CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT
2015 – 2016

July 1, 2015 – June 30, 2016

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 31st 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 third 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:

- Seven new funded projects, including four by the National Science Foundation.

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

- Hosting of the 13th Frontiers in Applied and Computational Mathematics (FACM) conference. The two day meeting was attended by more than 150 participants, and focused on biostatistics, mathematical and computational aspects of materials science, computational wave propagation, microscale and biological studies of fluid dynamics, and mathematical biology.

We are glad to announce that the G. A. Kriegsmann Graduate Fellowship has been established. This endowed fellowship will be awarded annually to a doctoral student in the Mathematical Sciences program at NJIT. We are all very pleased indeed to be able to honor the many achievements that Greg has made to the applied mathematics community, both at NJIT and elsewhere.

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 2015-2016

Dr. John S. Abbott	Corning Incorporated
Dr. Peter E. Castro	Eastman Kodak Company (formerly)
Dr. Ned J. Corron	U.S. Army AMCOM
Mr. Erik Gordon	Trillium Trading, LLC
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Mr. George Quillan	Prudential Financial
Dr. Richard Silberglitt	Rand Corporation
Dr. Anne-Sophie Vanroyen	Modus Quantitative Advisors
Dr. Benjamin White	Exxon Research & Engineering

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
Froese, Brittany
Golowasch, Jorge
Goodman, Roy
Guo, Wenge
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 4, **Sookkyung Lim**, University of Cincinnati,
Generalized Immersed Boundary Method Applied to Biofluid Problems

September 11, **Gretar Tryggvason**, University of Notre Dame,
Direct Numerical Simulations of Complex Multiphase Flows

September 18, **Bill Henshaw**, Rensselaer Polytechnic Institute (RPI),
Over-Coming the Fluid-Structure Added-Mass Instability for Incompressible Flows

September 25, **Robert Lipton**, Louisiana State University,
Novel Dispersion from Metamaterials

October 2, **Yuri V. Lvov**
Fermi Pasta Ulam System - New Ideas about Old Problems

October 9, **Carlos Garcia-Cervera**, University of California, Santa Barbara,
Undulations in Smectic A Liquid Crystals

October 16, **Darko Volkov**, Worcester Polytechnic Institute,
An All-Frequency Weakly-Singular Surface Integral Equation for Maxwell's Equations in Dielectric Media

October 23, **George Biros**, University of Texas at Austin,
Fast Integral Equation Algorithms for Boundary Value Problems with Variable Coefficients

October 30, **Wooyoung Choi**, NJIT,
Can We Predict Evolving Nonlinear Waves in the Ocean, or Even Those in Laboratory Tanks?

November 6, **Cyrill Muratov**, NJIT,
Low Density Phases in a Uniformly Charged Liquid with Homogeneous Neutralizing Background

November 13, **Richard Seager**, Columbia University,
The Atmosphere-Ocean Dynamics of North American Droughts

November 20, **Gadi Fibich**, Tel Aviv University,
Necklace Solitary Waves on Bounded Domains

December 4, **Surajit Sen**, State University of New York at Buffalo,
Physics of and with Nonlinear Waves - Why They Matter

January 22, **Johnny Guzmán**, Brown University,
Finite Element Methods for High Contrast Interface Problems

January 29, **Anthony Rosato**, NJIT,
Investigation of Energetic Granular Flows via Simulations, Experiments and Theory

February 12, **Lev Ostrovsky**, NOAA Earth Science Laboratory,
Asymptotic Perturbation Theory for Solitons

February 19, **Kyle Mandli**, Columbia University,
Enabling Storm Surge Prediction for High-Resolution Forecasts and Climate Scenarios

February 26, **David Shirokoff**, NJIT,
Approximate Global Minimizers for Pairwise Interaction Problems

March 2, **Richard M. McLaughlin**, UNC Chapel Hill,
Tailoring the Tails in Taylor Dispersion

March 11, **Ivan Christov**, Purdue University,
Multiple-Scale Asymptotics of Plane Waves in Media with Variable Phase Speed

April 1, **Kevin Mitchell**, University of California, Merced,
Dynamical Barriers to Front Propagation in Active Fluid Flows

April 8, **Dmitry Golovaty**, The University of Akron,
On the Landau-de Gennes Model for Nematic Liquid Crystalline Films

April 15, **Nilima Nigam**, Simon Fraser University,
High Accuracy Computation of Mixed Dirichlet-Neumann Eigenvalues

April 22, **Alexander Idesman**, Texas Tech University,
A New Accurate Numerical Approach to Structural Dynamics and Wave Propagation Problems

April 29, **Michael Zabarankin**, Stevens Institute of Technology,
Analytical Solution for Spheroidal Drop under Axisymmetric Linearized Boundary Conditions

Applied Statistics Seminar

October 15, **Wei Yann Tsai**, Columbia University,
The Probability of Being in Response Function and its Applications

October 22, **Sunil Dhar**, NJIT,
Studying the Optimal Scheduling for Controlling Prostate Cancer under Intermittent Androgen Suppression

November 5, **Mingyao Li**, University of Pennsylvania,
Modeling Transcriptomic Variations in RNA Sequencing

November 12, **Bodhisattva Sen**, Columbia University,
Adaptation in Shape Constrained Regression

November 19, **Kelly Zou**, Pfizer, Inc., ROC Analysis,
Classification Methods, and Comparative Effectiveness Research

December 3, **Feng Yang**, Columbia University,
Model Selection in High-Dimensional Misspecified Models

December 10, **Cun-Hui Zhang**, Rutgers University,
Tensor Completion via Nuclear Norm Minimization

February 9, **Tao Lu**, State University of New York,
High-Dimensional Nonparametric ODE Models for Dynamic Gene Regulation Networks

March 3, **Zhigen Zhao**, Temple University,
A New Approach to Multiple Testing of Grouped Hypotheses

March 24, **Mingge Xie**, Rutgers University,
Confidence Distribution for Bridging Bayesian, Frequentist and Fiducial (BFF) Inferences

March 31, **Zongming Ma**, University of Pennsylvania,
Achieving Optimal Misclassification Proportion in Stochastic Block Model

April 21, **Sharon Xiangwen Xie**, University of Pennsylvania,
Survival Analyses with Missing Outcomes

April 28, **Yan Ma**, George Washington University,
The HCUP SID Imputation Project

Mathematical Biology Seminar

September 22, **Jonathan Platkiewicz**, City College of New York,
A Needle in a Haystack: Inferring a Monosynaptic Dynamic from In Vivo Extracellular Recordings

September 29, **Brooke Flammang**, NJIT,
A Bioinspired Long-Term, Reversible Underwater Adhesive Mechanism

October 27, **Diana Thomas**, Montclair State University,

Mathematical Modeling of Lifestyle Interventions and Beyond

November 3, **Aurel Lazar**, Columbia University,
NeuroInformation Processing Machines

November 17, **William Lytton**, SUNY Downstate Medical Center,
Schizophrenia, Information Flow-Through and Minimal Perturbations: Simulation Studies in the Brain

December 8, **Josh Bongard**, University of Vermont,
Evolving Robots to Study Adaptive Behavior

December 15, **Julijana Gjorgjieva**, Brandeis University,
Neural Circuits for Peristaltic Wave Propagation in Crawling Drosophila Larvae

February 23, **Robert McDougal**, Yale University,
Neuron Strategies for the Simulation and Visualization of Spatial Mathematical Neuroscience Models

March 8, **Yong-Ick Kim**, NJIT,
The Molecular Mechanism of the Cyanobacterial Circadian Clock

March 22, **Dietmar Oelz**, NYU,
Force Generation and Contraction of Random Actomyosin Bundles

March 29, **Patrick Fletcher**, National Institutes of Health,
From Global to Local: Exploring the Relationship between Parameters and Behaviors in Models of Electrical Excitability

April 26, **Catherine Carr**, University of Maryland,
Listening with Two Ears

May 3, **Calvin Zhang**, NYU,
A Benefit of Randomness in Synaptic Vesicle Release

Fluid Mechanics and Waves Seminars

September 14, **Xin Tong**, Courant Institute of Mathematical Science,
Filtering with Noisy Lagrangian Tracers

September 21, **Carlos Colosqui**, Stony Brook University,
Crossovers from Capillary-Driven to Thermally-Driven Wetting

October 19, **Antoine Cerfon**, Courant Institute of Mathematical Science,

High Performance Elliptic Solvers for Magnetic Fusion

November 2, **Lina Ma**, Pennsylvania State University,
Efficient Spectral Methods on PDE in Spherical Domain

November 9, **Ross Lund**, NJIT,
Phase Transitions in Biaxial Nematic Liquid Crystals

November 16, **Te-sheng Lin**, National Chiao Tung University,
Weak-Interaction Theory and Bound State Formation in Electrified Falling Liquid Films

November 30, **Mu-Ping Nieh**, University of Connecticut,
Properties and Applications of Well-Defined Self-Assembled Lipid Nanodiscs (Bicelles)

December 7, **Shreya Mittapalli**, NJIT,
Lossy Compression of Structures Scientific Data Sets

February 15, **David Seal**, U.S. Navy,
Finite Difference Methods for Magnetohydrodynamics Equations

February 29, **Abe Clark**, Yale University,
A Phase Diagram for Fluid-Driven Sediment Transport

March 21, **Nan Chen**, Courant Institute of Mathematical Science,
Predicting the Cloud Patterns of the Madden-Julian Oscillation through a Low-Order Nonlinear Stochastic Model

April 18, **Abhinendra Singh**, City College of New York,
Effect of Cohesion on the Flow Behavior: From Dry Granular Matter to Suspensions

May 2, **Aditya Khair**, Carnegie Mellon University,
Transient Electrohydrodynamics of Low-Conductivity Drops

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Shahriar Afkhami

A Numerical Approach for the Direct Computation of Flows Including Fluid-Solid Interaction: Modeling Contact Angle, Film Rupture, and Dewetting (with L. Kondic and K. Mahady), Physics of Fluids, Vol. 28, 062002, June 2016.

Interfacial Deformation and Jetting of a Magnetic Fluid (with L. Cummings, I. Griffiths), Computers and Fluids, Vol. 124, pp. 149–156, January 2016.

Instability Of Nano And Microscale Liquid Metal Filaments: Transition From Single Droplet Collapse To Multi-Droplet Breakup (with C. Hartnett, K. Mahady, J. Fowlkes, L. Kondic, and P. Rack), Langmuir, Vol. 31, pp. 13609-13617, November 2015.

On The Influence Of Initial Geometry On The Evolution Of Liquid Filaments (with K. Mahady and L. Kondic), Physics of Fluids, Vol. 27, 092104, October 2015.

Denis Blackmore

The Lagrangian And Hamiltonian Aspects Of The Electromagnetic Vacuum-Field Theory Models (with N. Bogolubov Jr. and A. Prykarpatsky), Boson Journal of Modern Physics, Vol. 2, pp. 105-196, March 2016.

The Augmented Unified Localizable Crisis Scale (with E. Rohn), Technological Forecasting and Social Change, Vol. 100, pp. 186-197, November 2015.

Tapped Granular Column Dynamics: Simulations, Experiments and Modeling (with A. Rosato, L. Zuo, H. Wu, D. Horntrop, D. Parker, and C. Windows-Yule), Computational Particle Physics, Vol. 3, pp. 333-348, October 2015.

Integrability Analysis Of A Two-Component Burgers Type Hierarchy (with A. Prykarpatsky, E. Özçag, K. Soltanov), Ukrainian Mathematical Journal, Vol. 67, pp. 167- 185, September 2015.

Wooyoung Choi

An Explicit Data Assimilation Scheme For A Nonlinear Wave Prediction Model Based On A Pseudo-Spectral Method (with S. Yoon and J. Kim), IEEE J. of Oceanic Engineering, Vol. 41, pp 112-122, January 2016.

Linda Cummings

Flow And Fouling In A Pleated Membrane Filter (with G. Richardson and T. Witelski), Journal of Fluid Mechanics, Vol. 795, pp. 36-59, May 2016.

Interfacial Deformation And Jetting Of A Magnetic Fluid (with S. Afkhami and I. Griffiths), Computers and Fluids, Vol. 124, pp. 149–156, January 2016.

Substrate Induced Gliding In A Nematic Liquid Crystal Layer (with E. Mema and L. Kondic), Physical Review E, Vol. 92, 062513, December 2015.

Transitions In Poiseuille Flow Of Nematic Liquid Crystal (with T. Anderson, E. Mema, and L. Kondic), International Journal of Nonlinear Mechanics, Vol. 75, pp. 15-21, October 2015.

Three-Dimensional Coating Flow of Nematic Liquid Crystal on an Inclined Substrate (with M. Lam, T.-S. Lin, and L. Kondic), European Journal of Applied Mathematics, Vol. 26, pp. 647-669, October 2015.

Sunil Dhar

Comparison of Changes in Tensile Strength in 3 Different Flexible Epidural Catheters under Various Conditions. (with A. Fiol, R. Horvath, C. Schoenberg, N. Ahmed, and V. Le), Anesthesia & Analgesia, Vol. 123, pp. 233-237, April 2016.

Casey Diekman

A Conserved Bicycle Model for Circadian Clock Control of Membrane Excitability (with T. Han, K. Aranda, D. Moose, K. White, A. Dinner, B. Lear, D. Ren, I. Raman, and R. Allada), Cell, Vol. 162, pp. 836-848, August 2015.

Javier Diez

Drops with Non-Circular Footprints (with P. Ravazzoli, A. G. González), Physics of Fluids 28, 042106, 2016.

Metallic Thin-Film Instability with Thermal Noise: The Role of Spatially Extended Noise Correlations (with A. G. González, R. Fernández), Physical Review E 93, 013120, 2016.

Inertial and Dimensional Effects on the Instability of A Thin Film (with A. G. González, M. Sellier), Journal of Fluid Mechanics, 787, 449, 2016.

Breakup of Thin Liquid Filaments on Partially Wetting Substrates: from Micrometric to Nanometric Scales (with A. G. González), Brazilian Journal of Physics, Vol. 45, 2015.

Brittany Froese

Freeform Illumination Optics Construction Following An Optimal Transport Map (with Z. Feng and R. Liang), Applied Optics, Vol. 55, pp. 4301-4306, June 2016.

Numerical Methods For The 2-Hessian Elliptic Partial Differential Equation (with A. Oberman and T. Salvador), IMA Journal of Numerical Analysis, May 2016.

Composite Method For Precise Freeform Optical Beam Shaping (with Z. Feng and L. Rongguang), Applied Optics, Vol. 54, pp. 9364-9369, November 2015.

Creating Unconventional Geometric Beams with Large Depth of Field Using Double Freeform-Surface Optics (with Z. Feng, C.-Y. Huang, D. Ma, and R. Liang), Applied Optics, Vol. 54, pp. 6277-6281, July 2015.

David Horntrop

Tapped Granular Column Dynamics: Simulations, Experiments and Modeling (with A. Rosato, L. Zuo, D. Blackmore, H. Wu, D. Parker, and C. Windows-Yule), Computational Particle Mechanics, Vol. 3, pp. 333-348, October 2015.

Shidong Jiang

A Hybrid Method for Systems of Closely Spaced Dielectric Spheres and Ions (with Z. Gan, E. Lutjin, and Z. Xu), SIAM Journal on Scientific Computing, Vol. 38, pp. B375-B395, May 2016.

Analysis and Solutions of the Integral Equation Derived from the Linearized BGKW Equation for the Steady Couette Flow (with L.-S. Luo), Journal of Computational Physics, Vol. 316, pp. 416-434, April 2016.

Extension of the Debye-Mie-Lorenz Formalism to the Time Domain (with L. Greengard and T. Hagstrom), Journal of Computational Physics, Vol. 299, pp. 98-105, October 2015.

Computing the Ground State and Dynamics of the Schrodinger-Poisson Equation via Nonuniform FFT (with W. Bao, Q. Tang, and Y. Zhang), Journal of Computational Physics, Vol. 291, pp. 72-89, September 2015.

Lou Kondic

A Numerical Approach For The Direct Computation Of Flows Including Fluid-Solid Interaction: Modeling Contact Angle, Film Rupture, And Dewetting (with K. Mahady and S. Afkhami), Physics of Fluids, Vol. 28, 062002, June 2016.

Scaling Properties of Force Networks for Compressed Particulate Systems (with L. Kovalcinova and A. Goullet), Physical Review E, Vol. 93, 042903, May 2016.

Structure of Force Networks in Tapped Particulate Systems of Disks and Pentagons. I. Clusters and Loops (with L. Pugnaloni, M. Carlevaro, M. Kramar, and K. Mischaikow), Physical Review E, Vol. 93, 062902, April 2016.

Structure of Force Networks in Tapped Particulate Systems of Disks and Pentagons. II. Persistence Analysis (with M. Kramar, L. Pugnaloni, M. Carlevaro, and K. Mischaikow), Physical Review E, Vol. 93, April 2016.

Steady Flow Dynamics during Granular Impact (with A. Clark and Robert Behringer), Physical Review E, Vol. 93, 050901(R), April 2016.

Fully Nonlinear Dynamics Of Stochastic Thin Film Dewetting (with S. Nesic, R. Cuerno, and E. Moro), Physical Review E, Vol. 93, 061002(R), January 2016.

Substrate Induced Gliding In A Nematic Liquid Crystal Layer (with E. Mema and L. Cummings), Physical Review E, Vol. 92, 062513, December 2015.

Instability of Nano and Microscale Liquid Metal Filaments: Transition from Single Droplet Collapse to Multi-Droplet Breakup (with C. Hartnett, K. Mahady, S. Afkhami, and P. Rack), Langmuir, Vol. 31, pp. 13609-13617, November 2015.

Evolution of Force Networks in Dense Particulate Media (with M. Kramar, A. Goullet, and K. Mischaikow), Physical Review E, Vol. 90, 052203, November 2015.

Transitions In Poiseuille Flow Of Nematic Liquid Crystal (with T. Anderson, E. Mema, and L. Cummings), International Journal of Nonlinear Mechanics, Vol. 75, pp. 15-21, October 2015.

Three-Dimensional Coating Flow of Nematic Liquid Crystal on an Inclined Substrate (with M. Lam, L. Cummings and T.-S. Lin), European Journal of Applied Mathematics, Vol. 26. pp. 647-669, October 2015.

On The Influence Of Initial Geometry On The Evolution Of Liquid Filaments (with K. Mahady and S. Afkhami), Physics of Fluids, Vol. 27, 092104, October 2015.

Percolation And Jamming Transitions In Particulate Systems With And Without Cohesion (with L. Kovalcinova and A. Goullet), Physical Review E, Vol. 92, 032204, October 2015.

Dense Granular Flow — A Collaborative Study (with P. Mort, J. Michaels, R. Behringer, C. Campbell, M. Kheiripour Langroudi, M. Shattuck, J. Tang, G. Tardos, and C. Wassgren), Powder Technology, Vol. 284, pp. 571 - 584, July 2015.

Ji Meng Loh

Fast Food And Liquor Store Density, Co-Tenancy, And Turnover: Vice Store Operations In Chicago, 1995-2008, Applied Geography, Vol. 67, pp. 1-13, January 2016.

Zoi-Heleni Michalopoulou

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, EL131-EL136, July 2016.

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, pp. 1-11, May 2016.

Light Absorption Properties of the New York/New Jersey Harbor Estuary (with B. Wang, L. Axe, R. Riman, M. C. Tan, and L. Wei), Hydrobiologia, Vol. 766, pp. 173-188, February 2016.

Richard Moore

Incorporating Radiation in Noise-Induced Phase Evolution of Optical Solitons (with D. Cargill), SIAM Journal on Applied Dynamical Systems, Vol. 15, pp. 1025–1061, January 2016.

Cyrill Muratov

Low Density Phases In A Uniformly Charged Liquid (with H. Knuepfer and M. Novaga), Communications in Mathematical Physics, Vol. 345, pp. 141–183, June 2016.
One-Dimensional Domain Walls In Thin Ferromagnetic Films With Fourfold Anisotropy (with R. Lund), Nonlinearity, Vol. 29, pp. 1716-1734, May 2016.

On Well-Posedness Of Variational Models Of Charged Drops (with M. Novaga), Proceedings Royal Society London, Vol. 472, 20150808, March 2016.

Uniqueness Of One-Dimensional Neel Wall Profiles (with X. Yan), Proceedings Royal Society London, Vol. 472, 20150762, March 2016.

Orbital-Free Density Functional Theory Of Out-Of-Plane Charge Screening In Graphene (with J. Lu and V. Moroz), Journal of Nonlinear Science, Vol. 25, pp. 1391-1430, December 2015.

Eventual Self-Similarity Of Solutions For The Diffusion Equation With Nonlinear Absorption And A Point Source (with P. Gordon), SIAM Journal of Mathematical Analysis, Vol. 47, pp. 2903–2916, July 2015.

David Shirokoff

A Fourier Penalty Method for Solving the Time-Dependent Maxwell's Equations in Domains with Curved Boundaries (with R. Galagusz and J.-C. Nave), Journal of Computational Physics, Vol. 306, pp. 167-198, February 2016.

Sundarraman Subramanian

Bootstrap Likelihood Ratio Confidence Bands for Survival Functions under Random Censorship and Its Semiparametric Extension, Journal of Multivariate Analysis, Vol. 147, pp. 58-81, February 2016.

Ronald Sverdlove

Conflicts in Bankruptcy and the Sequence of Debt Issues (with S. Ravid and A. Bris), Journal of Financial and Quantitative Analysis, Vol. 50, pp. 1353-1386, December 2015.

Jonathan James Wylie

The Evolution Of A Viscous Thread Pulled With A Prescribed Speed (with B. H. Bradshaw-Hajek and Y. M. Stokes), Journal of Fluid Mechanics, Vol. 795, 380, 2016.

Asymptotic Analysis Of A Viscous Thread Extending Under gravity (with H. Huang and R.M. Miura), Physica D, Vol. 313, pp. 51-60, 2015.

Yuan-Nan Young

Electrohydrodynamics of a Viscous Drop with Inertia (with H. Nganguia, A. Layton, W.-F. Hu, and M.-C. Lai), Physical Review E, Vol. 93, 053114, May 2016.

Vesicle Electrohydrodynamic Simulations by Coupling Immersed Boundary and Immersed Interface Methods (with W.-F. Hu, M.-C. Lai, and Y. Seol), Journal of Computational Physics, Vol. 317, pp. 66-81, April 2016.

Near-Wall Dynamics Of Concentrated Hard-Sphere Suspensions: Comparison Of Evanescent Wave DLS Experiments, Virial Approximation And Simulations (with Y. Liu, J. Blawzdziewicz, B. Cichocki, J. Dhont M. Lisicki, E. Wajnryb, P. Lang), Soft Matter, Vol. 11, pp. 7316-7327, August 2015.

Gating Of a Mechanosensitive Channel Due To Cellular Flows (with O. Pak, G. Marple, S. Veerapaneni, and H. Stone), Proceedings of the National Academy of Sciences, Vol. 112, pp. 9822-9827, August 2015.

BOOKS AND BOOK CHAPTERS

Michael Booty

A Hybrid Numerical Method For Interfacial Flow With Soluble Surfactant And Its Application To An Experiment In Microfluidic Tipstreaming (with M. Siegel, S. Anna), edited by M.T. Rahni, M. Karbaschi, and R. Miller, Progress in Colloid and Interface Science, Vol. 5, pp. 309 – 330, Florida: CRC Press, December 2015.

Michael Siegel

A Hybrid Numerical Method For Interfacial Flow With Soluble Surfactant And Its Application To An Experiment In Microfluidic Tipstreaming (with M. Siegel, S. Anna), edited by M.T. Rahni, M. Karbaschi, and R. Miller, Progress in Colloid and Interface Science, Vol. 5, pp. 309 – 330, Florida: CRC Press, December 2015.

PROCEEDINGS PUBLICATIONS

Denis Blackmore

Overview Of Continuous And Discrete Modeling Of A Tapped Column (with A. Rosato, L. Zuo, H. Wu, D. Horntrop, D. Parker, and C. Windows-Yule), ASCE 2015 Eng. Mech. Conf. Proceedings, 5, August 2015.

Bruce Bukiet

State of the Art PD - the Online Professional Learning Exchange (with J. Lipuma), Association for the Advancement of Computing in Education (AACE), Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2015, pp. 619-624, October 2015.

B. PRESENTATIONS

Shahriar Afkhami

June 3 - 4, 2016: FACM, NJIT, Newark, NJ
Direct Computations of Marangoni-Induced Flows Using a Volume of Fluid Method

May 20, 2016: 9th International Conference on Multiphase Flow, ICMF, Florence, Italy
Numerical Simulation of Microlayer Formation during the Inertia-Controlled Growth Phase of Bubbles in Nucleate Boiling

January 20, 2016: The Fifth Northeast Complex Fluids and Soft Matter Workshop, NCS, NYU Poly
Interfacial Dynamics of Thin Viscoelastic Films and Drops

November 19 - 20, 2015: American Physical Society, 68th Annual Meeting of the Division of Fluid Dynamics, APS, Boston, MA

1) A Boundary Condition For Fluid/Fluid Flow At The Solid Interface
2) Direct Numerical Simulation Of Nanofilm Instability Driven By Liquid/Solid Interactions
3) On The Influence Of Initial Geometry On The Evolution Of Liquid Filaments

October 5, 2015: International Conference on Transport Processes at Fluidic Interfaces, UT Darmstadt, Darmstadt, Germany

1) A Positive Definite Preserving Numerical Method For Viscoelastic Two-Phase Flows
2) Capillary Self-Focusing In A Microfluidic System

July 15 - 20 2015: Bifurcation and Instabilities in Fluid Dynamics, Paris, France

1) Influence Of Initial Geometry On The Evolution Of Liquid Filaments
2) Jetting Of A Magnetic Liquid Under An Applied Magnetic Field Gradient

Denis Blackmore

December 8, 2015: 13th International Conference on Dynamical Systems – Theory and Applications, Lodz, Poland
Advances in Dynamical Simulation and Analysis of Granular Flow

July 7, 2015: 9th European Conference on Solid Mechanics, Madrid, Spain
Overview of Continuum and Discrete Modeling of a Tapped Column

Michael Booty

May 23, 2016: International Conference on Multiphase Flow 2016, Firenze, Italy
A Hybrid Numerical Method for Two-Phase Flow with Soluble Surfactant

May 11, 2016: SIAM Conference on Mathematical Aspects of Materials Science, SIAM, Philadelphia, PA
A Hybrid Numerical Method for Electrokinetic Flow with Deformable Interfaces

February 2016: Seminar, UC Merced, Merced, CA
A Hybrid Numerical Method for Interfacial Flow with Transition Layers

November 23, 2015: 68th Annual Meeting of the American Physical Society Division of Fluid Dynamics, American Physical Society, Boston, MA
Simulation of Drop Tipstreaming in a Flow Focusing Geometry with a Hybrid Numerical Method

November 18, 2015: Workshop 3: Modeling and Computation of Transmembrane Transport, Mathematical Biosciences Institute, Ohio State University
A Hybrid Numerical Method for Electrokinetic Flow with Deformable Interfaces

Bruce Bukiet

June 30, 2016: Summer Math Institute, Rochester Institute of Technology, Rochester, NY
Who Will Win The Pennant? Understanding Baseball with High School Math

March 23, 2016: 17th Annual NJEDge "STEAM" Faculty Showcase, NJEDge
Integrating Student Reflection through Writing in a Constructively Aligned Upper Level Undergraduate Numerical Methods Class

Wooyoung Choi

May 31, 2016: Seminar, Yonsei University, Seoul, Korea
Mathematical Modeling Nonlinear Internal Long Waves

May 19, 2016: Workshop on Nonlinear Waves in Fluids, RIMS, University of Kyoto, Kyoto, Japan
Surface Expressions of Nonlinear Internal Waves

May 16, 2016: Courses on Nonlinear Water Waves, University of Waseda, Tokyo, Japan
Asymptotic Theories of Nonlinear Water Waves

March 15, 2016: Seminar, Loughborough University, Loughborough, United Kingdom
Modeling Nonlinear Ocean Waves and Its Challenges

March 11, 2016: Seminar, University of College London, London, United Kingdom
Predicting Highly Nonlinear Ocean Waves With Breaking – Is It Possible?

November 6, 2015: Workshop on nonlinear internal waves in stratified flows, University of Limerick, Ireland
Internal Solitary Waves and Their Interaction with a Free Surface

October 2015: Applied Mathematics Colloquium, DMS, NJIT, Newark, NJ

Can We Predict Evolving Nonlinear Waves In The Ocean Or Even Those In Laboratory Tanks?

August 11, 2015: Workshop on nonlinear waves and fluid mechanics, National Institute of Mathematical Sciences, Daejeon, Korea
Free Surface Effects on Internal Solitary Waves

July 13, 2015: Inha University, Inchon, Korea
A Combined Theoretical and Experimental Study of Nonlinear Water Waves

Linda Cummings

June 14, 2016: European Conference on Mathematics for Industry (ECMI), Santiago de Compostela, Spain
Mathematical Modeling of Membrane Filtration

April 2016: British Applied Mathematics Colloquium (BAMC), University of Oxford, United Kingdom
Free Surface Flow of Nematic Liquid Crystal

December 2015: Harvard Widely Applied Mathematics Seminar, Harvard University, Cambridge, MA
Mathematical Models of Membrane Filtration

November 21, 2015: APS DFD Meeting, NSF, Boston, MA
Topological Transitions in Unidirectional Flow of Nematic Liquid Crystal

July 20, 2015: Bifurcation and Instabilities in Fluid Dynamics, Paris, France
Instabilities of a Nematic Liquid Film on an Incline

Sunil Dhar

June 3 - 4, 2016: FACM, NJIT, Newark, NJ
Multivariate Logistic Type Models Based on Inverse Sampling Scheme (presented by Yalin Zhu)

Casey Diekman

June 3 - 4, 2016: FACM, NJIT, Newark, NJ
Eupnea, Tachypnea, and Autoresuscitation in a Closed-loop Model of Respiratory Control

May 23, 2016: Society for Research on Biological Rhythms, Palm Harbor, Florida
Entrainment Maps: A New Tool for Understanding Circadian Oscillator Models

May 12, 2016: Rinzel/Reyes Lab Meeting, Center for Neural Science, New York University
Eupnea, Tachypnea, and Autoresuscitation in a Closed-loop Model of Respiratory Control

April 19, 2016: Biomathematics Colloquium, Courant Institute of Mathematical Sciences, New York University
Multi-level Regulation in the Mammalian Circadian Clock

April 16, 2016: Garden State Undergraduate Mathematics Conference, MAA, William Paterson University
Data-Driven Biophysical Modeling of Neuronal Dynamics

April 11, 2016: Krasnow Institute Monday Seminar, George Mason University, Fairfax, Virginia
Multi-level Regulation in the Mammalian Circadian Clock

April 2, 2016: International Congress of Neuroethology, Montevideo, Uruguay
A Model of Caenorhabditis Elegans Locomotion Network Produces Coherent Undulatory Motor Output When Excitatory Motoneurons Are
March 3, 2016: STG Lab Meeting, Nadim/Golowasch/Bucher, NJIT, Newark, NJ
Role of Ionic Current Co-Regulation in Circadian Activity of GnRH Neurons

February 2, 2016: Optical Imaging Data Analysis Workshop, SAMSI, Durham, North Carolina
Calcium Imaging and Neuronal Dynamics

November 15, 2015: AMS Fall Eastern Sectional Meeting, AMS, Rutgers University, New Brunswick, NJ
Modeling Circadian Rhythmicity of Cardiac Arrhythmias

October 21, 2015: SfN Annual Meeting, Society of Neuroscience, Chicago, Illinois
Modeling the Caenorhabditis Elegans Locomotion Network: An Opportunity in Connectivity

October 16, 2015: 8th Satellite symposium on Motor Systems, Northwestern University, Chicago, IL
Modeling the Caenorhabditis Elegans Locomotion Network: An Opportunity in Connectivity

October 14, 2015: SAMSI Workshop on Challenges in Linking Statistical and Mathematical Neuroscience, SAMSI, Boston University, Boston, MA
Neuronal Data Assimilation

October 2, 2015: From Industrial Statistics to Data Science, University of Michigan, Ann Arbor, MI
Discovering Functional Neuronal Connectivity from Serial Patterns in Spike Train Data

August 10, 2015: 2015 Undergraduate Capstone Conference, MBI, Ohio State University, Columbus, OH
Data-Driven Biophysical Modeling of Neuronal Dynamics

August 3, 2015: World Congress of Chronobiology, European Biological Rhythms Society, Manchester, UK
Modeling Circadian Rhythmicity of Cardiac Arrhythmias

July 30, 2015: Eighth International Undergraduate Research Symposium, NJIT, Newark
Data-Driven Biophysical Modeling of Neuronal Dynamics

Javier Diez

September 2015: 100th Reunión Nacional de Física, Merlo (San Luis), Argentina
Ruido Térmico Estocástico En La Inestabilidad De Películas Líquidas Delgadas

September 2015: 100th Reunión Nacional de Física, Merlo (San Luis), Argentina
Efectos Inerciales En La Inestabilidad De Películas Líquidas Delgadas Y Gruesas

September 2015: 100th Reunión Nacional de Física, Merlo (San Luis), Argentina
Gota De Base No Circular: Estudio Experimental Y Modelado

October 2015: X Ibero-American Workshop on Complex Fluids and their Applications, Florianópolis (Santa Catarina), Brazil
Inertial, Dimensional and Stochastic Effects on the Instability of a Thin Liquid Film

Brittany Froese

June 14, 2016: Moving Mesh Methods, University of Bath, Bath, UK
Numerical Optimal Transportation Using the Monge-Ampere Equation

March 28, 2016: Mathematical Sciences Colloquium, Rensselaer Polytechnic Institute, Troy, NY
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

March 22, 2016: Numerical Analysis Seminar, University of Maryland, College Park, MD
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

March 7, 2016: Applied and Computational Mathematics Seminar, Georgia Institute of Technology, Atlanta, GA
Meshfree Finite Difference Methods for Fully Nonlinear Elliptic Equations

February 18, 2016: Applied Mathematics Colloquium, Columbia University, New York, NY
Numerical Optimal Transportation Using the Monge-Ampere Equation

February 8, 2016: Analysis and Applied Mathematics Seminar, Chicago, IL
Numerical Optimal Transportation Using the Monge-Ampere Equation

January 4, 2016: Computational Seismology, Tsinghua Sanya International Mathematics Forum, Sanya, China
Comparison of Seismic Signals Using the Wasserstein Metric

November 9, 2015: MOKALIEN Meeting, INRIA, Paris, France
Beam Shaping Using the Monge-Ampere Equation

October 15, 2015: Nonlinear PDEs, Numerical Analysis, and Applications, University of Pittsburgh, Pittsburgh, PA
Meshfree Finite Difference Methods for Nonlinear Elliptic Equations

Wenge Guo

August 2015: 2015 Joint Statistical Meetings, Seattle, WA
On Generalized Fixed Sequence Procedures for Controlling the FWER (author only)

David Horntrop

July 7, 2015: 9th European Conference on Solid Mechanics, Madrid, Spain
Overview of Continuum and Discrete Modeling of a Tapped Column

Shidong Jiang

June 2016: Faculty Summer Talk, NJIT, Newark, NJ
Introduction to the Fast Multipole Method

June 3 - 4, 2016: FACM, NJIT, Newark, NJ

1) A High Order Integral Equation Method For Solving The Heat Equation With Complex Geometries In Three Dimensions
2) An Efficient Pair-Potential Method For Coarse-Grained Lipid Bilayer Membrane Simulations In LAMMPS

May 2016: SIAM Materials Science Conference, SIAM, Philadelphia, PA
Second Kind Integral Equation Formulation for Dislocation Dynamics

May 11, 2016: 2016 SIAM Conference on Mathematical Aspects of Materials Science, SIAM, Philadelphia, PA
An Accurate Metropolis-Hastings Algorithm and a Fast Multipole Method for Coarse-Grained Lipid Bilayer Membrane in Solvent

March 2016: Applied Math Seminar, Department of Mathematics, University of California at Irvine, Irvine, CA
Mode Calculation of Optical Waveguides

January 2016: HKUST IAS Focused Program on Computational & Mathematical Problems in Materials Science, Hong Kong University of Science and Technology, Hong Kong
Mode Calculation of Optical Waveguides

January 2016: Seminar at Department of Mathematics, Hong Kong University of Science and Technology, Hong Kong
Integral Equation Methods for Fourth Order PDEs

January 2016: The 5th Northeast Complex Fluids and Soft Matter Workshop, NYU Tandon School of Engineering, Brooklyn, NY
Efficient Brownian Dynamics Simulation of DNA Molecules with Hydrodynamic Interactions in Linear Flows

August 2015: 8th International Congress on Industrial and Applied Mathematics, ICIAM, Beijing, China

1) A Hybrid Method For Solving The Poisson Equation In The Presence Of Multiple Closely Compacted Spheres
2) Efficient Sum-Of-Exponentials Approximations For The Heat Kernel And Their Applications

August 2015: Workshop on Mathematical Foundations for Fast Multi-resolution interactions & Large Data Analysis, Duke University, Durham, NC
Efficient Brownian Dynamics Simulation of DNA Molecules with Hydrodynamic Interactions

July 2015: Seminar at Hong Kong University of Science & Technology, Hong Kong
Fast and Accurate Evaluation of Nonlocal Coulomb and Dipole-Dipole Interactions via the Nonuniform FFT

July 2015: Talk at Chinese Academy of Sciences, Beijing, China
Integral Equation Methods for Fourth Order PDEs

Lou Kondic

June 23, 2016: Colloquium, Twente University, Enschede, The Netherlands
Force Networks in Particulate-Based Systems: Persistence, Percolation, and Universality

June 20, 2016: 8th International Marangoni Association Conference, NSF, Bad Honnef, Germany
Instabilities of Manometric Fluid Films on Thermally Conductive Substrate

June 3 - 4, 2016: FACM, NJIT, Newark, NJ
Direct Computations of Marangoni-Induced Flows Using a Volume of Fluid Method

May 15, 2016: Colloquium, Rutgers University, New Brunswick, NJ
Force Networks in Particulate-Based Systems: Persistence, Percolation, and Universality

November 21, 2015: APS DFD Meeting, NSF, Boston, MA
Topological Transitions in Unidirectional Flow of Nematic Liquid Crystal

November 20, 2015: APS DFD Meeting, NSF, Boston, MA
1) Direct Numerical Simulation Of Nanofilm Instability Driven By Liquid/Solid Interactions
2) Quantitative Comparison Of Experiments And Numerics In Granular Materials
3) On The Influence Of Initial Geometry On The Evolution Of Liquid Filaments

July 20, 2015: Bifurcation and Instabilities in Fluid Dynamics, Paris, France
1) Influence Of Initial Geometry On The Evolution Of Liquid Filaments
2) Instabilities Of A Nematic Liquid Film On An Incline

July 15, 2015: ESMC 2015, Madrid, Spain
Topological Measures Describing Force Networks in Dense Granular Matter

Victor Matveev

June 3 - 4, 2016: FACM, NJIT, Newark, NJ
Novel Method for Approximating Equilibrium Single-Channel Ca2+ Domains

October 20, 2015: Annual Meeting of the Society for Neuroscience, Chicago, IL
1) Reduced Endogenous Ca2+ Buffering Speeds Active Zone Ca2+ Signaling
2) Novel Method For Approximating Equilibrium Single-Channel Ca2+ Domains

October 6, 2015: NYU Biomathematics & Computational Biology Colloquium, New York University
Modeling Cell Calcium Dynamics on Fine Spatio-Temporal Scales: Comparison of Deterministic and Stochastic Approaches, And Novel Steady-State Approximations

August 9, 2015: Gordon Research Conference on Cerebellum, Lewiston, ME
Reduced Endogenous Ca2+ Buffering Speeds Active Zone Ca2+ Signaling

July 20, 2015: CNS 2015 (Annual Meeting of the Organization for Computational Neuroscience), Prague, Czech Republic
A Novel Method for Approximating Equilibrium Single-Channel Ca2+ Domains

Zoi-Heleni Michalopoulou

May 26, 2016: Meeting of the Acoustical Society of America, Salt Lake City, Utah
Seabed Property Inversion – Sequential and Direct Approaches

February 22, 2016: Stockton University, Galloway, NJ
Inverse Problems in Ocean Acoustics

Richard Moore

June 6, 2016: Faculty Summer Talks, NJIT, Newark, NJ
Optimal Control in Nonlinear Waves

March 15, 2016: Nonlinear Waves Seminar, University of Colorado, Boulder, Boulder, CO
Accounting For Radiation in Rare Events Produced By Stochastic Soliton Dynamics

August 14, 2015: International Congress on Industrial and Applied Mathematics, Beijing, China
Towards Optimal Control in Lagrangian Data Assimilation

August 13, 2015: International Congress on Industrial and Applied Mathematics, Beijing, China
The Year of Light in Industrial Mathematics: Case Studies from MPI

July 15, 2015: Seminarios en la interfase: entre la Matemática, la Informática, y las Ciencias Naturales, University of Buenos Aires, Buenos Aires, Argentina
Minimum Action Paths and Rare Events in Wave Equations

Cyrill Muratov

June 2016: CRM workshop on Workshop on Partial Order in Materials, University of Montreal, Montreal, CA
Low Density Phases In Geometric and Phase Field Models Of Uniformly Charged Liquids

June 2016: PIMS workshop on Nonlocal Variational problems and PDEs, University of British Columbia, Vancouver, CA
Low Density Phases In Geometric and Phase Field Models Of Uniformly Charged Liquids

February 2016: PDE Seminar, University of Texas at Austin, Austin, TX
Low Density Phases In Geometric and Phase Field Models Of Uniformly Charged Liquids

January 2016: National Congress on Calculus of Variations, INDAM, Levico Terme, Italy
Low Density Phases In Geometric and Phase Field Models Of Uniformly Charged Liquids

January 2016: Oxford-NYU Workshop on Mathematical Models of Defects and Patterns, New York University, New York, NY
Low Density Phases In Geometric and Phase Field Models Of Uniformly Charged Liquids

December 2015: SIAM Conference on PDEs, NSF, Phoenix, AZ
A Non-Local Variational Problem Arising From Studies of Nonlinear Charge Screening in Graphene Monolayers

October 2015: Applied Math Colloquium, Colorado State University, Fort Collins, CO
Winding Domain Walls In Thin Ferromagnets Films

July 2015: PDE Seminar, University of Pisa, Pisa, Italy
A Non-Local Variational Problem Arising From Studies of Nonlinear Charge Screening in Graphene Monolayers

Farzan Nadim

November 11, 2015: 2nd International Conference on Medical Engineering and Health Technology (IMEHT2015), Mashhad, Iran
Preferred Frequencies of Neurons and Synapses in an Oscillatory Network

October 18 & 21, 2015: 2015 Annual Meeting of the Society for Neuroscience (SFN), Chicago, IL

1) Does Axonal Influence On The Spike Interval Matter?
2) The Effect of Resonance Frequency on Network Oscillations Through Electrical Gap Junction Coupling

October 9, 2015: Newark Neurotalks, Rutgers University, Newark, NJ
The Generation and Coordination of Oscillations in a Small Network

September 30, 2015: Neuroscience Seminar, CUNY Downstate Medical Center, Brooklyn, NY
How Does A Neuron Maintain Its Phase In An Oscillatory Network?

August 3, 2015: Small Circuits & Behavior Meeting, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA
Frequency-Dependent Actions of Neuromodulators

July 19 & 22, 2015: Workshop on Spike Initiation: Models and Experiments, Organization for Computational Neuroscience, Prague, Czech Republic

1) The Synaptic Effects Of Ectopic Spike Initiation And The History Dependence Of Axonal Conduction
2) Synaptic Inputs Are Tuned To Match Intrinsic Properties To Maintain Phase In Oscillatory Neural Networks

Horacio Rotstein

December 10, 2015: CNS - NYU (Rinzel-Reyes lab), CN - NYU, New York, NY
Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

December 2, 2015: NIH - NIAAA, Bethesda, MD
Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

October 18, 2015: 2015 Annual Meeting of the Society for Neuroscience (SFN), Chicago, IL
The Effect of Resonance Frequency on Network Oscillations through Electrical Gap Junction Coupling

October 1, 2015: NYU Medical School - Buzsáki Lab Meeting, New York, NY
Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

September 22, 2015: Biomathematics and Computational Biology Seminar, Courant Institute of Mathematical Sciences, NYU, New York, NY
Inhibition-Based Theta Resonance: A Modeling Study

September 17, 2015: Department of Biological Sciences, STG Lab Meeting, NJIT, Newark, NJ
Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

August 17, 2015: Challenges in Computational Neuroscience Opening Workshop, SAMSI, NC
Inhibition-based theta resonance in a hippocampal network: a modeling study

August 10, 2015: 2015 Undergraduate Capstone Conference, MBI, Ohio State University, Columbus, OH
Data-Driven Biophysical Modeling of Neuronal Dynamics

July 30, 2015: Eighth International Undergraduate Research Symposium, NJIT, Newark, NJ
Data-Driven Biophysical Modeling of Neuronal Dynamics

July 22, 2015: Computational Neuroscience Meeting (CNS-2015) - Workshop on Neuronal Oscillations, OCNS, Prague, Czech Republic
Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

July 11, 2015: Computational Neuroscience Group Universitat Pompeu Fabra, Barcelona, Catalunya, Spain
Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

July 8, 2015: Seminari de Sistemes Dinamics, University of Barcelona /Politechnic University of Catalunya, Barcelona, Spain

Frequency Preference Response to Oscillatory Inputs in Neuronal Models: A Geometric Approach to Subthreshold Resonance

David Shirokoff

June 29, 2016: ICOSAHOM 2016, Rio de Janeiro, Brazil
Unconditional Stability for Multistep IMEX Schemes

May 8, 2016: 2016 SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA
Approximate Global Minimizers for Pairwise Interacting Systems

April 11, 2016: Analysis Seminar, Fordham University, Bronx, NY
Approximate Global Minimizers for Pairwise Interacting Systems

March 29, 2016: Numerics Seminar, Columbia University, New York, NY
Approximate Global Minimizers for Pairwise Interacting Systems

February 26, 2016: Applied Mathematics Colloquium, NJIT, Newark, NJ
Approximate Global Minimizers for Pairwise Interacting Systems

January 13, 2016: Wonapde 2016, Concepcion, Chile
High Order Penalty Methods: A Fourier Approach to Solving PDE's On Domains with Curved Boundaries

January 5, 2016: Oxford-NYU Workshop on Mathematical Models of Defects and Patterns, New York University, New York, NY
Approximate Global Minimizers for Pairwise Interacting Systems

December 8, 2015: 2015 SIAM Conference on Analysis of PDE, Scottsdale, AZ
A New Method for Finding Approximate Global Minimizers to Pairwise Interaction Problems

November 4, 2015: Numerics Seminar, Massachusetts Institute of Technology, Massachusetts Institute of Technology, Cambridge, MA
Approximate Global Minimizers for Large Systems of Interacting Particles

October 27, 2015: United States Naval Academy, Annapolis, MD
High Order Penalty Methods: A Fourier Approach to Solving PDE's On Domains with Curved Boundaries

September 25, 2015: George Mason University, Fairfax, VA
A Simple, Efficient and Accurate Method for Computing the Order-Disorder Phase Transition in Double Well Energy Functionals

August 10, 2015: ICIAM conference 2015, Beijing, China
An Efficient, Accurate Method for Computing the Order-Disorder Phase Transition in Double-Welled Energy Functionals

Michael Siegel

June 2016: Burgers Program for Fluid Dynamics, University of Maryland, College Park, MD
1) Boundary Integral Methods For Water Waves And Related Problems I
2) Boundary Integral Methods For Water Waves And Related Problems II

May 23, 2016: International Conference on Multiphase Flow 2016, Firenze, Italy
A Hybrid Numerical Method for Two-Phase Flow with Soluble Surfactant

February 2016: Seminar, UC Merced, Merced, CA
A Hybrid Numerical Method for Interfacial Flow with Transition Layers

January 2016: Seminar, Fields Institute, Toronto, Canada
Singularity Formation and Well-Posedness Theory in Fluid-Interface Problems

December 2015: Applied Math Seminar, Imperial College, London, UK
Analysis and Computations of the Initial Value Problem for Hydroelastic Waves

November 2015: 68th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Boston, MA
Simulation of Drop Tipstreaming in a Flow Focusing Geometry with a Hybrid Numerical Method

November 5, 2015: Applied Math Lab Seminar, NYU Courant Institute, New York, NY
Analysis and Computations of the Initial Value Problem for Hydroelastic Waves

September 3, 2015: Numerical Analysis Seminar, KTH, Stockholm, Sweden
Analysis and Computations of the Initial Value Problem for Hydroelastic Waves

August 11, 2015: International Congress of Industrial and Applied Mathematics, Beijing, China
Analysis and Computations of the Initial Value Problem for Hydroelastic Waves

Ronald Sverdlove

March 4, 2016: Midwest Finance Association Annual Meeting, Atlanta, Georgia
Discussion of “Prices and Volatilities in the Corporate Bond Market” by Jack Bao, Jia Chen, Kewei Hou, and Lei Lu

November 6, 2015: 26th Conference on Financial Economics and Accounting, Rutgers University, Piscataway, NJ
Discussion of "Price Discrimination against Individual Investors: Evidence from U.S. Options Market" by Yubin Li, Chen Zhao, and Zhaodong Zhong

October 15, 2015: FMA Annual Meeting, Financial Management Association, Orlando, Florida
Discussion of "Corporate Social Responsibility and Cost of Bond Issuance" by Wei Du, Dawei Jin, Liuling Liu, and Haizhi Wang

Catalin Turc

July 25, 2015: International congress on WAVES, INRIA, Karslruhe, Germany
Comparisons of Integral Equations Formulations for High-Frequency Two-Dimensional Helmholtz Transmission Problems in Domains with Corners

Yuan-Nan Young

June 3 - 4, 2016: FACM, NJIT, Newark, NJ
An Efficient Pair-Potential Method for Coarse-Grained Lipid Bilayer Membrane Simulations in LAMMPS

May 11, 2016: 2016 SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA

1) An Accurate Metropolis-Hastings Algorithm and a Fast Multipole Method for Coarse-Grained Lipid Bilayer Membrane in Solvent
2) Fluctuation and Dynamics of a Lipid Bilayer Membrane Under an Electric Field

January 2016: The 5th Northeast Complex Fluids and Soft Matter Workshop, NYU Tandon School of Engineering, Brooklyn, NY
Efficient Brownian Dynamics Simulation of DNA Molecules with Hydrodynamic Interactions in Linear Flows

November 15, 2015: 68th American Physical Society/Division of Fluid Dynamics Meeting, Boston, MA
Fluctuation and Dynamics of a Lipid Bilayer Membrane under an Elec- Tric Field

November 14, 2015: AMS, Rutgers University, New Brunswick, NJ
Gating of a Mechanosensitive Channel Due To Cellular Flow

August 2015: Workshop on Mathematical Foundations for Fast Multi-resolution interactions & Large Data Analysis, Duke University, Durham, NC
Efficient Brownian Dynamics Simulation of DNA Molecules with Hydrodynamic Interactions

August 20, 2015: Center for Theoretical Sciences, National Taiwan University
Gating of a Mechanosensitive Channel Due To Cellular Flows and Mathematical Modeling of Mechanosensing of TRPP1-TRPP2

August 12, 2015: 8th International Congress on Industrial and Applied Mathematics, Beijing, China
An Immersed Interface Method for Axisymmetric Electrohydrodynamic Simulations in Stokes and Navier-Stokes Flows

July 24, 2015: IMA Hot Topic Workshops: Mathematics of Biological Charge Transport: Molecules and Beyond, University of Minnesota, Minneapolis, MN
Membrane Fluctuations and Dynamics under an Electric Field

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES AND AWARDS

Shahriar Afkhami

Session Chair, American Physical Society, Division of Fluid Dynamics, November 20, 2015.

Session Chair, International Conference on Transport Processes at Fluidic Interfaces, October 6, 2015.

Journal Editor, Journal of Engineering Mathematics, January 1, 2016 - Current.

Awards

June 5, 2016: CNRS Research Fellowship from Le Centre National de la Recherche Scientifique.

September 5, 2015: Travel Support Award from ICERM, Brown University.

John Bechtold

Member, Bergen Community College, STEM Advisory Board, March 2013 - Current.

Denis Blackmore

Editorial Review Board Member, Universal Journal of Physics and Application, March 2015 - Current.

Associate Editor, Mechanics Research Communications, September 2007 - Current.

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

Editorial Board, Atlantis/Springer Advanced Book Series: Studies in Mathematical Physics: Theory and Applications
(Editor-in-Chief, Norbert Euler), April 2011 - Current.

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

Editorial Board, Recent Patents in Space Technology, October 2009 - Current.

Editorial Board, Differential Equations and Applications, September 2008 - Current.

Editorial Board, Regular and Chaotic Dynamics, September 2008 - Current.

Editorial Board, Mathematical Bulletin of the Shevchenko Scientific Society, September 2008 - Current.

Bruce Bukiet

Member, Edelman Award Committee, 2004 - Current.

Committee Chair, Mathematical Association of America, November 13 - Current.

Linda Cummings

Organizing Committee, 31st Annual MPI (Mathematical Problems in Industry) workshop, University of Delaware, June
Organizing Committee Member, FACM, 2016.

Editorial Advisory Board, Quarterly Journal of Mechanics & Applied Mathematics, May 2013 - Current.

Associate Editor, IMA Journal of Applied Mathematics, July 1, 2011 - Current.

Committee Member, Newton Institute, Cambridge, June 1, 2011 - Current.

Casey O. Diekman

Institute partner meeting representative: Mathematical Biosciences Institute, Ohio State University, Columbus, OH, February 2014.

Track Organizer, World Congress on Chronobiology, August 2, 2015 - August 6, 2015.

Session Chair, Minisymposium on Modeling: From Oscillators to Real-World Tools, Manchester, August 3, 2015.

Javier Diez

Vice-director of "Centro de Investigaciones en Fìsica e Ingenierìa del Centro de la Provincia de Buenos Aires (CIFICEN)" (Research Center of CONICET and UNCPBA)

Director of "Instituto de Fìsica Arroyo Seco (IFAS)" (Research Center of Facultad de Ciencias Exactas, UNCPBA)

Wenge Guo

Associate Editor of PLOS ONE, October 2012 - Current.

Associate Editor of the Journal of Biometrics and Biostatistics, June 2010 - Current.
Associate Editor of Calcutta Statistical Association Bulletin, April 2014 - Current.

David Horntrop

Awards

September 2015: Excellence in Teaching Award (Lower Division Undergraduate Instruction) from NJIT

Jay Kappraff

Member of the Editorial Board of ISIS Symmetry Journal, 2003 - Current.

Lou Kondic

Workshop Organizer, European Solid Mechanics Conference, Spain, February 1, 2015 - August 1, 2016.

Member, FACM Organizing Committee, 2016.

Workshop Organizer, Symposium on Statics and Dynamics of Dense Granular Matter, September 1, 2014 - September 1, 2015.

Zoi-Heleni Michalopoulou

Editor, Journal of the Acoustical Society of America, July 1, 2011 - Current.

Associate Editor, IEEE, Journal of Oceanic Engineering, May 11, 2015 - Current.

Committee Member, Acoustical Society of America, September 1, 2009 - Current.

Petronije Milojevic

Editor, Mathematica Moravica, September 1996 - Current.

Editor, Facta Universitatis, September 1985 - Current.

Richard O. Moore

Advisor, SIAM Student Chapter at NJIT, 2014 – 2015.

Organizing Committee Member, 31st Annual MPI (Mathematical Problems in Industry) workshop, University of Delaware, June 18, 2010 - Current.

Cyrill Muratov

Associate Editor, Networks and Heterogeneous Media, January 1, 2009 - Current.

Farzan Nadim

Chairperson, NIH Study Section August 2012 - Current.

Senior Editor, Encyclopedia of Computational Neuroscience (Springer), May 1, 2012 - Current.

Editor, Frontiers in Neural Circuitry, September 2009 - Current.

Editor, Journal of Neuroscience, January 1, 2013 - December 31, 2016.

Board of Directors Member, Organization for Computational Neuroscience, September 2012 - September 2015.

Horacio Rotstein

New York University, Visiting Scholar

Rutgers University - Newark, NJ, Member of the Graduate Faculty

Program Committee Member, International Neural Network Society & IEEE Computational Intelligence

Guest Editor, Chaos, an Interdisciplinary Journal of Nonlinear Science, "Focus Issue on Rhythms and Dynamic Transitions in Neurological Disease: Modeling, Computation and Experiment" (with T. Kaper and M. Kramer)

Michael Siegel

Associate Editor, Journal of Engineering Mathematics, September 2015 - Current.

Member of Editorial Board, SIAM Journal of Applied Mathematics, September 1, 2005 - Current.

Workshop Organizer, Fields Institute, Toronto, January 2016.

Member of Organizing Committee, Conference on Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ, June 2015.

Awards

August 1, 2015: Wallenberg Professorship from KTH Sweden.

Sundarraman Subramanian

Awards

May 5, 2016: 2016 CSLA Excellence in Graduate Education Award from NJIT.

Ronald Sverdlove

Program Organizer, Midwest Finance Association, October 10, 2014 - Current.

Catalin Turc

Associate Editor, Proceedings Royal Society Open Science, June 2014 - Current.

Antai Wang

Awards

November 1, 2015: Award from the Robert Maplethorpe Foundation.

October 1, 2015: Faculty Seed Award from NJIT.

B. FACM 2016 CONFERENCE: FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS

The thirteenth conference on Frontiers in Applied and Computational Mathematics, under the abbreviated title FACM 2016, was held at the New Jersey Institute of Technology on June 3-4. Now that the conference has reached its early teens it has become a more mature event perhaps, but its content continues to evolve each year in seeking out and presenting those developments that are most interesting at the forefront of current research in applied mathematics and statistics.

This year, FACM 2016's main focus in statistics was on biostatistics, but also included was a distinct group of talks and a plenary talk on the new and rapidly evolving area of optical imaging data analysis, which spans fields from statistics to neuroscience and other applications in the life sciences. In applied mathematics, the focus topics were mathematical and computational aspects of materials science, computational wave propagation, microscale and biological studies of fluid dynamics, and mathematical biology. Typical of the cross-disciplinary aspect of FACM meetings was a group of talks organized by Gal Haspel of the Biological Sciences Department at NJIT on the dynamics and neural control of animal locomotion.

The conference had 153 total participants, of whom 79 visited from 55 universities other than NJIT, and 5 visited from either a government laboratory or industry. Twelve participants visited from 9 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 37 posters on a variety of research topics.

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

- **Robert Kass**, of Carnegie Mellon University, on “Oscillations and Synchrony in Spike Trains: A Statistical Perspective”
- **Mitchell Luskin**, of the University of Minnesota, on “Mathematical Modeling of Incommensurate 2D Materials”
- **Laura Miller**, of the University of North Carolina at Chapel Hill, on “Flight of the Smallest Insects”
- **Andre Nachbin**, of the Instituto Nacional de Matematica Pura e Aplicada (IMPA), Brazil, on “The Uncertain Trajectory of a Pilot Wave”

The organizing committee for this year’s conference was: Michael Booty (Chair), with Casey Diekman, Lou Kondic, Ji Meng Loh, Jonathan Luke, David Shirokoff, Catalin Turc, and Yuan-Nan Young, all of the Department of Mathematical Sciences at NJIT, with the following external committee members: Fioralba Cakoni (Rutgers University), Gal Haspel (Biological Sciences, NJIT), Sarah Olson (Worcester Polytechnic Institute), Mark Reimers (Michigan State University), Gideon Simpson (Drexel University), Daphne Soares (Biological Sciences, NJIT), and Yuanjia Wang (Columbia University).

FACM 2016 Group Photograph

FACM 2016 Poster Presentations

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

Statistical Data Analysis
New Jersey Meadowlands Commission: November 1, 2006 – December 31, 2015
Daljit S. Ahluwalia

Linear Conductance-Based Mechanisms Underlying Oscillations in Neuronal Networks
National Science Foundation: October 1, 2011 - September 30, 2015
Amitabha Bose (PI), Jorge Golowasch (Co-PI) and Farzan Nadim (Co-PI)

Efficient Methods for Electromagnetic and Acoustic Problems
National Science Foundation: July 15, 2013 - June 30, 2016
Yassine Boubendir

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

CREATIV: Nonlinear Data Reduction Applied to Dense Granular Media
National Science Foundation: September 15, 2012 - August 31, 2015
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

Cell Calcium Dynamics
National Science Foundation: July 1, 2015 - June 30, 2016
Victor Matveev

Efficient Inversion in Ocean Acoustics with Iterative, Sequential, and Analytical Methods
Office of Naval Research: January 1, 2013 - December 31, 2015
Zoi-Heleni Michalopoulou

Collaborative Research: Mathematical and Computational Methods for Stochastic Systems in Nonlinear Optics
National Science Foundation: September 1, 2011 - August 31, 2015
Richard O. Moore

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

Collaborative Research: Dynamics of Morphogen Gradients
National Science Foundation: October 1, 2011 - September 30, 2015
Cyrill Muratov

Mechanisms of Frequency Preference in Neurons and Networks: Biophysics and Dynamics
National Science Foundation: September 1, 2013 - August 31, 2016
Horacio Rotstein

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

MIMO Radar Clutter Modeling Phase II, STTR Phase II
Air Force Office Scientific Research: February 1, 2014 - January 31, 2016
Catalin Turc (Co-PI, with MathSys Inc.), STTR Phase II

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

Collaborative Research: The MPI workshop and GSMM Camp
National Science Foundation: March 1, 2012 - Feb 28, 2015
Linda Cummings (PI), Richard Moore (Co-PI)

Interdisciplinary Undergraduate Program in Nanotechnology at NJIT: Linking K-12 through Graduate Education via Nanotechnology
National Science Foundation: January 1, 2014 - December 31, 2015
Zoi-Heleni Michalopoulou, Raquel Perez-Castillejos, John Carpinelli, Haim Grebel, and Somenath Mitra

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

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

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

Cell Calcium Dynamics
National Science Foundation: July 1, 2015 - June 30, 2016
Victor Matveev

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

A Special Mass Gauging Concept for Large-Scale Cryogenic Propellant Tanks
National Aeronautics and Space Administration: September 10, 2015 - May 30, 2016
Cyrill Muratov

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

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

CAMS MEMBER EXTERNALLY FUNDED PROJECTS -- NOT THROUGH CAMS

Inestabilidades en Peliculas Liquidas Conformadas: Formacion de Gotas Submilimetricas y Nanometricas
Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICET, Argentina): July 2013 - July 2016
Javier Diez

Formación de Patrones por Inestabilidad de Películas Líquidas Hasta Escalas Nanométricas
Agencia Nacional de Promoción de la Ciencia y la Tecnología (ANPCyT, Argentina): July 2013 - July 2016
Javier Diez

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

Numerical Methods for Viscoelastic Flows Including Three-Phase and Fluid-Structure Interaction Problems
National Science Foundation: July 1, 2016 - June 30, 2019
Shahriar Afkhami

Conference on Frontiers in Applied and Computational Mathematics 2016
National Science Foundation: July 1, 2016 - June 30, 2017
Michael Booty (PI), Michael Siegel and Amitabha Bose (Co-PIs)

Improved Methods for Wave Propagation
National Science Foundation: July 1, 2016 - June 30, 2019
Yassine Boubendir

Collaborative Research: Nonlinear Interaction between Surface and Internal Gravity Waves in the Ocean
National Science Foundation: July 1, 2016 - June 30, 2019
Wooyoung Choi

Surface Gravity Wave - Internal Gravity Wave Interactions and a New Perspective on Upper Ocean Mixing at High Wind States
Naval Research: July 1, 2016 - June 30, 2018
Wooyoung Choi

Nematic Liquid Crystals: Dielectowetting and Dewetting
National Science Foundation: July 1, 2016 - June 30, 2019
Linda Cummings (PI), Lou Kondic (Co-PI)

Predicting Performance and Fouling of Membrane Filters
National Science Foundation: July 1, 2016 - June 30, 2019
Linda Cummings (PI), Lou Kondic (Co-PI)

Neural Mechanisms Underlying Undulatory Locomotion
National Science Foundation (IOS): July 1, 2016 - ???
Gal Haspel (PI), Casey Diekman (Co-PI)

Studying the Optimal ON/Off Scheduling and Survivability during Androgen Deprivation Therapy for Prostate Cancer Cohorts
National Institutes of Health: July 1, 2016 - June 30, 2019
Sunil Dhar (PI), Antai Wang (Co-PI)

CAREER: Neuronal Data Assimilation Tools and Models for Understanding Circadian Rhythms
National Science Foundation: July 1, 2016 - June 30, 2021
Casey Diekman

Sloan Research Fellowship in Mathematics
Sloan Fellowship: July 1, 2016 - June 30, 2019
Casey Diekman

Mathematical Modeling of Daily Biological Timekeeping
Simons Foundations: July 1, 2016 - June 30, 2019
Casey Diekman

Numerical Methods for Optimal Transportation
Simons Foundations: July 1, 2016 - June 30, 2019
Brittany Froese

Meshfree Finite Difference Methods for Nonlinear Elliptic Equations
National Science Foundation: July 1, 2016 - June 30, 2019
Brittany Froese

Nonlinear Dynamics of Waves and Vortices
National Science Foundation: July 1, 2016 - June 30, 2019
Roy Goodman

Quantifying Complex Spatiotemporal Systems
Defense Advanced Research Projects Agency: July 1, 2016 - June 30, 2018
Lou Kondic

Structure Evolution during Phase Separation in Colloids under Microgravity
NASA: July 1, 2016 - June 30, 2018
Lou Kondic (PI), Boris Khusid (Co-PI)

Collaborative Research: Computations, Modeling and Experiments of Self and Directed Assembly for Nanoscale Liquid Metal Systems
National Science Foundation: July 1, 2016 - June 30, 2019
Lou Kondic (PI), Shahriar Afkhami (Co-PI)

NRT-DESE: Quantitative and Scientific Research for Energy Environmental Sustainability
National Science Foundation: July 1, 2016 - June 30, 2021
Ji Meng Loh (PI), S. Jiang, M. Nakayama, S. Cai, Y. Chen (Co-PIs)

Non-Linear Analysis of Inhomogenous Stop-And-Frisk Spatio-Temporal Point Data
National Science Foundation: July 1, 2016 - June 30, 2018
Ji Meng Loh

EDT: Enriched Doctoral Training at NJIT for students in the Mathematical Sciences
National Science Foundation: July 1, 2016 - June 30, 2019
Zoi-Heleni Michalopoulou (PI), Linda Cummings (Co-PI), Ji Meng Loh (Co-PI) , Richard Moore (Co-PI), Michael Siegel (Co-PI)

Shallow Water Inversion with Optimization and Direct Methods
Office of Naval Research: July 1, 2016 - June 30, 2019
Zoi-Heleni Michalopoulou
Collaborative Research: Data-Enabled Control and Influence Applied To Ocean Glider Exploration
DMS-CDS&E-MSS: July 1, 2016 - June 30, 2019
Richard Moore

Collaborative Research: OP: Rare Events and Broadband Noise In Nearly Integrable Optical Systems
National Science Foundation: July 1, 2016 - June 30, 2018
Richard Moore

Magnetization Dynamics at Nanoscale
National Science Foundation: July 1, 2016 - June 30, 2019
Cyrill Muratov

A Special Mass Gauging Concept for Large-Scale Cryogenic Propellant Tanks
National Aeronautics and Space Administration: September 10, 2015 - May 30, 2016
Cyrill Muratov

Complex Patterns in Networks of Relaxation Oscillators with Dynamic Non-Local Coupling
National Science Foundation: July 1, 2016 - June 30, 2019
Horacio Rotstein

Preferred Spike Frequency Responses in Neuronal Networks: Revealing the Biophysical and Dynamic Mechanisms
National Science Foundation: July 1, 2016 - June 30, 2019
Horacio Rotstein

US-Israel Research Proposal: Network Resonance: Spiking Mechanisms and Behavioral Implications
National Science Foundation (CRCNS): July 1, 2016 - June 30, 2019
Horacio Rotstein

Spiking Network Mechanisms Underlying Gamma Oscillations
Binational Science Foundation (US-Israel): July 1, 2016 - June 30, 2019
Horacio Rotstein

Approximate Global Minimizers for Large Systems of Pairwise Interacting Particles
National Science Foundation: July 1, 2016 - June 30, 2019
David Shirokoff

Bootstrap Model Checks for Single Index Mean and Quantile Regression with Applications
National Science Foundation: July 1, 2016 - June 30, 2019
Sundarraman Subramanian

Innovative Physics-based Modeling Tool for Application to Passive Radio Frequency Identification System on Rotocraft
Naval Air Systems Command (NAVAIR): July 1, 2016 - June 30, 2018
Catalin Turc

Efficient Solutions and Wave Propagation Problems In Multi-Layered, Multiple Scattering Media
National Science Foundation: July 1, 2016 - June 30, 2019
Catalin Turc

New Strategies to Analyze Survival Data Using Frailty Models
National Institutes of Health: July 1, 2016 - June 30, 2018
Antai Wang

New Strategies to Analyze Survival Data Using Frailty Models
Simons Foundations: July 1, 2016 - June 30, 2021
Antai Wang

SIV Infection of Viral-Induced CD4t Cells in Vivo
Robert Mapplehthorpe Foundation: July 1, 2016 - June 30, 2018
Wei (PI), Antai Wang (Co-PI)

Collaborative Research: Theoretical, Computational and Experimental Investigations on the Interaction between a Lipid Bilayer Membrane and Solid
National Science Foundation: July 1, 2016 - June 30, 2019
Yuan-Nan Young

Collaborative Research: Hierarchical Models of Mechanotransduction and Associated Transport
National Science Foundation: July 1, 2016 - June 30, 2019
Yuan-Nan Young

Collaborative Research: Electrokinetics-Mediated Hydrodynamics of a Biological Membrane during Morphological Changes
National Science Foundation: July 1, 2016 - June 30, 2019
Yuan-Nan Young

Collaborative Research: Theoretical, Computational and Experimental Investigations on Activation of Mechanosensitive Channels
National Science Foundation: July 1, 2016 - June 30, 2019
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 the 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 takes the form of the workstations and desktop PC's that are made available in faculty, postdoctoral associate, and student offices, which are networked, plus other more major, shared facilities of the CMCL.

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

DMS has expanded its Stheno cluster in a sequence of stages since its first server, Stheno-1, became operational in November 2011. In the year covered by this report, department funds were used to purchase two IBM iDataPlex dx360 servers in June 2015. This cluster is intended to be used to test (or debug) and run MPI (message-passing interface) codes.

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.

B. STATISTICAL CONSULTING LABORATORY REPORT (July 2015 - June 2016)

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. Consulting activities with external organizations include:

Date: Jan 2016
Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Analysis of Hackensack River and Tributaries Sediment Data
Consultant: Ji Meng Loh

Date: Jun 2016
Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Analysis of 2007-2015 Metals and Organics Data for Secaucus High School Marsh Soil Study
Consultants: Ji Meng Loh and PhD student Xieyang Jia

Date: Mar 2016
Client: Hackensack University Medical Center
Description: Analysis of Environmental Chemicals Data in Fetal Cord Blood and Maternal Urine
Consultants: Ji Meng Loh and PhD student Yalin Zhu

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, 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.

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

Cavitation in Insects: Mechanisms for Switching on the Embryonic Tracheal System, with Arthur Woods (University of Montana)

Computations, Modeling and Experiments of Self and Directed Assembly for Nanoscale Liquid Metal Systems, with Lou Kondic (NJIT)

Deformation of a Sessile Ferrofluid Droplet in An Applied Magnetic field, with Linda Cummings (NJIT) and Amir Hirsa (RPI)

Direct Computation and Modeling of Nanoscale Fluid Problems Including Fluid-Solid Interaction, Thermal Effects and Phase Change, with Lou Kondic (NJIT)

Liquid Metals on Nanoscale: Modeling and Computation, with Lou Kondic (NJIT)

Micorfluidics Flow Focusing, with Alex Leshansky

John Bechtold

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

Denis Blackmore

A Gauge-Theoretical Analysis of Magnetic Reconnection, with Kevin Urban (Masters Graduate Student)

Axial and Radial Pressure in Cylindrical Silos, with Anthony Rosato (NJIT) and Xavier Tricoche (Purdue University)

Density Relaxation in Granular Systems, with Anthony Rosato (NJIT) and David Horntrop (NJIT)

Dynamical Systems Modeling of Dilating/Contracting Granular Systems, with Anthony Rosato (NJIT), Luo Zuo (NJIT Graduate Student), National Ching (NJIT Graduate Student), Andrew Harlow (NJIT Graduate Student), Xavier Tricoche (Purdue University), Kevin Urban (NJIT Graduate Student)

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

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

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

Local Periodic Perturbations of Limit Cycles, with John Tavantzis (Rutgers-Newark, NJIT Emeritus)

New Techniques for Analyzing Strange Attractors, with Yogesh Joshi (Kingsborough Community College)

Perturbations of the Forced van der Pol Equation, John Tavantzis (Rutgers-Newark, NJIT Emeritus)

Michael Booty

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

Surfactant Effects in Low Reynolds Number Flows, with Yuan-Nan Young (NJIT) and Michael Siegel (NJIT)

Amitabha Bose

Linear Conductance-Based Mechanisms Underlying Oscillations in Neuronal Networks, with Jorge Golowasch (NJIT) and Farzan Nadim (NJIT)

Mathematical Analysis of Circadian Rhythm Models with Casey Diekman (NJIT)

Yassine Boubendir

A Preconditioner for Wave Problems Based on the Perfectly Matched Layer, with Peter Petropoulos (NJIT) and Dawid Midura (Ph.D. Graduate Alumni)

Acceleration of an Iterative Method for the Evaluation of High-Frequency Multiples Scattering Effects, with Reitich Fernando and Fatih Ecevit

Coupling Finite and Boundary Element Methods Using Localized Adaptive Radiation Condition for Maxwell's Equations, with Abderrahmane Bendali and Nicolas Zerbib

Well-Conditioned Integral Equations for Acoustic Transmission Problems, with Catalin Turc (NJIT)

Bruce Bukiet

Education Research, with James Lipuma

Math Modeling Of Prostate Cancer Treatment, with Hans Chaudhry (NJIT), Tom Findley (VA Hospital, East Orange), Nan Gao (Rutgers-Newark), Zhiming Ji, and Sunil Dhar (NJIT)

Daniel Bunker

Augmented Reality for Ecological Data and Processes, with Gareth Russell

Cascading Effects of Urbanization on Pollinator and Plant Communities, with Caroline DeVan, Timothy Blockus, and Dominic Evangelista

Effects Of Generalist Herbivores On Plant Communities, Linda Rohleder (Graduate Student), Timothy Blockus (Undergraduate Student), Dominc Evagelista (Undergraduate Student), Don Waller, Alex Royo, Bill McShea, Steeve Cote, Caroline DeVan (Graduate Student), and Brian Traw

Life History Tradeoffs and Species Abundance, with Brian Mitchell, Timothy Blockus, and Aditya Madala

Spontaneous Dispersion of Particles in Liquid Surfaces, with Pushpendra Singh

Linda Cummings

Bistability and "Gliding" In A Nematic Liquid Crystal Display Device, with Lou Kondic (NJIT), Chenjing Cai (Ph.D. Graduate Alumni), and Ensela Mema (Ph.D. Graduate Student)

Deformation of a Sessile Ferrofluid Droplet in An Applied Magnetic field, with Shahriar Afkhami (NJIT) and Amir Hirsa (RPI)

Extensional Dynamics of a Nematic Liquid Crystal Sheet, with Tim Myers (CRM, Barcelona) and Jonathan Low (CRM, Barcelona)

Free Surface Instability of a Thin Film of Nematic Liquid Crystal, with Lou Kondic (NJIT), Michael Lam (Ph.D. Graduate Student), with Lou Kondic (NJIT), Michael Lam (Ph.D. Graduate Student), Te-Sheng Lin (University of Loughborough), and Uwe Thiele (University of Loughborough)

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

Mathematical Models for Filtration, with Pejman Sanaei (Ph.D. Graduate Student) and Giles Richardson (University of Southampton)

Mathematical Models for Tissue Engineering, with Jeffrey Pohlmeyer (Ph.D. Graduate Alumni) and Sarah Waters (University of Oxford)

Mathematical Models Related to the Drawing of Glass Sheets and Optical Fibers, with Chris Breward (University of Oxford), John Abbott (Corning, Inc.), Tom Witelski (Duke University), Ian Griffiths (University of Oxford), and Michele Taroni (University of Oxford)

Two-Dimensional Stokes Flow in Doubly-Connected Domains, with John King (University of Nottingham, UK)

Sunil Dhar

Math Modeling of Prostate Cancer Treatment, with Bruce Bukiet (NJIT), Hans Chaudhry (NJIT), Tom Findley (VA Hospital, East Orange), Nan Gao (Rutgers-Newark), and Zhiming Ji

Casey Diekman

Correlated Expression of Ion Channel in Circadian Neurons, with Jorge Golowasch (NJIT)

Daylength Encoding by Circadian Clock Neurons, with Mino Belle (University of Manchester) and Hugh Piggins (University of Manchester)

Global Coupling of Genetic Oscillators, with Amitabha Bose (NJIT) and Horacio Rotstein (NJIT)

Involvement of Neural Oscillators and Proprioception in Locomotion of C. elegans, with Gal Haspel (NJIT), Jordan Storm (NJIT), and Antonio Jurko (NJIT)

Ion Channel Expression in SCN2.2 Cell Line, with Jorge Golowasch (NJIT) and Rebecca Deek (NJIT Graduate Student)

Brittany Froese

Beam Shaping Following an Optimal Transportation Map, with Zexin Feng (University of Arizona) and Rongguang Liang (University of Arizona)

Seismic Full Waveform Inversion Using The Wasserstein Metric, with Bjorn Engquist (University of Texas at Austin) and Yunan Yang (University of Texas at Austin Graduate Student)

Roy Goodman

Instabilities Of Localized Solutions To Nonlinear Wave Equations With Defects, with Michael Weinstein (Columbia University) and Jeremy Marzuola (University of North Carolina)

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

Numerical Methods for Invariant Manifolds, with Jacek Wrobel (NJIT), Casayndra Basarab (NJIT), and Priyanka Shah (NJIT)

Wenge Guo

Analysis Of Longitudinal Microarray Data, with Antai Wang (NJIT), Ji Meng Loh (NJIT), Xu Zhang (NJIT), and Xin (James) Li (Georgetown University)

Multiple Testing Procedures for Multiple Pairwise Comparisons in Genomic Studies, with Shyamal Peddada (National Institute of Environmental Health Sciences)

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

The Control of Directional Errors in Stepwise Procedures under Dependence, with Joseph P. Romano (Stanford University)

David Horntrop

Density Relaxation in Granular Systems, with Anthony Rosato (NJIT) and Denis Blackmore (NJIT)

Modeling and Simulation of Credit Risk, with Bo Ren (NJIT) and William Morokoff (Standard and Poors)

Variance Reduction for Stochastic Differential Equations, with Megha Billamoria (NJIT) and Sandeep Singh (NJIT)

Lou Kondic

Bistability and "Gliding" In A Nematic Liquid Crystal Display Device, with Linda Cummings (NJIT), Chenjing Cai (Ph.D. Graduate Alumni), and Ensela Mema (Ph.D. Graduate Student)

Computations, Modeling and Experiments of Self and Directed Assembly for Nanoscale Liquid Metal Systems, with Shahriar Afkhami (NJIT)

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Free Surface Instability of a Thin Film of Nematic Liquid Crystal, with Linda Cummings (NJIT), Michael Lam (NJIT), Te-Sheng Lin (University of Loughborough), and Uwe Thiele (University of Loughborough)

Liquid Metals on Nanoscale: Modeling and Computation, with Shahriar Afkhami (NJIT)

Ji Meng Loh

Analysis Of Longitudinal Microarray Data, with Antai Wang (NJIT), Wenge Guo (NJIT), Xu Zhang (NJIT), Xin (James) Li (Georgetown University)

Victor Matveev

Calcium Nanodomains in Neurotransmitter and Hormone Release, with Morten Gram Pedersen, Arthur Sherman, and Michela Riz (Graduate Student)

Properties of Synaptic Calcium Channels, with Elize Stanley

Eliza Michalopoulou

Contaminant Behavior And Impacts To Environmental Systems, with Lisa B. Axe, Liping Wei (NJIT), Jahan Kauser (NJIT), John Dyksen (NJIT), Bin Wang (NJIT Graduate Student), Nimrat Sandhu (NJIT Graduate Student), Zhan Shu (NJIT Graduate Student), Shuangyi Zhang (NJIT Graduate Student), Stephen Gitungo (NJIT/ Hatch Mott Graduate Student)
Explosive Detection with THz Spectroscopy, with John F. Federici, Dale E. Gary, and Robert B. Barat

Sequential Particle Filtering, with Caglar Yardim and Peter Gerstoft

Statistical Modeling of the Invariance Principle for Tracking, with Lisa Zurk

Richard Moore

Effects of Thermal Perturbations on Magnetic Droplet Solitons, with Mark Hoefer and Peter Wills (Graduate Student)

Heating of Thin Ceramic Slabs in Microwave Cavities, with Shuchi Agrawal (NJIT Ph.D. Alumni)

Importance Sampling In Data Assimilation, Christopher Jones (UNC-Chapel Hill) and Damon McDougall (Institute for Computational Engineering and Sciences, U. Texas-Austin)

Localized Patterns in Thermally Active Parametric Gain Media, with Keith Promislow (Michigan State University)

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

Optimal Control in Data Assimilation, Damon McDougall and Ani Hsieh

Cyrill Muratov

Density Functional Theory for Massless Fermions in Graphene, with Vitaly Moroz (University of Swansea) and Jianfeng Lu (Duke University)

Domain Walls In Thin Film Ferromagnets, with Ross Lund (NJIT), Antonio Capella-Kort (UNAM), Hans Kneupfer (University of Heidelberg), Gabriel Chaves-O'Flynn (NYU), and Valery Slastikov (Bristol University)

Front Propagation In Geometric And Phase Field Models Of Stratified Media, with Matteo Novaga (University of Pisa), Annalisa Cesaroni (University of Padua), and Peter Gordon (University of Akron)

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

Gyroid Structures in Material Science, with David Shirokoff (NJIT)

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

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

Supercritical Fronts For Reaction Diffusion Equations in Infinite Cylinders, with Peter Gordon and Matteo Novaga (University of Padua)

Farzan Nadim

Linear Conductance-Based Mechanisms Underlying Oscillations In Neuronal Networks, with Jorge Golowasch (NJIT), Amitabha Bose (NJIT), Y. Guan (NJIT Graduate Student)

Temporal Fidelity of Axonal Action Potential Conduction and Its Neuromodulation, with Dirk Bucher

Peter Petropoulos

A Preconditioner for Wave Problems Based on the Perfectly Matched Layer, with Yassine Boubendir (NJIT) and Dawid Midura (NJIT Ph.D. Alumni)

Algorithms for the Computation of Fractional Derivatives, with Matthew Causley

Electrohydrodynamics and Interfacial Fluid Dynamics, with Lyudmyla Barannyk (University of Idaho) and Demetrius Papageorgiou (Imperial College, UK)

Electrohydrodynamics and Interfacial Fluid Dynamics, with Thomas Anderson (NJIT Undergraduate Student) and Demetrius Papageorgiou (Imperial College, UK)

Numerical Simulation of Pattern Formation in Systems with Global Feedback, with Horacio Rotstein (NJIT)

Horacio Rotstein

Coregulation of Conductances in Neuronal Models, with Jorge Golowasch (NJIT) and Motolani Olarinre (Graduate Student)

Dynamic Compensation Mechanism Give Rise to Period and Duty Cycle Level Sets in Oscillatory Neuronal Models, with Jorge Golowasch (NJIT) and Motolani Olarinre (Graduate Student)

Dynamics of Fronts in Bistable Systems with Delayed Global Feedback, with Yassine Boubendir (NJIT)

Dynamics of Medial Entorhinal Cortex Layer II Stellate Cells and Related Networks, with Dongwook Kim (NJIT Ph.D. Graduate Alumni), John White, and Tilman Kispersky

Global Coupling of Genetic Oscillators, with Casey Diekman (NJIT) and Amitabha Bose (NJIT)

Numerical Simulation of Pattern Formation in Systems with Global Feedback, with Peter Petropoulos (NJIT)

Pattern Formation in Relaxation Oscillators with Inhibitory Global Feedback, with Hui Wu (Graduate Student)

Subthreshold and superthreshold frequency preferences (resonance) in nonlinear neural models, With Dongwook Kim (NJIT Ph.D. Graduate Alumni), Farzan Nadim (NJIT), and Nima Sheikholeslami (Graduate Student)

The Canard Phenomenon In Piece-Wise Linear Systems, with Steve Coombes

David Shirokoff

Gyroid Structures in Material Science, with Cyrill Muratov (NJIT)

High-Order Mixed Finite Elements For A Pressure-Poisson Equation Reformulation Of The Navier-Stokes Equations With Electric Boundary Conditions, with Dong Zhou (Temple University), Benjamin Seibold (Temple University), Ruben Rosales (MIT), and Prince Chidyagwai (Loyola Maryland)

Resolving Order-Loss in Runge-Kutta Methods for Boundary Value Problems, with Dong Zhou (Temple University), Benjamin Seibold (Temple University), and Ruben Rosales (MIT)

Michael Siegel

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

Mechanics of Retinal Detachment, with Tom Chou

Surfactant Effects in Low Reynolds Number Flows, with Yuan-Nan Young (NJIT) and Michael Booty (NJIT)

Sundarraman Subramanian

Analysis of Doubly Truncated Survival Data Using Nonparametric Methods, with Antai Wang (NJIT) and Jin Qin (NIH)

Simultaneous Confidence Bands from Two-sample Censored Data, with Nubyra Ahmed (Ph.D. Graduate Alumni)

Ronald Sverdlove

A Critical Study of the Concept of a Collective, with Glenn Shafer and Vladimir Vovk

Financial Bubble Project, with William V. Rapp, Mark Somers, Michael A. Ehrlich, Porchiung B. Chou, Zhipeng Yan, and Rajiv Mehta

Relations between Prices in the Stock Market and the CDS Market, with Ren-raw Chen (Fordham University)

The Central Bank and the Risk Sharing Network for Financial Institutions, with Michael A. Ehrlich and Porchiung B. Chou

Catalin Turc

High-Order Solutions of Integral Equation Formulations of Helmholtz Transmission Problems in Two-Dimensional Domains with Corners, with Victor Dominguez (University of Navarra, Spain) and Mark Lyon (University of New Hampshire)

Reduced Bases Simulation of Wave Propagation in Urban Environments, with Oscar Bruno (Caltech) and Mark Lyon (University of New Hampshire)

Antai Wang

Analysis of Doubly Truncated Survival Data Using Nonparametric Methods, with Jin Qin (NIH) and Sundarraman Subramanian (NJIT)

Analysis of Longitudinal Microarray Data, with Ji Meng Loh (NJIT), Wenge Guo (NJIT), Zhang Xu (NJIT Graduate Student), and Xin Li (Georgetown University)

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

Yuan-Nan Young

Dynamics and Rheology of a Compound Vesicle in Shear Flow, with Jerzy Blazdziewicz, Petia Vlahovska, and Shravan Veerapaneni

Dynamics of Primary Cilium, with Christopher Jacobs (Columbia University)

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

Electrodeformation of a Surfactant-Laden Viscous Drop, with Herve Nganguia (Ph.D. Graduate Alumni)

Poration of a Lipid Bi-Layer Membrane, with Herve Nganguia (Ph.D. Graduate Alumni)

Surfactant Effects in Low Reynolds Number Flows, with Michael Booty (NJIT) and Michael Siegel (NJIT)

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

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

David J. Horntrop, Associate Chair for Undergraduate Studies

Report on 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 third 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 2015 cohort consisted of nine students: Andres Alban, Hardik Darji, Atsuki Imamuram, Joseph Ballardo, Jonathan Dougherty, Nilanjan Haldar, Josef Mohrenweiser, Michael Rivera, and William Ruys. Their research mentors were Casey Diekman, David Horntrop, William Morokoff (industry mentor, Standard & Poor's), and Marvin Nakayama (Computer Science Department, NJIT). The 2016 cohort consists 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 are: Ji Meng Loh, Eliza Michalopoulou, and Richard Moore. EXTREEMS-QED students presented their research at a number of conferences during the past year including the MBI Undergraduate Capstone Conference, the Garden State Undergraduate Mathematics Conference, and Frontiers in Applied and Computational Mathematics.

Many students have been engaged in research outside the EXTREEMS-QED program and have presented and published their work. For example, Joseph Ballardo is participating in an REU program at Ohio State University during summer 2016. William Ruys has a research internship at Argonne National Laboratory during summer 2016. 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. David Anderson received a Fulbright Fellowship to continue his studies in Germany; David is the first NJIT undergraduate to be awarded a Fulbright. At the Garden State Undergraduate Mathematics Conference, 3 of our students placed in the top 4 in the individual competition with Thomas Tu placing first. Our students 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 on April 29, 2016. The inductees were Jimmie Adriazola, Joseph Ballardo, Alina Mohit-Tabatabai, Danial Qureshi, Armando Rosa, and Tadanaga Takahashi. 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 UCLA, Caltech, RPI, Northwestern, and the University of Delaware. Examples of employers of our recent graduates include MetLife, Prudential Financial, Chubb, NY Life, Buck Consultants, and Trillium Management. Many of our recent graduates are also serving as mentors of our current undergraduates in a program recently developed by Karen Rappaport.

Pi Mu Epsilon Mathematics Honor Society Induction Ceremony
April 29, 2016

B. GRADUATE PROGRAMS

Lou Kondic, Associate Chair for Graduate Studies

The graduate programs of the Department of Mathematical Sciences continue to build on their recent successes. In addition to the ongoing success of our four MS programs, in Applied Mathematics, Applied Statistics, Biostatistics, and Mathematical & Computational Finance, our PhD program continues to attract high-caliber students who carry out cutting-edge research with our faculty.

Our PhD students have an impressive collective record of presenting their research, thereby gaining exposure on a national and international stage. Each year we send our students to high-profile international meetings such as the APS meetings, SIAM meetings, and meetings of the Acoustical Society of America, where their work brings credit to the department and NJIT. In addition, almost all of our students present posters or talks at the annual Frontiers in Applied and Computational Mathematics conference, which is described in Section VIB of this report. The PhD students organize their own summer seminar series, in which each research-active student makes a presentation. The department also hosts an active SIAM Student Chapter, with Richard Moore as its Faculty Advisor.
Our PhD students are strongly encouraged to publish their work in quality peer-reviewed journals, and most have two papers or sometimes more accepted for publication by the time of their graduation. A full list of our students' accomplishments in conference presentations and peer-reviewed publications follows.

Our graduates continue to succeed in their careers post-NJIT, with recent non-academic destinations for our PhD graduates including Google, HSBC, Oak Ridge National Laboratory, and Merck.

PhDs Awarded in the Period Covered by the Report

Rianka Bhattacharya
Thesis: Two-Sample Location Scale Estimation and Testing from Semiparametric Random Censorship Models
Advisor: Sundar Subramanian

Kyle T. Mahady
Thesis: Methods for the Direct Simulation of Nanoscale Film Breakup and Contact Angles
Advisor: Shahriar Afkhami (Advisor) and Lou Kondic (Co-advisor)

Hao Wu
Thesis: Investigation of Infinite-Dimensional Dynamical System Models Applicable to Granular Flows
Advisor: Denis L. Blackmore

Publications, Presentations, & Conferences (not including FACM Participation)

Mahdi Bandegi

Publications

Electromigration-driven Evolution of the Surface Morphology and Composition for a Bi-Component Solid Film (with M. Khenner), Math. Model. Nat. Phenom., Volume 10, Number 4, 2015 Micro-nanophenomena.

Valeria Barra

Poster Presentations

October 16-18, 2015: Scientista Symposium, Microsoft, New York, NY
Numerical Study of Thin Layers of Viscoelastic Fluids
S. Afkhami, L. Kondic

October 28, 2015: Graduate Students Research Day 2015, NJIT
Surface instabilities and droplets formation in thin viscoelastic films
S. Afkhami, L. Kondic

Presentations

January 15, 2016: The Fifth Annual Northeast Complex Fluids and Soft Matter Workshop, NYU Tandon School of Engineering, New York, NY
Interfacial Dynamics of Thin Viscoelastic Films and Drops
(S. Afkhami, L. Kondic)

April 20, 2016: The Dana Knox Research Showcase, NJIT
Interfacial Dynamics of Thin Viscoelastic Films and Drops
(S. Afkhami, L. Kondic)

Conferences and Workshop Attendance

June 13-17, 2016: Mathematical Problems in Industry, Duke University, Durham, NC
- Worked on a project to evaluate algorithms for remote sensing of land mines.
Project name: "Scoring Practices for Remote Sensing"
Industrial Representative: CoVar Applied Technologies
Rui Cao

Posters

April 20, 2016: Dana Knox Research Showcase, NJIT, Newark, NJ
A Hybrid Numerical Method for Electro-Osmotic Flow with Deformable Interfaces

Presentations

June 10-12, 2016: 2016 International Conference of Microfluidics, Nanofluidics and Lab-on-a-Chip, Dalian, China
A Numerical Method for Electrokinetic Flow with Deformable Interfaces

Malik Chabane

Conferences and Workshop Attendance

NYU-Oxford Workshop on Mathematical Models of Defects and Patterns

Ruihua Cheng

Posters

October 1, 2015: From Industrial Statistics to Data Science Conference in University of Michigan
Learning-Based Method with Valence Shifters for Sentiment Analysis

April 2016: Dana Knox Student Research Showcase in New Jersey Institute of Technology
Learning-Based Method with Valence Shifters for Sentiment Analysis

Szu-Pei Fu

Presentations

June 14, 2016: New Jersey Institute of Technology, Newark, NJ.
Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions (presentation), (with Yuan-Nan Young and Shidong Jiang)

May 11, 2016: The 2016 SIAM Conference on Mathematical Aspects of Materials Science (MS16), Sheraton Society Hill Hotel, Philadelphia, PA
An Accurate Metropolis-Hastings Algorithm and a Fast Multipole Method for Coarse-Grained Lipid Bilayer Membrane in Solvent (presentation),
(with Shidong Jiang, Nawaf Bou-Rabee, Yuan-Nan Young, Zhangli Peng and Hongyan Yuan)

Jan 15, 2016: The 5th Northeast Complex Fluids and Soft Matter Workshop (NCS5), NYU Tandon School of Engineering, Brooklyn, NY
Efficient Brownian Dynamics Simulation of DNA Molecules with Hydrodynamic Interactions in Linear Flows (Yuan-Nan Young and Shidong Jiang)

July 30, 2015: Graduate student-faculty Summer seminars, New Jersey Institute of Technology, Newark, NJ
A Metropolis-Hastings Algorithm for Simulation of DNA with HydrodynamicInteractions
(with Yuan-Nan Young and Shidong Jiang)

Conferences and Workshop Attendance

November 14, 2015: AMS Fall Eastern Sectional Meeting, Rutgers University, New Brunswick, NJ

Dec 25-26, 2015: National Center for Theoretical Sciences Winter School Modeling, Simulation and Analysis of Biology and Physiology, National Taiwan University, Taipei, Taiwan

Lenka Kovalcinova

Publications

Scaling Properties of Force Networks for Compressed Particulate Systems (with A. Goullet and L. Kondic), Phys. Rev. E, Vol. 93, 042903, 2016.

Percolation And Jamming Transitions In Particulate Systems With And Without Cohesion (with A. Goullet and L. Kondic), Phys. Rev. E, 92, 032204, 2016.

Presentations

November 2015: Fall Eastern Sectional AMS Meeting, New Brunswick, NJ
Importance of Topological Measures in Describing Sheared Granular Systems

Conferences and Workshop Attendance

June 13-17, 2016: Modeling Problems in Industry (MPI) at Duke University, Durham, NC

Michael Lam

Presentations

November 2015: 68th APS DFD, Boston, MA
Instabilities in Thin Nematic Liquid Crystal Films and Drops

Ensela Mema

Publications

Substrate-Induced Gliding In A Nematic Liquid Crystal Layer (with Kondic, L. and Cummings, L. J.), Physical Review E, Vol. 92, 062513, December 2015.

Poster

April 20, 2016: Dana Knox Showcase, NJIT, Newark, NJ
Flexoelectric Effect in a Freedericksz Transition Cell

Presentation

March 14 - 18, 2016: APS March Meeting, Baltimore, MD
Effect of an applied electric field on a weakly anchored non-planar nematic liquid crystal layer

Matthew Moye

Presentations

June 16, 2016: Student Summer talk, New Jersey Institute of Technology, Newark, NJ
Parameter Estimation Techniques of Neuron Models

June 29, 2016: Math-Bio Journal Club, New Jersey Institute of Technology, Newark, NJ
Dynamical State and Parameter Estimation: Abarbanel et al.

Aminur Rahman

Publications

Neimark–Sacker Bifurcation And Evidence Of Chaos In A Discrete Dynamical Model Of walkers (with D. Blackmore), Chaos, Solitons & Fractals, Vol. 91, pp. 339-349, 2016.

Presentations

June 21, 2016: NJIT Graduate Student Seminar, New Jersey Institute of Technology, Newark, NJ
A Tempest in the Mathematics of Time: A Brief History of Chaos and Its Appearance in Walking Droplets and Electronic Circuits

November 24, 2015: American Physical Society 68th Annual Division of Fluid Dynamics Meeting, Hynes Convention Center, Boston, MA
Neimark-Sacker Bifurcation and Evidence of Chaos in a Discrete Dynamical Model of Walkers.

November 14, 2015: American Mathematical Society Fall Northeast Sectional Conference 2015, Rutgers University, New Brunswick, NJ
(Invited) Neimark-Sacker Bifurcation and Evidence of Chaos in a Discrete Dynamical Model of Walkers

October 7, 2015: Mechanical and Industrial Engineering Colloquium, New Jersey Institute of Technology, Newark, NJ
(Invited) The Chaotic Ballet of Walking Droplets

Conferences and Workshop Attendance

June 13-17, 2016: Mathematical Problems in Industry 2016, Duke University, Durham, NC
June 3-4, 2016: FACM 2016, NJIT, Newark, NJ

June 22-26, 2015: Mathematical Problems in Industry 2015, University of Delaware, Newark, DE

Pejman Sanaei

Publications

Flow and Fouling in a Pleated Membrane Filter (with G.W. Richardson, T. Witelski, L.J Cummings), Journal of Fluid Mechanics, Vol. 795, pp. 36-59, 2016.

Posters

April 2016: Dana Knox Research Showcase, NJIT, Newark, NJ
Optimum Pore Profile and Fouling in Membrane Filters

October 2015: Graduate Student Association (GSA) Research Day
Flow and Fouling in a Pleated Membrane Filter

Presentations

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

April 2016: Applied Math Days, Rensselaer Polytechnic Institute (RPI)
Permeability Profile in Optimization Filter Membrane Performance

January 2016: The 5th Northeast Complex Fluids and Soft Matter Workshop (NCS5) (New York University Tandon, School of Engineering
Optimum Permeability Profile and Fouling in Membrane Filters

November 2015: American Physical Society-Division of Fluid Dynamics, Boston, MA
Flow and fouling in Membrane Filters: Effects of Membrane Morphology

Conferences and Workshop Attendance

June 2016: Mathematical Problems in Industry, MPI, Duke University

YiMing Yu

Posters

July 25-August, 2016: Gene Golub SIAM Summer School 2016, Philadelphia, PA
Biased Monte Carlo Simulation for Likelihood of Phase Slip of a Mode-Locked Laser Model

Presentations

August 8-11, 2016: SIAM Conference on Nonlinear Waves and Coherent Structures (NWCS16), Philadelphia, PA
Biased Monte Carlo Simulation for Likelihood of Phase Slip of a Mode-Locked Laser Model

Conferences and Workshop Attendance

July 25-August, 2016: Gene Golub SIAM Summer School 2016, Philadelphia, PA

June 2015: New Perspectives in Markov Chain Monte Carlo, Spain

Yalin Zhu

Presentations

August 13, 2015: Student Summer Talks, NJIT, Newark, NJ
Controlling the Overall False Discovery Rate in Testing Multiple Ordered Families of Hypotheses

Graduate Student Poster Presentations at FACM 2016

Mahdi Bandegi, *Approximate Global Minimizers of Pairwise Interactions*

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

Szu-Pei Fu, *Coarse-Grained Molecular Dynamics Simulations of Lipid Bilayer Membrane*

Emel Khan, *Investigating Frequency Preferences of Chemical Systems in Response to Periodic Forcing*

Lenka Kovalcinova, *Percolation and Jamming Transitions in Particulate Systems*

Michael Lam, *Instabilities in Thin Nematic Liquid Crystal Films*

Randolph Leiser, *Network Response to Periodic Inputs*

Ensela Mema, *Flexoelectric Effects in a Freedericksz Transition Cell*

Pejman Sanaei, *Investigating the Performance of Pleated Membrane Filters*

Ivana Seric, *Direct computations of Marangoni-induced Flows Using a Volume of Fluid Method*

Shaobo Wang, *A High Order Integral Equation Method for Solving the Heat Equation with Complex Geometries in Three Dimensions*

YiMing Yu, *Biased Monte Carlo Simulation for Likelihood of Phase Slip of a Mode-Locked Laser Model*

Yalin Zhu, *FWER Controlling Multiple Testing Procedures for Discrete Data* (poster) and *Multivariate Logistic Type Models Based on Inverse Sampling Scheme*

Graduate Student Honors and Awards

Randolph Leiser

CSLA Outstanding Graduate Student, NJIT, May 5, 2016

Aminur Rahman

NJIT Excellence in Teaching by a Teaching Assistant, NJIT, 2016

Pejman Sanaei

NJIT Class of '58 Fellowship Award, 2016

NJIT Ahluwalia Fellowship Award, 2015

NJIT GSA Research Day Award, 2015

Rui Cao

Ahluwalia Fellowship Award of 2015, December 11, 2015

PhD Summer Program Activities

Summer Program Seminars: Faculty and Student Talks

Tuesday, May 31, **Pejman Sanaei**, Models for Membrane Filtration

Thursday, June 02, **Michael Lam**, Instabilities in Very Thin Nematic Liquid Crystal Films

Monday, June 06, **Richard Moore**, Optimal Control in Nonlinear Waves

Tuesday, June 07, **Ensela Mema**, Mathematical Models for Polymer-Nematic Interactions

Thursday, June 09, **Lenka Kovalcinova**, Numerical Simulations of Dense Granular Systems with and Without Cohesive Effects

Monday, June 13, **Ji Meng Loh**, A Single-Index Model for Inhomogeneous Spatial Point Processes

Tuesday, June 14, **Szu-Pei Fu**, Brownian Dynamics Simulations of Lipid Bilayer Membrane with Hydrodynamic Interactions in LAMMPS

Thursday, June 16, **Matthew Moye**, Parameter Estimation Techniques of Neuron Models

Tuesday, June 21, **Aminur Rahman**, A Brief History of Chaos and its Appearance in Walking Droplets and Electronic Circuits

Thursday, June 23, **Casayndra Basarab**, Hamiltonian Bifurcations in Schrodinger Trimers

Monday, June 27, **Shidong Jiang**, An Introduction to the Fast Multipole Method

Tuesday, June 28, **Ivana Seric**, Direct Computations of Marangoni-induced Flows Using a Volume of Fluid Method

Thursday, June 30, **Nanyi Dong**, Thin Film Evolution under Pulsed Laser Introduced Marangoni Effect

Tuesday, July 05, **Horacio Rotstein**, Inhibition-Based Theta Resonance in a Hippocampal Network: A Modeling Study

Thursday, July 07, **Randolph Leiser**, Network Response to Periodic Inputs: Heterogeneous vs. Homogeneous Cell Components

Monday, July 11, **Wooyoung Choi**, On Strongly Nonlinear Long Wave Motions in Density-stratified Flows

Tuesday, July 12, **Ruihua Cheng**, Learning-Based Method with Valence Shifters for Sentiment Analysis

Thursday, July 14, **YiMing Yu**, Rare Event Simulation for Exit Problem

Monday, July 18, **Valeria Barra**, Numerical Study of Thin Viscoelastic Films

Tuesday, July 19, **Haiyang Qi**, Boundary Integral Equation Formulations and Nystrom Discretizations for the Solution of Helmholtz Problems

Thursday, July 21, **Michael Pedneault**, Decomposition Methods for the Solution of Multiple Scattering Problems

Monday, July 25, **Roy Goodman**, Managing Applied Math Research

Tuesday, July 26, **Michael Booty**, Surfactant Solubility in the Large Peclet Number Limit

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

Monday, August 01, **Yassine Boubendir**, Coupling Finite and Boundary Element Methods for the Helmholtz Equation

Tuesday, August 02, **Andrew deStefan**, Numerical Methods for Optimal Path Planning of Autonomous Vehicles

Thursday, August 04, **Li Yu**, Brief Introduce to Penalty Equation, Spectral Method and Shallow Water Wave

Thursday, August 04, **Linwan Feng**, A Generalized Graphical Approach to Sequentially Rejective Multiple Testing Procedures

Monday, August 08, **Shahriar Afkhami**, Moving Boundary Fluid Dynamics Problems

Tuesday, August 09, **Ryan Allaire**, Analysis of Thin Films and Linear Stability Analysis

Tuesday, August 09, **Ryan Atwater**, Response of a Dielectric Sphere in an Electrolyte due to an AC Field

Tuesday, August 09, **Brandon Behring**, Stability of Leap-Frogging Pairs of Four Point Vortices

Thursday, August 11, **Subha Datta**, Sufficient Dimension Reduction Techniques and Why We Need Them

Thursday, August 11, **Ziyan Guo**, Shallow Water Configuration

GSMM Camp and MPI Workshop 2016

CAMS members Linda Cummings and Richard Moore are PIs on grant NSF DMS 1261596, which funds the annual Graduate Student Mathematical Modeling Camp (GSMMC) and the Mathematical Problems in Industry (MPI) Workshop. These two events run in consecutive weeks in June each year.

The Camp exists to provide graduate students with intensive training in mathematical modeling, team work, and all aspects of presentation skills. Students work in groups of around eight, under the guidance of an experienced faculty mentor, on modeling a real-world problem brought by the mentor. At the 2016 Camp (held at Rensselaer Polytechnic Institute) four mentors brought problems on chemical filtration, biomass and water accumulation in plant cells during growth, defect detection in micro filtration media, and low atmosphere climate modeling.
The experience and skills that students gain during the Camp prepare them well for the MPI workshop held in the week following (all Camp attendees are expected to participate in MPI). MPI 2016 was held at Duke University. At this workshop academic participants address problems of pressing industrial concern, presented by industrial stakeholders (who pay a modest fee in return for the work carried out and a written technical report). The 2016 workshop featured four problems, brought by W.L. Gore and Associates, Revon Systems, CoVar Applied Technologies, and Clypd. NJIT and CAMS were well-represented, with a total of eight participants (seven graduate students and one faculty member, PI Moore - PI Cummings was unable to participate due to giving a plenary lecture at the 2016 European Conference for Mathematics in Industry). As usual, excellent progress was made on all industrial problems considered, with industry representatives highly satisfied with the outcomes. MPI 2017 will be held at NJIT, organized by Cummings and Moore.

GSMM Camp and MPI Workshop 2016

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