CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT

2011-2012

NJIT New Jersey's Science & Technology University

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I. FROM THE DIRECTOR

The Center for Applied Mathematics and Statistics (CAMS) heads into its 27th year as a vehicle to support research in applied mathematics and statistics at NJIT. One of the key activities of CAMS is the hosting of the annual Frontiers in Applied and Computational Mathematics meeting. This year we held our ninth conference and as always this was attended by many of our Ph.D. alumni and former postdocs. We are grateful that our former students and postdocs could join us in this event. We are also happy to report that, despite a difficult job market, our recent Ph.D. graduates were able to obtain postdoc positions at prestigious institutions such as the University of Oxford and Tulane. We hope to see these former students at a future FACM meeting.

We take particular pride in the undergraduate research supported by CAMS, which has significantly increased in the past few years. Examples include the Undergraduate Mathematics and Biology Training Program (UBMTP) funded by the National Science Foundation, which provides innovative training and research at the intersection of mathematics and biology. NJIT Provost Ian Gatley 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.

DMS also receives substantial funding for graduate student and faculty research from sources such as the National Science Foundation, National Institutes of Health, Office of Naval Research, Department of Defense, NASA, Newark Beth Israel Medical Center, NJ Meadowlands Commission and private industry. This year, CAMS faculty were awarded eight new grants from NSF and other agencies.

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

- Continued hosting of the Frontiers in Applied and Computational Mathematics (FACM) conference. The ninth conference was held on May 19-21, 2012. The three-day meeting focused on application of mathematics to fluid dynamics, wave propagation, and mathematical biology, as well as applied statistics, and attracted over 172 participants.

- The purchase of a 96-core extension to our newest computer cluster, Stheno. This doubles the size of computer capabilities for multicore parallel computations.

- The continued awarding of a Gary Thomas Fellowship to Mathematical Sciences doctoral student Cassandra Basarab. This fellowship is the leading award given by the university to a student pursuing doctoral studies.

- The support of 4 postdoctoral fellows, 1 by the department and 3 by outside funding.

As always, the accomplishments of CAMS have been built with the support and dedication of many individuals. We are grateful to Ian Gatley, Provost and Sr. Vice President of Academic Affairs, Fadi Deek, Dean of CSLA, and Don Sebastian, Sr. 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.

Daljit S. Ahluwalia, Director ***Michael Siegel, 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 - 2012

Dr. John S. Abbott	Corning Incorporated
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Dr. Ned J. Corron	U.S. Army AMCOM
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Ms. Krystyna J. Monczka	Hewitt Associates
Mr. George Quillan	Prudential Financial
Dr. Richard Silberglitt	Rand Corporation
Dr. Benjamin White	Exxon Research & Engineering

III. MEMBERS AND VISITORS

Department of Mathematical Sciences

Afkhami, Shahriar
Ahluwalia, Daljit S.
Andrushkiw, Roman
Bechtold, John
Bhattacharjee, Manish
Blackmore, Denis
Booty, Michael
Bose, Amitabha
Boubendir, Yassine
Bukiet, Bruce
Bunker, Daniel
Choi, Wooyoung
Cummings, Linda
Deek, Fadi
Dhar, Sunil
Dios, Rose
Golowasch, Jorge
Goodman, Roy
Gordon, Peter
Goullet, Arnaud
Guo, Wenge
Horntrop, David
Jain, Aridaman
Jiang, Shidong
Johnson, Kenneth
Kappraff, Jay
Kondic, Lou
Kriegsmann, Gregory A.
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
Siegel, Michael
Subramanian, Sundar
Sverdlove, Ronald
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 Research Professors

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 of East Anglia, Norwich, England
Wylie, Jonathan	City University of Hong Kong

IV. COLLOQUIA AND SEMINARS

Department of Mathematical Sciences Colloquium

September 2 **Roy Goodman**, NJIT
Oscillatory Instabilities and Complex Dynamics in a System of Waveguides

September 9 **Marvin Nakayama**, NJIT
Kernel Density Estimation When Applying Importance Sampling, With Applications to Quantile Estimation

September 16 **Sanjeeva Balasuriya**, Connecticut College
Transport and Barriers in Unsteady Flows

September 23 **Xiaofan Li**, Illinois Institute of Technology
Microstructual Evolution in Elastic Media

September 30 **Lisa Fauci**, Tulane University
Waving Rings and Swimming in Circles: Some Lessons Learned through Biofluiddynamics

October 7 **Philip Yecko**, Montclair State University
Ferrofluids: A New Look at a Dirty Old Liquid

October 14 **Carlo Laing**, Massey University, New Zealand
Chimera States in Heterogeneous Kuramoto Networks

October 21 **Paul Steen**, Cornell University
Dynamics and Stability of Reconfigurable Capillary Surfaces

October 28 **Rajarshi Roy**, University of Maryland
Synchronization in Real Networks: Control and Optimization

November 4 **Jon Kettenring**, Drew University
Coping with High Dimensionality in Massive Datasets: An Overview

November 11 **Michael Mackey**, McGill University
A Mathematical Modeling Study of Neutrophil Dynamics in Response to Chemotherapy and G-CSF

November 18 **John Guckenheimer**, Cornell University
Mixed Mode Oscillations

December 2 **Kenny Breuer**, Brown University
The Mechanics of Bacterial Motility in Viscous and Viscoelastic Fluids

December 9 **Michael Weinstein**, Columbia University
Scattering, Homogenization and Waves in Microstructures

January 20 **Shahriar Afkhami**, NJIT
Low-Ca Transient Breakup of Elongated Drops in a Microfluidic T-junction

January 27 **Francisco Javier**, University of Delaware
Integral Absorbing Boundary Conditions in the Time Domain

February 3 **Catalin Turc**, Case Western University
Efficient, Accurate and Rapidly-convergent Algorithms for Evaluation of the Interaction between Electromagnetic Fields and Complex Structures

February 10 **Shane Ross**, Virginia Tech
Geometric and Probabilistic Descriptions of Chaotic Phase Space Transport

February 17 **Ian Dryden**, University of South Carolina
Sparse Paradigm Free Mapping: Detection of Activations and Resting State Networks in fMRI.

February 24 **Gideon Simpson**, University of Minnesota
Coherent Structures and Shocks in a Periodic Nonlinear Maxwell System

March 2 **Susan Minkoff**, University of Maryland, Baltimore County
Multiscale Modeling and Analysis of the Wave Equation

March 9 **Issac Klapper**, Montana State University
Modeling of Microbial Biofilm Communities

March 23 **Mark Sussman**, Florida State University
A Coupled Level Set-Moment of Fluid Method for Incompressible Two-Phase Flows

March 30 **Marian Gidea**, Institute for Advanced Studies
Hamiltonian Instability and its Applications to Astrodynamics

April 13 **Cecila Diniz Behn**, Gettysburg College
Dynamics of Sleep-wake Regulation

Apri 20 **Leonid Berlyand**, Penn State University
PDE Models of Collective Swimming in Bacterial Suspensions

April 27 **David Pine**, New York University
Random Organization: How Periodic Forcing Can Organize Non-equilibrium Systems

Applied Statistics Seminar

September 9 **Zhigen (Gene) Zhao**, Department of Statistics, Temple University
On the Credible Interval under the Zero-Inflated Mixture Prior in High Dimensional Inference

September 15 **Errol C. Caby**, AT&T Labs Research, Florham Park, NJ
Mining Port-level IP Data

October 6 **Yichao Wu**, North Carolina State University
Continuously Additive Models for Functional Regression

October 20 **Matt Hayat**, College of Nursing, Rutgers University
Model-based Prediction of Solar Particle Events

October 27 **M. Bhaskara Rao**, University of Cincinnati Medical Centre
Algebraic Statistics and Applications to Statistical Genetics

November 3 **Ganesh K. (Mani) Subramaniam**, AT&T Labs, Florham Park, NJ
Exploratory Analysis of Large-Scale Spatial-Temporal Data

November 10 **Kai Zhang**, Department of Statistics, The Wharton School, University of Penn.
Valid Post-Selection Inference

November 16 **Li He**, Department of Statistics, Temple University
Optimal Multiple Testing Procedure Incorporating Signal Strength

December 1 **Fei Liu**, Business Analytics & Mathematical Sciences, IBM T. J. Watson Research Center
High-Dimensional Variable Selection in Meta Analysis for Censored Data

December 8 **Ji Meng Loh**, AT&T Labs - Research, Florham Park, NJ
K-scan for Anomaly Detection in Spatial Point Patterns

January 19 **Michael Ehrlich**, Department of Finance, NJIT
Opportunities in Applied Finance

February 16 **Amy Davidow**, Department of Preventive Medicine & Community Health, University of Medicine and Dentistry of New Jersey, Newark, NJ
Diagnostic Accuracy Studies and Spectrum Bias

February 22 **Ji Meng Loh**, AT&T Labs - Research, Florham Park, NJ
Accounting for Spatial Correlation in the Scan Statistic

February 23 **Huaihou Chen**, Department of Biostatistics, Columbia University
Flexible Models and Methods for Longitudinal and Multilevel Functional Data

February 29 **Gavino Puggioni**, Real Lab, Biology Department, Emory University
Bayesian Hierarchical Models with Dynamic Structures and Latent Variables: Methodology and Applications

March 1 **Weili He**, Director, Biostatistics and Research Decision Sciences, Merck Sharp & Dohme Corporation, Rahway NJ
A Framework for Joint Modeling and Joint Assessment of Efficacy and Safety Endpoints for Probability of Success Evaluation and Optimal Dose Selection

March 8 **Kai Zhang**, Department of Statistics, The Wharton School, University of Penn.
Valid Post-Selection Inference

March 20 **Li He**, Department of Statistics, Temple University
Optimal Multiple Testing Procedure Incorporating Signal Strength

March 22 **Xiaohong Huang**, Principal Statistician, Biostatistics & Programming Sanofi, Bridgewater, NJ
Estimation of Treatment Effect for the Sequential Parallel Design

March 29 **Brian L. Egleston**, Biostatistics and Bioinformatics Facility, Fox Chase Cancer Center, Philadelphia, PA
The Impact of Misclassification due to Survey Response Fatigue on Estimation and Identifiability of Treatment Effects

April 12 **Michael Tortorella**, Professor, Industrial and Systems Engineering Department, Rutgers University
Some Explorations of the Kaplan-Meyer Estimator in the Presence of Immunes

Mathematical Biology Seminar

September 20 **Andrew Phillips**, Harvard Medical School
Modeling Mammalian Sleep/Wake Physiology to Understand Dynamics at the Behavioral Level

September 27 **Borja Ibarz**, Center for Neural Science, New York University
Preserving Tonotopy across Feed-forward Networks

October 18 **Amitabha Nandi**, Yale University
Impact of the Dynamic Cytoskeleton on Intracellular Sub-diffusion: A Local Motion Analysis

November 8 **Amit Bose**, Mathematical Sciences, NJIT
Future Direction in Dynamical Systems

November 22 **Esteban Tabak**, Courant Institute of Mathematical Sciences, NYU
Identifying Behavioral Traits through Continuous Feature Selection

November 29 **UBM Students**, Department of Mathematical Sciences, NJIT

February 14 **Horacio G. Rotstein**, Mathematical Sciences, NJIT
Resonance in Neural Models

March 27 **Horacio G. Rotstein**, Mathematical Sciences, NJIT
Relating Stochastic Synchrony and Phase-resetting Curves

April 3 **Horacio G. Rotstein**, Mathematical Sciences, NJIT
A Phase-plane Analysis Approach to the Mechanism of Generation of Subthreshold Resonance in Neural Models

Fluid Mechanics Seminar

September 12 **Boris Khusid**, NJIT
Electrodeless Drop-on-demand Printing of Personalized Medicines

September 26 **Camille Duprat**, Princeton University
Elastocapillary Flows

October 10 **Leif Ristroph**, Courant Institue
Maneuverability and Stability of Flying Insects

October 24 **Paul R. Chiarot**, SUNY at Binghamton
Electrospray and Continuous Ink-jet Technologies: Novel Applications and the Electrohydrodynamics of Droplets and Sprays

October 31 **Andrew Wells**, Yale University
Optimal Potential Energy Fluxes: Casting New Light on Convection and Alloy Solidification

November 7 **Charles Maldarelli**, City College of New York
The Self-propulsion of Colloidal Particles

November 14 **Alejandro G. Gonzalez**, UNCPBA, Tandil, Argentina
Models and Experiments of Contact Line Instabilities in Straight Rivulets and Rings

November 28 **Stephen Wilson**, University of Strathclyde, United Kingdom
Sheets, Rivulets, Ridges and Dry Patches

December 5 **Praveen Ramaprabhu**, University of North Carolina
Numerical Simulations of the Nonlinear Rayleigh-Taylor Instability

January 23 **Bin Liu**, Brown University
Helical Swimming in Viscoelastic and Porous Media

February 6 **Lou Kondic**, NJIT
Modeling Thin Film Instabilities with Application to Liquid Metals on Nanoscale

February 13 **Ricardo Barros**, IMPA
Non-Boussinesq Effects on the Stability of Stratified Shear Flows

February 20 **Jean-Luc Thiffeault**, University of Wisconsin
Simple Models of Stirring by Swimming Organisms

February 27 **Roseanna Zia**, Princeton University
Particle Motion in Colloids: Microviscosity, Microdiffusivity, and Normal Stresses

March 5 **Meenakshi Dutt**, Rutgers University
Harnessing Spontaneous and Self-Assembly to Design Biomimetic Functionalized Nanotube-Lipid Hybrid Structures

March 19 **Petia Vlahovska**, Brown University
Nonlinear Electrohydrodynamics of a Viscous Droplet

April 16 **Yang Liu**, Drexel University
Convergence Analysis of the Immersed Boundary Method

April 23 **Trushant Majmudar**, New York University
Experiments and Theory of Undulatory Locomotion in Structured Media

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Shahriar Afkhami

On the Motion of Superparamagnetic Particles in Magnetic Drug Targeting (with P. Yue, S. Lee, and Y. Renardy), Acta Mechanica, Vol. 223, pp. 505-527, 2012.

Obstructed Breakup of Slender Drops in a Microfluidic T Junction (with A. M. Leshansky, M.-C. Jullien, and P. Tabeling), Physical Review Letters, Vol. 108, 264502, 2012.

John Bechtold

Premixed Flame Propagation in a Confining Vessel with Weak Pressure Rise (with A.P. Kelley and C.K. Law), Journal of Fluid Mechanics, Vol. 691, pp. 26-51, 2012.

Flame-flow Interactions and Flow Reversal (with G. Bansal and H.G. Im), Combustion and Flame, Vol. 159(4), pp. 1489-1498, 2012.

Manish Bhattacharjee

Analysis of Two-dimensional Warranty Servicing Strategy with an Imperfect Repair Option (with R. Banerjee), Quality Technology & Quantitative Management (special issue in honor of S. Zacks), Vol. 9 (1), pp. 23-34, 2012.

Warranty Servicing with a Brown-Proschan Repair Option (with R. Banerjee), APJOR: Asia-Pacific Journal of Operations Research, Vol. 29 (3), June 2012.

Denis Blackmore

The AKNS Hierarchy and the Gurevich--Zybin Dynamical System Integrability Revisited (with Y. Prykarpatsky, J. Golenia, and A. Prykarpatsky), Math. Bull. Shevchenko Scientific Soc., Vol. 11, 258-282, December 2011.

Isospectral Integrability Analysis of Dynamical Systems on Discrete Manifolds (with A. Prykarpatsky and Y. Prykarpatsky), Opuscula Math., Vol. 32 (1), pp. 41-66, January 2012.

The AKNS Hierarchy Revisited: A Vertex Operator Approach and its Lie-algebraic Structure (with A. Prykarpatsky), J. Nonlin. Math. Phys., Vol. 19, 1250001, March 2012.

Exponentially Decaying Discrete Dynamical Systems (with Y. Joshi), Recent Patents on Space Tech., Vol. 2 (1), pp. 37-48, April 2012.

Evolution of Solids Fraction Surfaces in Tapping: Simulation and Dynamical Systems Analysis (with V. Ratnaswamy, A. Rosato, X. Tricoche, N. Ching, and L. Zuo), Granular Matter, Vol. 14, pp. 169-174, May 2012.

Victoria Booth

Multiple Signals from the Suprachiasmatic Nucleus Required for Circadian Regulation of Sleep-Wake Behavior in the Nocturnal Rat (with M. Fleshner, D. Forger, and C. Diniz Behn), Phil. Trans. R. Soc. A, Vol. 369, pp. 3855-3883, 2011.

Fast-Slow Analysis of REM Sleep Dynamics (with C. Diniz Behn), SIAM J. Appl. Dyn. Sys., Vol. 11, pp. 212-242, 2012.

Michael Booty

Semi-Analytical Solutions for Two-Dimensional Elastic Capsules in Stokes Flow (with M. Higley and M. Siegel), Proceedings of the Royal Society A, Published on-line, May 16, 2012. doi: 10.1098/rspa.2012.0090.

Amitabha Bose

Inhibitory Feedback Promotes Stability in an Oscillatory Network (with F. Nadim and S. Zhao), J. Neural Eng., Vol. 8, 065001, 2011.

Excitable Nodes on Random Graphs: Relating Dynamics to Network Structure (with T.U. Singh, K. Manchanda, and R. Ramaswamy), SIADS, Vol. 10, pp. 987-1012, 2011.

Daniel Bunker

Ecosystem Services, Targets, and Indicators for the Conservation and Sustainable Use of Biodiversity (with C. Perrings, S. Naeem, F. Ahrestani, P. Burkill, G. Canziana, T. Elmqvist, R. Ferrati, F. Jaksic, J. Fuhrman, Z. Kawabata, A. Kinzig, G. Mace, F. Milano, H. Mooney, A.-H. Prieur Richard, J. Tschirhart, and W. Weisser), Frontiers in Ecology and the Environment, Vol. 9(9), pp. 512-520. doi: 10.1890/100212, 2011.

Wooyoung Choi

Frequency Spectra Evolution of Two-dimensional Focusing Wave Groups in Finite Depth Water, J. of Fluid Mech. (with Z. Tian, and M. Perlin), Vol. 688, pp. 169-194, August 2011.

Holmboe Instability in Non-Boussinesq Flows, Phys. of Fluids (with R. Barros), Vol. 23, 124103, December 2011.

An Eddy Viscosity Model for Two-dimensional Breaking Waves and its Validation with Laboratory Experiments, Phys. of Fluids (with Z. Tian, and M. Perlin), Vol. 24, 036601, March 2012.

Linear Stability of Finite Amplitude Capillary Waves on Water of Infinite Depth, J. of Fluid Mech. (with R. Tiron), Vol. 696, pp. 402-422, April 2012.

Linda Cummings

Instability of Gravity-driven Flow of Liquid Crystal Films (with S. P. Naughton, N.K. Patel, I. Seric, L. Kondic and T. S. Lin), SIURO, Vol. 5, June 2012.

Analysis of Biochemical Equilibria Relevant to the Immune Response: Finding the Dissociation Constants (with R. Perez-Castillejos and E.T. Mack), Bull. Math. Biol. Vol. 74 (5), pp. 1171-1206, May 2012.

Defect Modeling in Spreading Nematic Droplets (with T.-S. Lin and L. Kondic), Phys. Rev. E, Vol. 85, 012702, January 2012.

Sunil K. Dhar

Sexual Dimorphism in Cardiac Triacylglyceride Dynamics in Mice on Long Term Caloric Restriction (with N. H. Banke, L. Yan, K. M. Pound, et al.), Journal of Molecular and Cellular Cardiology, Vol. 52 (3), pp. 733-740, March 2012.

Book Review: Biostatistical Methods: The Assessment of Relative Risks, Second Edition, by J. M. Lachin, Journal of Biopharmaceutical Statistics, Vol. 22 (4), pp. 872-873, 2012.

Inhibition of Smooth Muscle Myosin as a Novel Therapeutic Target for Hypertension (with X. Zhao, D. Ho, P. Abarzúa, et al.), The Journal of Pharmacology and Experimental Therapeutics, Vol. 339, pp. 307-312, October 2011.

H11 Kinase/Heat Shock Protein 22 Deletion Impairs Both Nuclear and Mitochondrial Functions of STAT3 and Accelerates the Transition Into Heart Failure on Cardiac Overload/Clinical Perspective Circulation Association (with H. Qiu, P. Lizano, L. Laure, X. Sui, E. Rashed, J. Yeon Park, C. Hong, S. Gao, E. Holle, D. Morin, et al.), American Heart, Vol. 124, pp. 406-415, July, 2011.

Preemptive Conditioning of the Swine Heart by H11 kinase / Hsp22 Provides Cardiac Protection through Inducible Nitric Oxide Synthase (with L. Chen, P. Lizano, X. Zhao, X. Sui, Y. Shen, D. E. Vatner, S. F. Vatner, and C. Depre), The Am. J. Phys.-Heart Circ. Phys., Vol. 300(4), pp. H1303–H1310, 2011.

Jorge Golowasch

Adult Mouse Basal Forebrain Harbors Two Distinct Cholinergic Populations Defined by Their Electrophysiology (with T. Cagri and L. Zaborszky), Frontiers in Behavioral Neuroscience, Vol. 6(21), pp. 1-14, 2012.

Neuromodulation Independently Determines Correlated Channel Expression and Conductance Levels in Motor Neurons of the Stomatogastric Ganglion (with S. Temporal, M. Desai, O. Khorkova, G. Varghese, A. Dai, D.J. Schulz), J. Neurophysiology, Vol. 107, pp. 178-727, 2012.

Recovery of Rhythmic Activity in a Central Pattern Generator: Analysis of the Role of Neuromodulator and Activity-dependent Mechanisms (with Y. Zhang), J. Computational Neuroscience, 31(3): 685-699, 2011.

Roy Goodman

High-Order Bisection Method for Computing Invariant Manifolds of Two-Dimensional Maps (with J. Wróbel), International Journal of Bifurcation and Chaos, Vol. 21, pp. 2017-2042, 2011.

Hamiltonian Hopf Bifurcations and Dynamics of NLS/GP Standing-wave Modes, J. Phys. A: Math. Theor., Vol. 44, 425101, 2011.

Arnaud Goullet

Topology of Force Networks in Compressed Granular Media (with L. Kondic, C.S. O'Hern, M.Kramar, K. Mischaikow, and R.P. Behringer), Europhys. Lett., Vol. 97, (5/54001), February 2012.

Wenge Guo

On Adaptive Procedures Controlling the Familywise Error Rate (with Sanat Sarkar and Helmut Finner), Journal of Statistical Planning and Inference, Vol. 142, pp. 65-78, January 2012.

Claus Holzapfel

Ecological and Environmental Issues Faced by a Developing Tibet (with C. Yu, Y. Zhang, R. Zheng, X. Zhang, and J. Wang), Environmental Science and Technology, Vol. 46, pp. 1979-1980, 2012.

Relationships between Seed Mass and Dormancy Along an Aridity Gradient– From Communities to Populations (with D. Harel and M. Sternberg), Basic and Applied Ecology, Vol. 8, pp. 674-684, 2011.

Huaxiong Huang

Lifetime Ruin Minimization: Should Retirees Hedge Inflation or Just Worry About It? (with M.A. Milevsky), Journal of Pension Economics and Finance, Vol. 10, pp. 363-387, July 2011.

Diffusion in a Cellular Medium: A (1+1)- Dimensional Model, (with J.J. Wylie and R.M. Miura), Bulletin of Mathematical Biology, Vol. 73, pp. 1682-1693, July 2011.

The Geometry and Dynamics of Binary Trees, Mathematics and Computers in Simulation, (with T.H.S van Kempen, T. David, P.L. Wilson), Mathematics and Computers in Simulation, Vol. 81, pp. 1464-1481, 2011.

Retirement Spending on Planet Vulcan: Longevity Risk and Withdrawal Rates (with M.A. Milevsky), AAII JOURNAL, September 2011.

Stretching of Viscous Threads at Low Reynolds Numbers (with J.J. Wylie and R.M. Miura), Journal of Fluids Mechanics, Vol. 683, pp. 212-234, September 2011.

A Continuum Neuronal Model for the Instigation and Propagation of Cortical Spreading Depression (with W. Yao and R.M. Miura), Bulletin of Mathematical Biology, Vol. 73, pp. 2773-2790, November 2011.

A Constrained Level Set Method for Simulating the Formation of Liquid Bridges (with D. He), Commun. Comput. Phys., Vol. 12, pp. 577-594, February 2012.

Shidong Jiang

Second Kind Integral Equations for the First Kind Dirichlet Problem of the Biharmonic Equation in Three Dimensions (with B. Ren, P. Tsuji, L. Ying), J. Comput. Phys., Vol. 230, 7488-7501, August 2011.

Lou Kondic

Topology of Force Networks in Compressed Granular Media (with A. Goullet, C.S. O'Hern, M. Kramar, K. Mischaikow, R.P. Behringer), Europhys. Lett., Vol. 97, 54001, pp. 1-6, February 2012.

Microstructure Evolution during Impact on Granular Matter (with X. Fang, W. Losert, C.S. O'Hern, R.P. Behringer), Phys. Rev. E, Vol. 85, 011305, pp. 1-20, February 2012.

Thin Hanging Films with Fronts: Two Dimensional Flow (with T-S. Lin, A. Filippov), Phys. Fluids, Vol. 24, 022105 pp. 1-16, January 2012.

Defect Modeling in Spreading Nematic Droplets (with T-S. Lin, L. Cummings), Phys. Rev. E, Vol. 85, 012702, pp. 1-5, January 2012.

Instability of a Transverse Liquid Rivulet on an Inclined Plane (with J. Diez, A.G. Gonzalez), Phys. Fluids, Vol. 24, 032104, pp. 1-23, January 2012.

Competing Liquid Phase Instabilities during Pulsed Laser Induced Self-assembly of Copper Rings into Ordered Nanoparticle Arrays on SiO2 (with Y. Wu, J.Fowlkes, N.A. Roberts, J. Diez, A.G. Gonzalez, P. Rack), Langmuir, Vol. 27, 13314-13321, August 2011.

On Evaporation of Sessile Drops with Moving Contact Lines (with N. Murisic), J. Fluid Mech. Vol. 679, 219-246, July 2011.

Zoi-Heleni Michalopoulou

Particle Filtering for Passive Fathometer Tracking (with C. Yardim and P. Gerstoft), Journal of the Acoustical Society of America, Vol. 131, pp. EL74-80, January 2012.

Model-based Ocean Acoustic Signal Processing (with E. J. Sullivan and C. Yardim), Acoustics Today, Vol. 7(3), pp. 8-16, October 2011.

Effects of Cd, Cu, Ni, and Zn on Brown Tide Alga Aureococcus Anophagefferens Growth and Metal Accumulation (with B. Wang, L. Axe, and L. Wei), Environmental Science and Technology, Vol. 46(1), pp. 517-524, January 2012.

Robert M. Miura

A Simplified Neuronal Model for the Instigation and Propagation of Cortical Spreading Depression (with H. Huang and W. Yao), Adv. Appl. Math. Mech., Vol. 3, pp. 759-773, December 2011.

A Continuum Neuronal Model for the Instigation and Propagation of Cortical Spreading Depression (with W. Yao and H. Huang), Bull. Math. Biol., Vol. 73, pp. 2773-2790, November 2011.

Stretching of Viscous Threads at Low Reynolds Numbers (with J.J. Wylie and H. Huang), J. Fluid Mech., Vol. 683, pp. 212-234, September 2011.

Restricted Diffusion in Cellular Media: (1+1)-dimensional Model (with H. Huang and J.J. Wylie), Bull. Math. Biol., Vol. 73, pp. 1682-1694, July 2011.

Cyrill Muratov

Domain Structure of Bulk Ferromagnetic Crystals in Applied Fields Near Saturation (with H. Knuepfer), J. Nonlin. Sci., Vol. 21, pp. 921-962, August 2011.

Self-similar Dynamics of Morphogen Gradients (with P. Gordon and S. Y. Shvartsman), Phys. Rev. E, Vol. 84, pp. 041916, October 2011.

Dynamical Model of Rocket Propellant Loading with Liquid Hydrogen (with V. V. Osipov, M. J. Daigle, M. Foygel, V. N. Smelyanskiy, and M. D. Watson), J. Spacecraft Rockets, Vol. 48, pp. 987-998, November 2011.

Global Exponential Convergence to Variational Traveling Waves in Cylinders (with M. Novaga), SIAM J. Math. Anal., Vol. 44, pp. 293–315, January 2012.

Farzan Nadim

Dopamine Modulation of Ih Improves Temporal Fidelity of Spike Propagation in a Motor Axon (with A.W. Ballo and D. Bucher), J. Neuroscience, Vol. 32(15), pp. 5106-5119, April 2012.

Inhibitory Feedback Promotes Stability in an Oscillatory Network (with S. Zhao, L. Zhou, and A. Bose), J. Neural Engineering, Vol. 8, (6):065001, December 2011.

Peptide Neuromodulation of Synaptic Dynamics in an Oscillatory Network (with S. Zhao, A.F.

Sheibanie, M. Oh, and P. Rabbah), J. Neuroscience, Vol. 31(39), pp. 13991-4004, October 2011.

Demetrios T. Papageorgiou

Compound Viscous Thread with Electrostatic and Electrokinetic Effects (with D.T. Conroy, O.K. Matar and R.V. Craster), J. Fluid Mech., Vol. 701, pp. 171-200, June 2012.

Surfactant Destabilization and Non-linear Phenomena in Two-fluid Shear Flows at Small Reynolds Numbers (with A. Kalogirou and Y.-S. Smyrlis), IMA J. Appl. Maths, Vol. 77, pp. 351-360, June 2012.

Non-linear Waves in Electrified Viscous Film Flow down a Vertical Cylinder (with A.W. Wray and O.K. Matar), IMA J. Appl. Maths, Vol. 77, pp. 430-440, June 2012.

Suppression of Rayleigh-Taylor Instability using Electric Fields (with L. Barannyk and P.G. Petropoulos), Math. Comput. Simulat., Vol. 82, pp. 1008-1016, February 2012.

Viscous Pressure-driven Flows and their Stability in Channels with Vertically Oscillating Walls (with L. Espin), Phys. Fluids, Vol. 24, 023604, February 2012.

The Influence of Electric Fields and Surface Tension on Kelvin- Helmholtz Instability in Two-dimensional Jets (with S. Grandison and J.-M. Vanden-Broeck), ZAMP, Vol. 63, pp. 125-144, February 2012.

Computational Study of the Dispersively Modified Kuramoto-Sivashinsky Equation (with G. Akrivis and Y.-S. Smyrlis), SIAM J. Sci. Comp., Vol. 34, pp. A792-A813, April 2012.

Dynamics of a Viscous Thread Surrounded by Another Viscous Fluid in a Cylindrical Tube under the Action of a Radial Electric Field: Breakup and Touchdown Singularities (with Q. Wang), J. Fluid Mech., Vol. 683, pp. 27-56, September 2011.

Peter Petropoulos

Suppression of Rayleigh-Taylor Instability using Electric Fields (with L.L. Barannyk and D.T. Papageorgiou), Mathematics and Computers in Simulation 82 (6), pp. 1008-1016, 2012.

Anthony Rosato

Evolution of Solids Fraction Surfaces in Tapping: Simulation and Dynamical Systems Results, Granular Matter (with V. Ratnaswamy, D. Blackmore, X. Tricoche, N. Ching, L. Zuo), Vol. 14(2), pp.163-168, 2012.

Tapping Dynamics of Granular Columns and Beyond (with D. Blackmore, X. Tricoche, K. Urban, V. Ratnaswamy), Journal of Mechanics, Materials and Structures 6 [1-4], 71-86 (2011).

Horacio G. Rotstein

Canard-like Explosion of Limit Cycles in Two-dimensional Piecewise-linear Models of FitzHugh-Nagumo Type (2011) (with S. Coombes and A. M. Gheorghe), SIAM J of Applied Dynamical Systems (SIADS), Vol. 11, pp. 135-180, 2012.

Michael Siegel

A Mechanical Model of Retinal Detachment (with T. Chou), Physical Biology, Vol. 9, 046001, June 2012.

A Non-stiff Boundary Integral Method for 3D Porous Media Flow with Surface Tension (with D. M. Ambrose), Math. Comp. Sim., Vol. 82 (6), pp. 968--983, February 2012.

Semi-Analytical Solutions for Two-Dimensional Elastic Capsules in Stokes Flow (with M. Higley and M. Booty), Proceedings of the Royal Society A, Published on-line, May 16, 2012. doi: 10.1098/rspa.2012.0090.

Sundar Subramanian

Model-based Likelihood Ratio Confidence Intervals for Survival Functions, Statistics and Probability Letters, Vol. 82, pp. 626-635, January 2012.

Louis Tao

Improved Dimensionally-reduced Visual Cortical Network using Stochastic Noise Modeling (with J. Praissman and A. T. Sornborger), Journal of Computational Neuroscience, Vol. 32, pp. 367-376, 2012.

The Role of Fluctuations in Coarse-grained Descriptions of Neuronal Networks (with D. Cai, M. S. Shkarayev, A. V. Rangan, D. W. McLaughlin and G. Kovacic), Communications in Mathematical Sciences, Vol. 10, pp. 307-354, 2012.

Jonathan Wylie

Stretching of Viscous Threads at Low Reynolds Numbers (with H.Huang and R.M.Miura), Journal of Fluid Mechanics, Vol. 683, 212, 2011.

Critical Role of Friction for a Single Particle Falling through a Funnel (with Q.Zhang and Y.Fang), Physical Review E, Vol. 83, 051303, 2011.

Diffusion in a Cellular Medium: A (1+1)-Dimensional Model, (with H.Huang and R.M.Miura), Bulletin of Mathematical Biology, Vol. 73, 1682, 2011.

BOOKS AND BOOK CHAPTERS

Amitabha Bose

A PRC Description of How Inhibitory Feedback Promotes Oscillation Stability (with F. Nadim and S. Zhao), Eds. Schultheiss, Nathan W.; Prinz, Astrid A.; Butera, Robert J., pp. 399-418, 2012.

TECHNICAL REPORTS (EXTERNAL)

Denis Blackmore

Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, Preprint #IC/2010/090. Lagrangian and Hamiltonian Analysis of Infinite-dimensional Dynamical Systems (with Bogolubov (Jr.), Prykarpatsky, Y., and Prykarpatsky, A.), July 2011.

Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, Preprint #IC/2010/098. Optimal Strategy Analysis of Competing Portfolio Market with a Polyvariant Profit Function (with Bogolubov (Jr.), Kyshakevych, B., and Prykarpatsky, A.), August 2011.

Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, Preprint #IC/2010/097. Projection-Algebraic Scheme for Differential Operators (with Lustyk, M., Bogolubov (Jr.), and

Prykarpatsky, A., Analysis of the Calogero), August 2011.

Robert M. Miura

Report for AIM SQuaRE on Modeling Cortical Spreading Depression (with H. Huang), American Institute of Mathematics, Palo Alto, California, September 2011.

PROCEEDINGS PUBLICATIONS

Roman I. Andrushkiw

Diagnosis of Breast Cancer Using Averaged Proximity Measure Between Samples (with E. Golubeva, D. Klyushin, Yu. Petunin, N. Boroday), Proceedings of the 2011 International Conference on Bioinformatics and Computational Biology, Vol. 2, pp. 387-382, H. Arabnia and Q. Tran, eds., WORLDCOMP, July 2011.

John Bechtold

Effects of Variable Specific Heats on Markstein Lengths and Flamefront Stability (with F. Wu and C.K. Law), Fall Technical Meeting, Eastern States Section of the Combustion Institute, October, 2011.

An Asymptotic Theory of Premixed Flames in Dense Fluids (with D. Fong and C.K. Law), 2012 Spring Technical Meeting of Western States Section of the Combustion Institute, Tempe AZ, March, 2012.

Victoria Booth

Modeling the Temporal Architecture of Rat Sleep-Wake Behavior (with C. Diniz Behn), Conf. Proc. IEEE Eng. Med. Biol. Soc. 2011:4713-4716, 2011.

Michael Booty

Magnetic Field Assisted Heterogeneous Device Assembly (with V. Kasisomayajula, A.T. Fiory, and N.M. Ravindra), The Minerals, Metals & Materials Society (TMS) 2012 Conference Proceedings, Vol. 1, Materials Processing and Interfaces, pp. 651-661. March 2012.

Linda Cummings

Modeling of Three Dimensional Nematic Droplets (with T.-S. Lin and L. Kondic), Proceedings of 24th International Liquid Crystal Conference, Mainz, Germany, 2012.

Jorge Golowasch

Local Synaptic Interactions within the Cholinergic Basal Forebrain (with T. Unal and L. Zaborsky), 41st Society for Neuroscience Meeting, Soc. Neurosci. Abstracts, 294.13, 2011.

Intracellular Signaling of Peptidergic Neuromodulatory Input to the Pyloric Network in the Stomatogastric Ganglion of Cancer Borealis (with M. Gray), 41st Society for Neuroscience Meeting, Soc. Neurosci. Abstracts, 707.04, 2011.

Effects of Ionic Current Co-variation on the Rhythmic Activity of a Follower Neuron in the Pyloric Network of Cancer Borealis (with S. Zhao), 41st Society for Neuroscience Meeting, Soc. Neurosci. Abstracts, 585.07, 2011.

A Subset of Neuromodulators Co-released from a Projection Neuron have a Dominant Effect on the Activity and Synaptic Currents of the Crab Pyloric (with M. Desai, F. Sheibanie, and F. Nadim), 41st Society for Neuroscience Meeting, Soc. Neurosci. Abstracts, 707.03, 2011.

Claus Holzapfel

The Use and Misuse of Climatic Gradients for Evaluating Climate Impact on Dryland Ecosystems - An Example for the Solution of Conceptual Problems (with M. Sternberg, K. Tielbörger, P. Sarah, J. Kigel, H. Lavee, A. Fleischer, F. Jeltsch, and M. Köchy), In: J. Blanco & H. Kheradmand (Eds.), Climate Change - Geophysical Foundations and Ecological Effects, pp. 361-374, 2011.

Richard O. Moore

Noise Dependent Soliton Phase Distributions in Simulations of Stochastic Nonlinear Schrodinger Equations (with D. S. Cargill and C. J. McKinstrie), Proceedings of the 10th Annual Conference on the Mathematical and Numerical Aspects of Waves, The Pacific Institute for the Mathematical Sciences, pp. 497-500, July 2011.

Generation and Stabilization of Localized Solutions through Nonlocal Coupling in the Parametrically Forced Nonlinear Schrodinger Equation, Proceedings of the 10th Annual Conference on the Mathematical and Numerical Aspects of Waves, The Pacific Institute for the Mathematical Sciences, pp. 501-504, July 2011.

Cyrill Muratov

Nucleate Boiling in Long- term Cryogenic Propellant Storage in Microgravity (with V. V. Osipov, V. N. Smelyanskiy and R. W. Tyson) Proceedings of the 62nd International Astronautical Congress, IAC-11.A2.6.4.x12034, Cape Town, South Africa, September 2011.

Farzan Nadim

A PRC Description of How Inhibitory Feedback Promotes Oscillation Stability (with S. Zhao and A. Bose), In: Phase Response Curves in Neuroscience, Schultheiss, Prinz, Butera Eds: Springer Series in Computational Neuroscience, 2012.

B. PRESENTATIONS

Shahriar Afkhami

November 2011: APS Annual Meeting of the Division of Fluid Dynamics, Baltimore, MD
Comparison of Navier-Stokes Solution and Lubrication

July 2011: ICIAM 2011, Vancouver, Canada
Adaptive Volume-of-fluid Simulations of Dynamic Wetting Lines

July 2011: Gerris Flow Solver meeting, Universite Pierre et Marie Curie, Paris, France
Simulating Multiphase Systems

Roman I. Andrushkiw

July 2011: International Conference on Bioinformatics and Computational Biology, Las Vegas, NV
Diagnosis of Breast Cancer Using Averaged Proximity Measure Between Samples

John Bechtold

October 2011: Fall Technical Meeting, Eastern States Section of the Combustion Institute
Effects of Variable Specific Heats on Markstein Lengths and Flamefront Stability

March 2012: 2012 Spring Technical Meeting of Western States Section of the Combustion Institute, Tempe, AZ
An Asymptotic Theory of Premixed Flames in Dense Fluids

May 2012: FACM 2012, NJIT, Newark, NJ
An Asymptotic Theory of Premixed Flames in Dense Fluids (poster)

Manish Bhattacharjee

May 2012: Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ
Managing Warranty Costs with Variable Usage Rate

Denis Blackmore

December 2, 2011: Mathematical Fluid Dynamics Seminar, New Mexico State University, Las Cruces, NM
Hamiltonian Dynamical Systems: Applications to Vortex and Granular Dynamics

May 31, 2012: Int'l. Conf. on Theory of Approximation of Functions and Its Applications, Ivan Ohienko National University, Kamianets-Podilsky, Ukraine
Infinite-Dimensional Dynamical System Approximation of Granular Flow

June 4, 2012: Math. Division of Shevchenko Scientific Soc. Jubilee Workshop on Nonlinear Dynamical Systems and Lax Integrability, Ivan Franko University, Drohobych, Ukraine
Integrability of a New Class of Infinite-Dimensional Hamiltonian Systems

June 6, 2012: Mathematics Seminar, AGH University of Science and Technology, Kraków, Poland
Infinite-dimensional Flow Field Models: Integrability, Wave Propagation, Vortex Invariants and Helicity Theorems

Victoria Booth

July 2011: SIAM Life Sciences meeting, Pittsburgh, PA
Invited speaker in Minisymposium on The role of adaptation and depression in neuronal network dynamics
Synaptic Depression Permits Co-existent Activity Patterns in Inhibitory Neuronal Networks

September 2011: International Conference of the IEEE Engineering in Medicine and Biology Society, Boston, MA
Modeling the Temporal Architecture of Rat Sleep-Wake Behavior

November 2011: 41st Annual Meeting of the Society for Neuroscience, Washington DC
1) Modeling the Fine Temporal Architecture of Rat Sleep-Wake Behavior
2) Phase Response Curve Modulation, Synaptic Plasticity, and Network Connectivity Renormalization

March 2012: Physics Department seminar, Illinois State University, Normal, IL
Neuron or Synapse: Which Determines Neuronal Network Activity?

May 2012: Applied and Computational Math Seminar, George Mason University, Fairfax, VA
Dynamics of Sleep-Wake Regulation

June 2012: Anesthesia/Sleep Disorders Workshop as part of Focus Program on "Towards Mathematical Modeling of Neurological Disease from Cellular Perspectives", Fields Institute, Toronto
Modeling the Temporal Architecture of Sleep-Wake Transition Dynamics

Michael Booty

July 2011: Seventh International Congress on Industrial and Applied Mathematics, Vancouver, British Columbia, Canada
An Efficient Surface-based Numerical Method for Flow with Soluble Surfactant

November 2011: American Physical Society, 64th Annual Meeting of the Division of Fluid Dynamics, Baltimore, MD
Numerical Simulation of Drop Dynamics with Soluble Surfactant

April 2012: Instituto de Investigaciones en Matemáticas Aplicadas, Universidad Nacional Autónoma de México, Mexico City. Invited presentation. Conference on Nonlinear Waves, Asymptotic Theory, and Applied Mathematics, in Honor of Professor A.A. Minzoni's Sixtieth Birthday.
Drop Dynamics with Soluble Surfactant

Amitabha Bose

November 2011: Drexel University, Philadelphia, PA
Dynamics on Random Graphs

March 2012: University of Pittsburgh, Pittsburgh, PA
Dynamics on Random Graphs

Bruce Bukiet

October 2011: Noyce Northeast Regional Conference, Philadelphia, PA
Using Technology Resources to Promote Interest in Math and Science
with Joya Clark and Arthur B. Powell (poster)

May 2012: NSF Robert Noyce Scholarship Program Annual Meeting, Washington, DC
Using Technology to Enhance Student Interest and Understanding of STEM Disciplines

May 2012: TECHS-NJ: NSF Robert Noyce Scholarship Program Annual Meeting, Washington, DC
A Focus on Technology to Enhance Student Learning and Motivation (poster)

Daniel Bunker

August 2011: 2nd International workshop on deer-forest relationships, Laval Universite, Quebec City, Quebec, Canada
Predicting Effects of Generalist Herbivores on Plant Communities by Leveraging Ecoinformatics to Integrate Plant Functional Trait Observations and Experimental Manipulations

September 2011: Meadowlands Environmental Research Institute, MERI, Lyndhurst, NJ
Research Update, Cascading Effects of Insect Pollinator Decline on Functional Diversity in Urban Ecosystems

March 2012: NJIT 2012 Advance Showcase and Seminar, Newark, NJ
TraitNet Semantic Data Registry - Leveraging Ontologies for Smart Data Discovery, NJIT GSA

Wooyoung Choi

July 2011: Workshop on Nonlinear Internal Waves, University of Tokyo, Tokyo, Japan
Asymptotic Models for Internal Solitary Waves in a Two-layer System and their Numerical Solutions

August 2011: Seminar at the Hyundai Heavy Industry, Korea
Short-term Deterministic Prediction of Evolving Nonlinear Wave Fields

October 2011: ONR Workshop on Evolving Nonlinear Wave Fields, Washington D.C.
On Predicting Evolving Nonlinear Wave Fields

November 2011: 64th Annual Meeting of the APS Division of Fluid Dynamics, Baltimore, MD
Large Amplitude Internal Waves in Weakly Stratified Oceans

March 2012: Seminar at the University of Bergen, Norway
Large Amplitude Internal Waves in Density Stratified Oceans and their Surface Expressions

June 2012: A Minisymposium at the SIAM Conference on Nonlinear Waves and Coherent Structures, Univ. of Washington, Seattle, WA
Asymptotic Models for Large Amplitude Internal Waves in Weakly Stratified Fluids

June 2012: The first joint SJTU-KAIST Research Symposium, Shanghai, China
Highly Nonlinear Internal Wave Motions and their Surface Expressions

Linda Cummings

June 2012: Applied Mathematics Seminar, Loughborough University, UK
Instabilities of Nematic Liquid Crystal Droplets

May 2012: University of Oxford Industrial and Applied Mathematics Seminar
Modeling Spreading of Thin Nematic Films

March 2012: Meet The Mathematicians outreach event for high school juniors, University College London
Mathematics Applied to Industry: Building Better Liquid Crystal Displays

February 2012: Fluid Dynamics seminar, Imperial College London
Instabilities in Thin Films of Nematic Liquid Crystals

January 2012: Free Boundary Problems in Fluid Mechanics, University of Nottingham, UK
Thin Film Models for Free Surface Flows of Nematic Liquid Crystal

November 2011: Duke University Biofluids seminar
Modeling of Stented and Catheterized Urinary Tracts

July 2011: ICIAM 2011 Minisymposium talk, Vancouver, Canada
Thin Film Models for Nematic Liquid Crystals

Sunil K. Dhar

May 2012: Minisymposium VI, Session on Clinical Trials and Biostatistics Applications II
Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology
Bootstrap Tests for Increased Discrimination of New Hemodynamic Variables

July 30-August 4, 2011: Joint Statistical Meeting, Miami Beach Convention Center, Miami Beach, FL
1) Generalized Linear Model under Extended Negative Multinomial Model

2) A Teaching Experience in the Medical Department: From Concepts to Computation

Roy Goodman

July 2011: 10th International Conference on the Mathematical and Numerical Aspects of Waves, Vancouver BC
Low-Dimensional Hamiltonian Dynamics In Nonlinear Optical Structures

November 2011: SIAM Conference on Analysis of Partial Differential Equations, San Diego, CA
Nearly Finite-Dimensional Dynamics in Optical Waveguides

March 2012: Center for Applied Mathematics Seminar, University of Massachusetts
Oscillatory Instabilities and Complex Nonlinear Dynamics in Walveguides

April 2012: Nonlinear Waves: Asymptotic Theory and Applied Mathematics, Mexico City, MX
Low-dimensional Hamiltonian Models of Nonlinear Wave Phenomena

June 2012: SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA
Nonlinear Dynamics and Normal Forms in the Time Dependent Nonlinear Schrodinger/Gross Pitaevskii Equations

Arnaud Goullet

November 2011: APS Division of Fluids Dynamics, Baltimore, MD
1) Percolation Theory Applied to the Force Field in Granular Material
2) The Dynamics of Granular Materials

Wenge Guo

September 2011: The 7th International Conference on Multiple Comparison Procedures, Washington, DC
Adaptive FWER and FDR Control under Block Dependence

November 2011: Biostatistics Seminar, School of Public Health, University of Medicine and Dentistry of New Jersey, Piscataway, NJ
Adaptive FWER and FDR Control under Block Dependence

May 2012: The Ninth Annual Conference on Frontiers in Applied and Computational Mathematics, Newark, NJ
Further Results on Controlling the False Discovery Proportion

May 2012: Summer program for graduate students, Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, NJ
Further Results on Controlling the False Discovery Proportion

May 2012: Biostatistics seminar, Memorial Sloan-Kettering Cancer Center, New York, NY.
Multiple Testing in a Two-Stage Adaptive Design with Combination Tests Controlling FDR

Claus Holzapfel

June 2012: International Symposium on Invasive Plants and Global Change, Urumqi, China
Novel Plant Communities in Arid Lands: The Role of Climate Change and Invasion

June 2012: Home for Foreign Experts. Meeting of Chinese Academyof Science (CAS) Senior International Scientists and Young Fellows' 2012, Beijing, China
Effects of Climate Change on High Altitude Vegetation (with Y. Zhang)

November 2011: Partners in Environmental Technology - Technical Symposium & Workshop.

Meeting DoD's Environmental Challenges, Washington, DC
Understanding the Fire-enhancing Impact of Non-native Annuals in Deserts: The Role of Spatial Patterns

August 2011: Ecological Society of America, Annual Meeting, Austin, TX
1) Urban Green Spaces: Traps or Havens for Migratory Birds?
2) Clonal Diversity and Resistance to Invasion in Remnant Salt Marsh Patches
3) Trophic Transfer of Heavy Metals and Avian Feeding Ecology in an Urban Brownfield
4) Spatial Patterns in the Distribution of Creosote (Larrea tridentata) and Burrobush (Ambrosia dumosa) in the Mojave and Sonoran Deserts: A Template for Fire Risk
5) Patterns of Annual Plant Seedling Recruitment Differ between Creosote Dominated Sites in the Mojave and Sonoran Deserts

Shidong Jiang

July 2011: ICIAM 2011, Vancouver, BC, Canada
Integral Equations and Fast Algorithms for Unsteady Stokes Flow

Lou Kondic

June 2012: Colloquium, Department of Chemical Engineering, Free University Brussels, Brussels, Belgium
Modeling Thin Film Instabilities

June 2012: Colloquium, Department of Physics, University Erlangen, Erlangen, Germany
From Energy Propagation to Force Networks in Dense Granular Matter

March 2012: Colloquium, Department of Mathematics, Imperial College, London, United Kingdom
Instabilities of Nanoscale Liquid Metal Films

March 2012: Colloquium, Department of Physics, Saarlandes University, Saabruecken, Germany
Spinodal and Nucleation Instabilities of Thin Liquid Films

March 2012: American Physical Society March Meeting, Boston, MA
Force Landscape for Particulate Systems

February 2012: Colloquium, Montclair State University, Montclair, NJ
Evolution of Nanoscale Liquid Metal Films

November 2011: Soft-Matter Seminar, New York University, New York City
Modeling Dense Granular Matter

November 2011: American Physical Society-Division of Fluid Dynamics Annual Meeting, Baltimore, MD
1. Granular Response to an Impact
2. 2D Granular Impact Dynamics with Photoelastic Particles
3. The Dynamics of Granular Materials
4. Study of 2D Granular Impact Dynamics with Photoelasic Particles
5. Percolation Theory Applied to the Force Field in Granular Material
6. Contact Line Induced Instabilities for Thin Fluid Films
7. Comparison of Navier-Stokes Solution and Lubrication Approximation: Dewetting of Nanoscale Liquid Rings
8. Pulsed Laser Induced Self-assembly of Nanoparticle Arrays: Competing Liquid Phase Instabilities
9. Contact Line Instability of a Liquid Rivulet Partially Wetting an Inclined Plane

July 2011: DTRA Basic Research Program Technical Review, Spriengfield, DC
On Influence of Microstructure on Granular Impact

Victor Matveev

July 2011: Annual Computational Neuroscience Meeting, Royal Institute of Technology, Stockholm, Sweden
Effects of Spatial Organization of Calcium Channels on Calcium Current Cooperativity of Exocytosis

November 2011: Annual Meeting of the Society for Neuroscience, Washington, DC
Calcium Cooperativity and Variability of Exocytosis: Domain Overlap vs Domain Sharing

April 2012: Exocytosis in Endocrine Cells: Linking Experiments and Theory, Lund University Diabetes Center, Malmo, Sweden
Calcium Channel Domain Overlap vs. Domain Sharing, and Calcium Current Cooperativity of Exocytosis

June 2012: Dynamics in Neural, Endocrine and Metabolic Systems, National Institutes of Health, Bethesda, MD
Non-local Interaction of Calcium Signals via Buffer Saturation: a Computational Study

Zoi-Heleni Michalopoulou

November 2011: Meeting of the Acoustical Society of America, San Diego, CA
1) Geoacoustic Inversion with Sequential Bayesian Filtering and Multipath Arrivals
2) Sequential Bayesian Filtering for a Varying Model-order Passive Fathometer Problem

October 2011: IEEE Workshop on Underwater Signal Processing, Kingston, RI
Sediment Layer Tracking with Particle Filtering

Robert M. Miura

June 2012: Canadian Applied and Industrial Mathematics Society Annual Meeting, Toronto, Ontario, Canada
Neurovascular Coupling During Cortical Spreading Depression: A Mathematical Model

June 2012: Canadian Symposium on Fluid Dynamics, Toronto, Ontario, Canada
Asymptotic Analysis of a Viscous Drop Falling Under Gravity

June 2012: American Headache Society, 54th Annual Scientific Meeting, Los Angeles, CA
Interconnected Neural, Vascular, and Metabolic Dysfunction During Cortical Spreading Depression: A Mathematical Model

April 2012: Drexel Mathematics Colloquium, Department of Mathematics, Drexel University, Philadelphia, PA
Migraine with Aura and Cortical Spreading Depression

July 2011, International Congress for Industrial and Applied Mathematics 2011, Minisymposium on Restricted Diffusion in Cellular Media, Vancouver, BC, Canada
Restricted Diffusion and Cortical Spreading Depression

July 2011: International Congress for Industrial and Applied Mathematics 2011, Minisymposium on Restricted Diffusion in Cellular Media, Vancouver, BC, Canada
Restricted Diffusion in Coupled Reaction-Diffusion Equations with Degenerate Source Terms

Richard O. Moore

July 2011: 7th International Congress on Industrial and Applied Mathematics, Vancouver, BC
Stabilization of Traveling Waves in Damped Dispersive Equations

July 2011: 10th Annual Conference on the Mathematical and Numerical Aspects of Waves, Vancouver, BC
Generation and Stabilization of Localized Solutions through Nonlocal Coupling in the Parametrically Forced Nonlinear Schrodinger Equation

November 2011: Geometric Methods for Infinite-Dimensional Dynamical Systems, Providence, RI
Matched Asymptotics and Traveling Waves in a Heat-Driven Optical System (poster)

December 2011: SAMSI Colloquium, Research Triangle Park, NC
Rare Event Simulations in Nonlinear Optics

February 2012: SAMSI Undergraduate Workshop, Research Triangle Park, NC
Importance Sampling in Optical Communication

April 2012: SIAM Conference on Uncertainty Quantification, Raleigh, NC
Reduced Models for Mode-Locked Lasers with Noise

April 2012: Differential Equations Seminar, North Carolina State University, Raleigh, NC
Monte Carlo Simulations Informed by Large Deviation Principles

May 2012: Frontiers in Applied and Computational Mathematics, Newark, NJ
Uncertainty in Mode-Locked Lasers with Noise

May 2012: SAMSI Transition Workshop, Research Triangle Park, NC
Uncertainty in Mode-Locked Lasers with Noise

June 2012: SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA
Uncertainty in Mode-Locked Lasers with Noise

Cyrill Muratov

July 2011: 7th International Congress on Industrial and Applied Mathematics, Vancouver, Canada
1) Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions
2) Domain Structure of Bulk Ferromagnetic Crystals in Applied Fields near Saturation

November 2011: SIAM Conference on Applications of Dynamical Systems, San Diego, CA
Front Propagation in Stratified Media: A Variational Approach

January 2012: Seminar on Differential Equations and Applications, University of Padova, Italy
Gamma-convergence for Pattern Forming Systems with Competing Interactions

February 2012: Workshop on Nonlocal PDEs, Variational Problems and their Applications, IPAM, Los Angeles, CA
Gamma-convergence for Pattern Forming Systems with Competing Interactions

April 2012: Analysis Seminar, Courant Institute of Mathematical Sciences, New York, NY
Asymptotic Properties of Ground States of a Semilinear Elliptic Problem with a Vanishing Parameter

June 2012: NSF PIRE Summer School for Graduate Students, New Frontiers in Multiscale Analysis and Computing for Materials, IMA, University of Minnesota, Minneapolis, MN

Gamma-convergence for Pattern Forming Systems with Competing Interactions

Farzan Nadim

April 2012: Colloquium in Cognitive Neuroscience, CUNY Graduate Center, NY
Preferred Frequencies in an Oscillatory Network

March 2012: Neuroscience Honors Speaker, Bowdoin College, Brunswick, ME
Preferred Frequencies in an Oscillatory Network

November 2011: Society for Neuroscience Annual Meeting, Washington, DC
1) Modeling of Synapses Showing a Preferred Frequency in an Oscillatory Neuronal Network
2) Synaptic Output is Influenced by the Presynaptic Burst Waveform in an Oscillatory Network
3) Modeling History-dependence of Conduction Delay in a Non-myelinated Axon
4) A Subset of Neuromodulators Co-released from a Projection Neuron have a Dominant Effect on the Activity and Synaptic Currents of the Crab Pyloric Network

Anthony Rosato

September 2011: Madrid Polytechnic University
Transition of Random Granular Assemblies towards Structural Order via Mechanical Tapping

August 2011: Institute for Multiscale Simulation, Universität Erlangen-Nürnberg
Tapped Density Relaxation: Solids Fraction Evolution and Microstructure

Horacio G. Rotstein

September 2011: Department of Biology, City College of New York (CCNY)
Dynamic Mechanisms of Generation of Frequency Preference Responses to Oscillatory Inputs in Neurons

November 2011: Annual Meeting of the Society for Neuroscience (SFN), Washington, DC
Subthreshold and Firing-frequency Resonance in a Persistent Sodium/h-current Model: The Role of Nonlinearities and Time Scales

March 2012: Center for Molecular and Behavioral Neuroscience, Rutgers University
Dynamic Mechanisms of Generation of Frequency Preference Response to Oscillatory Inputs in Neural Systems

April 2012: Department of Mathematics, Rutgers University
Dynamic Mechanisms of Generation of Subthreshold Resonance in Neural Models

May 2012: Frontiers in Applied and Computational Mathematics (FACM), Newark, NJ
A Modeling Study of Conductance Co-regulation in Neural Models

June 2012: Department of Mathematical Sciences, NJIT, Summer Faculty Seminar Series
Mechanisms of Frequency Preference Response to Oscillatory Inputs in Reduced Neural Models

Michael Siegel

June 2012: Workshop on Eigenvalues, Singular Values and Fast PDE Algorithms,
Banff, Alberta, Candad
A Small-scale Decomposition for 3D Boundary Integral Computations with Surface Tension

January 2012: Conference on Free Boundary Problems in Fluid Mechanics, University of Nottingham, Nottingham, UK
Elastic Capsules in 2D Stokes Flow

December 2011: Mathematical Biology Seminar, Duke University, Durham, NC
Elastic Capsules in 2D Stokes Flow

October 2011: Applied Math Seminar, University of Alberta, Edmonton, Alberta
An Efficient Surface-based Numerical Method for Flow with Soluble Surfactant

July 2011: ICIAM 2011, Vancouver, BC
A Non-stiff Boundary Integral Method for 3D Flow with Surface Tension

Sundar Subramanian

July 2011: Summer seminar series, Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, NJ
An Overview of Survival Analysis (joint work with Shoubhik Mondal)

Louis Tao

May 2012: Center for Quantitative Biology, Peking University, Beijing, PRC
Mapping Functional Connectivity between Neuronal Ensembles in Larval Zebrafish Transgenic for a Ratiometric Calcium Indicator

Yuan-Nan Young

October 2011: 48th Annual Technical Meeting of the Society of Engineering, Evanston, IL
Dynamics of the Primary Cilium in Shear Flow

November 2011: Christopher Westlake's Lab at NIH Cancer Research Center, Bethesda, MD
Dynamics of the Primary Cilium in Shear Flow

December 2011: National Center for Theoretical Sciences (NCTS), National Taiwan University, Taipei, Taiwan
Active Membrane and Vesicle Dynamics

January 2012: NCTS Workshop on Ion Channel, Taipei, Taiwan
Dynamics of the Primary Cilium in Shear Flow

March 2012: AMS Section Meeting, University of Kansas
Dynamics of the Primary Cilium in Shear Flow

May 2012: Kevli Institute of Theoretical Physics in China, Beijing
1) Nonlinear Dynamics of an Elastic Membrane under a DC Electric Field
2) Dynamics of Capsules and Compound Vesicles under Flow

C. TECHNICAL REPORTS

REPORT 1112-1*:* *Semi-analytic Solutions for Elastic Capsules in 2D Flow*
Michael Higley, Michael Siegel, and Michael R. Booty

REPORT 1112-2: *A Teaching Experience in the Medical Department: From Concepts to Computation*
Sunil K. Dhar

REPORT 1112-3: *Modeling Photon Generation*
Shuchi Agrawal, David A. Edwards, Joseph D. Fehribach, John Gounley, Isaac Harris, Richard Moore, Takeshi Takahashi, and Jacek Wrobel

REPORT 1112-4: *Canard-like Explosion of Limit Cycles in Two-dimensional Piecewise-linear Models of FitzHugh-Nagumo Type*
Horacio G. Rotstein, Stephen Coombes, and Ana Maria Gheorghe

REPORT 1112-5: *Simple Modeling of Bistable Nematic Liquid Crystal Display Devices: What is the optimal design?*
L.J. Cummings, C. Cai, and L. Kondic

REPORT 1112-6: *Influence of Electric Field Gradient on a Stretched Nematic Sheet*
L.J. Cummings, J. Low, and T.G. Myers

REPORT 1112-7: *Model-based Likelihood Ratio Confidence Intervals for Survival Functions*
Sundar Subramanian

REPORT 1112-8: *Potential Theory for Initial-boundary Value Problems of Unsteady Stokes Flow in Two Dimensions*
Shidong Jiang

REPORT 1112-9: *Swing, Release, and Escape Mechanisms Contribute to the Generation of Phase-locked Cluster Patterns in a Globally Coupled FitzHugh-Nagumo Model*
Horacio G. Rotstein and Hui Wu

REPORT 1112-10: *Dynamic Mechanisms of Generation of Oscillatory Cluster Patterns in a Globally Coupled Chemical System*
Horacio G. Rotstein and Hui Wu

REPORT 1112-11: *Microstructure Evolution during Impact on Granular Matter*
L. Kondic, X. Fang, W. Losert, C. S. O'Hern, and R.P. Behringer

REPORT 1112-12: *Instability of a Transverse Liquid Rivulet on an Inclined Plane*
Javier A. Diez, Alejandro G. Gonzalez, and Lou Kondic

REPORT 1112-13*: Instability of Gravity Driven Flow of Liquid Crystal Films*
Sean P. Naughton, Namrata K. Patel, and Ivana Seric

REPORT 1112-14: *Thin Films Flowing down Inverted Substrates: Three Dimensional Flow*
T.-S. Lin, L. Kondic, and A. Filippov

REPORT 1112-15: *Model Checks via Bootstrap When There Are Missing Binary Data*
Gerhard Dikta, Sundar Subramanian, and Thorsten Winkler

REPORT 1112-16: *Managing Warranty Costs with Variable Usage rates*
Sonia Bandha and Manish C. Bhattacharjee

REPORT 1112-17: *Dynamics of the Primary Cilium in Shear Flow*
Yuan-Nan Young, M. Downs, and C. R. Jacobs

REPORT 1112-18: *On the Dimension of Solutions of Nonlinear Equations*
P. S. Milojevic

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES AND AWARDS

Shahriar Afkhami

Foundation Herbette, visiting researcher grant, University of Lausanne, Exnted Award: January 2012 - December 2012

Visiting Assistant Professor: Dept. of Mathematics, Virginia Polytechnic Institute & State University

Daljit S. Ahluwalia

Member of Committee of Meeting and Conferences, AMS

Roman I. Andrushkiw

Vice-President, Director of Mathematical Sciences, Shevchenko Scientific Society, Inc.

Denis Blackmore

Associate Editor, Mechanics Research Communications (2007 -)

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

Editorial Board, Journal of Nonlinear Mathematical Physics (2010 -)

Editorial Board, Recent Patents in Space Technology (2009 -)

Editorial Board, Differential Equations and Applications (2008 -)

Editorial Board, Regular and Chaotic Dynamics (2006 -)

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

Served on NSF Dynamical Systems Panels: March, 2012.

Listed in latest Who's Who in the World

Victoria Booth

Program Committee, Society for Industrial and Applied Mathematics

Treasurer, Organization for Computational Neuroscience

Advisory Committee, Activity Group on Dynamical Systems in the Society for Industrial and Applied Mathematics, 2012-2013

Organizer of ECC12, 12th conference on Experimental Chaos and Complexity, University of Michigan, May 16-19, 2012

Organizer of American Institute of Mathematics workshop on “Stochastic Dynamics of Small Networks of Neurons”, February 20-24, 2012

Wooyoung Choi

WCU Visiting professor, Korea Advanced Institute of Science and Technology. July 2011-June 2012

Visiting Professor, University of Tokyo, June 2012-August 2012

Linda Cummings

Visiting Fellow at the Oxford Centre for Collaborative Applied Mathematics (OCCAM), January 2012-July 2012

Visiting Fellow at St. Catherine's College, University of Oxford, January 2012-March 2012

Wenge Guo

Member, Editorial Board of the Journal of Biometrics and Biostatistics

Claus Holzapfel

Member of Editorial Board, Perspectives in Plant Ecology, Evolution and Systematics

Aridaman K. Jain

Chair of the American Society for Quality (ASQ) Writing Committee for “An Attribute Skip-Lot Sampling Program: ASQ/ANSI S1-2012”. An American National Standard published by American Society for Quality on May 18, 2012.

Chair of the American Society for Quality (ASQ) Writing Committee for “An Attribute Chain Sampling Program: ASQ/ANSI S3-2012”. An American National Standard published by American Society for Quality on May 18, 2012.

Judge at the Twenty-ninth Annual North Jersey Regional Science Fair at Rutgers University, New Jersey, March 17, 2012.

Zoi-Heleni Michalopoulou

Associate Editor, Journal of the Acoustical Society of America

Robert M. Miura

Chairperson, Board of Trustees, Mathematical Biosciences Institute, Ohio State University, Columbus, Ohio, 2008-2011.

Co-Editor-in-Chief, Analysis and Applications, World Scientific.

SIAM Book Editorial Board, 2009-2011.

Editorial Board, SIAM Journal on Applied Mathematics, 2008-2011.

Editorial Board, Canadian Applied Mathematics Quarterly.

Editorial Board, SIAM Book Series on Monographs on Mathematical Modeling and Computation.

Reviewer, Grant Proposal, Banff International Research Station, Banff, Alberta, (2008-Present)

Member, William Benter Prize in Applied Mathematics Selection Committee, City University of Hong Kong, Kowloon, Hong Kong (2009-2011).

Chair, Session on Mathematical Biology and Medicine, Canadian Applied and Industrial Mathematics Society Annual Meeting (June 26, 2012).

Richard O. Moore

July 2011: Minisymposium Chair, 10th Annual Conference on the Mathematical and Numerical Aspects of Waves, Vancouver, BC

September 2011: NJIT Excellence in Teaching Award, Lower Division Undergraduate Instruction

November 2011: Minisymposium Chair, Geometric Methods for Infinite-Dimensional Dynamical Systems, Providence, RI

Cyrill Muratov

Associated Editor, Networks and Heterogeneous Media

Farzan Nadim

Reviewing Editor, Journal of Neuroscience

Review Editor, Frontiers in Neural Circuits

Member, NIH Sensorimotor Integration Study Section

Demetrios T. Papageorgiou

Co-Editor in-Chief, IMA Journal of Applied Mathematics

Editorial Board Member, Computational and Applied Mathematics

Anthony Rosato

Fulbright Senior Research Fellowship, University of Salerno (May - Sept. 2011)

Editorial Board member, Kona - Powder and Particle

Fellow of the American Society of Mechanical Engineers

Editor-in-Chief, Mechanics Research Communications, ASCE Engineering Mechanics Institute

Mechanics Institute - Inelasticity Committee Member

Member of the International Hoover Award Board

ASME representative, American Academy of Mechanics, John Colandra Italian American Institute

UK Committee on Publication Ethics

Horacio G. Rotstein

Member of Conference Program Committee: July 31 to August 5, 2011: International Joint Conference on Neural Networks (IJCNN), San Jose, CA, International Neural Network Society & IEEE Computational Intelligence Society.

Michael Siegel

Member of Editorial Board, SIAM Journal of Applied Mathematics.

Member of Organizing Committee, Conference on Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ, May 2012.

Thesis defense committee (`Opponent'), KTH, Stockholm, Sweden.

Minisymposium organizer (with M. Booty), The Boundary Integral Method and its Applications ICIAM 2011, Vancouver, BC.

Sundar Subramanian

Chair of Statistics Mini Symposium (Censoring and Survival Analysis), Frontiers of Applied and Computational Mathematics 2012, Newark, NJ.

B. FACM'12 CONFERENCE ON FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS

The Ninth Conference on Frontiers in Applied and Computational Mathematics (FACM '12) at the New Jersey Institute of Technology was held on May 18-20 and was focused on wave propagation and electromagnetics, mathematical biology, fluid dynamics, and applied statistics.

The conference featured 5 plenary talks, 76 minisymposium talks (many of which were given by junior faculty), and 8 contributed talks by postdocs and graduate students. The contributed talks were selected from a large number of applications and were presented in the same sessions as the invited talks, giving these young researchers a chance to showcase their research results. In addition to the talks, there were 26 posters on a variety of research topics. A reception and banquet were held on the second night of the conference.

The plenary speakers for the conference were Mark Ablowitz (University of Colorado), Carson Chow (National Institutes of Health), Sally Morton (University of Pittsburgh), Keith Promislow (Michigan State University), and Jane Wang (Cornell University).

The organizing committee for this years conference was Daljit S. Ahluwalia and Jonathan Luke (Co-Chairs), Amitabha Bose, Sunil Dhar, Lou Kondic, Peter Petropoulos, and Michael Siegel. Full program details are online at: http://m.njit.edu/Events/FACM12/ .

At the banquet, a joint Keynote speech was given by Mark Ablowitz and Robert Miura, who discussed the history of the famous development of inverse scattering theory. Ablowitz and Miura were key contributors to the theory, and they shared fascinating anecdotes. By all accounts it was a very successful meeting.

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

Parallel Simulations of Drop Breakup in a MicroFluidic T-Junction
National Computational Science Alliance Award, NSF-supported Consortium: April 13, 2011 - April 13, 2012
Shahriar Afkhami

Conferences on Frontiers of Applied and Computational Mathematics, 2011-2013
National Science Foundation: June 1, 2011 - June 30, 2014
Daljit S. Ahluwalia and Michael Siegel

Statistical Data Analysis
NJ Meadowlands Commission: November 1, 2006 - December 31, 2011
Daljit S. Ahluwalia and Aridaman Jain

Nonlinear Dynamics of Flames with Applications at High Pressure
National Science Foundation: July 1, 2008 - June 30, 2013
John Bechtold

Collaborative Research: A Unified Dynamical Systems-Simulation-Visualization Approach to Modeling and Analyzing Granular Flow Phenomena
National Science Foundation - CMMI Dynamical Systems Program:
September 1, 2010 - August 31, 2013
Denis Blackmore (PI at NJIT), Anthony Rosato (Co-PI at NJIT), and Xavier Tricoche (PI at Purdue)

Hybrid Algorithms for Wave Propagation
National Science Foundation: September 15, 2010 - August 31, 2013
Yassine Boubendir

NJIT Science Education Workshops
Novartis: January 1, 2011 - December 31, 2011
Bruce Bukiet and Roumiana Petrova

Expansion of Professional Development Workshop on Digital Learning Tools
Roche: December 2009 - August 2011
Bruce Bukiet, Robert Friedman, Fadi Deek, and James Lipuma

Encouraging High School Students to Pursue Degrees in Math and Science: Focus on Skills and Career Opportunities for College Math and Science Majors
Roche: December 2009 - August 2011
Bruce Bukiet, Robert Friedman, Fadi Deek, and James Lipuma

Professional Development Workshop Employing Digital Learning Tools in Your Classroom: Using Probes, Sensors and Computer Learning Modules to Enhance Understanding of High School Mathematics and Science

Roche: October 2009 - August 2011
Robert Friedman, Bruce Bukiet, Eric Blitz, Fadi Deek, and James Lipuma

Computation and Communication: Promoting Research Integration in Science and Mathematics (C2PRISM)
NSF: March 2007 – February 2013
Fadi Deek, Robert Friedman, and Bruce Bukiet

TECHS-NJ Teacher Education Collaboration for High-Need Schools - New Jersey
National Science Foundation: August 2006 – July 2012
Bruce Bukiet, Arthur B. Powell (Rutgers-Newark), Ismael Calderon (Newark Museum), and Gayle Griffin (Newark Public Schools)

Optimum Vessel Performance in Evolving Nonlinear Wave Fields
Office of Naval Research: May 1, 2005 - August 31, 2012
Wooyoung Choi, Robert Beck, and Marc Perlin

Modeling and Analysis of Nematic Liquid Crystals in Thin Geometries: Bistable Configurations and Free Surface Instabilities
National Science Foundation: September 15, 2009 – August 31, 2012
Linda Cummings and Lou Kondic

Computation and Communication: Promoting Research Integration in Science and Mathematics (C2PRISM)
National Science Foundation: April 1, 2007 - March 31, 2012
Fadi Deek, Bruce Bukiet, and Robert Friedman

Biostatiscal Analysis of Cell and Molecular Biology Experimental Data
UMDNJ: July 01, 2009 - August 31, 2011
Sunil K Dhar

Role of Neuromodulators and Activity in the Regulation of Ionic Currents and Neuronal Network Activity
National Institute of Mental Health: March 31, 2009 – March 30, 2014
Jorge Golowasch

Nonlinear Waves and Dynamical Systems
National Science Foundation: July 1, 2008 - June 30, 2012
Roy Goodman

Collaborative Research: Constructing New Multiple Testing Methods
National Science Foundation: June 1, 2010 - May 31, 2013
Wenge Guo

Integral-Equation-Based Fast Algorithms and Graph-Theoretic Methods for Large-Scale Simulations
National Science Foundation: July 15, 2009 - June 30, 2013
Shidong Jiang

Collaboratory Research in Dense Particulate Flow
National Science Foundation: July 2010 – July 2012
Lou Kondic

Microstructure and Fluidization in Granular Media
Department of Defense Basic and Applied Sciences Directorate: April 2010 - March 2015
Lou Kondic, Robert P. Behringer (Duke University), Corey O'Hern (Yale University), and Wolfgang Losert (University of Maryland)

Computational Homology, Jamming, and Force Chains in Dense Granular Flows
National Science Foundation: October 1, 2008 - September 30, 2012
Lou Kondic

Calcium Dynamics in Exocytosis and Synaptic Facilitation
National Science Foundation: August 1, 2008 - July 31, 2013
Victor Matveev

UBM Group: Undergraduate Biology and Mathematics Training Program at NJIT
National Science Foundation: September 1, 2009 - August 31, 2012
Victor Matveev, Gareth Russell, and Jorge Golowasch

Efficient Inversion in Underwater Acoustics with Iterative and Sequential Bayesian Approaches
Office of Naval Research: January 1, 2010 - December 31, 2012
Zoi-Heleni Michalopoulou

Restricted Diffusion in Cellular Media: Application to Cortical Spreading Depression
National Science Foundation: October 1, 2010 - September 30, 2013
Robert M. Miura, Huaxiong Huang, Jonathan J. Wylie

Thermal Effects on the Dynamics of Singularity Formation in Viscous Threads
National Science Foundation: August 15, 2007 – July 31, 2012
Robert M. Miura

Winding Domain Walls in Thin Ferromagnetic Films
National Science Foundation: September 1, 2009 - August 31, 2013
Cyrill Muratov

Regulation of Neuronal Oscillation by Synaptic Dynamics
National Institutes of Health: August 1, 2006 - July 31, 2012
Farzan Nadim

Collaborative Research: Efficient Surface-based Numerical Methods for 3D Interfacial Flow with Surface Tension
National Science Foundation: October 1, 2010 - September 30, 2013
Michael Siegel

Numerical Methods and Analysis for Interfacial Fluid Flow with Soluble Surfactant
National Science Foundation: October 1, 2010 - September 30, 2013
Michael Siegel, Michael Booty, and Yuan-Nan Young

Direct Numerical Simulations of Elastic Filament Suspensions and Multi-Scale Modeling of Soft-Particle Suspensions
National Science Foundation: September 1, 2009 - August 31, 2011
Yuan-Nan Young

PROJECTS FUNDED DURING PRESENT FISCAL YEAR

Statistical Consulting for Data Analysis
Newark Beth Israel Medical Center: January 11, 2012 – January 10, 2013
Daljit S. Ahluwalia and Aridaman Jain

ENGAGE Mini Grant
National Science Foundation Educational Grant as part of WEPAN Grant
September 1, 2011 - Dec. 31, 2012
Priscilla Nelson, Denis Blackmore, David Lubliner, N.M. Ravindra

Science Education Workshops
Roche: Dec. 1, 2011 - Dec. 31, 2012
Bruce Bukiet, James Lipuma, and Roumiana Petrova

NJIT Science Education Program
HSBC Bank USA: Oct. 2011 - Sept. 2012
Bruce Bukiet and James Lipmua

Collaborative Research: The MPI Workshop and GSMM Camp
Collaborating Institutions: RPI, WPI, U Delaware
National Science Foundation: March 1, 2012 – February 28, 2013
Linda Cummings and Richard Moore

Collaborative Research: Mathematical and Computational Methods for Stochastic Systems in Nonlinear Optics
National Science Foundation: September 1, 2011 - August 31, 2014
Richard O. Moore and Tobias Schaefer

Collaborative Research: Dynamics of Morphogen Gradients
National Science Foundation: July 01, 2011 - June 30, 2014
Cyrill Muratov, Peter Gordon, and Stanislav Shvartsman

Strongly Non-equilibrium Phenomena at H2 and Ox Phase Boundaries
NASA: January 1, 2012 - September 1, 2012
Cyrill Muratov

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

Collaborative Research: Cavitation in Insects: Physical Mechanisms for Switching on the Embryonic Tracheal System
National Science Foundation: September 1, 2011 – August 31, 2014
Shahriar Afkhami

Collaborative Research: Multi-scale Phenomena in Ferrofluids near Contact Lines: Enhancing Actuation
National Science Foundation: September 1, 2012 – August 31, 2015
Shahriar Afkhami

Collaborative Research: Direct Numerical Simulations of Multiphase Flows with Interfaces and Particulates, Effects of Fluid Rheology and Confinement
National Science Foundation: September 1, 2012 – August 31, 2015
Shahriar Afkhami

Dynamics of Multiphase Systems: Viscoelastic and Electrowetting Effects
National Science Foundation: September 1, 2012 – August 31, 2015

Shahriar Afkhami and Linda Cummings

Liquid Metals on Nanoscale: Modeling and Computation
National Science Foundation: July 1, 2012 - June 30, 2015
Shahriar Afkhami and Lou Kondic

MRI: Development Neural and Visual Assessment Equipment
National Science Foundation: 2012-2014
T. Alvarez and S.K. Dhar

Functional Mechanisms of Neural Control in Convergence Insufficiency
National Eye Institute: 2013-2018
T. Alvarez, M. Scheiman, S.K. Dhar, and B. Biswal

Linear Conductance-based Mechanisms Underlying Oscillations in Neuronal Networks
National Science Foundation: October 1, 2012 – September 30, 2015
Amitabha Bose, Jorge Golowasch, and Farzan Nadim

Capacity Building for Teacher Certification in Engineering Science
National Science Foundation: October 1, 2012 - September 30, 2014
Norman Loney, Bruce Bukiet, Yuan Ding, James Lipuma, and Laurent Simon

FRG Collaborative Research: Coupled Internal and Free-surface Wave Dynamics in Stratified Fluids
National Science Foundation: September 1, 2012 – August 31, 2015
Wooyoung Choi and Michael Siegel

Modeling and Analysis of Nematiac Films: Flow-substrate Interactions
National Science Foundation: August 1, 2012 – July 31, 2015
Linda Cummings and Lou Kondic

DMS/NIGMS: Multi-Level Model of Reperfusion Injury
National Science Foundation: September 1, 2012 – August 31, 2015
Linda Cummings and Raquel Perez-Castillejos

Effects of Ionic Conductance Correlations on Neuronal Network Activity
NIH: December 1, 2012 - November 30, 2017
Jorge Golowasch and Horacio G. Rotstein

Low-dimensional Hamiltonian Phenomena in Optics
National Science Foundation: September 1, 2012 – August 31, 2015
Roy Goodman

Numerical Methods for Stochastic Differential Equations
Simons Foundation: September 1, 2012 - August 31, 2017
David J. Horntrop

Collaborative Research: Fast Integral Equation Methods for Unsteady Stokes Flow
NSF Computational Mathematics Program: September 1, 2012 – August 31, 2015
Shidong Jiang

Instabilities and Nano-assembly of Laser-irradiated Metallic Materials
Department of Energy: July 1, 2012 - June 30, 2015
Lou Kondic and Shahriar Afkhami

Collaborative Research: Experimental and Computational Study of the Instabilities and Transport and Self Assembly of Nanoscale Metalic Thin Films and Nanostructures

National Science Foundation: September 1, 2012 - August 30, 2015
Lou Kondic and Philip Rack (U. Tennessee)

Liquid Metals on Nanoscale
Department of Energy: September 1, 2012 – August 31, 2015
Lou Kondic and Shahriar Afkhami

Pan-American Study Institute on Dense Particulate Matter
National Science Foundation: January 1, 2013 - October 30, 2014
Lou Kondic and Robert Behringer (Duke U.)

Support for participants at ESMC 2012
National Science Foundation: July 1, 2012 - June 30, 2013
Robert Behringer (Duke U.) and Lou Kondic

CREATIV: Nonlinear Data Reduction for Particulate Systems
National Science Foundation: October 1, 2012 - September 30, 2015
Konstantin Mischaikow (Rutgers U.), Robert Behringer (Duke U.), and Lou Kondic

Pattern Formation by Competing Short-range and Long-range Interactions
National Science Foundation: July 1, 2012 - June 30, 2015
Cyrill Muratov

Regulation of Neuronal Oscillations by Synaptic Dynamics
NIH: February 1, 2012 - November 30, 2016
Farzan Nadim

Latent Time-scales in Bursting Oscillatory Networks
NSF/NIH CRCNS: July 1, 2012 – June 30, 2015
Horacio Rotstein and Farzan Nadim

Latent Time Scales in Bursting Neural Models
National Science Foundation: July 1, 2012 - June 30, 2015
Horacio G. Rotstein

Mechanisms of Frequency Preference in Oscillatory Neural Systems
National Science Foundation: July 1, 2012 - June 30, 2015
Horacio G. Rotstein

Semiparametric Confidence Bands for Survival and Quantile Functions
National Science Foundation: July 1, 2012 – June 30, 2015
Sundar Subramanian

MPS-BIO: Collaborative Research: Mathematical and Experimental Study of Lipid Bilayer Shape and Dynamics Mediated by Surfactants and Proteins
National Science Foundation: September 1, 2012 – August 31, 2015
Yuan-Nan Young, Howard Stone (Princeton University), and Shravan Veerapaneni (Michigan University)

A Systematic Approach to Primary Cilia Mechanosensory Mechanisms: An Integrated Mathematical, Numerical, and Experimental Study
National Science Foundation/NIH NIGMS: September 1, 2012 – August 31, 2015
Yuan-Nan Young and Christopher Jacobs (Columbia University)

PROPOSED PROJECTS - NOT THROUGH CAMS

Internal Wave Modeling
Wooyoung Choi, Roberto Camassa (University of North Carolina, Chapel Hill), Ricardo Barros (IMPA, Brazil), Roxana Tiron (Korea Advanced Institute of Science and Technology)

Pre-Proposal: Predicting Effects of Generalist Herbivores on Plant Communities
National Science Foundation: April 1, 2013 - March 30, 2017
Daniel E. Bunker, Norman Bourg, Line Lapointe, Alex Royo, William McShea

CAREER: Predicting Effects of Generalist Herbivores on Plant Communities - Leveraging Ecoinformatics to Integrate Plant Functional Trait Observations with Experimental Data,
National Science Foundation: March 31, 2012 - March 30, 2017
Daniel E. Bunker

Preliminary Proposal: Maintenance of Synchrony within a Tri-trophic Interaction under Climate Warming Scenarios: Cavity Nesting Bees, Floral Resources, and Natural Enemies,
National Science Foundation: April 1, 2013 - March 30, 2016
Daniel E. Bunker, Kimberly M. Russell, Caroline DeVan

Using Traits of Native Plants to Predict Deer Impacts
National Fish and Wildlife Foundation: February 1, 2013 - January 31, 2015
Daniel E. Bunker

Native Plant and Pollinator Recovery from Deer Overabundance
National Fish and Wildlife Foundation: January 1, 2013 - December 31, 2014
Daniel E. Bunker

Nonlinear Surface Wave Experiments
Wooyoung Choi, Zhigang Tian (Korea Advanced Institute of Science and Technology), Marc Perlin (University of Michigan)

CONTINUING PROJECTS — NOT THROUGH CAMS

Computational Study of Drop Deformation in Systems with Two Immiscible Liquids
National Science Foundation: June 30, 2009 - May 1, 2012
Yuriko Renardy, Pengtao Yue, and Shahriar Afkhami (Investigator)

RCN: TraitNet - Coordinating Trait-based Ecological and Evolutionary Research
National Science Foundation: March 31, 2007 - March 31, 2012
Shahid Naeem and Daniel Bunker

Inestabilidades en Flujos de Recubrimiento
Agencia Nacional de Promocion de la Ciencia y la Tecnologia (ANPCyT, Argentina)(PICT 2498/06): June 2008 - December 2011
Javier A. Diez

Understanding and Combating the Fire-enhancing Impact of Non-native Annuals in Desert Scrub through the Tools of Population and Landscape Ecology
Strategic Environmental Research and Development Program (SERDP)/DoD, 2010 -2014

Claus Holzapfel and Kirk Moloney

Effects of Climate Change on Tibetan High Altitude Vegetation
Visiting Professorship for Senior International Scientist of the Chinese Academy of Science - since June 2011 (ongoing)
Claus Holzapfel

Modeling, Analysis and Computing for Problems from Industry
Nature Science and Engineering Research Council (Canada): April 1, 2010 - March 31, 2015
Huaxiong Huang

Modeling Cortical Spreading Depression
American institute of Mathematics: November 2008 - August 2012
Robert M. Miura and Huaxiong Huang

Stretching of Viscous Threads
Research Grants Council of the Hong Kong Special Administrative Region, China, City University of Hong Kong: 2011-2014
Jonathan J. Wylie, Huaxiong Huang, and Robert M. Miura

Finsurance: Theory and Computation Mathematics of Information Technology and Complex Systems
NCE (Canada) April 1, 2010 - March 31, 2012
T.S. Salisbury (PI), Core Investigators: H. Huang, S. Jaimungle, S. Lin, D. Charles, M. Morales

Modeling for Contaminant Removal by Air Sparging--A Theoretical Model and Centrifuge Validation
National Natural Science Foundation of China: January 2009 - December 2011
Liming Hu and Jay Meegoda

Deflection of Granular Jets
CERG (Hong Kong) 2008-20
Jonathan Wylie

PROJECTS FUNDED DURING PRESENT FISCAL YEAR - NOT THROUGH CAMS

Dynamics of Sleep-Wake Regulation
NSF, Division of Mathematical Sciences: October 1, 2011 – September 30, 2014
Victoria Booth and Cecilia Diniz Behn

Impacts of Deer Browse on Pollinator Communites
Garden Club of America: March 20, 2012 - March 20, 2013
Daniel E. Bunker (Supporting) and Caroline DeVan (Principal)

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 of Applied Mathematics and Statistics (CAMS) at NJIT to fulfill their educational and research missions. Thus, DMS and CAMS, with SCREMS, UBM, and MRI grants from NSF and the generous support of NJIT, have maintained the CAMS/Math Computation Laboratory (CMCL) for the research needs of their members since 1989.

Computational support provided by CMCL for the proposers takes the form of the desktop PC's made available to investigators in their offices and the shared facilities of the CMCL. In addition, there is a network of Sun Workstations, and PCs running Windows available to the faculty, postdoctoral associates, and students.

Major computational facilities include an AMD Opeteron cluster that was purchased with the support of an NSF Major Research Instrumentation (MRI) grant, and expanded with an NSF Computational Science Training for Undergraduates in the Mathematical Sciences (CSUMS) grant. The system is a 77 node (174 processor) Beowulff type cluster, and features AMD Opteron processors running at 2.4 GHz with a fast Myrinet interconnect. The cluster has been operational since March 30, 2005.

In 2010, a 32 core system was purchased with department funds. The system uses AMD Opteron processors running at 2.3 GHz, and a total 64GB memory. More recently, a 96 core system was purchased with department funds and became operational in November 2011. The system uses Intel Xeon processors running at 2.53 GHz, and a total 768GB memory. This computer is intended for jobs that require large memory, and parallel computations using OpenMP. An extension to this cluster which effectively doubles its capabilities has been purchased with departmental funds and is expected to go online in September 2012. All computational facilities are maintained by the University Computing Systems (UCS), headed by David Perel, Director of UCS.

Recognizing the need to support scientific and engineering computing essential to research efforts across the campus, NJIT began in 1998 to provide all faculty members and graduate students access to centralized computing servers for research purposes. Presently, the main university wide facility is a 112 node cluster (AMD Opteron Dual Core CPU at 2.4 GHz, 2GB RAM/CPU).

Meeting rooms

A conference room and the CAMS Reading Room are available for formal and informal research meetings.

B. STATISTICAL CONSULTING LABORATORY REPORT

The mathematical Sciences faculty serves the NJIT community and outside individuals and organizations as statistical consultants. Here are some examples of such consulting activities.

Date: July 2011, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: Completed a statistical analysis of 3 years of data on 5 air pollutants and fitted regression models to describe each pollutant concentration as a function of meteorological factors such as air temperature, relative humidity, solar radiation, wind speed, and wind direction.
Consultants: Gavin Lynch, and Professor Aridaman Jain

Date: May - June 2012, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: Updated the previous 4-year statistical analysis of the data from organic composite for PCB and OCP as well as for 9 metal concentrations in the sediments along the Eastern side of the Secaucus High School (SHS) site by adding data for the 5th year collected in May 2011. It was found that 5 Metals (Cr, Cu, Hg, Ni, and Zn) had statistically significantly lower concentrations in April 2010 compared to the previous 3 periods.
Consultant: Professor Aridaman Jain

Date: July - September 2011, Client: Dawn Semplea (Dept. of Earth and Environmental Sciences at Rutgers - Newark.)
Description: Conducted statistical analysis of Air Pollutants (NO, NO2, NOx and Ozone), meteorological variables, and hospitalizations data to explore the effects of air pollutants on hospitalizations. Identified several outliers for hospitalizations that needed to be investigated.
Consultants: Gavin Lynch, Shoubhik Mondal, and Professor Aridaman Jain

Date: September 2011, Client: Dr. Donald H. Sebastian (Sr. Vice President, NJIT)
Description: Verified principle component analysis of Carnegie classification data of colleges and university rankings.
Consultant: Professor Sunil Dhar

Date: October 2011, Client: Dr. Mojgan Mohtashami (Advanced Infrastructure Design, Inc.)
Description: Conducted a statistical analysis of defects determined by two methods of measurement - Actual Roller Straight Edge (RSE) and a Simulation of RSE - for assessing the degree of relationship between the two methods by plotting the defects and computing correlations between runs for these two methods.
Consultants: Gavin Lynch and Professor Aridaman Jain

Date: January - February 2012, Client: Dr. Harvey Homan (Urovalve, Inc.)
Description: Reviewed the presentation of the results of the assessment of Urinate Bladder Management System and the computation of approximate confidence intervals, as planned by Urovalve, Inc. Provided suggestions for the elimination of discrepancies in the report and for making the results statistically sound. Provided the exact confidence intervals for various proportions of interest such as subjects experiencing success in different aspects of catheter treatment.
Consultants: Gavin Lynch, Professor Sunil Dhar, and Professor Aridaman Jain

Date: November - December 2011, Client: Jennifer LaRosa, M.D. (Newark Beth Israel Medical Center)
Description: Conducted a statistical analysis of the data from a survey to estimate the tendency of medical doctors and fellows to medicate the burn patients liberally or conservatively.
Consultants: Gavin Lynch and Professor Ken Johnson

Date: January - June 2012, Client: Adam Sivitz, M.D. (Newark Beth Israel Medical Center)
Description: Compared the tested and non-tested patients with respect to the following variables: age, gender, fever, nausea, vomiting, rebound, rlq tender, migratory pain, cough hop, anorexia, symptom duration, wbc, pathology.
Consultant: Professor Ken Johnson

Date: January - June 2012, Client: Michael Corbett, M.D. (Newark Beth Israel Medical Center)
Description: Analyzed the demographic differences between the tested and non-tested patients for Pharyngeal and Rectal Chlamydia and Gonorrhea Infections with respect to variables such as age, gender, ethnicity, risk factor, duration of infection, and duration of clinic enrollment.
Consultant: Professor Ken Johnson

Date: January - June 2012, Client: Cena Tejani, M.D. (Newark Beth Israel Medical Center)
Description: Analyzed the visual analogue scale (VAS) rated outcomes of two types of suture - absorbable and non-absorbable – for the trunk and extremity lacerations. An Analysis of Variance breakdown showed that there is no evidence to support the hypothesis that the suture types or the reviewers have any effects on the VAS score.
Consultant: Professor Aridaman Jain

Date: January - June 2012, Client: Adam Sivitz, M.D. (Newark Beth Israel Medical Center)
Description: Conducted a statistical analysis of the sonography and radiology measurements of length and width of pyloric for infants with suspected hypertrophic pyloric stenosis (HPS).
Consultant: Professor Aridaman Jain

IX. CURRENT AND COLLABORATIVE RESEARCH

A. RESEARCH AREAS IN CAMS

Mathematical Biology

Researchers in CAMS working on problems related to Mathematical Biology: Booth, Bose, Bukiet, Dhar, Georgieva, Golowasch, Holzapfel, Nadim, Matveev, Miura, Muratov, Perez, Rotstein, Russell, and Tao.

Mathematical Biology broadly refers to the branch of mathematics that is devoted to the study of biological processes. Recently, there has been quite a bit of emphasis on the intersection of mathematics with developmental biology, neurophysiology, and especially genomics. Moreover, mathematicians are applying their modeling and analytical skills to the study of various diseases, such as diabetes, Parkinson's disease, 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, and statistics, to name only a few. Researchers in Mathematical Biology at NJIT have strong interdisciplinary research programs since most of them have active collaborations with experimentalists. This group of Mathematical Biologists is the largest in a department of mathematics in North America.

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 (STNS). Various aspects of Computational and Mathematical neuroscience are being studied by Victor Matveev, Horacio Rotstein, Louis Tao, Amitabha Bose, and Robert Miura. Matveev studies mechanisms responsible for short-term synaptic plasticity. He is particularly interested in understanding the role of residual calcium in synaptic facilitation. Tao is interested primarily in the modeling and analysis of the dynamics of neuronal networks, with application to visual cortex and other large-scale cortical networks. He focuses on developing analytical techniques to study networks in simplified settings and on identifying possible biological functions of emergent network dynamics. 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 for persistent localized activity in excitatory networks. Miura has worked extensively on modeling and analysis of models for electrical activity in excitable cells, including neurons and pancreatic beta-cells. He is currently working on mathematical models for spreading depression, a slowly propagating chemical wave in the cortex of various brain structures, which has been implicated in migraine with aura.

In the area of Developmental Biology, Cyrill Muratov is interested in developing models that describe the patterning events leading to the formation of dorsal appendages during Drosophila egg development. He studies a system of coupled reaction-diffusion equations driven by a localized input and characterizes the oocyte phenotype by the number of peaks in the signaling pattern. Gareth Russell studies complex ecological systems, including predictive models of wading bird species in the Everglades National Park.

Fluid Dynamics

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

There are ten 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, asymptotical 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, Vanden-Broeck), thin films (Cummings, Diez, Kondic), electrohydrodynamics (Papageorgiou, Petropoulos, Vanden-Broeck), hydrodynamic stability theory (Papageorgiou), sedimentation (Luke), granular flow (Kondic, Rosato) and combustion (Bechtold, Booty, Bukiet, Gordon). A particular focus for several of the faculty members (Afkhami, Booty, Choi, Cummings, Huang, Kondic, Papageorgiou, Siegel, Vanden-Broeck, Wang, Wylie, 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, and Petropoulos.

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 develops multi-scale 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 occuring 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, Bhattacharjee, Boubendir, Bukiet, Choi, Goodman, Horntrop, Jiang, Kondic, Luke, Matveev, Michalopoulou, Moore, Muratov, Papageorgiou, Petropoulos, Rosato, Siegel, Tao, and Young.

Given the rapid development of the power of computers 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 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 immersed boundary method is being developed and refined in order to improve computational 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. 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: Bhattacharjee, Dhar, Dios, Guo, Jain, Johnson, and Subramanian.

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 Ari Jain.

The current research interests of the Statistics faculty are in the following broad and overlapping areas: applied probability models (Bhattacharjee, Dhar), Bayesian modeling (Bhattacharjee), bioinformatics and computational biology (Guo), bootstrap methods (Subramanian), censored time-to-event data analysis (Dhar, Subramanian), computational statistics (Guo, Subramanian), discrete multivariate distribution/reliability models and inverse sampling (Dhar), distribution theory and statistical inference (Bhattacharjee, Dhar, Subramanian), empirical processes (Dhar, Subramanian), high dimensional inference (Guo), minimum distance estimation (Dhar), multiple imputations methods (Subramanian), multiple testing (Guo), non-traditional applications of reliability theory (Bhattacharjee), orthogonal arrays in experimental designs (Dios), semiparametric estimation and inference (Dhar, Subramanian), statistical issues in clinical trials (Guo, Dhar), statistical theory of reliability and survival analysis (Bhattacharjee, Dhar, Subramanian), stochastic orders and their applications (Bhattacharjee), and survey sampling (Jain).

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 modeling flowing complex fluids including viscoelastic liquids, electro/magnetohydrodynamics, interfacial flows in porous media, dynamic contact lines, and microfluidics. Studies of existence of solutions, flow stability, asymptotic behavior, and singularities of such problems pose a great challenge. He uses numerical modeling for addressing some of these mathematical open questions and for understanding the underlying physical mechanisms of these phenomena. His current energy and environmental related projects involve large-scale 3D computations of drop dynamics and breakup in polymer processing, microfluidics, and electrowetting. Motivated by biomedical and pharmaceutical applications, he recently has been studying the deformation and motion of ferrofluid droplets in viscous media.

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.

Roman Andrushkiw

The research of Roman Andrushkiw has focused on the spectral theory of operator-valued functions and the analysis of free boundary problems, with application to numerical modeling in the area of cryosurgery and medical diagnostics. His study of operator-valued functions deals with spectral theory and approximation methods for eigenvalue problems that depend nonlinearly on the spectral parameter. His study of Stefan-type free boundary problems is concerned with modeling of heat transfer phenomena in the freezing of living tissue, involved in cryosurgery. His current projects include the development of a variational method for approximating the eigenvalues of polynomial differential operator pencils, and the study of a pattern recognition algorithm in medical diagnostics related to breast cancer.

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 non-premixed 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.

Manish C. Bhattacharjee

Manish Bhattacharjee's research focus is on applied probability and associated problems of statistical inference for such models. Prime areas of interest and work are aspects of Statistical Reliability Theory that have a common interface with engineering reliability and biostatistics (nonparametric survival models, proportional hazards, competing risks, censoring). Current ongoing research focuses on some aspects of mutual shape duality of hazard rates vs. mean remaining life and their implications for modeling.

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. Among his current projects are acoustically generated particle flows, biocomplexity of marshes, competing species dynamics, dynamical models in economics, integrability of infinite-dimensional dynamical systems (PDEs), particle dynamics, phyllotaxis, virtual reality systems, vortex dynamics, and weak shock waves.

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 and combustion, with some electromagnetics. His studies on combustion have focused on time-dependent and multidimensional dynamics of propagating reaction waves in mixed and multiphase systems, prototype reaction-diffusion models, dynamics of fast reaction waves, and droplet burning. He has also 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, surfactants, and membranes (with Michael Siegel and Yuan-Nan Young), thermal waves in microwave heating and processing (with Greg Kriegsmann), and studies of the interaction of flexible membranes or sails in potential flow (with Jean-Marc Vanden-Broeck, University College London).

Amitabha Bose

The research of Amitabha Bose focuses on the applications of dynamical systems to mathematical neurophysiology. His studies in neurophysiology include modeling sleep rhythms in the thalamocortical system, phase precession of hippocampal place cells, and the development of rigorous mathematical techniques to analyze such problems. His current projects include modeling phase maintenance in the pyloric network of crustaceans, persistent activity in cortical circuits and rhythmogenesis in frog ventilatory systems.

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. He has studied the dynamics of detonation waves, including curved detonations and detonation models of discrete mixtures. He currently uses his expertise in this area to study issues related to homeland security. Prof. Bukiet also researches biological systems and has done work modeling stresses in the heart, blood flow in arteries, and air flow in the lungs, and currently works in the area of postural stability. The goal of this work is in diagnosis of balance problems and evaluation of treatment options. Finally, he works 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-principal investigator.

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 acquired statistical consulting experience.

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.

Rose Dios

The research of Rose Dios has focused upon statistical design of experiments with particular emphasis on the study of the existence of balanced fractional factorial designs arising from orthogonal and balanced arrays. She also has applied statistical modelling techniques to research problems in remote sensing, environmental engineering, and clinical medicine, including cardiac risk analysis and recurrence of cancer.

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 diffential 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.

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.

Peter Gordon

The research of Peter Gordon is focused on the analysis of reaction diffusion advection equations and systems arising in the context of combustion and fluid mechanics. More specifically, his research covers the analytical study of front propagation in hydraulically resistant media. This includes the classification of propagation regimes, initiation of detonation, and quenching and transition from deflagration to detonation. In fluid mechanics, he has studied the effects of advection on propagation of combustion fronts, and in particular how cellular flow can lead to enchantment, blow off and extinction of a flame.

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 genereralized error rates in large-scale multiple testing. Their main applications are on bioinformatics and computational biology. His current research projects include estiamte 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

The research of Shidong Jiang has mainly focused on fast numerical algorithms for PDEs and their applications to large scale problems in physics, chemistry and engineering. He has developed a fast and accurate numerical algorithm for the nonreflecting boundary conditions for the Schrodinger equation. He also developed a stable second integral equation formulation for scattering by open surfaces in two dimensions. When the SKIE formulation is combined with a Fast Multipole Method and iterative solver, a fast and stable numerical algorithm has been developed for large scale open surface problems arising in biology and antenna and radar design. Recently, he has derived analytical solutions for the hyperpolarizabilities for the one dimensional infinite single electron periodic systems which showed that the overall symmetry in nonlinear optics is actually broken.

Lou Kondic

The research of Lou Kondic has concentrated on modeling and numerical simulations of two groups of physical systems: a) two fluid flows with emphasis on the interfacial dynamics, as well as free surface flows, and b) dynamics of granular systems. His studies of supersonic dynamics of gas bubbles in liquids exposed to acoustic radiation involved analytical and computational modeling of the convective and radiative energy transfer between fluids, and were applied predominantly to the effect of single bubble sonoluminescence. His research in the field of granular materials consisted of developing analytical models, as well as molecular dynamics simulations of 2D and 3D granular systems, with emphasis on the collective effects. His work on the dynamics of thin liquid films involved performing large-scale computational simulations with the goal of understanding contact line instabilities and resulting pattern formation. Currently, he is involved in modeling and simulations of granular materials in a microgravity environment, and in the development of numerical methods for highly nonlinear partial differential equations related to the flows of thin liquid films.

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.

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. Micro-mechanic 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 underwater acoustics. Currently, new global optimization approaches based on the tabu methodology are being developed for matched-field source localization and geoacoustic inversion. Also, arrival time and amplitude estimation in uncertain environments is pursued via a novel Gibbs sampling scheme.

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 singlevalued and multivalued nonlinear maps, and Hammerstein equations. He has widely applied these abstact 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 signalling. 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.

Cyrill B. Muratov

The main research direction of Cyrill B. Muratov is pattern formation, self-organization, and non-linear dynamics in systems described by coupled reaction-diffusion equations, with primary applications to biological systems and materials science. He uses dynamical systems theory, singular perturbation techiniques, matched asymptotics, non-local eigenvalue problems, as well as exact analytic, variational, and numerical methods, to study traveling wave solutions, interfacial patterns, and more complicated spatiotemporal patterns. Current ongoing projects with biological applications include analytical studies of excitability, pulse propagation, and spiral waves in excitable biological cells, and modeling and computational analysis of autocrine loops in cell signaling networks. His research in materials science involve studies of the kinetics of domain pattern formation in systems with long-range interactions and polymer-liquid crystal systems, as well as formation of hot spots in ceramic and other materials.

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 elecrophysiological 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 his 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 he hopes 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.

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.

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.

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.

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

Sensing of Dynamic Ferrofluidic Oil/Water Systems in Porous Media, Amir Hiras (RPI)

Direct Pore-scale Numerical Simulations, Ivan Lunati (Institute of Geophysics, University of Lausanne)

Numerical Simulations and Asymptotic Modeling of Capillary Flow Focusing, Alex Leshansky (Technion - Israel Institute of Technology)

Modeling of Viscoelastic Two-phase Flows, Yuriko Renardy and Michael Renardy (Virginia Tech)

Cavitation in Insects: Mechanisms for Switching on the Embryonic Tracheal System, Arthur Woods (Division of Bilogical Sciences, UMontana)

John Bechtold

New Theories of Flames at Elevated and High Pressures, C.K. Law (Princeton University)

Denis Blackmore

Dynamical Analysis of Granular Flows, A. Rosato (NJIT), X. Tricoche (Purdue), and K. Urban (NJIT)

Magnetic Reconnection, K. Urban (NJIT)

Integrability of Infinite-dimensional Hamiltonian Systems, A. Prykarpatsky (AGH-Krakow), N. Bogolubov (Moscow State), and V. Samoylenko (Lviv)

Dynamical Modeling and Analysis of Nonlinear Phenomena, Y. Joshi (Kingsborough) and A. Rahman (Delaware)

Regularity and Chaos in Vortex Dynamics, M. Brons (Technical University of Denmark), A. Goullet (NJIT), and B. Shashikanth (New Mexico State)

Indices for Detecting Periodicity in Hamiltonian Dynamical Systems, C. Wang (ECC) and X. Wang (Beijing Univ.)

Emergency Scale Modeling and Analysis, E. Rohn (Ben Gurion U.)

Computing Fractal Dimensions, A. Zaleski (NJIT)

Roy Goodman

Localized Modes in Optical Fibers with Nonlinearity Management, Gadi Fibich (Tel Aviv University) and Vered Rom-Kedar (Weizmann Institute)

Instabilities of Nonlinear Waves, Michael Weinstein (Columbia University), Jeremy Marzuola (North Carolina)

Chaotic Dynamics in Waveguides, Theoretical and Experimental, Alexander Szameit, Friedrich Schiller University Jena (Germany)

Wenge Guo

Constructing New Multiple Testing Methods, Sanat Sarkar (Temple University)

David J. Horntrop

Packing of Granular Materials, A. Rosato (New Jersey Institute of Technology)

Shidong Jiang

Integral Equation Methods for Unsteady Stokes Flow, S. Veerapaneni (University of Michigan), L. Greengard (Courant Institute, NYU), M. Kropinski (SFU, Canada), and B, Quaife (University of Texas at Austin)

Lou Kondic

Dense Granular Systems and Topology, Robert Behringer (Duke University), Konstantin Mischaikow (Rutgers University)

Breakup of Finite Fluid Films and Rivulets, Javier Diez, Alejandro Gonzalez (UNCPBA, Argentina)

Instabilities of Nano-scale Metal Structures, Philip Rack (U. Tennessee and Oak Ridge National Laboratory)

Victor Matveev

Role of Short-Term Synaptic Plasticity in Rhythmic Neural Circuits, A. Bose and F. Nadim (NJIT)

Localization of Calcium Influx during Exocytosis in the Retinal Photoreceptor Cells, J. Singer (University of Maryland at College Park)

Spatio-Temporal Calcium Dynamics during Beta-Cell Insulin Release, M.G. Pedersen (University of Padova, Italy)

Coupling between Presynaptic Calcium Channels and Neurotransmitter Release, E.F. Stanley (Toronto Western Research Institute)

Zoi-Heleni Michalopoulou

Tracking with Invariance Striations, Lisa Zurk (Portland State University)

Passive Fathometer Processing for Reflector Tracking, Peter Gerstoft and Caglar Yardim (Scripps Institution of Oceanography, UCSD)

Signal Propagation in Dispersive Qaveguides, Leon Cohen (Hunter College, CUNY)

Robert M. Miura

Restricted Diffusion in Cellular Media with Application to Cortical Depression, H. Huang (York University, Toronto, Canada) and J.J. Wylie (City University of Hong Kong, Hong Kong)

Stretching of Heated Viscous Threads, H. Huang (York University, Toronto, Canada) and J.J. Wylie (City University of Hong Kong, Hong Kong)

Asymptotic Analysis of a Falling Viscous Drop, J.J. Wylie (City University of Hong Kong, Hong Kong) and H. Huang (York University, Toronto, Canada)

Modeling Cortical Spreading Depression and Neurovascular Coupling, H. Huang (York University, Toronto, Canada), W. Yao (Fudan University, Shanghai, China), J.J. Wylie (City University of Hong Kong, Hong Kong), K.C. Brennan (UCLA, Los Angeles, USA), Josh Chang (UCLA, Los Angeles, USA)

Discovery and Assessment of New Target Sites for Anti-HIV Therapies, N. Madras (York University, Toronto, Canada), C. Breward (University of Oxford, Oxford, UK), J. He?ernan (York University, Toronto, Canada), M.P. Soerensen (Tech. University of Denmark, Lyngby, Denmark), S, Qazi (Gustavus Adolphus College, St. Peter, MN, USA)

Mathematical Modeling of Alternative Polyadenylation of CSTF3, Y. Cheng (Neuchatel, Switzerland), B. Tian (UMDNJ, Newark, NJ, USA)

Richard O. Moore

Mathematical and Computational Methods for Stochastic Systems in Nonlinear Optics, Tobias Schaefer (CUNY Staten Island)

Data Assimilation with Directed Observations, Damon MacDougall (University of Warwick) and Christopher K. R. T. Jones (University of North Carolina)

Large Deviation Principles Applied to Nonlinear Wave Equations, James Nolen (Duke University) and Chia Yee Lee (SAMSI/Duke University)

Cyrill Muratov

Modeling and Analysis of Morphogen Dynamics, P. V. Gordon (NJIT) and S. Y. Shvartsman (Princeton University)

Pattern Formation in Micromagnetics, G. Chaves (NJIT), M. Chermisi (NJIT) and H. Knuepfer (Hausdorff Center, University of Bonn)

A Variational Approach to Traveling Waves and Propagation Phenomena for Ginzburg-Landau and Combustion Problems in Infinite Cylinders, A. Cesaroni (University of Padova, Italy) and M. Novaga (University of Padova, Italy)

Geometric Variational Problems for Systems with Competing Short-range and Long-range Interactions, H. Knuepfer (Hausdorff Center, University of Bonn) and M. Novaga (University of Padova, Italy)

Modeling the Behavior of Cryogenic Fluids in the Context of Rocket Propulsion, V. Osipov and V. Smelyanskiy (NASA Ames Research Center)

Ground States for Classical and Quantum Systems, Jianfeng Lu (Courant Institute for Mathematical Sciences) and Vitaly Moroz (Department of Mathematics, Swansea University, UK)

The Gamma-limit of the Two-dimensional Ohta-Kawasaki Energy, Dorian Goldman (Laboratoire Jacques-Louis Lions, Paris, France) and Sylvia Serfaty (Laboratoire Jacques-Louis Lions, Paris, France)

Farzan Nadim

Temporal Fidelity of Action Potential Conduction in Axons, D Bucher (University of Florida)

Horacio G. Rotstein

Frequency Preference in Neuron and Neuronal Networks, Farzan Nadim NJIT), Nancy Kopell (Boston University), John White (University of Utah), Gyorgy Buzsaki (NYU Medical School)

Effect of Ionic Conductance Correlations on Neuronal Network Activity, (Jorge Golowasch)

Michael Siegel

Numerical Methods and Analysis for Interfacial Fluid Flow with Soluble Surfactant, Michael Booty (NJIT), Jacek Wrobel (NJIT), Qiming Wang (UBC), Yuan Young (NJIT)

Efficient Surface-based Numerical Methods for 3D Interfacial Flow with Surface Tension, David Ambrose (Drexel), Svetlana Tlupova (U. of Michigan), Carlo Fazioli (NJIT), Anna-Karin Tornberg (KTH, Sweden)

Mechanical Modeling of Retinal Detachment, Tom Chou (UCLA)

Yuan-Nan Young

Mechanosensory Mechanisms of the Primary Cilium, Christopher Jacobs (Columbia University)

Boundary-integral Simulations of Swimming by a Flagellum, Shravan Veerapaneni (Michigan University)

Surfactant-mediated Electro-deformation of a Viscous Drop, Petia Vlahovska (Brown University)

Lipid Transport of Electro-deformed Vesicles, Herve Nganguia (NJIT)

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

Zoi-Heleni Michalopoulou, Director of Undergraduate Studies

This year, four students from the Math Club took the Putnam Exam. Additionally, in the fall we had an Integral Bee, which was won by Dhrul Pancahl, with Harish Kajur in second. Seven undergraduate students were inducted into the Pi Mu Epsilon Mathematics Honor Society. Mathematical Sciences students were successful in obtaining REUs at other institutions, participated in research activities with DMS faculty, and obtained internships in industry.

Specifically:

- Thalia Aguirre had an internship with Metlife.
- Tejpal Ahluwalia participated in an REU on financial mathematics at WPI, attended a SAMSI workshop, and had an internship with Wellington Management.
- Grant Barr had an internship with Dealogic.
- William Bird had an internship with Hennan & Walsh.
- Josh Bracewell participated in an REU at the University of Nebraska on applied math research.
- Thomas Dougher had an internship with AEGIS Insurance.
- Chongui Gui had an internship with Mead Johnson Nutrition.
- Manuel Hercules had an internship at Plainfield High School.
- Albi Kavo had an internship with Trillium Trading.
- Sean Naughton, Namrata Patel, and Ivana Seric participated in a project on Instability of Gravity Driven Flow of Liquid Crystal Film under the supervisionguidnace of Professors Cummings and Kondic.
- Xing Nie had an internship with Metlife.
- Motolani Olarinre participated in a research project on Corelation of Conductances in Neural Models under the guidance of Professors Golowasch and Rotstein.
- Matan Shavit received an offer to intern at ManageIQ, an Enterprise Cloud Management company.
- Steve Susanibar was admitted into the Center for Emergent Materials REU program at Ohio State University.
- Tongtong Wang had an internship with Metlife.
- Anthony Zaleski participated in a research project on Euler-Lagrange Equations: Shapes of Charged Droplets under the guidance of Professor Muratov.
- Several students participated in UBM research projects (details are given below).

Pi Mu Epsilon Mathematics Honor Society

Pi Mu Epsilon is a national mathematics honor society. It was founded at Syracuse University and incorporated at Albany, New York on May 25, 1914. The purpose of Pi Mu Epsilon is the promotion and recognition of mathematical scholarship among students in postsecondary institutions. It aims to do this by electing members on an honorary basis according to their proficiency in mathematics and by engaging in activities designed to promote the

mathematical and scholarly development of its members.

The NJIT Chapter of the Pi Mu Epsilon honor society, headed by Professor Goodman, inducted seven new members this year. The ceremony took place on April 25, 2012. The students who were inducted in 2012 are:

- Clarence Amurao
- Josh Bracewell
- Nancy El Haddad
- Seojung Kim
- John Marin
- Mihir Sanghavi
- Joseph Zaleski

UBM – Undergraduate Biology and Mathematics Training Program, 2011-2012

The research supervisors and mentors for UBM during theacademic year 2011-2012 were Victor Matveev (Math), Gareth Russell (Biology), Jorge Golowasch (Biology), Daniel Bunker (Biology), Camelia Prodan (Physics), and Jessica Ware (Biology, Rutgers-Newark).

The student participants were Thomas Anderson (Math), Diane Avecillas (Math), Andrew Izquierdo (Math), Sundas Fatima (Biomedical Engineering), Corrado Mancini (Electrical Engineering), and Rambert Yan (Mechanical Engineering).

As in the previous years, the program started in the Spring semester (2012), with students taking the Mathematical Biology course (Math 373) taught by Prof. Daniel Bunker, along with a single-credit Undergraduate Research Seminar (Math 401) that involved a weekly 1.5 hour meeting led by Prof. Matveev and aimed at teaching modeling techniques, with an emphasis on statistical methods, differential equations, stochastic simulation and MATLAB programming.

During Spring 2012 students rotated through host laboratories: the Neurobiology laboratory of Dr. Jorge Golowasch (NJIT & Rutgers-Newark), the Evolutionary Biology and Phylogenetics laboratory of Dr. Jessica Ware (Rutgers-Newark), the Community Ecology and Ecoinformatics laboratory of Dr. Daniel Bunker (NJIT), and the Cell Biophysics laboratory of Dr. Camelia Prodan (NJIT). These rotations exposed the students for the first time to experimental research techniques, and gave them a selection of research projects to choose from. Based on the preferences of the UBM students, they were paired into three groups and assigned to one of the three participating laboratories. They started working on their research projects in May 2012, and will complete the active research phase of the program in Fall 2012.

The research projects were:

Lab: Dr. Jorge Golowasch
Students: Diane Avecillas (Math) and Corrado Mancini (Electrical Engineering)
“Proctolin Sensitivity Changes in the Crab Stomatogastric Ganglion upon its Decentralization”

Lab: Dr. Daniel Bunker
Students: Thomas Anderson (Math) and Rambert Yan (Mechanical Engineering)
"Dynamics, Parameter Sensitivity and Ontological Modeling of a Four-population Ecological System with Heterogeneous Interactions”

Lab: Dr. Camelia Prodan
Students: Sundas Fatima (Biomedical Engineering) and David Izquierdo (Math)

“Effect of Osmotic Pressure on Cell Volume and Other Cell Properties as a Model for Glaucoma”

Apart from full-time research work, the summer phase of the UBM program involved two weekly meetings attended by all students and their research mentors: one of the meetings was devoted to weekly student presentations of their research results, which helped to further develop communication skills, while the second meeting, led by V. Matveev, continued the training of mathematical and modeling topics, along with programming skills. All UBM research activities are documented on the UBM Program webpage maintained by the program. PI: V. Matveev: http://web.njit.edu/~matveev/UBM/

This year also saw the conclusion of the 2011 UBM program. The six students who had done their summer research in 2011 finalized their research projects and presented their research results in the Fall 2011 Mathematical Biology seminar:

Lab: Dr. Jessica Ware
Students: John Marin (Computer Science) and Sana Bendaoud (Biology)
“Effect of Nucleotide Compositional Bias among Taxa on Divergence Time Estimation”

Lab: Dr. Gareth Russell
Students: Zhuo Jiang (Math) and Kruti Shah (Biology)
"Scaling Movement Behavior from Microscopic Rules to Habitat Preference”

Lab: Dr. Camelia Prodan
Students: Ali Mustafa (Physics & Math) and Amanee Mustafa (Math)
“Testing Drug Potency by Single Cell Dielectric Spectroscopy”

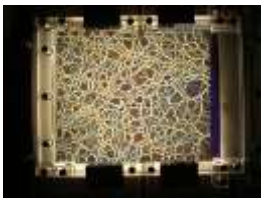
Attesting to the success of the program, several of the UBM students are continuing their involvement in research after the completion of the Program. One of the 2011 UBM students, Ali Mustafa, won a competitive NASA fellowship to continue his research in the laboratory of Dr. Camelia Prodan. Ali Mustafa also won the first prize during the NJIT Dana Knox Student Research Showcase held in April 2012.

Capstone Laboratory Project

The capstone project in 2012, conducted under the supervision of Professor Kondic, was on Topology and Percolation of Particulate Systems. The students who participated are Oscar Bueno, Andrew Helbers, Albi Kavo, Sean Kilroy, Xavier Lee, Christian Pando, Richard Petrie, and Anthony Zaleski. Te-Sheng Lin was the laboratory assistant.

This project concentrated on the force networks that form as a system of photoelastic particles is compressed. Photoelasticity allows to visualize these force networks and to analyze them using a variety of techniques. This approach allows to reach an insight regarding properties of these networks, which are known to be relevant in a number of applications involving dense granular matter, from building of silos, to earthquakes, or response of Martian (or any other) surface to an impact.

In the project, the students carried out physical experiments and produced sets of images (an example is shown).



The brightness of a given particle is at least approximately proportional to the total stress exerted. These images were then processed using image processing techniques to extract the information such as size, position, and stress of each particle. The data obtained by image processing were then analyzed using (i) topological tools, that measured the connectivity of the force networks; and (ii) percolation theory, which was applied to discuss universal properties of force networks. In addition, relevant fractal dimensions were computed. The results were compared to the

existing theoretical models.

The instructor acknowledges help by Drs. Robert Behringer of Duke University, Miro Kramar and Konstantin Mischaikow of Rutgers University, Mark Shattuck of CCNY, and Arnaud Goullet of NJIT. The project was in part supported by the NSF Grant No. DMS-0835611 (PI: L. Kondic).

B. GRADUATE STUDENT RESEARCH PROGRAMS

Michael Booty, Director of the Graduate Program

Ph.Ds Awarded August 2011:

Xiaoni Fang
Thesis: *Energy Propagation in Jammed Granular Matter*
Advisor: Lou Kondic

Rashi Jain
Thesis: *Sequential Bayesian Filtering for Spatial Arrival Time Estimation*
Advisor: Eliza Michalopoulou

Dongwook Kim
Thesis: *The Effect of Current and Conductance Inputs on Firing Rate Resonance in the Layer II Entorhinal Cortex Stellate Cell Mode*
Advisor: Horacio Rotstein

Ph.Ds Awarded May 2012:

Daniel Fong
Thesis: *Mathematical Models of Combustion at High Pressure*
Advisor: John Bechtold

Te-Sheng Lin
Thesis: *Instabilities in Newtonian Films and Nematic Liquid Crystal Droplets*
Advsors: Lou Kondic and Linda Cummings

Xing Zhong: *Energy Methods for Reaction-Diffusion Problems*
Advisor: Cyrill Muratov

<u>Publications, Presentations, and Conference Participation</u>:

Daniel Cargill

Publications:

Simultaneous Frequency Conversion, Regeneration and Reshaping of Optical Signal Pulses (with C.J. McKinstrie), Optics Express, vol. 20, pp. 6881-6886, March 2012.

Poster:

February 2012: SAMSI Workshop on Simulation of Rare Events, Research Triangle Park, NC
Noise-Driven Failure Events in Mode-Locked Lasers (with Richard Moore)

Feiyan Chen

Posters:

April 2012: 57th Annual Meeting of the New Jersey Academy of Science, Seton Hall University, South Orange, NJ
The Goodness-of-fit Tests for Geometric Models (with S. Dhar)

Daniel Fong

Proceedings Publications:

An Asymptotic Theory of Laminar Premixed Flames in Dense Fluids (with J.K. Bechtold and C.K. Law), 2012 Spring Technical Meeting of the Western States Section of the Combustion Institute, Tempe, AZ, March 19-20, 2012

Presentations:

August 2011: Aerospace Propulsion Division, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH
A New Method for Improving Turbulent Combustion Simulations

March 2012: 37th Annual Dayton-Cincinnati Aerospace Science Symposium, Dayton, OH
Turbulent Basis Functions for Flow Simulation

March 2012: 2012 Spring Technical Meeting of the Western States Section of the Combustion Institute, Tempe, AZ
An Asymptotic Theory of Laminar Premixed Flames in Dense Fluids

June 2012: Research Opportunities in Computational Science for Engineering Students, Vaughn College of Aeronautics and Technology, Flushing, NY
Mathematical Models of Combustion at High Pressure

Lenka Kovalcinova

Poster:

June 2011: Summer School on Soft Solids and Complex Fluids, University of Massachusetts, Amherst, MA
Force Networks in Slowly Compressed Granular Materials (with Arnaud Goullet and Lou Kondic)

Te-Sheng Lin

Publications:

Thin Films Flowing Down Inverted Substrates: Three Dimensional Flow (with L. Kondic and A. Filippov), Phys. Fluids, 22, 052105 (2012).

Defect Modeling in Spreading Nematic Droplets (with L. Kondic and L.J. Cummings), Phys. Rev. E, 85, 012702 (2012).

Presentations:

July 2011: ICIAM 2011, Vancouver, BC, Canada
Contact Line Induced Instabilities in a Hanging Fluid Film

November 2011: APS Division of Fluid Dynamics Annual Meeting, Baltimore MD
Contact Line Induced Instabilities for Thin Fluid Films

December 2011: Center of Mathematical Modeling and Scientific Computing,
NCTU, Taiwan
Instabilities in Thin Fluid Films

Posters:

April 2012: The Dana Knox Student Research Showcase, NJIT, Newark, NJ
Instabilities of Thin Fluid Films

Manman Ma

Posters:

April 2012: The Dana Knox Student Research Showcase, NJIT, Newark, NJ
A Numerical Method for Electro-Osmotic Flow with Moving Boundaries (with M. Siegel and M.R. Booty)

Xing Zhong

Presentations:

February 2012: Department of Mathematics, CUNY Graduate Center
Threshold Phenomena for Symmetric Decreasing Solutions of Reaction-Diffusion Equations

Contributions to the Frontiers in Applied and Computational Mathematics, 2012 meeting

NJIT's ninth FACM conference was held from May 18 to May 20, 2012. Mathematical Sciences graduate students made a number of valuable contributions, which are listed below.

Contributed talk: Jeffrey Pohlmeyer. Mathematical Model of Growth Factor Driven Haptotaxis and Proliferation in a Tissue Engineering Scaffold

Posters:

Sonia Bandha (with M.C. Bhattacharjee), Managing Warranty Costs with Variable Usage Rates
Feiyan Chen, The Goodness-of-fit Tests for Geometric Models
Daniel Fong, An Asymptotic Theory of Laminar Premixed Flames in Dense Fluids
Tao Lin, An Inverse Method for Estimating Sound Speed in a Stratified Ocean
Te-Sheng Lin, Instabilities of Thin Fluid Films
Gavin Lynch (with W. Guo), The Control of the False Discovery Rate in Fixed Sequence Multiple Testing
Manman Ma, A Numerical Method for Electro-Osmotic Flow with Moving Boundaries
Kyle Mahady, Volume of Fluid Simulations of the Breakup of a Rivulet
Dawid Midura, Acceleration of the Convergence of Non-Overlapping Domain Decomposition Methods Using the Cross-Point Technique
Oleksiy Varfolomiyev, Optimal Finite Difference Grids for Elliptic and Parabolic PDEs with Applications
Hao Wu, Tapping Dynamics for a Column of Particles and Beyond
Yang Zhang (with F. Nadim and D. Bucher), Modeling History-Dependence of Conduction Delay

in a Non-Myelinated Axon
Xing Zhong, Threshold Phenomena in Reaction-Diffusion Problems

Participation in Workshops

The University of Massachusetts at Amherst held its Fifth Annual Summer School on Soft Solids and Complex Fluids from June 3 to June 7, 2012. Mathematical sciences graduate student Lenka Kovalcinova participated in the summer school and presented a poster.

The CUNY High Performance Computing Center held a workshop on Accelerators in High Performance Computing and Computational Science, from June 5 to June 6 at the College of Staten Island, City University of New York. The following mathematical sciences graduate students participated: Tao Lin, Manman Ma, and Kyle Mahady.

GSMMC. The Ninth Annual Graduate Student Mathematical Modeling Camp was held at Rensselaer Polytechnic Institute from June 5 to June 8, 2012. The following mathematical sciences graduate students participated: Nanyi Dong, Aminur Rahman, Ivana Seric, and Hao Wu.

MPI. The Twenty-Eighth Annual Workshop on Mathematical Problems in Industry was held at the University of Delaware from June 11 to June 15, 2012. The following mathematical sciences graduate students participated: Casayndra Basarab, Nanyi Dong, Manman Ma, Jeffrey Pohlmeyer, Aminur Rahman, Ivana Seric, and Hao Wu.

Graduate Student-Faculty Seminars

Co-sponsored by the Graduate Student Association Mathematical Sciences Group and the NJIT-SIAM Student Chapter.

The aim of the seminars is to provide an opportunity for graduate students to present their research work to their peers and faculty, and for faculty to introduce graduate students to their area of research specialization. It aims to promote the general level of awareness of research among the graduate student body.

The seminar series website (http://math.njit.edu/seminars) lists recent seminar speakers with their titles and abstracts.
Details of older seminars are archived at http://math.njit.edu/seminars/archive.php

May 24	Wenge Guo, *Further Results on Controlling the False Discovery Proportion*
May 29	Oleksiy Varfolomiyev, *Optimal Grids for the Computation of Solutions to the Heat Equation*
	Yang Zhang, *Conduction Velocity in an Unmyelinated Axon Depends on both Short-Term and Long-Term History of Activity*
May 31	David Horntrop, *Stochastic Simulation for Self-Organization in Materials*
June 5	Nattapol Aunsri, *Particle Filtering for Tracking Problems: Basic Idea and Examples*
	Zhi Liang, *Fast Algorithms for Brownian Dynamics Simulations with Hydrodynamic Interactions*
June 7	Cyrill Muratov, *On the Shape of Charged Drops*
June 12	Chenjing Cai, *Optimization for a Bistable Nematic Liquid Crystal Display Device and the Study of Perturbation Effects*
	Tao Lin, *An Inverse Method for Estimating the Sound Speed in a Stratified Ocean*
June 14	Victor Matveev, *Cell Calcium Dynamics and Synaptic Transmission*
June 19	Feiyan Chen, *Goodness-of-Fit Tests for Geometric Models*
	Sonia Bandha, *Copula-Based Modeling and Computational Solutions to Some Warranty Cost Management Problems*
June 21	Roy Goodman, *Chaotic Scattering of Solitary Waves and Superballs*

June 26	Dawid Midura, *Coupling Finite Elements and On-Surface Radiation Conditions for Scattering Problems Using Domain Decomposition Methods*
	Hao Wu, *The Dynamics of Tapped Granular Systems*
June 28	Horacio Rotstein, *Mechanisms of Frequency Preference in Neural Systems*
July 3	Zeynep Akcay, *Predicting Phase-Locked Activity in Neural Networks Using Phase Response Curves*
	Manman Ma, *A Numerical Method for Electro-Osmotic Flow with Moving Boundaries*
July 5	Thomas Wolf (Brock University, Ontario, Canada), *Integrable Non-Abelian Laurent ODEs*
July 10	Lenka Kovalcinova, *Force Networks in Granular Media*
	Aminur Rahman, *A Scheme for Modeling and Analyzing the Dynamics of Logical Circuits*
July 12	Norbert Euler (Lulea University of Technology, Sweden), *Multipotentialisation of Evolution Equations and the Converse Problem*
July 17	Nanyi Dong, *Instabilities in the Spreading of Volatile Liquid Drops*
	Kyle Mahady, *Simulations of Contact Lines and Film Instability*
July 19	Amit Bose, *Phase-Locking in Neuronal Networks*
July 24	Ivana Seric, *Ferrofluid Drop Traveling through Viscous Media*
July 26	Sundarraman Subramanian, *Semiparametric Likelihood Ratio Confidence Intervals for Survival Probabilities*
July 31	Gavin Lynch, *The Control of the False Discovery Rate in Fixed Sequence Multiple Testing*
	Nubyra Chowdhury, *Survival Analysis - An Overview*
August 7	Shoubhik Mondal, *Model-based Cox Regression*
	Anjana Grandhi, *Multiple Hypothesis Testing - An Introduction*