 Gflops, and 6GB of RAM. The networking technology is 10GigE (i.e., 10 Gigabit) Ethernet, and node interconnect is Intel QDR InfiniBand. The server's local disk storage is 500GB (IBM).

* Server 2, Stheno-4, has: 2 nodes, each with two 6-core CPUs (Intel Xeon E5-2630 processors, 2.3GHz, 15MB cache, 1333MH), making a total of 24 CPU cores. The networking technology is 10GigE Ethernet, and node interconnect is Intel QDR InfiniBand. RAM total is 256 GB (DDR3, 1333MHz, LP RDIMM). The server's local disk storage is 1TB (IBM).

Stheno-3 and Stheno-5 are the two servers of the cluster that contain GPUs. These are currently CUDA (compute unified device architecture) capable, and are intended for general-purpose computation on GPU-accelerated computing nodes.

The successive upgrades from Stheno-1 to Stheno-5 bring the current Stheno cluster totals to 32 nodes and 392 CPU cores, with 3.84 TB of RAM, and 9.872 TB local disk storage.

Since 2010, DMS also has its own "Gorgon" cluster, which is intended for jobs that require large memory, and for parallel computations that use OpenMP, i.e., the Open Multi-Processing application programming interface. Like Stheno, Gorgon has been expanded in stages since it first became operational. Gorgon is now a 32 core system, with AMD Opteron 6134 processors running at 2.3 GHz, and a total of 64GB of shared memory.

The two clusters are maintained by NJIT's Academic and Research Computing Systems (ARCS) group, which is headed by Dr. David Perel as Director of ARCS.

In the broader domain, beyond DMS and CAMS, NJIT began in 1998 to make a commitment to support the scientific and engineering computing that is essential to research work across the campus by providing all faculty members and graduate students access to centralized servers for research purposes. The main NJIT cluster is "Kong", which recently received a substantial upgrade as part of a significant donation of computer equipment to NJIT from Linode. Linode is a Linux-based cloud hosting company based in Galloway, New Jersey.

* The upgrade, Kong-7, was completed in May 2015, and consists of 314 nodes, each with two 4-core CPUs (Intel Xeon L5520 processors, 2.27GHz). RAM total is 20.096TB. Manufacturer is Supermicro.

The Kong cluster now has a total of 359 nodes, 2812 CPUs, 22.704TB of RAM, and a disk storage of 318.8TB. Processors are all AMD Opteron or Intel Xeon models, with speeds from 2.2GHz to 2.8GHz. It also features two 2-GPU nodes (NVIDIA Tesla K20x) with 20 CPU cores per node. Each GPU has 2688 cores, with a peak performance double precision rate of 1.31Tflops, and 6GB of RAM.

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.

B. STATISTICAL CONSULTING LABORATORY REPORT

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 papers were published:

E. S. Ihde, S. Zamudio, J. M. Loh, Y. Zhu, J. Woytanowski and L. Rosen. Application of a Novel Mass Spectrometric (MS) Method to Examine Exposure to Bisphenol-A and Common Substitutes in a Maternal Fetal Cohort, *Human and Ecological Risk Assessment,* 2017 (accepted).

F. Artigas, J. M. Loh, J. Y. Shin, J. Grzyb and Y. Yao. Baseline and Distribution of Organic Pollutants and Heavy Metals in Tidal Creek Sediments after Hurricane Sandy in the Meadowlands of New Jersey, *Environmental Earth Sciences*, Vol. 76(293), April 2017.

The following consulting project is ongoing:

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

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, 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, 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, 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, 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.

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.

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 Simulation of Microlayer Formation in Nucleate Boiling, with J. Buongiorno (MIT)

Magnetophoretic Interaction of Ferrofluid Droplets in a Rotating Magnetic Field, with J. Feng (UBC)

Micorfluidics Flow Focusing, with A. Leshansky

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

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

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

A New Computational Method for Viscoelastic Two-Phase Flows, with V. Barra (Graduate Student)

John K. Bechtold

Theoretical Combustion, with C. K. Law (Princeton University), H. G. Im (University of Michigan), and M. Matalon (University 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), Xavier Tricoche, (Purdue University), and Kevin Urban (NJIT Graduate Student)

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

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

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

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

Solutocapillary Flows, with P. Sing and I. S. Fisher

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

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

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

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

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

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

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

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

Perturbations of the Forced Van Der Pol Equation, with J. Tavantzis (NJIT)

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

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

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

Global Coupling of Genetic Oscillators, with C. O. Diekman, and H. G. Rotstein

Yassine Boubendir

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

A Preconditioner for Wave Problems Based on the Perfectly Matched Layer, with P. Petropoulos and D. Midura (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), N. Gao (Rutgers-Newark), and Z. Ji (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

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

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

Augmented Reality for Ecological Data and Processes, with G. J. Russell

Spontaneous Dispersion of Particles in Liquid Surfaces, with P. Sing

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)

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

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

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

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

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

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. Bukiet, H. Chaudhry (NJIT), T. Findley (VA Hospital East Orange), N. Gao (Rutgers-Newark), and Z. Ji

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. Petal (Graduate Student), A. Shah (Undergraduate Student), A. Ng (Undergraduate Student), and E. Khan (Graduate Student)

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

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

Correlated Expression of Ion Channel in Circadian Neurons, with J. P. Golowasch

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

Ion Channel Expression in Scn2.2 Cell Line, with J. P. Golowasch and R. Deek (Undergraduate Student)

Roy H. Goodman

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

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

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

Wenge Guo

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

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

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

Brittany D. Hamfeldt

Seismic Full Waveform Inversion Using the Wasserstein Metric, with B. Engquist (University of Texas at Austin) and Y. Yang (University of Texas at Austin Graduate Student)

Multiscale Methods for the Monge-Ampere Equation, with C. Frederick (NJIT)

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

David J. Horntrop

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)

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

Lou Kondic

Free Surface Instability of a Thin Film of Nematic Liquid Crystal, with L. J. Cummings, 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. J. Cummings, C. Cai (NJIT), and E. Mema (Graduate Student)

Liquid Metals on Nanoscale: Modeling and Computation, with S. Afkhami

Ji Meng Loh

Analysis of Longitudinal Microarray Data, with A. Wang, W. Guo (NJIT), X. Zhang (NJIT Graduate Student), and X. Li (Georgetown University)

Victor V. Matveev

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

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

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), Nimrat Sandhu (NJIT Graduate Student), Zhan Shu (NJIT Graduate Student), Shuangyi Zhang (NJIT Graduate Student),

Sediment Layer Tracking with Ambient Noise, with P. Gerstoft

Sequential Particle Filtering, with C. Yardim and P. Gerstoft

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

Richard O. Moore

Noise and Rare Events in Optical Systems, with D. Cargill (Institute for Computational and Experimental Research in Mathematics, Brown University), C. McKinstrie (Alcatel-Lucent), and T.Schaefer (The College of Staten Island)

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

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

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

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

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 (NJIT)

Cyrill B. Muratov

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

Supercritical Fronts for Reaction Diffusion Equations in Infinite Cylinders, with P. Gordon, and M. Novaga (University of Padua)

Transitions and Soft Error Rates in Micromagnetic Devices, with R. O . Moore, and Y. Yu (NJIT Graduate Student)

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)

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

Gyroid Structures in Material Science, with D. G. Shirokoff

Nonlinear PDEs Involving Fractional Operators, with Y. Xiadong (University of Connecticut)

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

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

Farzan Nadim

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

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

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

Peter G. Petropoulos

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

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

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

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)

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

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

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

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

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

Pattern Formation in Relaxation Oscillators with Inhibitory Global Feedback, with H. Wu (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

Elements for a Pressure-Poisson Equation Reformulation of the Navier-Stokes Equations with Electric Boundary Conditions, with D. Zhou (Temple University), B. Seibold (Temple University), R. Rosales (MIT), and P. Chidyagwai (Loyola Maryland)

David G. Shirokoff

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

Gyroid Structures in Material Science, with C.B. Muratov

Global Minimizers in Pairwise Interaction Problems, with M. Bandegi (Graduate Student)

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

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

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

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. Li (Georgetown University)

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

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 X. Jia (NJIT Graduate Student)

Yuan-Nan Young

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

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

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

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

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

Electrodeformation of a Surfactant-Laden Viscous Drop, with H. Nguangia (Graduate Student)

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

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 consists of six students: Patricia Bobila, Salvatore Cordaro, Matthew Illingworth, Ivan Mitevski, Paulo Paz, and David Youssif. Their research mentors are Brittany Hamfeldt and Michael Siegel.

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 SIAM Annual Meeting. Many students have been engaged in research outside the EXTREEMS-QED program and have presented and published their work. For example, Diego Rios is participating in an REU program in New Mexico during summer 2017.

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 Trillium Management and Panasonic also employ our students as summer interns.

Our students have also received many honors and awards during the past year and have also found success on their actuarial examinations with more than 10 passed during the year. This year's Pi Mu Epsilon Mathematics Honor Society Induction Ceremony took place in April with Vincent Porcelli being inducted into membership. The department itself was honored by having its Mathematics of Finance and Actuarial Science program ranked fifth nationally in a study commissioned by SafecoInsurance.com.

Many students who graduate from our program continue either to enter graduate programs at other prestigious institutions or find gainful employment. Examples of graduate schools recently attended by our undergraduates include UTexas-Austin, UCLA, CalTech, RPI, 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

Title: Particulate Matter: Percolation, Persistence, Topology
Students: Jake Brusca, Sidney Carr, Robert Cuber, Andrew Firriolo, Christian Granier, Rahul Halder, Beatriz Mcnabb, Alina Mohit-Tabatabai, Josef Mohrenweiser, William Ruys, Angelo Taranto
Lab Assistants: Lenka Kovalcinova, Chao Chang
Instructor: Lou Kondic

Particulate systems are of relevance in a number of different fields, from granular matter to suspensions and bacterial colonies. This project focuses on particulate assemblies exposed to compression. When compression is sufficiently strong, the particulate assemblies go through the so-called jamming transition, during which the number of contacts of a typical particle increases dramatically, and the system becomes rigid. This process of jamming is associated with the development of mesoscale structures, large compared to particle size, and small compared to the size of the system. As a part of this Capstone project, these structures have been studied using a number of tools resulting from percolation theory, statistical mechanics as well as recently developed topological techniques. By combining the results obtained using a variety of different techniques, the participating students have been able to fully describe and quantify the emerging mesoscale structures.

The project has continued into a summer research project for one of the participating students, Angelo Taranto. The instructor acknowledges useful input by the collaborating group from Rutgers University, led by Prof. K. Mischaikow. Partial support by NSF grant No. DMS - 1521717 and DARPA contract HR0011-16-2-0033 is also acknowledged.

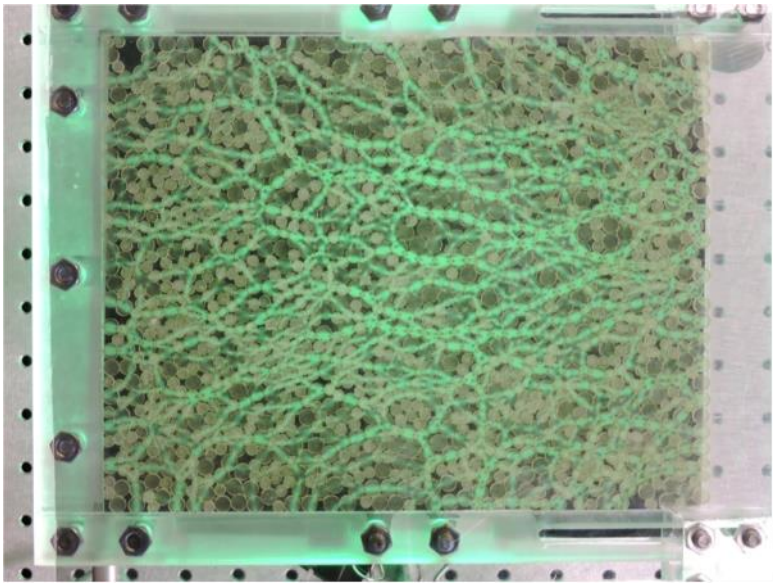


Figure 1: Photoelastic disks between cross-polarizers showing interaction forces (experiment).

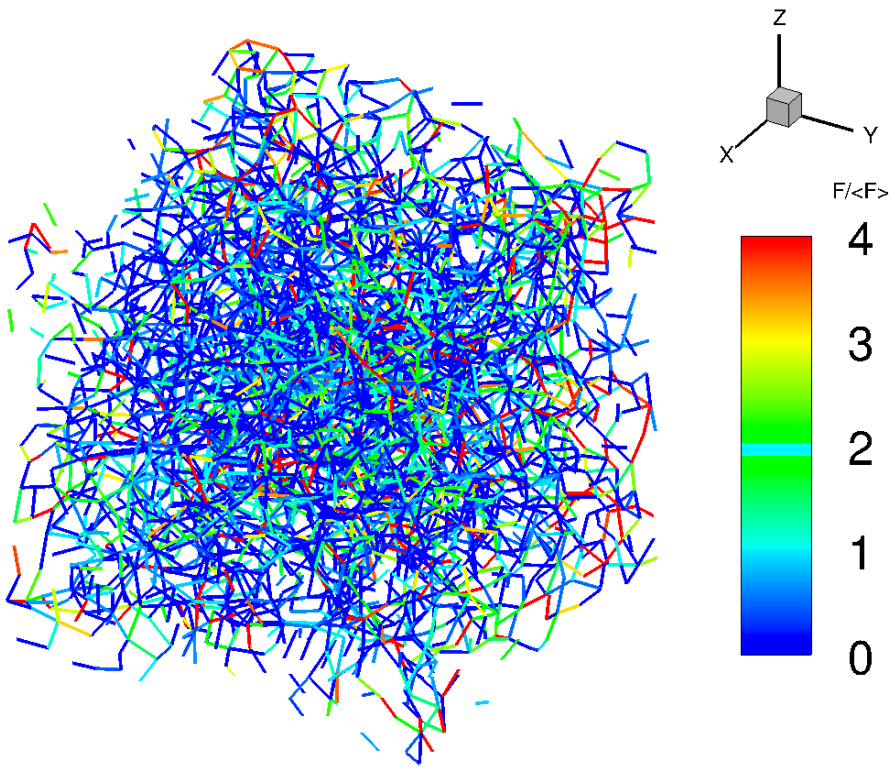


Figure 2: Force networks resulting from discrete element simulations in three spatial dimensions.

Title: Impact on Granular Matter
Students: Joseph Ballardo, Tadanaga Takahashi
Lab Assistants: Lenka Kovalcinova, Chao Chang
Instructor: Lou Kondic

Impact on dense gravitationally compacted assemblies of particles leads to complex dynamics of the impactor and of the granular particles themselves. The details of the intruder's dynamics, and of the causal connection between this dynamics and the material response has been a subject of extensive research during the last decade. In this project, we use topological tools to analyze the results of physical experiments carried out with photoelastic particles at Duke University. Photoelasticity allows to visualize (using high-speed imaging) the structure of the force/stress field in the granular assembly during impact. Novel computational topology methods allow for quantification of the force/stress field that develops during an impact. Such quantification has been carried out, leading to much better understanding of the particulate material response to impact.

The Capstone project has continued into a summer research project for one of the participating students, Tadanaga Takahashi, supported by an NSF REU supplement. The instructor acknowledges useful input by Abe Clark, PhD, Yale University, and by the collaborating groups from Rutgers and Duke Universities, let by Profs. K. Mischaikow and R. Behringer, respectively. Partial support by NSF grant No. DMS - 1521717 and DARPA contract HR0011-16-2-0033 is also acknowledged.

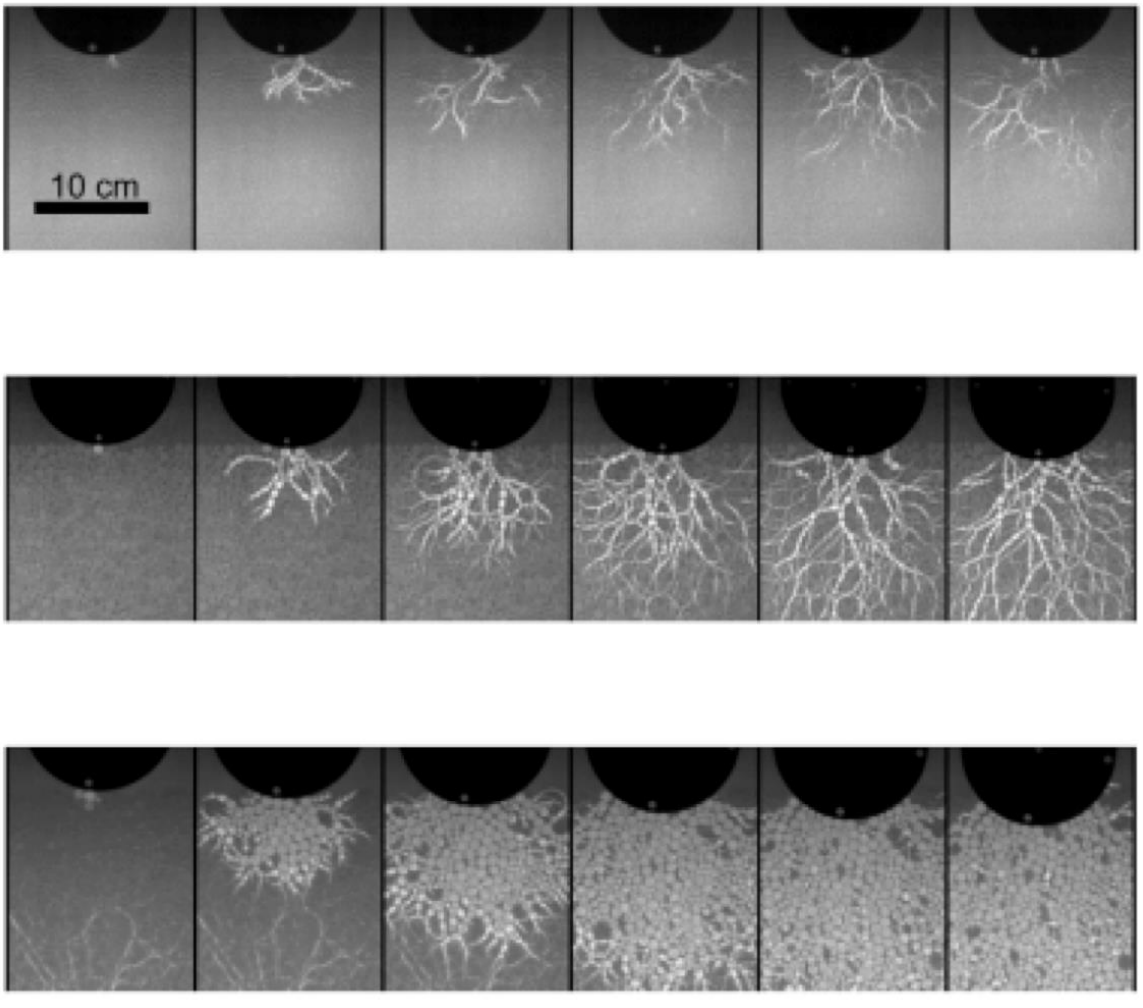


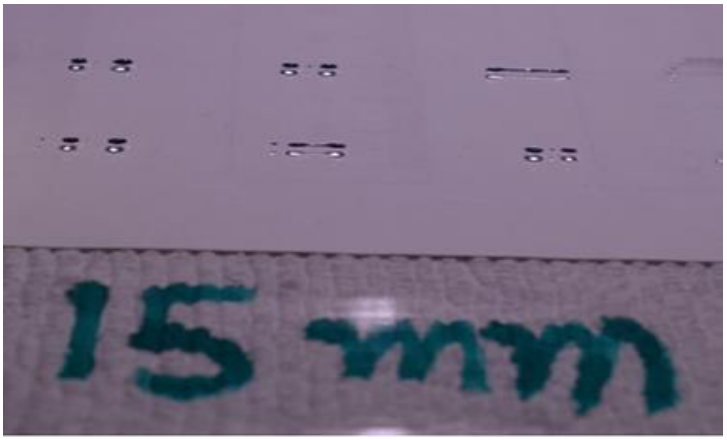
Figure 1: Force field developing in particulate systems exposed to impact (experiments carried out at Duke University under guidance by Prof. R. Behringer).

Title: Breakup of Finite Size Liquid Filaments involving Substrate Effects

Students: Burkhardt, Elise M., Castor, Michel T., Daudelin, Elizabeth J., Degraw, Brandon J., Dziedzic, Andrew, Ezra, Binah, Iyer, Urvya R., Kamath, Sonali J., Lozarito, Kimberly S., Marner, Matthew N., Nakrani, Mohit, Rios Pineda, Diego A., Schultz, Karl Markus, Syed, Musa W.
Lab Assistants: Valeria Barra, Ryan Allaire
Instructor: Shahriar Afkhami

The breakup of viscous filaments has, and is being studied experimentally, theoretically, and numerically. In this study, we focus on the breakup of finite size liquid filaments on substrates, using direct numerical simulations. Although there are many parameters involved when determining whether a liquid filament breaks up, we illustrate the effects of three parameters: Ohnesorge number, the ratio of the viscous forces to inertial and surface tension surfaces, the liquid filament aspect ratio, and a measure of the fluid slip on the substrate, i.e. slip length. Through these parameters, we are able to determine whether a liquid filament breaks up into one or multiple droplets or collapse into a single droplet on the substrate. We compare our results with the results for free standing liquid filaments. We show that the presence of the substrate promotes breakup of the filament. We also discuss the effect of the degree of slip on the break up. We comprehensively explore the parameter domain regions when including the slip effects. Partial support by NSF-CBET-1604351 is acknowledged.

Figure 1: Experiments: A 9mm long filament collapses into one single drop and –



(b) a 15mm long filament breaks up into two drops.

Figure 2: Simulations: Direct numerical computation of a filament (a) –

that breaks up into multiple drops (b).

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 we send our students to high-profile international meetings such as those organized by SIAM and the APS, earning them invaluable experience and recognition for their accomplishments. 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 workshops such as the annual Workshop on Mathematical Problems in Industry, held at NJIT in June of 2017. Our students have had much recent success in finding internships, in governmental research facilities such as Argonne National Laboratory or in private industries such as Alcatel-Lucent and Pixar Animation Studios.

It is ultimately the offers our students receive after graduation that indicates the health of our programs. Our recent graduates have been very successful, often receiving multiple offers to postdoctoral positions at universities including New York University and Fordham University, and to industrial positions at companies including Merck Pharmaceuticals and Sanofi S.A.

PhDs Awarded in the Period Covered by the Report

Casayndra H. Basarab
Thesis: Hamiltonian Bifurcations in Schrödinger Trimers
Advisor: Roy H. Goodman

Ruihua Cheng
Thesis: Structural Exploration and Inference of the Network
Advisor: Ji Meng Loh

Nanyi Dong
Thesis: A Research on Liquid Metal Film Instabilities in Nano Scale
Advisor: Lou Kondic

Lenka Kovalcinova
Thesis: Numerical Simulations of Dense Granular Systems with and Without Cohesive Effects
Advisor: Lou Kondic

Ensela Mema
Thesis: Mathematical Models for Polymer-Nematic Interactions
Advisor: Linda J. Cummings and Lou Kondic

Aminur Rahman
Thesis: Qualitative Modeling of Chaotic Logical Circuits and Walking Droplets: A Dynamical Systems Approach
Advisor: Denis Blackmore

Shaobo Wang
Thesis: Efficient High-Order Integral Equation Methods for the Heat Equation
Advisor: Shidong Jiang

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

Valeria Barra

Publications

Interfacial Dynamics of Thin Viscoelastic Films and Drops, (with S. Afkhami and L. Kondic), *Journal of Non-Newtonian Fluid Mechanics*, Vol. 237, pp. 26-38, November 2016.

Conferences and Workshop Attendance

June 19-23, 2017: The 33rd Annual Workshop on Mathematical Problems in Industry, NJIT, Newark, NJ

William Batson (Postdoctoral Associate)

Publications

Thermocapillary Modulation of Self-Rewetting Films (with Y. Agnon, A. Oron), *J. Fluid Mech*., Vol. 819, pp. 562-591, May 2017.

Presentations

April 7, 2017: Complex Fluids Group, Department of Mechanical Engineering, Princeton University, Princeton, NJ
Thermocapillary Modulation of Self-Rewetting Films

April 5, 2017: Group Meeting, Department of Mathematical Science, NJIT, Newark, NJ
Thermocapillary Instability of Thin Liquid Films with Substrate Heat Conduction

October 28, 2016: Department of Chemical Engineering, University of Florida, Gainesville, FL
Oscillatory Excitation of Thin Films with Nonlinear Surface Tension

September 12, 2016: Department of Mathematical Sciences, NJIT, Newark, NJ
Oscillatory Excitation of Thin Films with Nonlinear Surface Tension

Conferences and Workshop Attendance

March 30, 2017: Tenth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, GA
Experimental and Theoretical Aspects of Single-Mode Faraday Waves

November 2016: Annual APS DFD Meeting, Portland, OR
Oscillatory Excitation of Thin Films with Nonlinear Surface Tension

Subha Datta

Presentations

March 6, 2017: The Genetic Analysis Workshops, San Diego, CA
Joint Screening of Ultra-High Dimensional Variables Based on Mixed Effect Models for Family-Based Genetic Studies

Szu-Pei Fu

Publications

Lennard-Jones Type Pair-Potential Method for Coarse-Grained Lipid Bilayer Membrane Simulations in LAMMPS (with Z. Peng, H. Yuan, R. Kfoury and Y.-N. Young), *Computer Physics Communications*, Vol. 210, pp. 193–203, January 2017.

Presentations

March 2017: APS March Meeting 2017, New Orleans, LA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

March 2017: SIAM CSE 2017, Atlanta, GA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

November 2016: LAMMPS 69th Annual Meeting of the APS/DFD, San Francisco, CA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions

July 2016: The 2016 SIAM Annual Meeting, Boston, MA
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

Conferences and Workshop Attendance

January 2017: HKUST-ICERM Integral Equation Methods, Fast Algorithms and Their Applications to Fluid Dynamics and Materials Science workshop, Hong Kong

May 2017: The Northeast Complex Fluids and Soft Matter Workshop (NCS7) at Princeton University, NJ

May 2017: HKUST-ICERM Integral Equation Methods, Fast Algorithms and Their Applications to Fluid Dynamics and Materials Science Workshop, Brown University, Providence, RI

November 2016: NJIT Graduate Student Research Day, Newark, NJ,

March 2017: 43rd Northeast Bioengineering Conference, Newark, NJ

Binan Gu

Conferences and Workshop Attendance

June 14-17, 2017: GSMMC at Rensselaer Polytechnic Institute

June 19-23, 2017: Mathematical Problems in Industry (MPI) at NJIT, Newark, NJ

Lenka Kovalcinova (Postdoctoral Associate)

Presentations

May 26 2017: Northeast Complex Fluids and Soft Matter Workshop, Princeton, NJ
On Connection between Topology and Memory Loss in Sheared Granular Materials (with M. Kramar, K. Mischaikow, L. Kondic)

March 2017: APS March Meeting 2017, New Orleans, LA
On Connection between Topology and Memory Loss in Sheared Granular Materials (with M. Kramar, K. Mischaikow, L. Kondic)

Michael Lam

Posters

November 21, 2016: APS 69th Annual Division of Fluid Dynamics Meeting, Portland, OR
Large Scale GPU Simulations of the Generalized Thin Film Equation

Presentations

April 19, 2017: Dana Knox Student Research Showcase, NJIT, Newark, NJ
Weak Free Surface Anchoring Model for Partially Wetting Nanoscale Nematic Liquid Crystal Films

February 29, 2017: SIAM Conference on Computational Science and Engineering, Atlanta, GA

Weak Free Surface Anchoring Model Partially Wetting Nanoscale Nematic Liquid Crystal Films

November 21, 2016: APS 69th Annual Division of Fluid Dynamics Meeting, Portland, OR
Nucleation Type Instabilities in Partially Wetting Nanoscale Nematic Liquid Films

Conferences and Workshop Attendance

June 14-17, 2017: GSMMC at Rensselaer Polytechnic Institute

June 19-23, 2017: Mathematical Problems in Industry (MPI) at New Jersey Institute of Technology (NJIT), Newark, NJ

Randolph Leiser

Posters

June 2017: International Conference on Mathematical Neuroscience, Boulder, CO
Frequency Response Alternating Map: A Mutually Forced Approach to Resonant Networks

April 19, 2017: Dana Knox Student Research Showcase 2017, NJIT, Newark, NJ
Effects of Input Amplitude and Global Coupling on Network Synchrony and Entrainment (with Axel Turnquist)

October 17-21, 2016: Dynamical Systems and Data Analysis in Neuroscience: Bridging the Gap, Columbus, OH
Frequency Response Alternating Map: A Mutually Forced Approach to Resonant Networks

Presentations

July 11-15, 2016: SIAM Annual Meeting, Boston, MA
Pancreatic Beta Cells: Synchronization and Intrinsic Heterogeneity

2017: Math Colloquium, The College of New Jersey, Ewing Township, NJ
Frequency Response Alternating Map: A Mutually Forced Approach to Resonant Networks

Conferences and Workshop Attendance

May 30-June 2, 2017: International Conference on Mathematical Neuroscience, Boulder, CO

October 17-21, 2016: Dynamical Systems and Data Analysis in Neuroscience: Bridging the Gap, Columbus, OH

July 11-14, 2016, SIAM Life Sciences Meeting, Boston, MA

Aminur Rahman

Publications

Neimark—Sacker Bifurcations and Evidence of Chaos in a Discrete Dynamical System Model of Walkers (with D. Blackmore), *Chaos, Solitons & Fractals*, Vol. 91, pp. 339-349, October 2016.

Presentations

May 20-25, 2017: SIAM Conference on Applications of Dynamical Systems, Snowbird Resort, UT
Bifurcations in Walking Droplet Dynamics (with D. Blackmore)

February 22, 2017: Numerical Methods for PDEs Seminar, Massachusetts Institute of Technology, Cambridge, MA
Dynamical Modeling and Analysis of Walking Droplets and Chaotic Logical Circuits

February 8, 2017: Dynamical Systems Seminar, University of Rhode Island, South Kingstown, RI Dynamical Modeling and Analysis of Chaotic Logical Circuits and Walking Droplets

January 4, 2017: Joint Mathematics Meetings 2017, Atlanta, GA
The Chaotic Ballet of Walking Droplets (with D. Blackmore)

September 24, 2016: American Mathematical Society Sectional Conference, Brunswick, ME
Neimarck-Sacker Bifurcations and Evidence of Chaos in a Discrete Dynamical Model of Walkers (with D. Blackmore)

Pejman Sanaei

Publications

Flow and Fouling in Membrane Filters: Effects of Membrane Morphology (with L. J. Cummings), *Journal of Fluid Mechanics*, Vol. 818, pp. 744-771, May 2017.

Posters

August 2016: Gene Golub SIAM Summer School, Drexel University, Philadelphia, PA
Investigating the Performance of Pleated Membrane Filters

Presentations

March 2017: SIAM Computational Science and Engineering Meeting, Atlanta, GA
Mathematical Modeling of Pleated Membrane Filters (with G. W. Richardson, T. Witelski, L. J. Cummings)

June 24-25, 207: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Internal Structure and Morphology Profile in Optimizing Filter Membrane Performance

May 2017: Northeast Complex Fluids and Soft Matter Workshop, Princeton University, Princeton, NJ
The Effect of Scaffold Morphology on Tissue Growth

April 19, 2017: Dana Knox Student Research Showcase, NJIT, Newark, NJ
Modeling Complex Internal Geometry of Membrane Filters

April 2017: Applied Math Days Rensselaer Polytechnic Institute, Troy, NY
Curvature and Stress Driven Tissue Growth in a Tissue Engineering Scaffold

January 2017: Northeast Complex Fluids and Soft Matter Workshop, Stevens Institute of Technology, Hoboken, NJ
Modeling Branching Pore Structures in Membrane Filters

December 2016: The 69th New England Complex Fluids Workshop, Boston, MA
Flow and Fouling in Membrane Filters: Effects of Membrane Morphology

May 2016: Graduate Student Seminar, NJIT, Newark, NJ
Models for Membrane Filtration

November 2016: American Physical Society Meeting of the Division of Fluid Dynamics, Portland, OR
Optimizing Internal Structure of Membrane Filters (with L. J. Cummings)
November 2016: American Physical Society Meeting of the Division of Fluid Dynamics, Portland, OR
Modeling Branching Pore Structures in Membrane Filters (with L. J. Cummings)

July 2016: SIAM Annual Meeting, Boston, MA
Optimum Permeability Profile and Fouling in Membrane Filters (with L. J. Cummings)

Conferences and Workshop Attendance

February-March 2017: SIAM Computational Science and Engineering Meeting, Atlanta, GA

November 2016: American Physical Society Meeting of the Division of Fluid Dynamics, Portland, OR

July 2016: SIAM Annual Meeting, Boston, MA

July–August 2016: Gene Golub SIAM Summer School, Drexel University, Philadelphia, PA

June 2016: Mathematical Problem in Industry, Duke University, Durham, NC

Ivana Seric

Posters

April 19, 2017: Dana Knox Student Research Showcase, NJIT, Newark, NJ
Breakup of Liquid Metal Filaments

November 1, 2016: Graduate Student Research Day, NJIT, Newark, NJ
Breakup of Liquid Metal Filaments

Presentations

June 8, 2017: University of North Carolina, Chapel Hill, NC
Direct Numerical Simulations of Variable Surface Tension Flows Using a Volume-of-Fluid Method

May 1, 2017: Numerical Analysis Seminar, Los Alamos National Laboratory, Los Alamos, NM
Direct Numerical Simulations of Variable Surface Tension Flows Using a Volume-of-Fluid Method

April 7-8, 2017: Applied Math Days 2017, Rensselaer Polytechnic Institute, Troy, NY
Direct Numerical Simulations of Variable Surface Tension Flows Using a Volume-of-Fluid Method

February 27-March 3, 2017: SIAM Conference on Computational Science and Engineering, Atlanta, GA
Direct Computations of Marangoni-Induced Flows Using a Volume-of-Fluid Method

January 13, 2017: Complex Fluids and Soft Matter Workshop, Stevens Institute of Technology, Hoboken, NJ
Explicit Demonstration of the Role of Marangoni Effect in the Breakup of Nanoscale Liquid Filaments

November 20-22, 2016: American Physical Society Meeting of the Division of Fluid Dynamics, Portland, OR
Explicit Demonstration of the Role of Marangoni Effect in the Breakup of Nanoscale Liquid Filaments

November 20-22, 2016: American Physical Society Meeting of the Division of Fluid Dynamics, Portland, OR
Breakup of Liquid Metal Filaments (with K. Mahady, S. Afkhami, and L. Kondic)
Video: http://gfm.aps.org/meetings/dfd-2016/57d9b4c8b8ac31179100093c

Conferences and Workshop Attendance

May 26, 2017: Northeast Complex Fluids and Soft Matter Workshop, Princeton University, Princeton, NJ

Yixuan Sun

Conferences and Workshop Attendance

June 14-17, 2017: Graduate Student Mathematical Modeling Camp at RPI, Troy, NY

June 19-23, 2017: Mathematical Problems in Industry at NJIT, Newark, NJ

Axel Turnquist

Posters

April 19, 2017: Dana Knox Student Research Showcase, NJIT, Newark, NJ
Effects of Input Amplitude and Global Coupling on Network Synchrony and Entrainment (with Randolph J. Leiser)

Conferences and Workshop Attendance

June 19-23, 2017: Mathematical Problems in Industry at NJIT, Newark, NJ

Yiming Yu

May 15−19, 2017: International Conference on Mathematical and Numerical Aspects of Wave Propagation, Minneapolis, MN
Quasi-Stable Dynamics of a Mode-Locked Laser

Yalin Zhu

Software

R Package MHTmult (with W. Guo), May 2017. https://cran.r-project.org/package=MHTmult.

R package FixSeqMTP (with W. Guo), January 2017. https://cran.r-project.org/package=FixSeqMTP.

R package ADCT (with W. Guo), November 2016. https://cran.r-project.org/package=ADCT.

R package MHTdiscrete (with W. Guo), February 2017. https://cran.r-project.org/package=MHTdiscrete.

R package ph2bye (with R. Qin), August 2016. https://cran.r-project.org/package=ph2bye.
R package ph2mult (with R. Qin), November 2016. https://cran.r-project.org/package=ph2mult.
Posters

June 12-14, 2017: ASA Biopharmaceutical Section Nonclinical Biostatistics Conference, Rutgers University, Piscataway, NJ
FWER Controlling Procedures for Discrete Data in Clinical Safety Analysis

April 19, 2017: Dana Knox Student Research Showcase 2017, NJIT, Newark, NJ
Selective Inference for Hierarchical Testing in Clinical Safety Studies

April 10, 2017: NJIT President's Forum and Innovation Day, NJIT, Newark, NJ
Generalized Inverse Sampling Scheme-Based GLM Package

November 2016: ASA NJ Chapter/Bayer Statistics Workshop, Bayer Pharmaceuticals, Whippany, NJ
FWER Controlling Procedures for Discrete Data in Clinical Safety Analysis

November 1, 2016: Graduate Student Research Day, NJIT, Newark, NJ
FWER Controlling Multiple Testing Procedures for Discrete Data

Presentations

June 12-14, 2017: ASA Biopharmaceutical Section Nonclinical Biostatistics Conference, Rutgers University, Piscataway, NJ
A Selective Inference-based Two-stage Procedure for Clinical Safety Studies

April 3, 2017: Three-minute Research Profile Competition, NJIT, Newark, NJ
FWER Controlling Procedures for Discrete Data

August 2016: Biostatistics and Data Management Seminar, Regeneron Pharmaceuticals, Tarrytown, NY
Statistical Designs for Phase II Oncology Clinical Trials

Conferences and Workshop Attendance

Feb 23-25, 2017: Conference on Statistical Practice, Jacksonville, FL

March 12-15, 2017: Eastern North American Region Spring Meeting, Washington, DC

Graduate Student Poster Presentations at FACM 2017

Valeria Barra, Gravity-Driven Instabilities of Thin Viscoelastic Films on an Inverted Plane

Rui Cao, A Hybrid Numerical Method for Electro-Osmotic Flow with Deformable Interfaces

Pejman Sanaei, Curvature and Stress Driven Tissue Growth in a Tissue Engineering Scaffold Pore

Andrew deStefan, Numerical Methods for Finding Optimal Sampling Paths for Autonomous Vehicles

Yixuan Sun, Investigating the Performance of Pleated Membrane Filters

Randolph Leiser, Frequency Response Alternating Map: A Mutually Forced Approach to Resonant Networks

Matthew Moye, Data Assimilation and Electrophysiological Modeling of Mammalian Circadian Clock Neurons

Lenka Kovalcinova (Postdoc), On Connection between Topology and Memory Loss in Sheared Granular Materials

Yalin Zhu, Multivariate Logistic Type Models Based on Inverse Sampling Scheme

Awards

Rui Cao

Fall 2016: Ahluwalia Award

Szu-Pei Fu

Fall 2016: Ahluwalia Fellowship

Michael Lam

June 2016: ORISE/ORAU Research Fellowship to participate in a research training program/internship at the Coastal and Hydraulics Laboratory of the U.S. Army Engineer Research and Development

Randolph Leiser

Kriegsmann Fellowship

Aminur Rahman

NJIT Excellence in Instruction

Pejman Sanaei

February-March 2017: SIAM-CSE Student Travel Award
Fall 2016: NJIT Ahluwalia Fellowship Award
2016: NJIT GSA Research Day Award
July-August 2016: Gene Golub SIAM Summer School Travel Award
2016: NJIT GSA Conference Travel Award

Ivana Seric

March 2017: Graduate Student Association Travel Award for SIAM - CSE Meeting
November 2016: Graduate Student Association Travel Award for APS - DFD Meeting
November 2016: American Physical Society, Division of Fluid Dynamics Travel Award for APS - DFD Meeting

Axel Turnquist

Provost Doctoral Fellowship

Yiming Yu

CSLA Award for Outstanding Graduate Student

Yalin Zhu

2017: Certificate of Distinction for Research Showcase, NJIT
2017: GSA Travel Award for Presentation, NJIT
2017: Travel Award for GSA Three-minute Research Profile (3MRP) Competition, NJIT
2017: Certificate of Distinction for Graduate Students Research Day, NJIT

PhD Summer Program Activities

Student Talks - Summer 2017

June 7, **Ivana Seric**, Direct Numerical Simulations of Variable Surface Tension Flows Using a Volume-of-Fluid Method

June 9, **Pejman Sanaei**, Mathematical Modeling of Membrane Filtration

June 14, **Szu-Pei Fu**, One-Particle-Thick Coarse-Grained Lipid Bilayer Membrane Simulations in LAMMPS

June 21, **Andrew deStefan**, Numerical Methods for Finding Optimal Sampling Paths for Autonomous Vehicles

June 23, **Rui Cao**, Numerical Simulation of Time-dependent Electrophoresis

June 28, **Mahdi Bandegi**, A Study of Minimizers for Pairwise Interaction Problems Using Convex Relaxation

June 30, **Subha Tirtha Datta**, Joint Screening of Ultra-High Dimensional Variables for Family-Based Genetic Studies

July 5, **Haiyang Qi**

July 7, **Valeria Barra**, Numerical Study of Thin Viscoelastic Films

July 12, **Yalin Zhu**, A Selective Inference-based Two-stage Procedure for Clinical Safety Studies

July 14, **Linwan Feng**, Penalty Methods and the Numerical Solutions of Shallow Water Wave Equations

July 19, **Michael Pedneault**, What are Financial Derivatives and How to Price Them Fairly

July 21, **Randolph J. Leiser**, Heterogeneous Networks: Connectivity and Periodic Forcing

July 26, **Yan Zhang**, Conditional Confidence Interval Based on Uncorrelated and Correlated Screening

July 28, **Jacob Lesniewski**, Numerical Methods for Optimal Transport

July 28, **Ryan Allaire**, Heat Transfer in Thin Liquid Metals

August 2, **Xieyang Jia**, Modeling Semi-competing Risk Data Using Copula

August 4, **Keyang Zhang**, Convergence of a Boundary Integral Method for Interfacial Stokes Flow

August 9, **Matthew Moye**, Data Assimilation and Electrophysiological Modeling of Mammalian Circadian Clock Neurons

August 11, **Yixuan Sun**, Mathematical Modeling of Pleated Membrane Filters

August 11, **Zhongcheng Lin**, A Statistical Test for Dependent Censoring

August 16, **Axel Turnquist**, Linear-Nonlinear Cascade Models in Neuroscience

August 16, **Binan Gu**, Mathematical Modeling of Membrane Filtration

August 18, **Jimmie Adriazola**, Dynamics of Optimally Controlled Ultracold Gases

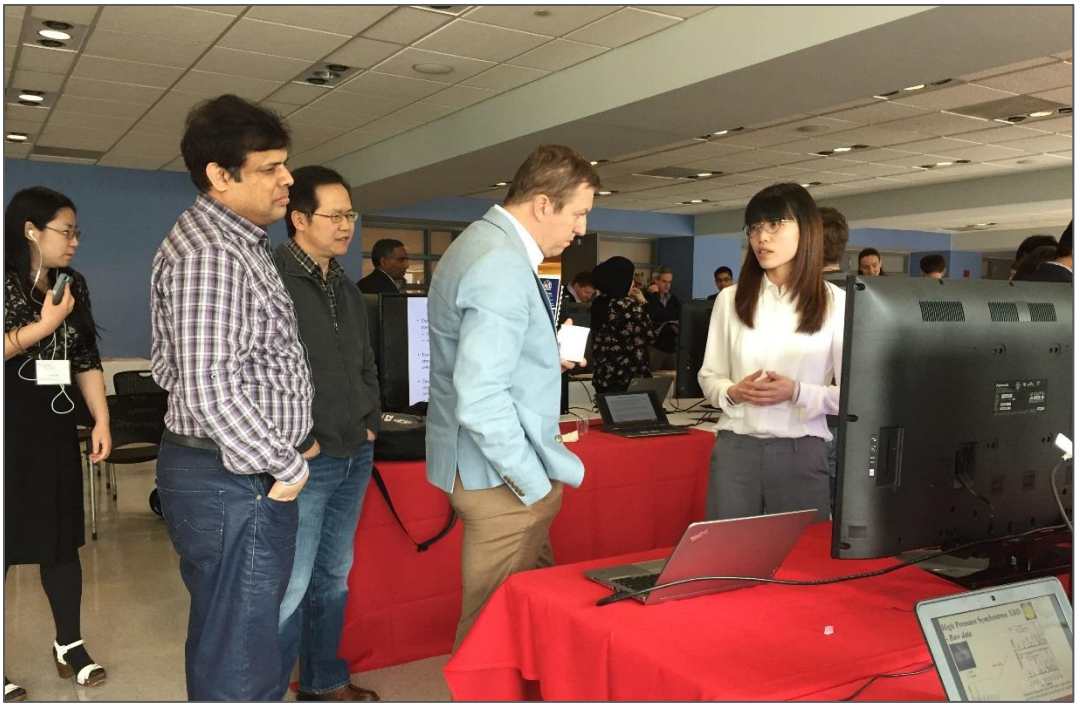
August 18, **Yinbo Chen**, Stationary Ca2+ Nanodomain Approximations

August 23, **Brandon Behring**, Stability of Leap-Frogging Pairs of Point Vortices

August 23, **Guangyuan Liao**, Entrainment Map: a new tool for Circadian Oscillator Models

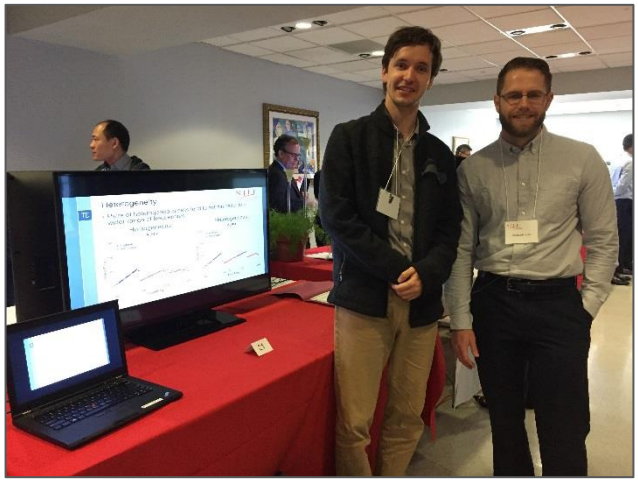
Ph.D. Students at the Dana Knox Student Research Showcase 2017
(Left to right: Michael Lam, Ivana Seric, Randolph J. Leiser, Matthew Moye, Li Yu, Axel Turnquist, Pejman Sanaei)

Yalin Zhu at the Dana Knox Student Research Showcase 2017



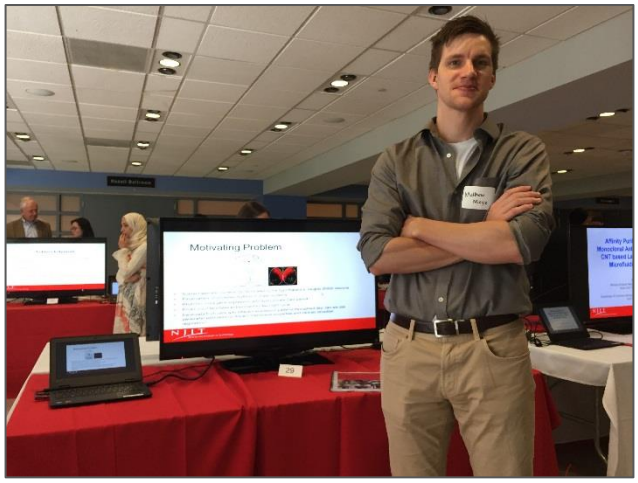
Li Yu at the Dana Knox Student Research Showcase 2017

Ivana Seric



Axel Turnquist and Randolph J. Leiser

Michael Lam



Matthew Moye

Pejman Sanaei and Victor Matveev

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