CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT

2009-2010

NJIT New Jersey's Science & Technology University

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I. FROM THE DIRECTOR

The Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) continue to make strides in undergraduate and graduate research and education. A cornerstone of our undergraduate research activities is the recently awarded Undergraduate Mathematics and Biology Training Program (UBMTP) grant from the National Science Foundation, the second such grant secured by the department. This program provides innovative training and research at the intersection of mathematics and biology. Undergraduates in UBMTP have excelled, performing published research and giving talks at scientific meetings nationwide. A significant number of UBMTP students enter graduate programs in a range of science and technology fields, or go on to medical or dental school. Other department programs with a significant thrust in undergraduate research include the NSF funded Computational Science Training for Undergraduates in the Mathematical Sciences (CSUMS) program. The department encourages all undergraduates interested in research, even those who are not eligible for the UBMTP and CSUMS programs, and we have been very successful in obtaining funds to support motivated students.

For graduate student and faculty research, DMS as always receives substantial funding from sources such as the National Science Foundation, National Institutes of Health, Office of Naval Research, Department of Defense, NASA, the Howard Hughes Medical Institute, State of NJ and private industry.

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

- The awarding of a Fulbright Fellowship and a highly competitive NSF Cyber Enabled Discovery grant to CAMS faculty members. A CAMS member was invited to serve on a prestigious NIH Study Panel, which affords the opportunity to steer the national biomedical research effort.

- The submission of a Research Training Grant proposal to NSF. This program funds groups of researchers having related research goals in the mathematical sciences with significant funds to foster research-based training and education.

- The joining with the University of Delaware and Worcestor Polytechnic Institute to host the Mathematical Problems in Industry (MPI) workshop over the next three years. MPI is a problem solving workshop that attracts leading applied mathematicians and scientists from universities, industry, and national laboratories.

- The hosting of the seventh annual Frontiers in Applied and Computational Mathematics (FACM) conference in May, 2010. This three day meeting with a focus on mathematical biology, fluid dynamics, wave propagation and applied statistics attracted over 190 participants. FACM 2010 was held in conjunction with the Spring 2010 Eastern Sectional Meeting of the American Mathematical Society.

- The 8th FACM conference will focus on wave propagation and electromagnetics, and will celebrate the 25th anniversary of CAMS. It promises to be an exciting meeting.

The accomplishments of CAMS have been built with the support and dedication of many individuals. We are grateful to Fadi Deek, Dean of CSLA, and Don Sebastian, Sr. Vice President for Research, for encouraging CAMS through their strong support of scientific research. We look forward to working with Ian Gatley, who recently joined NJIT as Provost and Sr. Vice President of Academic Affairs. Finally, we thank President Robert A. Altenkirch, 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 meeting, "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 - 2010

Dr. John S. Abbott	Corning Incorporated
Dr. Richard Albanese	Brooks Air Force Base
Dr. Peter E. Castro	Eastman Kodak Company (formerly)
Dr. Ned J. Corron	U.S. Army AMCOM
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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
Chang, Chung
Choi, Wooyoung
Cummings, Linda
Deek, Fadi
Dhar, Sunil
Dios, Rose
Golowasch, Jorge
Goodman, Roy
Gordon, Peter
Goullet, Arnaud
Guo, Wenge
Higley, Michael
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
Papageorgiou, Demetrios
Perez, Manuel
Petropoulos, Peter
Rotstein, Horacio
Russell, Gareth
Siegel, Michael
Subramanian, Sundar
Sverdlove, Ronald
Tao, Louis
Wang, Qiming
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
Georgieva, Anna	Novartis Pharmaceuticals Corporation, East Hanover, NJ
Huang, Huaxiong	York University, Toronto, Canada
Tao, Louis	Peking University, China
Vanden-Broeck, Jean-Marc	University of East Anglia, Norwich, England
Wang, Raymond	Novartis Pharmaceuticals Corporation, East Hanover, NJ
Wylie, Jonathan	City University of Hong Kong

IV. COLLOQUIA AND SEMINARS

Department of Mathematical Sciences Colloquium

September 4 **Morton Denn**, Levich Institute, CCNY
Issues in the Flow of Yield-stress Liquids

September 11 **Sheldon Ross**, University of Southern California
Gambler Ruin Problems, and Pricing a Barrier Option under a Jump Diffusion Model

September 18 **Jun Zhang**, Courant Institute for Mathematical Sciences, NYU
Ratchets in Fluid Transportation and in Biological Locomotion

September 25 **Michael Brenner**, Harvard University
The Fluid Mechanics of Fungal Spore Ejection, and Solutions to the Moderate Reynolds Number Navier-Stokes Equations

October 2 **John Bush**, MIT
The Fluid Trampoline: Droplets Bouncing on a Soap Film

October 9 **Robert Gilmore**, Drexel
Chaos: What Have We Learned?

October 16 **Tony Rosato**, NJIT Mechanical Engineering
Density Relaxation of Granular Matter

October 23 **Jonathan Wylie**, City University of Hong Kong
Drawing of Viscous Threads with Temperature-dependent Viscosity

October 30 **Itai Cohen**, Cornell
Defects and Epitaxy: Using Colloids to Investigate Statistical Mechanics Phenomena

November 6 **Shahriar Afkhami**, Department of Mathematical Sciences, NJIT
Determination of Interfacial Tension for a Hydrophobic PDMS-based Ferrofluid Droplet Suspended in Glycerol under Uniform Magnetic Fields

November 13 **Iskander Akhatov**, North Dakota State University
Direct Write: Modeling and Experiment

November 20 **Oliver Jensen**, University of Nottingham, UK
Instabilities of Flows in Flexible Tubes and Channels

December 4 **Peter Palffy-Muhoray**, Liquid Crystals Institute, Kent State University
Motors Based on Shape Change: See How They Run

January 22 **Yuriko Renardy**, Virginia Tech
Numerical Simulation of Drop Deformation in Shear

January 29 **Stefano Fusi**, Columbia University
Computational Advantages of Multi-stage Memory Systems

February 5 **Denis Blackmore**, New Jersey Institute of Technology
Approximations to Granular Relaxation Flows: Lattices, Limits, Infinite-dimensional Dynamical Systems and Solitons

February 12 **Linda Cummings**, New Jersey Institute of Technology
Complex Variable Methods Applied to Moving Boundary Problems

February 19 **Weiqing Ren**, Courant Institute, NYU
The Moving Contact Line Problem and the Spreading of Liquid Thin Films

March 5 **Olof Widlund**, Courant Institute, NYU
Domain Decomposition Methods for Large Problems of Elasticity

March 12 **Tom Witelski**, Duke University
Coarsening: Transient and Self-similar Dynamics in 1-D

March 26 **James Meiss**, University of Colorado at Boulder
Transitory Dynamical Systems and Transport

April 9 **Hassan Aref**, Virginia Tech
Point Vortices: A Classical Mathematics Playground

April 16 **Greg Wilson**, University of Toronto
High Performance Computing Considered Harmful

April 23 **Vladimir Druskin**, Schlumberger-Doll Research
Optimal Finite Difference Grids for Neumann-to-Dirichlet Operators

April 30 **Bob Kohn**, Courant Institute, NYU
The Evolution of a Crystal Surface: Steps, PDE's, and Self-similarity

Applied Statistics Seminar

September 9 **Sheldon Ross**, University of Southern California
Multiple Item Selling Problems

September 17 **Glen Atlas**, University of Medicine and Dentistry of New Jersey, Newark, NJ and Stevens Institute of Technology, Hoboken, NJ
Development of a Recursive Finite Difference Pharmacokinetic Model from an Exponential Model: Application to a Propofol Infusion

September 24 **Li Wang**, Ph.D., Global Biometric Sciences-Bristol-Myers Squibb Company
Orthogonal Blocking of Response Surface Split-plot Designs

October 15 **Das Purkayastha**, Ph.D., Novartis Pharmaceuticals
A Methodological Perspective of Predicting Circadian Fluctuations of 24-Hour Ambulatory Blood Pressure: A New Look to ABPM Analyses in Cardiovascular Clinical Trials

October 29 **Abhijit Dasgupta**, Ph.D., CEO ARAAstat
Exploration of High Dimensional Data Using a Flexible Learning Method

November 5 **Yi-Hsuan Lee**, Ph.D., Educational Testing Service
Controlling Item Exposure in Multidimensional Computerized Adaptive Testing

November 12 **Zhi Wei**, Department of Computer Science, NJIT
An HMM-based Optimal Multiple Testing Procedure for Genome-wide Association Studies

December 3 **Md. Aleemuddin Siddiqi**, Ph.D., Symbiance, Inc., Princeton Junction, NJ
Analysis of Microtubule Dynamics Using Growth Curve Models

January 21 **Xiaodong Lin**, Department of Management Science and Information Systems, Rutgers University
Regularization for Stationary Time Series

January 28 **Yujun Wu**, Department of Biostatistics and Programming, Sanofis-Aventis Inc., Bridgewater, New Jersey
Fast FSR Variable Selection with Applications to Clinical Trials

February 4 **Glen Laird**, Novartis Pharmaceutical Corporation
Estimation with Overdose Control Implementation at Novartis Oncology

February 11 **Jon Kettenring**, Drew University
Massive Datasets

February 18 **Xiaolong Luo**, Celgene Corporation
Estimation of Treatment Effect Following a Clinical Trial with Adaptive Design

March 4 **Cuiling Wang**, Albert Einstein College of Medicine
Correction of Bias from Non-random Missing Longitudinal Data Using Auxiliary Information

March 11 **M.C. Bhattacharjee**, New Jersey Institute of Technology
Are Class-L Distributions Really Aging?

March 25 **Xiaohui Luo**, Forest Research Institute, JerseyCity, NJ
Estimation of Treatment Difference in Proportions in Clinical Trials with Blinded Sample Size Re-estimation

April 1 **Chyi-Hung Hsu**, Novartis Pharmaceuticals, East Hanover, NJ
Evaluating Potential Benefits of Dose-exposure-response Modeling for Dose Finding

April 8 **Mani Lakshminarayanan**, Investigative Research, Late Development Statistics, Merck & Co. Inc.
Meaningful and Reproducible Conclusions in Clinical Trials: A Statistician's Perspective

April 29 **Amarjot Kaur**, Merck and Co. Inc., Rahway, NJ
Nonproportional Hazards Assumption in Time-To-Event Data

Mathematical Biology Seminar

September 22 **Farzan Nadim**, Department of Mathematical Sciences, NJIT
A Novel Bifurcation Diagram Arising from the Dynamics of an Oscillator-follower Inhibitory Network with A-current

September 29 **Avi Maayan**, Department of Pharmacology & Systems Therapeutics, Mount Sinai School of Medicine
Data Mining and Network Analysis in Systems Biology

October 6 **Hani Girgis**, John Hopkings University
Two Machine Learning Algorithms for Selecting and Ranking the Best Predicted Protein Structures

October 13 **Huaxiong Huang**, Department of Mathematics and Statistics, York University, Toronto, Ontario, Canada
Spreading Depression: A Simplified Neuron Model

October 27 **Hamid Reza Noori**, Princeton Neuroscience Institute, Princeton University
Neurochemical Oscillations in the Basal Ganglia

November 10 **Dongwook Kim**, Department of Mathematical Sciences, NJIT
Dynamics of Medial Entorhinal Cortex Layer II Stellate Cells Receiving Periodic and Non-periodic Inputs

November 17 **Michael Graupner**, Center for Neural Sciences, New York University
A Bistable Synaptic Model with Transitions between States Induced by Calcium Dynamics: Theory vs Experiment

December 1 **Xinxian Huang**, Department of Mathematical Sciences, NJIT
Using Feed-forward Networks to Infer Activity of Feedback Neuronal Networks

January 26 UBM Student Presentations:
Timothy Blockus, *An Analysis of Amax, LMA, and Phenolics of Shrubs within the Local Temperate Deciduous Biome*
Krutanjali Shah & **Yamin Noor**, *The Effect of Neuronal Morphology on Passive Properties of Neurons*
Fatima Elgammal & **Zehra Sadiq**, *Kinetics of Calcium+2, Cadherin and Adherens Junctions*

February 2 **Daniel Marti**, Center for Neural Systems, New York University
A Model of Two Interacting Accumulators for Reach and Saccade Reaction Time Behavior

February 9 **Mini Kurian**, Department of Mathematics, Arizona State University
Modeling Self-sustained Firing in Motoneuron after Spinal Cord Injury

March 2 **Yan (Felicia) Gai**, Center for Neural Sciences, New York University
Slope-based Stochastic Resonance: How Noise Enables Phasic Neuron Models to Encode Slow Signals

March 23 **Srdjan Ostojic**, Center for Theoretical Neuroscience, Columbia University
Fast Oscillations in the Cerebellar Purkinje Cell Layer: Network Versus Single Cell Mechanisms

March 30 **Darrell Haufler**, Center for Molecular and Behavioral Neuroscience, Rutgers University
Subthreshold Oscillations in Hippocampal Interneurons

April 6 **Guillermo Solovey**, Rockefeller University
Intracluster Percolation of Calcium Signals

April 13 **Jonathan Rubin**, Department of Mathematics, University of Pittsburgh
Implications of Phase Transitions Mechanisms in Neuronal Network Rhythms

April 20 **Camelia Prodan**, Department of Physics, NJIT
Topological Phonon Modes and Their Role in Dynamic Instability of Microtubules

April 27 **Chris Wiggins**, Department of Applied Physics and Applied Mathematics, Columbia University
Form, Function, and Information Processing in Stochastic Regulatory Networks

Fluid Mechanics Seminar

August 31 **Daniele Chiappini**, Department of Mechanical Engineering, University of Rome
Simulation of Multiphase Flows through Kinetic Approach

September 21 **Paulo Arratia**, Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania
The Effects of Polymer Molecular Weight on Filament Thinning and Drop Breakup in Microchannels

October 5 **Juhi Jang**, Courant Institute of Mathematics, New York University
On the Hilbert Expansion of the Boltzmann Equations

October 8 **Michael Higley**, Department of Mathematics, Penn State University
Floating and Falling: The Motion of a Sphere in a Bubbly Fluid

October 9 **Carlo Fazioli**, Department of Mathematics, University of Illinois, Chicago
Theoretical and Numerical Investigations of Variations of the Dirichlet-Neumann Operator

October 12 **Huaxiong Huang**, York University, Toronto, Canada
Numerical Solution of Problems with Moving Contact Lines

October 21 Joint Wave Seminar
Maria Cameron, Courant Institute of Mathematical Sciences, New York University
Analysis of Methods for the Study of Rare Events and Transition Paths

October 28 Joint Wave Seminar
Jean-Marc Vanden-Broeck, University College London, London, England
The Effects of Electric Fields on Inviscid and Viscous Free Surface Flows

November 2 **Charles Schroeder**, Department of Chemical and Biomolecular Engineering, University of Illinois, Urbana-Champaign
Manipulating Single Polymer Chains and Single Particles in Flow

November 16 Special Applied Math Seminar
Kevin Lin, Department of Mathematics, University of Arizona
Spike-Time Reliability of Layered Neural Oscillator Networks

January 25 **Michael Renardy**, Department of Mathematics, Virginia Tech University
Turning Polymeric Liquids into Theorems: Part one
February 1 *Turning Polymeric Liquids into Theorems: Part two*
February 8 *Turning Polymeric Liquids into Theorems: Part three*

February 19 **Weiqing Ren**, Courant Institute of Mathematical Sciences, New York University
The Moving Contact Line Problem and the Spreading of Liquid Thin Films

February 22 **Shreyas Mandre**, School of Engineering and Applied Sciences, Harvard University
The Mechanism of a Splash

March 1 **Christel Hohenegger**, Courant Institute of Mathematical Sciences, New York University
Understanding the Dynamics and Mechanics of Complex Fluids

March 8 **Henry Hess**, Department of Biomechanical Engineering, Columbia University
Molecular Shuttles, "Smart Dust" Biosensors and Active Self-assembly Powered by Kinesin Motors

March 24 **Amir H. Hirsa**, Department of Mechanical, Aerospace and Nuclear Engineering, RPI
Protein Assemblies at Flow Interfaces: 2D Crystallization and Amyloid Formation

March 29 **Thrushant Majmudar**, Courant Institute of Mathematical Sciences, New York University
Nonlinear Dynamics of Coiling and Folding in Viscoelastic Jets

April 5 **Arvind Gopinath**, Harvard University
Symmetry Breaking and Bifurcations in Rigid Rod Nematic Suspensions

April 12 Special Applied Math Seminar
Ratnasingham Shivaji, Department of Mathematics and Statistics, Mississippi State University
Positive Solutions for Classes of n by n Nonlinear Positone Elliptic Systems

April 19 **Eric Keaveny**, Courant Institute of Mathematical Sciences, New York University
Rotation-translation Coupling Strategies for Artificial Low Reynolds Number Propulsion

April 26 **Prabir Daripa**, Department of Mathematics, Texas A & M University
Some Recent Results on Multi-layered Hele-Shaw Flows

May 3 **Hao Lin**, Department of Mechanical and Aerospace Engineering, Rutgers University
Electrokinetic Transport in Electroporation-mediated Molecular Delivery

Waves on Wednesdays Seminar

October 21 **Maria Cameron**, Courant Institute, NYU
Analysis of Methods for the Study of Rare Events and Transition Paths
(joint with fluids seminar)

October 28 **Jean-Marc Vanden-Broeck**, University College London
The Effects of Electric Fields on Inviscid and Viscous Nonlinear Free Surface Flows (joint with fluids seminar)

December 2 **Chee Wei Wong**, Columbia University
Nonlinear and Quantum Optics in Photonic Crystal Nanostructures

March 24 **J. Douglas Wright**, Drexel University
Interaction Manifolds in Reaction Diffusion Systems

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Shahriar Afkhami

A Comparison of Viscoelastic Stress Wakes for Two-dimensional and Three-dimensional Newtonian Drop Deformations in a Viscoelastic Matrix under Shear (with P. Yue and Y. Renardy), Phys. Fluids, Vol. 21, 072106, July 2009.

A Mesh-dependent Model for Applying Dynamic Contact Angles to VOF Simulations (with S. Zaleski and M. Bussmann), J. Comput. Physics, Vol. 228, pp. 5370-5389, August 2009.

Height Functions for Applying Contact Angles to 3D VOF Simulations (with M. Bussmann), Int. J. Numer. Meth. Fluids, Vol. 61, pp. 827-944, November 2009.

Denis Blackmore

Discrete Dynamical Modeling and Analysis of the R-S Flip-flop Circuit (with A. Rahman and J. Shah), Chaos, Solitons and Fractals, Vol. 42, pp. 951-963. July 2009.

Upper and Lower Solutions Method for a Superlinear Duffing Equation (with C. Wang and X. Wang), Commun. Appl. Nonlin. Anal., Vol. 16, pp. 19-29, July 2009.

The Omega-limit Sets of a Flow and Periodic Orbits (with C. Wang and X. Wang), Chaos, Solitons and Fractals, Vol. 41, pp. 2690-2696, September 2009.

A Unified Localizable Emergency Events Scale (with E. Rohn), Int. J. Information Sys. for Crisis Response and Management (IJISCRAM), Vol. 1, pp. 1-14, October 2009.

A Solution Set Analysis of a Nonlinear Operator Equation using a Leray-Schauder Type Fixed Point Approach (with A. Prykarpatsky), Topology, Vol. 48, pp. 182-185, December, 2009.

Fractal Geometry Surface Modeling and Measurement for Musical Cymbal Surface Texture Design and Rapid Manufacturing (with J. Zhou and A. Vas), Periodical of Key Engineering Materials, Vol. 437, Measurement Technology and Intelligent Instruments IX, pp. 145-149, March 2010.

Victoria Booth

Open-source Logic-based Automated Sleep Scoring Software using Electrophysiological Recordings in Rats (with B.A.Gross, C.M.Walsh, G. Mashour, and G.R. Poe), Journal of Neuroscience Methods, Vol. 184, pp. 10-18, 2009.

Understanding Effects on Excitability of Simulated Ih Modulation in Simple Neuronal Models (with A. Lippert), Biological Cybernetics, Vol. 101, pp. 297-306, 2009.

Simulating Microinjection Experiments in a Novel Model of the Rat Sleep-Wake Regulatory Network (with C. Diniz Behn), Journal of Neurophysiology, Vol. 103, pp. 1937-1953, 2010.

Michael Booty

Influence of Surfactant Solubility on the Deformation and Breakup of a Bubble or Capillary Jet in a Viscous Fluid (with Y.-N. Young, M. Siegel, and J. Li), Phys. Fluids, Vol. 21, 072105, July 2009.

Indirect Template Method of Magnetic Field Assisted Assembly (with R.D. Rivero, I. Padron, A.T. Fiory, and N.M. Ravindra), Advanced Materials Research, Vols. 89-91, pp. 431-436, January 2010.

A Hybrid Numerical Method for Interfacial Fluid Flow with Soluble Surfactant (with M. Siegel), J. Comp. Phys., Vol. 229, pp. 3864-3883, February 2010.

Amitabha Bose

The Influence of the A-Current on the Dynamics of an Oscillator-Follower Inhibitory Network (with Y. Zhang and F. Nadim), SIAM J Appl Dyn Syst, Vol. 8, pp. 1564-1590, December 2009.

Yassine Boubendir

Analysis of Multiple Scattering Iterations for High-frequency Scattering Problems II: The Three-dimensional Case (with F. Reitich, F. Eceveit, and A. Anand), Numerische Mathematik, Vol. 114, No. 3, pp. 373-427, January 2010.

Stokes-Darcy Boundary Integral Solutions Using Preconditioner (with S. Tlupova), J. Comp. Phys., Vol. 228, (23), pp. 8627-8641, December 2009.

Chung Chang

Anesthetic-Specific Electroencephalographic Patterns During Emergence from Sevoflurane and Isoflurane in Infants and Children (with S.S. Lo, J.B. Sobol, N. Mallavaram, M. Carson, P.G. Grieve, R.G. Emerson, R.I. Stark, and L.S. Sun), Pediatric Anesthesia, Vol. 19 (12), pp. 1157-1165, Dec. 2009.

Sustained Convergence Induced Changes in Phoria and Divergence Dynamics (with Y.Y. Lee, B. Granger-Donetti, T.L. Alvarez), Vision Research, Vol. 49 (24), pp. 2960-2872, Dec. 2009.

Robust Fitting of PET Data to Improve Estimation: Application to [11C]-WAY-100635 Group Analysis (with F. Zanderigo, R. T. Ogden, S. Choy, A. Wong, R. V. Parsey), Journal of Cerebral Blood Flow and Metabolism, (advance online publication), Feb. 2010.

Wooyoung Choi

A Regularized Model for Strongly Nonlinear Internal Solitary Waves (with R. Barros and T.-C. Jo), J. Fluid Mech.,Vol. 629, pp. 73-85, June, 2009.

Nonlinear Surface Waves Interacting with a Linear Shear Current, Mathematics and Computers in Simulation, Vol. 80, pp. 29-36, September, 2009.

Linda Cummings

Flow Dynamics in a Stented Ureter (with J.H. Siggers, J.A.D. Wattis and S.L. Waters), IMA J. Math. Med. Biol., Vol. 26, pp. 1-24, 2009.

Modelling Crystal Aggregation and Deposition in the Catheterised Lower Urinary Tract, (with L.R. Band, S.L. Waters, J.A.D. Wattis), J. Math. Biol., Vol. 59, pp. 809-840, 2009.

Tracking Large Solid Constructs Suspended in a Rotating Bioreactor: A Combined Experimental

and Theoretical Study (with N. Sawyer, S.P. Morgan, F.R.A.J. Rose, S.L. Waters), Biotech. Bioeng., Vol. 104, pp. 1224-1234, 2009.

Discrete Breathers in a Two-dimensional Spring-mass Lattice (with Y. Xiang, J.A.D. Wattis, H. Susanto), J. Phys. A: Math. Gen., Vol. 42, 355207, 2009.

Fadi P. Deek

On the Design and Development of a Domain Based Integrated Knowledge Repository (with D. Lubliner and G. Widmeyer), SIGITE Research in Information Technology, Vol. 7, (1), pp. 4-24, 2010.

Strategies for Improving Open Source Software Usability: An Exploratory Learning Framework and a Web-based Inspection Tool (with L. Zhao and J. McHugh), International Journal of Open Source Software and Processes, Vol.1, (4), pp. 49 - 64, 2009.

Collaborative Learning Utilizing a Domain-Based Shared Data Repository to Enhance Learning Outcomes (with D. Lubliner and G. Widmeyer), Journal of Interactive Learning Environments, Vol. 17, (4), pp. 351-366, 2009.

Sunil K. Dhar

Book Review: Statistics at Square One, Eleventh Edition, by M. J. Campbell and T. D. V. Swinskow, Journal of Biopharmaceutical Statistics, Vol. 20 (03), pp. 703 - 704, May 2010.

Development of a Recursive Finite Difference Pharmacokinetic Model from an Exponential Model: Application to a Propofol Infusion (with Glen Atlas), IAENG International Journal of Applied Mathematics, Vol. 40 (1), IJAM_40_1_03, Feb 2010.

Cytochrome C Oxidase III as a Mechanism for Apoptosis in Heart Failure (with Changgong Wu, Lin Yan, Christophe Depre, et al.), The American Journal of Physiology-Cell Physiology, Vol. 297 (4), pp. C928-34, October 2009.

Javier Diez

On the Breakup of Fluid Rivulets (with A.G. Gonzalez and L. Kondic), Physics of Fluids, Vol. 21, 082105, 2009.

Instability of a Viscous Liquid Coating on a Cylindrical Fiber (with A.G. Gonzalez, R. Gratton, D. Campana, and F. Saita), Journal of Fluid Mechanics, Vol. 651, 117, 2010.

Thomas Erneux

Recovery Time Scales in a Quantum Dot Absorber (with E. Viktorov, P. Mandel, T.Piwonski, G. Madden, J. Pulka, G. Huyet, and J. Houlihan), Applied Phys. Letters, Vol. 94, 263502, June 2009.

Relaxation Characteristics of Quantum-dash-based Semiconductor Lasers (with E. A. Viktorov, P. Mandel, S. Azouigui, and A. Ramdane), Appl. Phys. Letters, Vol. 95, 231107, December 2009.

Bifurcation to Fronts due to Delay (with G. Kozyreff and M. Tlidi), Philos. Trans. of the Roy. Soc. A, Vol. 368, pp. 483-493, January 2010.

Asymmetric Square-waves in Mutually-coupled Semiconductor Lasers with Orthogonal Optical Injection (with D.W. Sukow, A. Gavrielides, B. Mooneyham, K. Lee, J. McKay, and J. Davis), Phys. Rev. E, Vol. 81, 025206(R), February 2010.

Optically Injected Quantum Dot Lasers (with E.A. Viktorov, B. Kelleher, D. Goulding, S.P.

Hegarty, and G. Huyet), Optics Letters, Vol. 35, pp. 937-939, April 2010.

Mathématiques Appliqués: Une Nouvelle Orientation (with Edouard Thomas), Tangente, Vol. 312, pp. 10-11, Jan.-Feb. 2010.

Anna Georgieva

Using Systems Biology Approach to Explore Hypotheses Underlying Diversity of the Renin Angiotensin System and the Response to Antihypertensive Therapies (with A. Lo, J. Beh, H. DeLeon, M. Hallow, R, Ramakrishna, M. Rodrigo, A. Sarkar, R. Sarangapani), In Clinical Trial Simulations, edited by C. Peck and H. Kimko, Springer, 2010.

Systems Toxicology Modeling for Predictions in Humans (with C. Migliorini, T. Lave, N. Parrott, M. Reddy, HP Grimm, C. Penland, A. Soubret, G. Helmlinger, K. Zuideveld), In Handbook of Systems Tocicology, edited by D. Casciano and S. Sahu, 2010.

Modeling and Simulation of Preclinical Safety: Towards an Integrative Framework (with A. Soubret, G. Helmlinger, B. Dumotier,R. Bibas), Special Review issue in Drug Metabolism Pharmacokinetics, 2009, Vol. 24(1), pp. 76-90.

Jorge Golowasch

Pacemaker Neuron and Network Oscillations Depend on a Neuromodulator-regulated Linear Current (with Sh. Zhao and F. Nadim), Frontiers in Behavioral Neuroscience, Vol. 4(21), pp. 1-9, 2010.

Membrane Capacitance Measurements Revisited: Dependence of Capacitance Value on Measurement Method in Non-isopotential Neurons (with G. Thomas, T. Taylor, A. Patel, A. Pineda, C. Khalil, F. Nadim), J. Neurophysiology, Vol. 102, pp. 2161–2175, 2009.

Roy Goodman

Nonlinear Hydrodynamic Phenomena in Stokes Flow Regime (with J. Blawzdziewicz, N. Khurana, E. Wajnryb, and Y.-N. Young), Physica D: Nonlinear Phenomena, Vol. 239, pp. 1214-1224, June 2010.

Peter Gordon

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Jay N. Meegoda

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Petronije S. Milojevic

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Cyrill Muratov

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Anthony Rosato

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Horacio G. Rotstein

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Michael Siegel

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Sundar Subramanian

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Yuan-Nan Young

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BOOKS AND BOOK CHAPTERS

Daniel Bunker

Book: Biodiversity, Ecosystem Functioning, and Human Wellbeing: An Ecological and Economic Perspective (with Naeem, S., Hector, A., Loreau, M., Perrings, C.), Oxford University Press, Oxford, UK, July 2009.

Book Chapters:

TraitNet: Furthering biodiversity research through the curation, discovery, and sharing of species trait data (with S. Naeem), In Biodiversity, Ecosystem Functioning, and Human Wellbeing: An Ecological and Economic Perspective, Naeem, S., Bunker, D., Hector, A., Loreau, M., Perrings, C., eds., pp. 281-289, Oxford University Press, July 2009.

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Thomas Erneux

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PROCEEDINGS PUBLICATIONS

Shahriar Afkhami

Direct Numerical Simulation of Ferrofluid Drops in a Cylindrical Microfluidic under the Influence of a Non-Uniform Magnetic Field (with L. Cummings, Y. Renardy, and M. Renardy), Proceedings of the 16th US National Congress on Theoretical and Applied Mechanics, June 2010.

Effects of Viscosity Ratio on the Transient and Steady Deformation of a Newtonian Drop in a Viscous and Viscoelastic Matrix under Shear Flow (with Y. Renardy and M. Renardy), Proceedings of the 16th US National Congress on Theoretical and Applied Mechanics, June 2010.

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Determining the Risk Degree in the Diagnosis of Cancer (with N.V. Boroday, K.N. Golubeva, D.A. Klyushin, Yu.I. Petunin). Proceedings of the International Conference on Bioinformatics and Computational Biology, Vol.2, pp.892-895, H. Arabnia, ed., Las Vegas, Nevada, July 2009.

John Bechtold

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Wooyoung Choi

Observation of Air Flow Separation over Steep Water Waves (with Z. Tian and M. Perlin), Proceedings of the 29th International Conference on Ocean, Offshore and Artic Engineering,

Shanghai, China, June, 2010.

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Direct Numerical Simulation of Ferrofluid Drops in a Cylindrical Microfluidic under the Influence of a Nonuniform Magnetic Field (with S. Afkhami, Y. Renardy, M. Renardy), Proceedings of the 16th US National Congress of Theoretical and Applied Mechanics, State College, PA, July 2010.

Fadi P. Deek

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Validation in Post-Secondary Assessment: Toward a Unified Theory (with N. Elliot), Proceedings of the Program and Learning Assessment Conference, Beirut, Lebanon, 2009.

Risk-Driven Management Contingency Policies in Collaborative Software Development (with M. Mohtashami), Proceedings of the 40th Annual meeting of the Decision Science Institute, CD-ROM, Baltimore, Maryland, 2009.

C2PRISM: A Transformative Role for Assessment (with R. Friedman, N. Elliot, R. Fellman, and B. Bukiet), Proceedings of E-Learn - World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, pp. 2580-2585, Vancouver, British Columbia, Canada, 2009.

Post-Merger Technology Integration: Influential Organizational and Information Systems Factors (with G. Baro-Morsell and A. Chakrabarti), Proceedings of the Americas Conference on Information Systems (AMCIS), CD-ROM, paper 440, San Francisco, California, 2009.

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Organic Design Techniques Utilized in the Development of a Domain-Based Integrated Knowledge Repository to Enhance Learning Outcomes (with D. Lubliner and G. Widmeyer), Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology (DESRIST 09), CD-ROM, Malvern, Pennsylvania, 2009.

Sunil K. Dhar

Engineering Pharmacology: Pharmacokinetic Models Using Recursive Finite Difference Equations (with Glen Atlas), Recent Advances in Clinical Medicine-Proceedings of the International Conference on Medical Pharmacology, WSEAS Press, pp. 110-116, 2010. Recent Advances in Biology and Biomedicine (with Glen Atlas), Conference Proceedings and Plenary Lecture. World Scientific and Engineering Academy and Society (WSEAS), Cambridge University, Cambridge, UK, February 2010.

Javier Diez

Stability of a Finite-length Rivulet under Partial Wetting Conditions (with A. G. Gonzalez, L. Kondic), Journal of Physics: Conference Series 166, 012009, 2009.

David J. Horntrop

Density Relaxation of Granular Matter through Monte Carlo Simulation (with A. Rosato, V. Ratnaswamy, O. Dybenko, L. Kondic), Powders and Grains 2009: Proceedings of the 6th International Conference on Micromechanics of Granular Media, eds. M. Nakagawa and S.

Luding, AIP, pp. 481-484, July 2009.

Lou Kondic

A Concise Review of Tapped Density Relaxation and Recent Discrete Element Results (with A.D. Rosato, V. Ratnaswamy, D.J. Horntrop, O. Dybenko), Proceedings of the IUTAM Symposium "Mathematical Modelling and Physical Instances of Granular Flows", ed. J. Goddard, Calabria, Italy, September 2009.

Stability of Finite-length Rivulet under Partial Wetting Conditions (with J. Diez, A.G. Gonzalez), J. of Physics: Conference Series, Vol. 166, 012009, pp. 1-14, August 2009.

Energy Transport through Dense Granular Matter (with X. Fang, O.M. Dybenko, R.P. Behringer), Powders and Grains 2009, eds. M. Nakagawa and S. Luding, AIP Conference Proceedings, Vol. 1145, pp. 293-296, July 2009.

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Jay N. Meegoda

Centrifugal Modeling of Gasoline Contaminated Sites: Pollutant Transport and Remediation (with Liming Hu, Irene M. C. Lo, Yan Liu, Shengyan Gao, and Zhaoqun Wu), Proc. of Int. Symposium on Geoenvironmental Eng., Hangzhou, China, eds.Y.M. Chen, X.W. Tang, and L.T. Zhan, Zhejiang University Press and Springer-Verlag GmbH, pp. 221-235, September 2009.

Robert M. Miura

Mediators of Mechanotransduction between Bone Cells (with S.V. Komarova, M. Lopes, S. Qazi, and D.J.N. Wall), ed. G. Lewis, Proceedings of the OCCAM-Fields-MITACS Biomedical Problems Solving Workshop 2009, pp. 31-38, May 2010.

Cyrill Muratov

Geometric Strong Segregation Theory for Compositionally Asymmetric Diblock Copolymer Melts (with M. Novaga, G. Orlandi and C. Garcia-Cervera), Singularities in Nonlinear Evolution Phenomena and Applications, CRM Series, Birkhauser, 2009.

Anthony Rosato

Discrete Element Modeling of Floor Pressures in a Cylindrical Vessel Filled with Bulk Solids (with S. Chester, O. R. Walton, and M.Cui), Powders & Grains 2009, American Institute of Physics Conference Proceedings, Vol. 1145, pp. 309-312.

Density Relaxation of Granular Matter through Monte Carlo Simulation (with D. Horntrop, V. Ratnaswamy, O. Dybenko, L. Kondic), Powders and Grains 2009: Proceedings of the 6th International Conference on Micromechanics of Granular Media, eds. M. Nakagawa and S. Luding, AIP, pp. 481-484, July 2009.

Destabilization of Pickering Emulsions using External Vibrations (with J. Cuadra and P. Singh), Proceedings of the 16th US National Congress on Theoretical and Applied Mechanics, State College, PA, June 2010.

B. PRESENTATIONS

Shahriar Afkhami

November 2009: New Jersey Institute of Technology, Newark, NJ
Determination of Interfacial Tension for a Hydrophobic PDMS-based Ferrofluid Droplet Suspended in Glycerol under Uniform Magnetic Fields

November 2009: APS Division of Fluid Dynamics, Minneapolis, MN
Deformation of a Hydrophobic Ferrofluid Droplet Suspended in a Viscous Medium under Uniform Magnetic Fields

December 2009: IMA workshop, Microfluidics: Electrokinetic and Interfacial Phenomena, University of Minnesota, MN
Numerical Simulations of Dynamic Wetting

June 2010: USNCTAM, Penn State, PA
1) Direct Numerical Simulation of Ferrofluid Drops in a Cylindrical Microfluidic under the Influence of a Non-Uniform Magnetic Field
2) Effects of Viscosity Ratio on the Transient and Steady Deformation of a Newtonian Drop in a Viscous and Viscoelastic Matrix under Shear Flow

Roman Andrushkiw

July 2009: International Conference on Bioinformatics and Computational Biology, Las Vegas, NV
Determining the Risk Degree in the Diagnosis of Breast Cancer (with N.V. Boroday, K.N. Golubeva, D.A. Klyushin, Yu.I. Petunin)

Manish Bhattacharjee

May 2010: Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology, Newark, NJ
A Usage Rate Sensitive Warranty Servicing Strategy with Imperfect Repairs (joint with Rudrani Banerjee)

Denis Blackmore

February 2010: NJIT Applied Mathematics Colloquium, Newark, NJ
Approximations to Granular Relaxation Flows: Lattices, Limits, Infinite-dimensional Dynamical Systems and Solitons

June 2010: Gordon Research Conference on Granular and Granular-Fluid Flow, Colby College, ME
Tapping Dynamics and Beyond

Victoria Booth

August 2009: Annual University of Michigan–Michigan State University Circadian Clocks Meeting
A Population Network Model of Neuronal and Neurotransmitter Interactions Regulating Rat Sleep-Wake Behavior

October 2009: University of Michigan Neuroscience Graduate Program Retreat
Modeling Neuronal Network Dynamics: Computational Studies in Sleep/Wake Regulation and Epilepsy

October 2009: 39th Annual Meeting of the Society for Neuroscience, Chicago, IL

1) Modeling the Interaction between Circadian and Sleep-Wake Regulatory Systems (with C. Diniz Behn)
2) REM Deprivation Effects on Spatial Learning and its Reversal using Multiple Flower-pots with High vs. Low Water (with C. M. Walsh, M. S. Carroll, B. A. Gross, and G. R. Poe)
3) Network Effects of Frequency-Dependent Phase Response Curves (with C. Fink and M. Zochowski)

October 2009: Mathematical Biology seminar, University of Michigan, Ann Arbor
Simulating Microinjection of Neurotransmitter Agonists and Antagonists in a Novel Model of the Sleep-Wake Regulatory Network

December 2009: Systems Biology Symposium, University of Michigan, Ann Arbor
1) Modeling the Interaction between Circadian and Sleep-Wake Regulatory Systems (with M. Fleshner and C. Diniz Behn)
2) Network Effects of Frequency-dependent Phase Response Curves (with C. Fink and M. Zochowski)

March 2010: Biological Rhythms and Sleep Seminar, University of Michigan, Ann Arbor
Modeling Neuronal Interactions between the Sleep-wake and Circadian Regulatory Systems

Michael Booty

July 2009: Seminar, Mathematics Department, Imperial College, University of London, UK
Influence of Surfactant on Examples of Interfacial Flow

October 2009: IMA workshop on Flowing Complex Fluids: Fluid Mechanics-interaction of Microstructure and Flow, University of Minnesota, MN
The Evolution of a Two-dimensional Cartesian Drop in an Imposed Linear Flow: The Influence of Surfactant and Surfactant Solubility

November 2009: American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, Minneapolis, MN
Efficient Numerical Computation of Fluid Interfaces with Soluble Surfactant (part I) (Speaker was Michael Booty, on joint work with Kuan Xu and Michael Siegel)

January 2010: Joint Mathematics Meeting of the AMS and MAA, AMS Special Session on Mathematics and Physical Experiment, San Francisco, CA
Experiments from a Capstone Laboratory at New Jersey Institute of Technology

Feb 2010: Banff International Research Station. Workshop on Small Scale Hydrodynamics: Theory and Application in Microfluidics and Thin Films, Banff, Canada
Surfactant Solubility Effects

March 2010: Seminar, Mathematical Sciences Department, University of Delaware, Newark, DE
Influence of Surfactant on Examples of Interfacial Flow

Yassine Boubendir

June 2010: IMA Participating Institutions Graduate Student Summer Program
Coupling Finite and Boundary Element Methods for the Helmholtz Equation

April 2010: Spring Central AMS Meeting 2010, St. Paul, MN
Overlapping Domain Decomposition Method for a Metal-dielectric Scattering Problem

August 2009: Advances in Boundary Integral Equations and Related Topics. A conference in honor of George C. Hsiaos 75th Birthday, Univ. of Delaware, Newark, DE
Domain Decomposition Methods for Solving Stokes-Darcy Systems Based on Boundary Integrals

July 2009: Applied Mathematics Seminar, Caltech
Non-Overlapping Domain Decomposition Techniques for the Helmholtz Equation

July 2009: Annual SIAM Meeting, Denver, CO
Convergence Improvement of Non-overlapping Domain Decomposition Method: Helmholtz Equation

Bruce Bukiet

July 2009: Annual Symposium on Statistics in Sports 2009, University of Missouri-St. Louis, MO
Mathematical Modeling for Understanding and Analyzing Baseball

October 2009: E-Learn 2009, Vancouver, Canada
C2PRISM: A Transformative Role for Assessment (with Robert S. Friedman, Norbert Elliot, Fadi P. Deek, and Robert Fellman)

February 2010: AAAS 2010 Annual Meeting, San Diego, CA
C2PRISM: Infusing Technology into High School Math and Science Classrooms (with Fadi P. Deek, Robert S. Friedman, Robert Fellman, and Ewa Solarz)

April 2010: MAA, New Jersey Section Spring 2010 Conference, Middlesex County College, Edison, NJ
Objectively Determining Major League Baseball's Most Valuable Players (with Kevin Fritz)

April 2010: New Jersey City University Mathematics Awareness Lecture Series - Mathematics and Sports, Jersey City, NJ
Mathematical Modeling of Baseball: Who will win the 2010 Pennant?

May 2010: Spring 2010 TLT Faculty Institute, NJIT, Newark, NJ iTunesU
How I Found Fame

Daniel Bunker

November 2009: TraitNet Ontology Workshop, Montpellier, France
Opening Remarks

Wooyoung Choi

August 2009: Marine Hydrodynamics Symposium, Munkyoung, Korea
Energy Dissipation in Two-dimensional Unsteady Plunging Breakers and an Eddy Viscosity Model

September 2009: Seminar at the Pusan National University, Pusan, Korea
Short-term Prediction of Evolving Nonlinear Wave Fields

September 2009: Seminar at the Korea University, Seoul, Korea
Giant Internal Waves in the Ocean

September 2009: Applied Mathematics Seminar at the Korean Advanced Institute of Science and Technology
A Regularized Model for Strongly Nonlinear Internal Solitary Waves and an Iterative Numerical Scheme

September 2009: Seminar at the Seoul National University, Seoul, Korea
Highly Nonlinear Wave Motions in the Ocean and Their Modeling

October 2009: University of Tokyo and KAIST Joint Symposium, Tokyo, Japan
A Unified Pseudo-spectral Formulation for Nonlinear Wave Hydrodynamics

October 2009: Seminar at the University of Hong Kong, Hong Kong, China
A Highly Nonlinear Wave Phenomenon in Stratified Oceans and a Regularized Model for Their Dynamics

November 2009: Seminar at the Ulsan University, Ulsan, Korea
Short-term Prediction of Evolving Nonlinear Ocean Waves

February 2010: Workshop on Observing and Predicting Ocean Wave Fields, Scripps Institution of Oceanography, La Jolla, CA
A Nonlinear Wave Model with Physics-based Parameterizations and its Numerical Solution

June 2010: The Second International Vonference: Nonlinear Waves-Theory and Applications, Beijing, China
1) Nonlinear Evolution of Broadband Surface Waves
2) Modeling Weakly Two-dimensional Water Wave Motions

Linda Cummings

July 2009: SIAM Annual Meeting, Denver, CO
Bistability in a Nematic Liquid Crystal Display Device

December 2009: IMA "Hot Topics" Workshop on Microfluidics: Electrokinetic and Interfacial Phenomena
Nematic Liquid Crystals in Thin Geometries

March 2010: NJIT Applied Math Colloquium
Complex Variable Methods in Free Boundary Problems

Sunil K. Dhar

October 2009: ASA Annual Meeting, New Orleans, LA
Comparing Bulk Modulus and Elastance of Tracheal Tube Cuffs In-Vivo (with Glen Atlas)

January 2010: International Indian Statistical Association Joint Meeting, Andhra Pradesh University, Visakhapatnam, Andhra Pradesh, India
Characterization of Bivariate Geometric Distributions with Inference

February 2010: 10th International Dead Sea Symposium on Cardiac Arrhythmias and Device Therapy, Tel Aviv, Israel
Afterload Assessment with Versus without Central Venous Pressure: A Preliminary Clinical Comparison (with Glen Atlas and J. Burger)

February 2010: World Scientific and Engineering Academy and Society (WSEAS), Cambridge University, Cambridge, UK
Engineering Pharmacology: Pharmacokinetic Models Using Recursive Finite Difference Equations (with Glen Atlas)

May 2010: Frontiers in Applied and Computational Mathematics, NJIT
Modeling with Bivariate Geometric Distribution (with Jing Li)

Javier Diez

December 2009: MRS Fall Meeting, Boston, MA
Directed, Liquid Phase Assembly of Patterned and Thin Metallic Films by Pulsed Laser Dewetting

September 2009: VIII Ibero-American Workshop on Complex Fluids and their Applications, Joao Pessoa, Paraiba, Brazil
The Stability of Partial Wetting Fluid Rivulets: Application to Nanometric Melted Metalic Films

November 2009: 57th. Annual Meeting Division of Fluid Dynamics (APS), Seattle, WA
Instability of a Micrometric Fluid Strip under Controlled Initial Conditions

Thomas Erneux

July 2009: SIAM Annual Meeting, Denver, CO
Multiple Time Scale Methods for Delay Differential Equations: Experiments, Simulations, and Asymptotics

September 2009: Workshop on Delay Differential Equations: from Theory to Applications, University of Bristol, U.K.
Bifurcation to Fronts Due to Delay

October 2009: Conference on Delayed Complex Systems, Dresden, Germany
Bifurcation to Fronts Due to Delay

February 2010: Palais de la découverte, Paris, France
Contrôle, Retard, et Oscillations

May 2010: Differential Equations and Applications Seminar, The Mathematical Institute, University of Oxford, Oxford
Delay Differential Equations in Action

May 2010: 8th AIMS Int. Conf. on Dynamical Systems, Differential Equations, and Applications, Dresden, Germany
Bifurcation of the Essential Spectrum for Neutral Delay Differential Equations

May 2010: 8th AIMS Int. Conf. on Dynamical Systems, Differential Equations, and Applications, Dresden, Germany
Delay Induced Canards

June 2010: Workshop on Low Dimensional Structures in Dynamical Systems with Variable Time Lags, American Institute of Mathematics, Palo Alto, CA
State Dependant Delays

Anna Georgieva

June 2010: Annual Meeting of the European Society of Hypertension, Oslo, Norway
A Systems Modeling Approach to Understanding the Results from AVOID

April 2010: 6th International Symposium on Measurement & Kinetics of In Vivo Drug Effects, Noordwijkerhout
Assessing Torsadogenic Risk using Mathematical Models (with A. Soubret)

August-September 2009: 10th International Conference for Systems Biology, Stanford University, Palo Alto, CA
Disease Modeling and Its Applications in Model-based R&D: Example of the Renin-Angiotensin-Aldsosterone System (with A. Lo and H. Schmidt)

Jorge Golowasch

April 2010: Whitney Laboratories, University of Florida

Co-regulation of Ionic Currents: Regulation and Role in Nervous System Function

Roy Goodman

August 2009: Analysis of Nonlinear Wave Equations and Applications in Engineering, Banff, Alberta, Canada
Bifurcations of Nonlinear Defect Modes

Peter Gordon

December 2009: SIAM Conference on Analysis of Partial Differential Equations, Miami, FL
1) Thermal Explosion in Porous Media
2) Traveling Fronts and Transient Patterns in KPP-type Systems

April 2010: Applied Mathematics Seminar, CUNY, New York
Thermal Explosion in Porous Media as a Blow Up Problem

June 2010: Applied Mathematics Seminar, Tel-Aviv University, Israel
Gelfand-Barenblatt Problem for Porous Media

Arnaud Goullet

May 2010: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Evolution of Large Amplitude Internal Waves with Varying Bottom Topography using a Regularized Model

October 2009: Seminar at the Division of Ocean Systems Engineering, KAIST, South Korea
Dynamic of Internal Waves in the Ocean

Wenge Guo

June 2010: ICSA 2010 Applied Statistics Symposium, Indianapolis, IN
Adaptive Multiple Testing Procedures under Dependence

March 2010: The 2010 ENAR Spring Meeting, New Orleans, LA
Adaptive Multiple Testing Procedures under Dependence

Michael Higley

November 2009: APS Division of Fluid Dynamics, Minneapolis, MN
Sedimenting Spheres in Bubbly Fluid: A Fluid Galton Model

May 2010: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Dispersion of Particles through Collision in a Bubbly Liquid

Claus Holzapfel

August 2009: Ecological Society of America, Albuquerque, NM
1) Boom and Bust in the Desert: The Failed Economy of an Invasive Grass in the Mojave Desert
2) Climate Change in Unpredictable Environments: A Soil Seed Bank Perspective
3) Hormesis in Bromus rubens at Multiple Dose Levels of Glyphosate
4) Links Between Soil and Plant Community Composition Patterns in an Urban Wildland
5) Soil Metal Contamination Influences the Vegetation Assemblage Development of an Urban Brownfield
6) The Vertical Dimension of Deer-Browse Effects on Forest Understory Diversity and Density

April 2010: Rutgers Chancellor's Research Day

Fusion Ecology: How to learn to love your new (plant) neighbor

April 2010: Center for Urban Environmental Sustainability (CUES) Workshop
What does it mean to be Urban in 21st Century NJ?

David J. Horntrop

August 2009: CSUMS Student Research Conference, Minneapolis, MN
Panelist: Life After CSUMS

May 2010: SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA
Stochastic Simulation for Self-Organization in Materials

Huaxiong Huang

October 2009: Seminar, Center for Scientific Computing and Engineering Research, Fudan University
Numerical Solution of Problems with Moving Contact Lines

October 2009: Seminar, Department of Mechanics and Engineering Science, Fudan University
Extension of Viscous Threads at Low Reynolds Number

December 2009: Workshop on Interface Problems in Fluids and Materials
Numerical Solution of Problems with Moving Contact Lines

June 2010: International Conference on Applied Mathematics, City University of Hong Kong, Hong Kong
Numerical Solution of Problems with Moving Contact Lines

Lou Kondic

June 2010: International Conference on Applied Mathematics, Hong Kong, China
Topology of Force Chains in Dense Granular Materials

May 2010: Spring Eastern Sectional Meeting of American Mathematical Society, Newark, NJ
Dense Granular Materials Materials: from Discrete to Continuum Description

May 2010: Max Plank Institute for Complex Systems, Gottingen, Germany
Discrete and Continuum Models for Signal Propagation in Dense Granular Matter

April 2010: TCG-XI DoD/DoE Workshop, Picatinny Arsenal, NJ
Response of Dense Granular Materials to an External Perturbation

March 2010: Colloquium, Ecole Superiure de Physique et de Chimie Industrielles (ESPCI), Paris, France
Discrete and Continuum Models for Signal Propagation in Dense Granular Matter

February 2010: DARPA Granular Dynamics Workshop, Washington, DC
Signal Propagation through Dense Granular Sytems

November 2009: American Physical Society-Division of Fluid Dynamics Annual Meeting, Minneapolis, MN
1) On Contact Line Induced Instability in Flow of Hanging Fluid Films
2) Topology of Force Chains in Dense Granular Materials
3) Drop Formation from an Unstable Partially Wetting Fluid Rivulet
4) Jamming and Energy Propagation through Dense Granular Materials

November 2009: MRS Fall Meeting, Boston, MA
Directed, Liquid Phase Assembly of Patterned and Thin Metallic Films by Pulsed Laser Dewetting

August 2009: Colloquium, Institute for Pure and Applied Mathematics (IMPA), Rio de Janeiro, Brazil
Discrete and Continuum Models for Signal Propagation in Dense Granular Matter

August 2009: Colloquium, Institute of Physics, UNCPBA, Tandil, Argentina
Discrete and Continuum Models for Signal Propagation in Dense Granular Matter

July 2009: Powders and Grains 2009, Denver, CO
Energy Transport through Dense Granular Matter

July 2009: Gordon Conferences on Nonlinear Science, South Hadley, MA
Signal Propagation through Dense Granular Systems

Gregory Kriegsmann

July 2009: Department of Mathematics, Air Force Institute of Technology, Dayton, OH
Electric Discharge Sintering: A Mathematical Model

August 2009: Department of Mathematics, Kent State University, Kent, OH
Finite Difference Approximations to Floquet Problems

Victor Matveev

March 2010: Mathematical Biology Seminar, Swarthmore College, PA
Quantifying Calcium Sensitivity of Synaptic Neurotransmitter Release

October 2009: Society for Neuroscience 39th Annual Meeting, Chicago, IL
Calcium Current vs. Calcium Channel Cooperativity of Exocytosis

Zoi-Heleni Michalopoulou

September 2009: NEAR Lab, Portland State University, Portland, OR
1) Sequential and Iterative Bayesian Methods in Underwater Acoustics
2) RDX Detection with THz Spectroscopy

September 2009: William Paterson University, NJ
Computational Mathematics: Research Activities in Ocean Acoustics and Beyond

November 2009: Portland State University, Portland, OR
Overview of Particle Filters: Ocean Acoustics Applications

November 2009: Meeting of the Acoustical Society of America, San Antonio, TX
1) Overview of Kalman and Particle Filters for Acoustic Applications
2) Gibbs Sampling for Modal Arrival Time and Amplitude Estimation from Time-frequency Representations of Acoustic Signals

October 2009: IEEE Workshop on Underwater Acoustics Signal Processing, RI
Sequential and Iterative Bayesian Methods for Acoustic Feature Estimation

Robert M. Miura

June 2010: Report for AIM SQuaRE, American Institute of Mathematics, Palo Alto, CA
Modeling Cortical Spreading Depression

June 2010: International Conference on Applied Mathematics, City University of Hong Kong, Hong Kong
Mathematical Modeling in Biology and Medicine

April 2010: Interdisciplinary Research Colloquium, Department of Electrical and Computer Engineering, NJIT, Newark, NJ
Migraine with Aura and Cortical Spreading Depression

February 2010: Granular and Multiphase Flows Colloquium, Granular Science Laboratory, Mechanical Engineering Center, NJIT, Newark, NJ
Stretching of Heated Threads

September 2009: Lehigh Math Colloquium, Department of Mathematics, Lehigh University, Bethlehem, PA
Migraine with Aura and Cortical Spreading Depression

July 2009: Society for Mathematical Biology Annual Meeting, Vancouver, B.C. Canada
Migraine With Aura and Cortical Spreading Depression

July 2009: SIAM Annual Meeting, Denver, CO
Stretching of (Heated) Viscous Filaments

July 2009: Neuchatel, Switzerland
Migraine With Aura: Treat It With Math

Richard Moore

October 2009: OSA Frontiers in Optics Conference, San Jose, CA
Methods for Simulating Rare Events in Optical Systems

Cyrill Muratov

September 2009: Workshop on Energy-Driven Systems, Carnegie Mellon University, Pittsburgh, PA
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

November 2009: PDE seminar, University of Padova, Italy
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

December 2009: SIAM Meeting on Analysis of PDEs, Miami, FL
A Variational Free-boundary Problem Arising in Combustion Theory

February 2010: Materials Working Group, Courant Institute of Mathematical Sciences, New York University, New York, NY
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

March 2010: PDE serminar, University of Tours, France
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

April 2010: PDE Seminar, University of Tokyo, Japan
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

April 2010: Applied Mathematics Seminar, Meiji University, Tokyo, Japan
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

May 2010: BIRS Workshop on Self-Assembly of BlockCopolymers: Theoretical Models and Mathematical Challenges, Banff, Canada
Droplet Phases in Compositionally Asymmetric Diblock Copolymer Melts in Two Dimensions

June 2010: Workshop on Phase Transitions, Mathematisches Forschungsinstitut Oberwolfach, Germany
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

June 2010: Italian Society on Industrial and Applied Mathematics (SIMAI) Congress, Cagliari, Italy
Droplet Phases in Non-local Ginzburg-Landau Models with Coulomb Repulsion in Two Dimensions

Farzan Nadim

September 2009: Mathematical Biology Seminar, NJIT, Newark, NJ
A Novel Bifurcation Diagram Arising from the Dynamics of an Oscillator-follower Inhibitory Network with A-current

November 2009: Society for Neuroscience Annual Meeting, Chicago, IL
1) The Influence of Waveform on the Preferred Frequencies of Neurons in an Oscillatory Network
2) Modeling Neuromodulation of Short-term Synaptic Dynamics in an Oscillatory Network
3) Modeling the Activation of a Voltage-gated Ionic Current by a Modulatory Projection Neuron
4) Co-modulation of Synaptic Strengths by Distinct Co-released Neurotransmitters

December 2009: Society of Neuroscientists of Africa (SONA), Symposium on Theoretical Neuroscience, Sharm Al Sheikh, Egypt
Determining Phase and Stability in Central Pattern Generators

January 2010: Whitney Institute, St. Augustine, FL
Preferred Frequencies of Bursting Pacemaker Neurons in an Oscillatory Network

January 2010: UBM Presentations at the Joint Mathematics Meeting, San Francisco, CA
The Effect of Neuronal Morphology on Passive Properties of Neurons

Demetrios T. Papageorgiou

August 2009: 3rd International Symposium on Bifurcations and Instabilities in Fluid Dynamics, Nottingham, U.K.
1) Dynamics of Thin Annular Films with Electrokinetic Effects (with R.V. Craster and O. Matar)
2) Jet Breakup with Surfactant above the Critical Micelle Concentration (with R.V. Craster and O. Matar)

November 2009: Fluids and Materials Seminar, Bristol University, U.K.
Interaction between Flow and Topography in Interfacial Electrohydrodynamics

November 2009: American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, Minneapolis, MN
Dynamics of Thin Annular Films with Electrokinetic Effects (with D. Conroy, R.V. Craster, and O. Matar)

December 2009: Applied Mathematics Seminar, Manchester University, U.K.

Interaction between Flow and Topography in Interfacial Electrohydrodynamics

December 2009: Applied Mathematics Seminar, University College London, U.K.
Dynamics of Falling Film Flows: Electrostatic and Topographical Effects

January 2010: Working Group on Industrial Multi Fluid Flows (IMFF), Paris, France
Analysis and Computations of Multi-fluid Electrohydrodynamic Flows

February 2010: Banff International Research Station, Canada
Small Scale Hydrodynamics: Microfluidics and Thin Films, Electrostatically Induced Instabilities in Interfacial Hydrodynamics

Anthony Rosato

July 2009: Powders & Grains 2009, Golden, CO
Density Relaxation of Granular Matter via Monte Carlo Simulations

March 2010: Univ. Politécnica Madrid, Spain
Density Relaxation: A Review of the Literature and Recent Results

May 2010: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Microstructure Evolution in Density Relaxation by Tapping (with O. Dybenko, D. Horntrop, V. Ratnaswamy, and X. Tricoche)

Horacio G. Rotstein

July 2009: Computational Neuroscience (CNS) Meeting, Workshop on Cortical Oscillations, Berlin, Germany
The Transition between Theta and Hyperexcitable (epileptic) Rhythmic Activity in Medial Entorhinal Cortex Layer II Stellate Cells

December 2009: Jornada de Finanzas del Sur in honor of Prof. Fabio Rotstein, Bahia Blanca, Buenos Aires, Argentina
Stocks and Noise: Representation of the Evolution of Unstable Economies

May 2010: Spring 2010 Eastern Sectional Meeting of the American Mathematical Society (AMS)
Canard Dynamic Structures and Their Roles in Generating Abrupt Transitions between Firing Frequency Regimes in Neural Models: The Stellate Cell Case

May 2010: 8th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, Dresden, Germany
Canard Dynamic Structures and Their Roles in Generating Abrupt Transitions between Firing Frequency Regimes in Neural Models: The Stellate Cell Case

June 2010: Neuroscience Theory Seminar, Universite Paris Descartes, Paris, France
The Mechanism of Abrupt Transitions between Firing Frequency Regimes in Medial Entorhinal Cortex Layer II Stellate Cells

June 2010: Graduate Students Seminar, Department of Mathematical Sciences, NJIT
The Role of Nonlinearities and Time Scale Separation in the Generation of Abrupt Transitions between Firing Frequency Regimes in Stellate Cells

June 2010: Neuroscience Seminar, Center for BioDynamics, Boston University
The Mechanism of Abrupt Transitions between Firing Frequency Regimes in Medial Entorhinal Cortex Layer II Stellate Cells

Gareth Russell

August 2009: Annual Meeting of the Ecological Society of America, Albuquerque, NM
Well-connected but Empty on the Inside: Active Dispersal can Reduce the Species Richness of Accessible Habitat Patches

Michael Siegel

June 2009: SIAM Annual Meeting, Denver, CO
Efficient Numerical Computation of Fluid Interfaces with Soluble Surfactant

November 2009: IMA Workshop on Flowing Complex Fluids: Fluid Mechanics--Interaction of Microstructure and Flow, University of Minnesota, MN
The Evolution of a Two-dimensional Cartesian Drop in an Imposed Linear Flow: The Influence of Surfactant and Surfactant Solubility

February 2010: Workshop on Small Scale Hydrodynamics: Microfluidics and Thin films, Banff International Research Station, Banff, Alberta, Canada
A Hybrid Numerical Method for Fluid Interfaces with Soluble Surfactant

Sundar Subramanian

January 2010: International Indian Statistical Association Conference, Vishakapatnam, India
Multiple Imputations Based Estimation of Survival Functions

Ronald Sverdlove

February 2010: Law and Economics Seminar, Stern School of Business, NYU, NY
Conflicts in Bankruptcy and the Sequence of Debt issues (with S. A. Ravid and A. Bris)

Louis Tao

December 2009: Seminar, Department of Psychology, Peking University
Low-Dimensional Characterization of Neuronal Network Activity in a Large-Scale Model of the Visual Cortex

August 2009: Development, Behaviors and Circuit, Yantai University, Yantai, Shandong, China
Low-Dimensional Characterization of Seizure Activity in Whole-Brain Imaging of Zebrafish Larvae

Jean-Marc Vanden-Broeck

February 2010: Workshop on thin films, BANFF, Canada
The Effects of Electric Fields on Free Surface Flows

April 2010: British Applied Mathematics Conference, Edinburgh, Scotland
Steady and Unsteady Free Surface Flows over Topography

June 2010: Workshop on Mathematical Challenges and Modelling of Hydroelasticity, ICMS, Edinburgh, Scotland
1) Nonlinear Two-dimensional Free Surface Flows under an Ice Sheet (with E.Parau)
2) Steady and Unsteady Three-dimensional Waves under an Ice Sheet (with E.Parau)

June 2010: The Second International Conference on Nonlinear waves, Beijing, China
Three Dimensional Gravity-capillary Waves and Related Problems

Yuan-Nan Young

July 2009: Summer School on Complex- and Bio-fluids, Cargese, Corsica
Dynamics of Elastic Filaments in Stokes Flow

September 2009: Applied Mathematics Seminar, Department of Mathematics, Duke University
Dynamics of Elastic Semi-flexible Filaments in Stokes Flow

October 2009: Seminar, Department of Mathematics, NJIT, Newark, NJ
The Effects of Electric Fields on Inviscid and Viscous Free Surface Flows

November 2009: APS Division of Fluid Dynamics, Minneapolis, MN
1) Hydrodynamic Interactions between Two Semi-flexible Inextensible Filaments in Stokes Flow
2) Dynamics of Polarly Driven Filaments

C. TECHNICAL REPORTS

REPORT 0910-1: *Inference for Comparing Two Treatments Using Kernel Density Estimation*
Sibabrata Banerjee, Sunil Dhar, and Farid Kianifard

REPORT 0910-2: *Development of a Recursive Finite Difference Pharmacokinetic Model from an Exponential Model: Application to a Propofol Infusion*
Glen Atlas and Sunil Dhar

REPORT 0910-3: *Homeomorphisms and Fredholm Theory for Perturbations of Nonlinear Fredholm Maps of Index Zero with Applications*
P.S. Milojevic

REPORT 0910-4: *An Efficient Algorithm for the Evaluation of Certain Convolution Integrals with Singular Kernels*
Shidong Jiang

REPORT 0910-5: *A Hybrid Numerical Method for Interfacial Fluid Flow with Soluble Surfactant*
M.R. Booty and M. Siegel

REPORT 0910-6: *Stability of Fronts and Transient Behavior in KPP Systems*
Anna Ghazaryan, Peter Gordon, and Alexander Virodov

REPORT 0910-7: *A Non-Stiff Boundary Integral Method for 3D Porous Media Flow with Surface Tension*
D. M. Ambrose and M. Siegel

REPORT 0910-8: *Effects of Neuronal Morphology on the Passive Properties of Neurons*
Krutanjali Shah, Amir Farzad Sheibanie, and Farzan Nadim

REPORT 0910-9: *The Effect of Morphology on the Passive Properties of Neurons*
Yamin Noor, Amir Farzad Sheibanie, and Farzan Nadim

REPORT 0910-10: *A PRC Description of How Inhibitory Feedback Promotes Oscillation Stability*
Farzan Nadim, Shunbing Zhao, and Amitabha Bose

REPORT 0910-11: *Modeling with Bivariate Geometric Distributions*
Jing Li and Sunil Dhar

REPORT 0910-12: *Network Frequency can be Predicted from the Preferred Frequency of Pacemaker Neurons in Response to Input Waveforms*
Hua-an Tseng and Farzan Nadim

REPORT 0910-13: *Self-Organized Density Relaxation by Tapping*
Anthony D. Rosato, Oleksandr Dybenko, Vishagan Ratnaswamy, David J. Horntrop, and Lou Kondic

REPORT 0910-14: *Thin Films Flowing Down Inverted Substrates: Two Dimensional Flow*
Te-Sheng Lin and Lou Kondic

REPORT 0910-15: *On the Breakup of Patterned Nanoscale Copper Rings into Nanoparticles: Competing Instability and Transport Mechanisms*
Yueying Wu, Jason D. Fowlkes, Philip D. Rack, Javier A. Diez, and Lou Kondic

REPORT 0910-16: *Homeomorphisms and Fredholm Theory for Perturbations of Nonlinear Fredholm Maps of Index Zero and of A-Proper Maps with Applications*
P. S. Milojević

REPORT 0910-17: *Optimal Costs of a Two-dimensional Warranty Servicing Strategy with an Imperfect Repair Option*
Rudrani Banerjee and Manish C. Bhattacharjee

REPORT 0910-18: *On the Complex Dynamics of a Red Blood Cell in Simple Shear Flow*
Petia M. Vlahovska, Yuan-Nan Young, Gerrit Danker, and Chaoqi Misbah

REPORT 0910-19: *Dynamics of a Semi-flexible Polar Filament in Stokes Flow*
Yuan-Nan Young

REPORT 0910-20: *Objective Method for Determining the Most Valuable Player in Major League Baseball*
Kevin Fritz and Bruce Bukiet

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES AND AWARDS

Daljit S. Ahluwalia

Member of Committee of Meeting and Conferences, AMS

Denis Blackmore

Associate Editor, Mechanics Research Communications

Editorial Board, Journal of Nonlinear Mathematical Physics

Editorial Board, Recent Patents in Space Technology

Editorial Board, Differential Equations and Applications

Editorial Board, Regular and Chaotic Dynamics

Editorial Board, Mathematical Bulletin of the Shevchenko Scientific Society

Organized (with M. Brons and C. Lim) a special session on Vortex Dynamics: Theory and Applications, AMS Meeting, NJIT, May 20, 2010

Victoria Booth

Program Committee, CNS International Computational Neuroscience Meeting, 2008-2010

Daniel Bunker

Workshop Co-organizer, TraitNet Ontology Workshop, Montpellier, France, November 2009

Co-Director, TraitNet Research Coordination Network

Wooyoung Choi

WCU Visiting professor, Korea Advanced Institute of Science and Technology. September 2009-December 2009

Linda Cummings

Faculty mentor at the Graduate Student Modeling Camp, RPI, 2009

Javier Diez

Councelor in the Superior Council of Universidad Nacional del Centro (elected for the period 2010-2012)

Thomas Erneux

Prix de La Recherche mention Sciences de la Communication – parrainage CNRS 2009

Jorge Golowasch

Co-Director and Faculty at the Marine Biological Laboratories, Woods Hole, MA, Neural Systems and Behavior course

Co-Organizer of the 2009 Annual STG Meeting, Chicago, IL

Peter Gordon

Organizer of minisymposium Concentration Phenomena and Blowup in Nonlinear Elliptic and Parabolic Problems at SIAM Conference on Analysis of Partial Differential Equations, December 2009

Arnaud Goullet

Conducted a High Performance Scientific Computing Workshop with MPI, sponsored (in part) by NJIT SIAM Student Chapter and NJIT's GSA.

Wenge Guo

Member, Editorial Board of the Journal of Biometrics and Biostatistics

Huaxiong Huang

Industry Program Committee, ICIAM 2011, Vancouver

Regional Scientific Director (Ontario), MITACS NCE

Managing Editor, Journal of Mathematics-in-Industry Case Studies

Associate Editor, Advances in Applied Mathematics and Mechanics

Editorial Board Member, Journal of Hydrodynamics

Aridaman Jain

Chair of the American Society for Quality (ASQ) Writing Committee for Chain Sampling Procedures for Inspection by Attributes: ANSI/ASQ S3

Chair of the High School Seniors/Juniors Essay Contest organized by the Visions of a Better World Conference, Seton Hall University, South Orange, NJ, October 2009

Gregory Kriegsmann

Associate Editorships: IMA Journal of Applied Mathematics, European Journal of Applied Mathematics, Journal of Engineering Mathematics, Analyis and Applications

Victor Matveev

Served on NSF DMS grant proposal review panel, April 2010

Jay N. Meegoda

Editorial Board member, ASTM Geotechnical Testing Journal
Editorial Board member, Springer Journal on Waste and Biomass Valorization
Associate Editor, ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste

Management

Robert M. Miura

SIAM Fellow, SIAM, July 2009

Chair, Board of Governors, Mathematical Biosciences Institute (NSF Funded), Ohio State University, Columbus, Ohio

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

SIAM Book Editorial Board

Editorial Board, SIAM Journal on Applied Mathematics

Editorial Board, Canadian Applied Mathematics Quarterly

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

Organizing Committee, International Conference on Applied Mathematics, City University of Hong Kong, Kowloon, Hong Kong, June 2010

Member, William Benter Prize in Applied Mathematics Selection Committee, City University of Hong Kong, Kowloon, Hong Kong

Reviewer, Meiji University Global Centers of Excellence Program

Member, SIAM Fellows Selection Committee, Philadelphia, PA

Chair, Session on Ion Dynamics, and Poster Judge, International Conference on Mathematical Biology and Annual Meeting of the Society for Mathematical Biology, July 2009

Farzan Nadim

Review Editor, Journal of Neuroscience

Review Editor, Frontiers in Neural Circuits

Anthony Rosato

Fulbright Senior Research Award: University of Salerno, Italy

Editor-in-Chief, Mechanics Research Communications

Hoover Award, ASME Alternate Board Member

Elsevier Distinguished Lectures in Mechanics - Organizer

Organizer: Granular and Multiphase Flows Colloquium Series

Member - Committee on Publication Ethics (UK)

Organizing Committee Member, Powders and Grains 2009

Horacio G. Rotstein

Member of the Scientific Committee, 4th Argentina School of Mathematics and Biology, Cordoba,

Argentina

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 2010

Sundar Subramanian

Session Chair, International Indian Statistical Association Conference, Vishakapatnam, India

Member of Organizing Committee, Frontiers of Applied and Computational Mathematics 2010, NJIT, Newark, NJ

Statistics Mini Symposium Chair, Frontiers of Applied and Computational Mathematics 2010, NJIT, Newark, NJ

Ronald Sverdlove

Discussant, Triple Crown Conference: Rutgers University, Fordham University, Baruch College, Newark, New Jersey (April 18, 2010 - April 30, 2010).

Discussant, Conference on Financial Accounting and Economics, Piscataway, New Jersey (October 20, 2009 - November 14, 2009).

Louis Tao

Editorial board member of Acta Biophysica Sinica

Jean-Marc Vanden-Broeck

Fellow of the Institute of Mathematics and its Applications

Editor, Quaterly Journal of Mechanics and Applied Mathematics

Editor, ANZIAM Journal

Guest Editor, Journal of Engineering Mathematics (special issue)

Selected as Chairman of the British Applied Mathematics Colloquium for 2012

Co-organiser of the workshop on Mathematical challenges and modelling of hydroelasticity, ICMS, Edinburgh, June 2010

B. CONFERENCE ON FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS (FACM '10)

The seventh conference on Frontiers in Applied and Computational Mathematics was held on May 21-23, 2010. The three day meeting was a broad-themed conference with sessions on mathematical biology, fluid dynamics, applied statistics (including biostatistics), electromagnetics and wave propagation.

FACM 2010 was held in conjunction with the Spring 2010 Eastern Sectional Meeting of the American Mathematical Society. The AMS meeting featured four plenary talks and a large number of parallel sessions covering a wide range of mathematics.

Daljit S. Ahluwalia, Chairman of the Department of Mathematical Sciences, opened the FACM conference and Fadi Deek, Dean of the College of Science and Liberal Arts, gave a welcoming address.

The plenary speakers for FACM 2010 were Russ Caflisch (UCLA), the Director of the Institute for Pure and Applied Mathematics at UCLA and a SIAM Fellow, Margaret Cheney (Renssalaer Polytechnic Institute), also a SIAM Fellow, and Leah Keshet (University of British Columbia), a well-known expert in mathematical biology. Ian Gatley, Provost and Senior Vice President for Academic Affairs, delivered a well-received keynote speech that highlighted the increasing role of applied and computational mathematics in diverse fields of science and technology, including his own specialty of astronomy.

The meeting featured 73 minisymposium talks and 43 poster presentations. As in the previous two meetings, this conference included contributed talks from postdoctoral researchers and graduate students in the main conference minisymposia. Forty excellent applications were received and 18 were selected to give a presentation. The minisymposium talks included leading researchers in fluid dynamics, wave propagation, mathematical biology and applied statistics, as well as a number of excellent talks given by junior faculty from around the US.

Left to right: M. Cheney, L. Keshet, D.S. Ahluwalia, R. Miura, M. Siegel, Provost Gatley, L. Cummings, and Russel Caflisch


Poster Session


Plenary Session

Banquet

Provost Ian Gatley

NSF Panel Discussion

In addition to the plenary and minisyposium talks, there was an NSF sponsored panel discussion on "Future Challenges in Applied and Computational Mathematics" with plenary speakers Russ Caflisch, Leah Keshet, and Margaret Cheney as panelists, as well as Ben White (Exxon Research and Engineering) who provided an industrial perspective. The moderator was Michael Siegel (NJIT).

Siegel's questions are listed below along with a summary of the panel responses:

1. What emerging area for the application of mathematics do you think has the most potential, or will be the most fertile?

The panel felt that the areas represented at the conference minisymposia, i.e. mathematical biology, fluid dynamics, wave propagation and applied statistics, would continue to be fertile. It was noted that emerging applications in information and system science, social science, optimization theory, and cell engineering are starting to generate some excitement among applied mathematicians. Many of the new applications will be data driven, and involve discrete math or models combining discrete and continuous approaches. The importance of interdisciplinary communication was stressed for researchers interested in pursuing these applications.

2. Graduate programs in applied mathematics evolve very slowly. If you were to design a program from scratch, what would it look like and how would it differ from current programs?

The panel agreed that most programs are well designed. Changes might include more interdisciplinary work, more coursework in other departments, and increased interaction with scientists and engineers. It was noted that classes on stochastics are often given in other departments, but should be taught in mathematics departments.

3. What is it that either does or should distinguish applied mathematics from other areas of science or engineering?

The panel labeled applied mathematicians as distributors of methods and ideas among the different fields of science and engineering. Applied mathematicians often come up with analytical and numerical methods that are less physically based than those developed by scientists and engineers. An example is the level set method, which is less physically intuitive than the finite element method. It was also felt that applied mathematicians, in view of their training, are better and more careful at formulating problems carefully, thinking about assumptions, making approximations, and implementing numerics.

4. A recent trend of math departments is to have laboratory experiments performed in the department? Do you think this is a useful trend?

In some fields this was thought to be a potentially useful trend. However, panelists noted that a danger is that it can lead to amateurish efforts, and act as a substitute for collaboration with professional experimentalists.

5. John Von Neumann observed in 1945 that there was a 'stalemate created by the purely analytical approach to nonlinear problems' and advocated the use of computers to overcome it. Is there a similar obstacle today?

The panel felt that a current obstacle is the existence of very large problems and data sets. While there are some methods for dealing with large data sets, such as dimension reduction, this remains an important area of research.

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

1. *Conferences on Frontiers in Applied and Computational Mathematics (FACM) 2008-2010*

   National Science Foundation: July 1, 2008 - June 30, 2011
   Daljit S. Ahluwalia
   Michael Siegel

2. *Statistical Data Analysis*

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

3. *Nonlinear Dynamics of Flames with Applications at High Pressure*

   National Science Foundation: July 1, 2008 - June 30, 2011
   John Bechtold

4. *Fulbright Travel Award*
   Amitabha Bose

5. *The Role of Short-term Synaptic Plasticity in Feedback Neuronal Networks*

   National Science Foundation: September 2006 - August 2010
   Amitabha Bose

6. *UBM: An Undergraduate Training Program in Biology and Mathematics at NJIT*

   National Science Foundation: September 2004 - August 2010
   Amitabha Bose
   Jorge Golowasch
   Farzan Nadim

7. *Science and Math Career Day and Professional Development Workshop for NJ Students and Teachers*

   Roche Foundation: October 2008 - October 2009
   Bruce Bukiet

8. *TECHS-NJ Teacher Education Collaboration for High-Need Schools - New Jersey*

   National Science Foundation: August 2006 - August 2011
   Bruce Bukiet
   Arthur B. Powell (Rutgers-Newark)
   Ismael Calderon (Newark Museum)
   Gayle Griffin (Newark Public Schools)

9. *Optimum Vessel Performance in Evolving Nonlinear Wave Fields*

Office of Naval Research: May 1, 2005 - April 30, 2011
Wooyoung Choi
Robert Beck
Marc Perlin

10. *CMG Collaborative Research: A Systematic Approach to Large Amplitude Internal Wave Dynamics*

National Science Foundation September 1, 2006 - August 31, 2009
Wooyoung Choi
Yuan-Nan Young
Roberto Camassa
Dave Lyzenga
Steve Ramp

11. *An Integrated Approach to Large Amplitude Internal Wave Dynamics and Their Surface Signatures*

Office of Naval Research: January 15, 2008 - December 31, 2010
Wooyoung Choi

12. *Computation and Communication: Promoting Research Integration in Science and Mathematics (C2PRISM)*

National Science Foundation: April 1, 2007 - March 31, 2012
Fadi Deek
Bruce Bukiet
Robert Friedman

13. *Rescue Beta-Adrenergic Cardiomyopathy by Inhibition of Adenylyl Cyclase*

National Institute of Health: March 2009 - February 2013
Dorothy E. Vatner
Sunil K. Dhar (Consultant)

14. *Role of Neuromodulators and Activity in the Regulation of Ionic Currents*

National Institutes of Health: May 6, 2009 – May 5, 2014
Jorge Golowasch

15. *Nonlinear Waves and Dynamical Systems*

National Science Foundation-Mathematical Sciences Division: July 1, 2008 - June 30, 2011
Roy Goodman

16. *Equipment and Modules for a Capstone Course in Applied Mathematics*

National Science Foundation September 1, 2005 - August 31, 2009
Lou Kondic
Michael Booty
Bruce Bukiet
Michael Siegel

17. *Computational Homology, Jamming, and Force Chains in Dense Granular Flows*

National Science Foundation: October 1, 2008 - September 30, 2012
Lou Kondic

18. *Processing of Ceramic Materials by Microwave and Ohmic Heating*

National Science Foundation: August 1, 2007 - August 1, 2010
Gregory A. Kriegsmann

19. *Calcium Dynamics in Exocytosis and Synaptic Facilitation*

National Science Foundation: August 1, 2008 - July 31, 2011
Victor Matveev

20. *Efficient Inversion in Underwater Acoustics*

Office of Naval Research: January 1, 2008 - December 31, 2012
Zoi-Heleni Michalopoulou

21. *Inversion in Shallow Water Environments: An Uncertainty Study*

Office of Naval Research: June 1, 2007 - December 31, 2010
Zoi-Heleni Michalopoulou

22. *CSUMS: Computational Mathematics for Undergraduates in the Mathematical Sciences at NJIT*

National Science Foundation: January 1, 2007- December 31, 2010
Zoi-Heleni Michalopoulou
Roy Goodman
David J. Horntrop
Michael Siegel

23. *Stretching of Heated Threads*

National Science Foundation: August 15, 2007 – July 31, 2010
Robert M. Miura
Jonathan J. Wylie (Investigator)
Huaxiong Huang (Investigator)

24. *Development of a Quantitative Neuroscience Doctoral Training Program*

Howard Hughes Medical Institute - National Institute of Biomedical Imaging and BioEngineering Interfaces Initiative: January 1, 2006 - December 31, 2010
Robert M. Miura
Joshua Berlin, NJMS-UMDNJ
James Tepper, Rutgers-Newark

25. *Collaborative Research: Patterns, Stability, and Thermal Effects in Parametric Gain Devices*

National Science Foundation: July 15, 2005 - June 30, 2010
Richard O. Moore
Keith Promislow (Michigan State University)

26. *Simulation of Rare Events in Lightwave Systems*

National Science Foundation University-Industry Cooperative Research Program: September 1, 2007 - August 31, 2009
Richard O. Moore
Colin McKinstrie (Alcatel-Lucent)

27. *Collaborative Research: Analysis of Spatiotemporal Signal Processing in Developmental Patterning*

National Science Foundation: August 15, 2007 - July 31, 2010
Cyrill Muratov
Stanislav Shvartsman

28. Regulation of Neuronal Oscillation by Synaptic Dynamics

National Institutes of Health: August 2006 - July 31, 2011
Farzan Nadim

29. *Interaction between Flow and Topography in Interfacial Electrohydrodynamics*

National Science Foundation-Mathematical Sciences Division: August 15, 2007 - July 31, 2010
Peter Petropoulos

30. *Rhythmic Oscillations in the Entorhino-Hippocampal System: Biophysics and Dynamics*

National Science Foundation: July 1, 2008 - June 30, 2011
Horacio G. Rotstein

31. *Collaborative Research: Numerics and Analysis of Singularities for the Euler Equations*

National Science Foundation: July 1, 2007 - June 30, 2011
Michael Siegel
Russel Caflisch

32. *Analysis and Numerical Computations of Free Boundaries in Fluid Dynamics: Surfactant Solubility and Elastic Fibers*

National Science Foundation - Division of Mathematical Sciences: July 15, 2007 - July 14, 2011
Michael Siegel
Michael Booty
Yuan-Nan Young

PROJECTS FUNDED DURING PRESENT FISCAL YEAR

1. *Modeling and Analysis of Nematic Liquid Crystals in Thin Geometries*

National Science Foundation: September 15, 2009 - August 31, 2012
Linda Cummings
Lou Kondic

2. *Biostatistical Analysis of Cell and Molecular Biology Exp Data*

UMDNJ: July 1, 2009 - June 30, 2010
Sunil Dhar

3. *Fluid Dynamics of Combustion*

US Israel Binational Science Foundation: January 1, 2010 - September 1, 2011
Peter Gordon

4. *Collaborative Research: Constructing New Multiple Testing Methods*

National Science Foundation: June 1, 2010 - May 31, 2013
Wenge Guo

5. *AF: Medium: Collaborative Research: Integral-Equation-Based Fast Algorithms and Graph-Theoretic Methods for Large-Scale Simulations*

National Science Foundation: July 15, 2009 - June 30, 2013
Shidong Jiang

6. 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)
Wolfgang Losert (University of Maryland)

7. *UBM Group: UG Biology and Mathematics Training Program at NJIT*

National Science Foundation: September 1, 2009 - August 31, 2012
Victor Matveev
Gareth Russell
Jorge Golowasch

8. *Efficient Inversion in Underwater Acoustics with Iterative and Sequential Bayesian Approaches*

Office of Naval Research: January 1, 2010 - December 31, 2012
Zoi-Heleni Michalopoulou

9. *Winding Domain Walls in Thin Ferromagnetic Films*

National Science Foundation: September 1, 2009 - August 31, 2012
Cyrill Muratov

10. *Upper Stage Engine Uncontainable Failure Analysis*

NASA: January 1, 2010 - December 31, 2010
Cyrill Muratov

11. *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

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

1. *Computational Investigation of Drop Dynamics*

   Department of Energy: January 1, 2010 - December 31, 2014
   Shahriar Afkhami

2. *Characterization of Porous Materials: Theory, Computations, and Experiments*

   National Science Foundation: July 1, 2010 - June 30, 2013
   Shahriar Afkhami
   Lou Kondic
   Gerardo Callegari

3. *Fractal Biology in Chaos of Cancer*

   NIH: January 1, 2010 - December 31, 2014
   Denis Blackmore

4. *DynSyst Special Topics: A Novel Dynamical Systems Approach to Vortex Breakdown Phenomena*

   National Science Foundation: September 1, 2010 - August 31, 2013
   Denis Blackmore

5. *Collaborative Research: A Unified Dynamical Systems-Simulation-Visualization Approach to Modeling and Analyzing Granular Flow Phenomena*

   National Science Foundation: September 1, 2010 - August 31, 2013
   Denis Blackmore
   Anthony Rosato

6. *Dynamics of Neuronal Networks from Random Graphs to Minimal Models*

   National Science Foundation: July 1, 2010 - June 30, 2013
   Amitabha Bose

7. *Hybrid Algorithms for Wave Propagation*

   National Science Foundation: July 1, 2010 - June 30, 2013
   Yassine Boubendir

8. *Multivariate Analysis of Image Data: Phase I & II*

   AC Birox, Inc.: October 1, 2009 - March 31, 2010
   Chung Chang

9. Biostatistical Analysis of Cell and Molecular Biology Exp Data

UMDNJ: July 1, 2009 - June 30, 2010
Sunil Dhar

10. Studies in Combustion of Porous Energetic Materials

National Science Foundation: July 1, 2010 - June 30, 2013
Peter Gordon

11. Propagation Phenomena in Some Reaction Diffusion Systems

National Science Foundation: July 1, 2010 - June 30, 2013
Peter Gordon

12. Topics in Fluid Dynamics of Combustion

US-Israel Binational Science Foundation: July 1, 2010 - June 30, 2012
Peter Gordon

13. Collaborative Research: Constructing New Multiple Testing Methods

National Science Foundation: July 1, 2010 - June 30, 2013
Wenge Guo

14. Spectral Schemes for SPDE

National Science Foundation: July 1, 2010 - June 30, 2013
David Horntrop

15. Intelligence Surveillance Video

APENG, Inc.: February 1, 2010 - May 31, 2010
Aridaman Jain

16. PIRE: Fluctuations and Response in Granular Materials

National Science Foundation: January 1, 2010 - December 31, 2014
Lou Kondic

17. Collaborative Research: Experimental and Computational Study of the Instabilities, Transport, and Self Assembly of Nanoscale Metallic Thin Films and Nanostructures

National Science Foundation: July 1, 2010 - June 30, 2013
Lou Kondic

18. Instabilities and Nanoassembly of Laser-Irradiated Metallic Materials

Department of Energy: July 1, 2010 - June 1, 2013
Lou Kondic

19. Interdisciplinary Training in Applied Mathematics

National Science Foundation: June 1, 2011 - May 31, 2016
Lou Kondic
Michael Booty
Wooyoung Choi

Linda Cummings
Michael Siegel

20. *EMSW21, Research Training Group: Interdisciplinary Training in Applied Mathematics: Analysis and Computation in Emerging Applications of Fluid Dynamics*

National Science Foundation: June 1, 2011 - May 31, 2016
Lou Kondic
Michael Booty
Wooyoung Choi
Linda Cummings
Michael Siegel

21. *Inertial Effects on the Stretching of Viscous Fluid Filaments*

National Science Foundation: June 1, 2010 - May 31, 2013
Robert M. Miura (PI)
Jonathan J. Wylie (Co-PI)
Huaxiong Huang (Co-PI)

22. *Restricted Diffusion in Cellular Media: Application to Cortical Spreading Depression*

National Science Foundation: June 1, 2010 - May 31, 2013
Robert M. Miura (PI)
Huaxiong Huang (Co-PI)
Jonathan J. Wylie (Co-PI)

23. *Mathematical and Computational Methods for Stochastic Systems in Nonlinear Optics*

National Science Foundation: July 1, 2010 - June 30, 2013
Richard Moore

24. *Role of Descending Projection Neurons*

National Science Foundation/NIH: July 1, 2010 - June 30, 2015
Farzan Nadim

25. *Numerical Methods and Analysis for Interfacial Fluid Flow with Soluble Surfactant*

National Science Foundation: July 15, 2010 - July 14, 2013
Michael Siegel
Michael Booty
Yuan-Nan Young

26. *Collaborative Research: Efficient Surface-based Numerical Methods for 3D Interfacial Flow with Surface Tension*

National Science Foundation: July 1, 2010 - June 30, 2013
Michael Siegel

27. *Semiparametric Models for Inference and Prediction of Cumulative Incidence Functions*

National Science Foundation: July 1, 2010 - June 30, 2013
Sundar Subramanian

28. Methods for Cumulative Incidence Estimation in Survival Analysis

NIH: April 1, 2011 - March 31, 2013
Sundar Subramanian

29. Visicle Interactions and Collective Behavior in Sheared Suspensions

National Science Foundation: January 1, 2010 - December 31, 2012
Yuan-nan Young

CONTINUING PROJECTS — NOT THROUGH CAMS

1. *Two-fluid Dynamics in Polymer Processing, Ferrohydrodynamics and Electrowetting*

National Computational Science Alliance, (LRAC) Award: October 1, 2008 - September 1, 2010
Yuriko Renardy
Shahriar Afkhami

2. *Computational Study of Drop Deformation in Systems with Two Immiscible Liquids*

National Science Foundation - Division of Mathematical Sciences: June 30, 2009 - May 1, 2012
Yuriko Renardy
Pengtao Yue
Shahriar Afkhami (Senior Investigator)

3. *Collaborative Research in Computational Neuroscience - Neuromodulation of Hippocampal Synaptic Plasticity in Waking & REM Sleep*

National Institutes of Health – National Institute of Mental Health: September 1, 2005 – August 31, 2009
Gina Poe
Victoria Booth

4. *Mathematical Modeling of Circadian and Homeostatic Interaction*

Air Force Office of Scientific Research February 1, 2008 – January 31, 2011
Victoria Booth
Daniel Forger
Cecilia Diniz Behn

5. *Establishing Long-Term Ecological Management and Monitoring Plan Utilizing Remote Sensing Techniques for the Wetlands of the New Jersey Meadowlands District*

NJ Meadowlands Commission, 2008-2009
Claus Holzapfel

6. *Establishing Long-term Ecological Management and Monitoring Plan for Liberty State Park*

NJ Department of Environmental Protection, 2008-2009
Claus Holzapfel

7. *Molecular Ecology of Restoration: the Role of Genetic Identity and Provenance of Spartina patens in Restoration of Native High Marsh Communities in the Meadowlands*

NJ Meadowlands Commission, MERI Fellow Program, 2008-2009
Claus Holzapfel
Edward Kirby

8. *Restoration Success Assessment / Community Ecology Research Project on the Formation of Plant Borders*

Department of Environmental Protection Grant, 2008-2010
Claus Holzapfel

9. *Temporal Dynamics and Molecular Ecology of Restored and Remnant Spartina patens High Marsh Communities in the NJ Meadowlands*

NJ Meadowlands Commission, MERI Fellow Program Grant, 2009/2010
Claus Holzapfel
Edward Kirby

10. *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
Kirk Moloney

11. *Mathematical and Computational Modeling for Problems from Biological and Industrial Applications*

Natural Science and Engineering Research Council of Canada: April 1, 2005 - March 31, 2010
Huaxiong Huang

12. *Modeling, Analysis and Computing for Problems from Industry*

NSERC Discovery Grant: 2010-2015
Huaxiong Huang

13. *Finsurance: Theory and Computation*

MITACS: 2008-2010
Huaxiong Huang
T. Salisbury
S. Jaimungle

14. *Reaching for a Better Understanding of the Portfolio Optimization Process*

MITACS: 2009
Huaxiong Huang

15. *Non-Contact Skid Resistance Measurement*

US Department of Transportation/New Jersey Department of Transportation:
January 2008 - December 2009
Jay Meegoda

Geoff Row

16. *Implementation of Maintenance Decision Support System in New Jersey*

US Department of Transportation/NJ Department of Transportation: July 2007 - July 2010
Steven Chien
Jay Meegoda

17. *Culvert Information Management System - Demonstration Project Phase II*

US Department of Transportation/NJ Department of Transportation: August 2008 - January 2010
Jay Meegoda
Tom Juliano

18. *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
Jay Meegoda

19. *ADVANCE Institutional Transformation Award: More than the Sum of its Parts: Advancing Women at NJIT through Collaborative Research Networks*

National Science Foundation: September 1, 2006 - August 31, 2009
Lisa Axe
Sima Bagheri
Zoi-Heleni Michalopoulou
Priscilla Nelson
Nancy Steffen-Fluhr

20. *Terahertz 2-D Imaging System for Stand-Off Detection of Concealed Metals and Explosives*

US Army - Picatinny Arsenal: November 1, 2008 - January 31, 2010
Bob Barat
John Federici
Dale Gary
Zoi-Heleni Michalopoulou

21. *Inestabilidades en Flujos de Recubrimiento*

Agencia Nacional de Promocion de la Ciencia y la Tecnologia (Argentina) July 2008 - July 2011
Javier Diez

22. *Thermal Effects on the Dynamics of Singularity Formation in Viscous Threads*

National Science Foundation-Mathematical Sciences Division 2007-2010
Jonathan Wylie

23. *Effects of Interstitial Fluid on Segregation in Slope Flows*

CERG (Hong Kong) 2007-2010
Jonathan Wylie

24. *Deflection of Granular Jets*

CERG (Hong Kong) 2008-2011
Jonathan Wylie

25. *Development of a THz 2-D Imaging System for Stand-off Detection of Concealed Explosives*

US Army - Picatinny Arsenal: November 1, 2008 - October 31, 2009
Bob Barat
John Federici
Dale Gary
Zoi-Heleni Michalopoulou

26. *Mathematical and Computational Modelling for Problems from Biological and Industrial Applications*

Natural Sciences and Engineering Research Council (NSERC), Canada
April 1, 2005 - March 31, 2010
Huaxiong Huang

27. *RCN: TraitNet - Coordinating trait-based ecological and evolutionary research*

National Science Foundation, March 31, 2007 - March 31, 2012
Shahid Naeem
Daniel Bunker

28. *Focused Research Group on Cortical Spreading Depression and Related Phenomena (August 1-8, 2010)*

Banff International Research Station: September 2008 - August 2010
Robert M. Miura
Huaxiong Huang

29. *SQuaRE on Modeling Cortical Spreading Depression (May 24-28, 2010)*

American institute of Mathematics: November 2008 - June 2010
Robert M. Miura
Huaxiong Huang

30. *An Automated, Real-time Identification and Monitoring Instrument for Reef Fish Communities*

National Science Foundation July 1, 2007 - June 30, 2011
Gareth Russell

PROPOSED PROJECTS - NOT THROUGH CAMS

1. *Collaborative Research: Competitive/Ecophysiological Trade-offs and Community Composition: a Test Case with Invasive Understory Shrubs*

National Science Foundation: March 2010 - February 2013
Daniel Bunker
Brian Mitchel

VIII. COMMITTEE REPORTS AND ANNUAL LABORATORY REPORT

A. MAJOR RESEARCH INSTRUMENTATION COMPUTER CLUSTER

The Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) at the New Jersey Institute of Technology, under the auspices of the MRI program at NSF, acquired a 67-node Beowulf-class computer cluster for research in the mathematical sciences. Each compute-node of the cluster is composed of two 2.0 GHz, 64-bit processors (AMD Opteron CPU); the cluster includes a total of 256 GB of memory, mass storage devices, scientific software, and hardware for a high speed Myrinet network. The machine is dedicated to the support of research by faculty and graduate students in CAMS and DMS, and is used for projects which involve mathematical modeling and the development of computational techniques to study fundamental processes in physical science and biology. Examples of these projects include: the development of efficient molecular dynamics methods with applications to fluid flow in nano-devices and drug molecule/protein target interactions; simulations of large interacting systems of neurons in the visual cortex; investigations of granular systems; studies of mesoscopic models for surface processes in biology; simulations of surface evolution in crystalline materials; and improved numerical methods for studying aspects of electromagnetic wave propagation. Ten nodes were added to the cluster in 2008.

The research activities are primarily involved with the mathematical modeling of important processes in science and technology and hence are of benefit to scientists and engineers in a wide variety of disciplines. For example, the research on molecular dynamics methods is used to obtain insights in the interactions between drug molecules and their protein targets, numerical simulations of interacting neurons in the visual cortex can lead to an improved understanding of high-level visual processing events, such as ``edge-detection,'' and studies of surface evolution in crystalline materials aid in the design of novel microelectronic devices. The cluster is used to obtain numerical solutions to continuum models of fluid dynamic phenomena, the study of flows in granular media, and many other complex fluid flow problems. In addition, the described research promotes interdisciplinary collaborations between applied mathematicians and scientists in diverse areas. Graduate students and postdocs involved in the research receive training in state-of-the-art numerical techniques.

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: June 2010, Client: Stephen F. Vatner, Ricardo Gelpi and Misun Park, Department of Cell Biology and Molecular Medicine, UMDNJ.
Description: Developed statistical procedures to compare linear relationships of LVW/ BW versus apoptosis within myocytes and non-myocytes for each animal (rat or dog) and for each of the two variables: endocardium and epicardium. For the preceding linear relationship, a statistical test is also developed to evaluate the difference between regression slopes corresponding to dogs and rats.
Consultant: Professor Sunil K. Dhar

Date: May – June 2010, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: Analyzed the water quality data collected during the past 15 years (1995 – 2008) to

determine the effects of distance from the river (for 3 different distance metrics), seasons, and time (i.e., years) on 7 metal concentrations and 13 other variables such as dissolved oxygen and nitrate. Identified the 9 water quality variables for which the distance from the river mouth has a statistically significant effect on their concentration. Similarly, identified 2 water quality variables for which the proximity index of distance from the sewage treatment plants has a statistically significant effect on their concentration. Fitted regression models to estimate the effects of years and seasons.
Consultant: Professor Aridaman Jain

Date: May - June 2010, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: MERI forecasts water depths at 3 MERI stations – Berry's Creek, Kearny, and Mill Creek – based on the water depth at Sandy Hook; these forecasting models have relatively large forecasting errors. We reviewed these models and developed an adjustment for the forecast at MERI sites that resulted in about 30% reduction in the forecast error.
Consultants: Professor Ken Johnson

Date: May – June 2010, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: Hexavalent chromium (Cr6), one of the main forms of chromium in environment, is highly toxic and carcinogenic. MERI is interested in estimating the effects of season, particle size, traffic, and environmental conditions on Cr6. Three sets of regression models were fitted: (i) traffic counts only, (ii) traffic counts and other measured variables such as CO2 and Ozone, and (iii) traffic counts, measured variables, and interactions with season. The first model describes Cr6 as a function of Diesel traffic. The second model explains 35.1% of the variation in Cr6 (compared to 6.2% for model 1). The third model was developed to account for the fact that the relationships between Cr6 and some of the measured variables are different for the two seasons. The third model, which explains 56.9% of the variation in Cr6, contains 8 terms – 3 main effects including summer and ozone and 5 interaction terms such as SXCO2, which is the interaction between CO2 and Season.
Consultant: Professor Aridaman Jain

Date: May – June 2010, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: Near-Road air quality data along with traffic counts, and temporal variables (temperature, humidity, precipitation, and wind speed) were collected for 11 weeks during December 2007 – July 2008. The metal concentrations in 8 particle sizes were grouped into 3 categories: PM1 (< 1μm), PM2.5 (1.0 – 2.5μm), and PM10 (2.5 – 14 μm). We found that the proportion of large size (PM10) particles increased from winter to summer while the proportion of middle size (PM2.5) particles decreased from winter to summer. Two sets of regression models were fitted to describe the proportion of PM1, PM2.5, and PM10 size particles: (i) only the count of gasoline and diesel vehicles and (ii) counts of vehicles as well as temporal variables. It was found that for several metals, the proportion of fine (PM1) and medium size (PM2.5) particles goes down and the proportion of large size (PM10) particles goes up as the temperature increases.
Consultant: Professor Aridaman Jain

Date: February - June 2010, Client: Al Limaye and Gerry Bonnar (ACBirox, LLC)
Description: We used the preliminary analysis completed in December 2009 as a building block and focused on the classification problem for the two biological samples. We developed a machine-learning algorithm, by utilizing the kernel method for functional data, for classification. First, we used a training dataset to estimate the optimal parameters (i.e. to minimize the misclassification rate) and then used the proposed algorithm with these parameter estimators for differentiating the independent test samples. Next, this algorithm will be used to classify other biological samples.
Consultant: Jing Li, Professor Chung Chang

Date: February - May 2010, Client: Qianhong Liu (APENG, INC.)
Description: Explored several regression models for estimating walking speed of persons as a function of the walking direction and the coordinates of the cell they walk by. The coordinates are obtained by dividing a camera field of view into 20 x 20 cells, so that the row and column numbers range from 1 to 20. It was found that there is a fairly strong linear relationship between the natural logarithm of the average walking speed and the natural logarithm of the row number, the natural logarithm of the column number and the square root of the natural logarithm of the walking direction. These regression models are useful for detecting abnormal behaviors and/or outliers.
Consultant: Peixin Zhang, Professor Aridaman Jain

Date: March - April 2010, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute)
Description: Conducted an exploratory data analysis of air pollutant concentrations at one ambient air-monitoring site in the Meadowlands. Developed preliminary seasonal models to describe the pollutant concentrations. Identified potential outliers. Now, MERI researchers are reviewing the data to eliminate outliers and missing values. Later we will analyze the refined data and compare the data with 44 other state controlled air monitoring sites in New Jersey.
Consultants: Rudrani Banerjee, Professors Ken Johnson, and Aridaman Jain

Date: October - December 2009, Client: Francisco Artigas (New Jersey Meadowlands Commission – Environmental Research Institute [MERI])
Description: MERI had developed forecasts for predicting floods in the Hackensack River 3-4 hours before the actual flood. We explored the possibility of developing more precise forecasting tools for forecasting 8 hours before the actual flood. In the end, it turned out that the precision of our forecasting model was comparable to that of MERI's forecasting model, which confirmed that MERI's model is good, even though it is not very precise.
Consultant: Professor Ken Johnson

Date: October - December 2009, Client: Al Limaye and Gerry Bonnar (ACBirox, LLC)
Description: Conducted a preliminary analysis of two groups of biological samples (8 samples for each group) and applied a permutation test to determine whether or not the mean intensities for the two groups are statistically significantly different. We also applied Fourier transform and set up a threshold to reduce the noise of the data, which makes the comparison of the two groups more precise. Then we computed the distances between the two sets of samples that will be useful for classification in the subsequent analysis.
Consultant: Jing Li, Professor Chung Chang

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: 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, Chang, 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 (Chang, Subramanian), censored time-to-event data analysis (Chang, 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 (Chang, Dhar, Subramanian), functional data analysis (Chang), high dimensional inference (Chang, Guo), imaging analysis (Chang), minimum distance estimation (Dhar), multiple imputations methods (Subramanian), multiple testing (Chang, 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, Chang, Dhar, Subramanian), stochastic orders and their applications (Bhattacharjee), and survey sampling (Jain).

Several CAMS members have active research programs in Biostatistics. This includes the development and application of statistical methodology to brain imaging data from positron emission tomography (PET) and functional MRI (Chang), and application of non- and semi-parametric statistical inference and computational methods, such as the bootstrap, in biostatistics.

B. RESEARCH DESCRIPTIONS

Shahriar Afkhami

The research of Shahriar Afkhami 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

The research of Victoria Booth is in the area of mathematical and computational neuroscience focusing on biophysical modeling of the electrical firing behavior of neurons and neuronal networks. Her collaborative and interdisciplinary research projects concentrate on quantitatively probing experimental hypotheses and providing experimentally-testable predictions. She is currently conducting modeling studies to investigate neural mechanisms promoting experimentally observed changes in hippocampal activity patterns that are associated with synaptic plasticity during waking and REM sleep, to study how pathologies at the neuronal level contribute to network-level dynamics in epilepsy, and to investigate the neurotransmitter interactions among brain stem neuronal nuclei that regulate wake and sleep states.

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 personnel 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 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.

Chung Chang

Chung Chang's research interests include functional data analysis, imaging analysis, bootstrapping, robust analysis, and multiple testing problems. The proposed methodologies involve robust estimation for nonlinear regression models, wild bootstrapping for functional data, and the robust bootstrapping method. The main application of these methodologies is on brain imaging data, including but not limited to the positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). The current research focuses on discovering the significant association between different brain regions and the depression status.

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.

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.

Anna Georgieva

Anna Georgieva's work in the Modeling and Simulation Department at Novartis Pharmaceuticals involves use of mathematical modeling and statistical approaches to aid drug development. More precisely, she has concentrated on the use of network inference algorithms to recover gene

regulatory networks and pathway fragments from high throughput genomics data. At the same time, she is developing mechanistic models to assess the pro-arrythmic potential of various therapeutic agents prior to entry into the clinic. Another current project involves the use of quantitative proteomics data to develop detailed mathematical models of signalling pathways and use these models to come up with optimal combination therapy for cancer patients.

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 estimate and control of the FDR under dependence and development of new multiple testing methodologies for different biomedical areas such as microarray data analysis, design and analysis of clinical trials, and high throughput screening assay.

Claus Holzapfel

As a community ecologist Claus Holzapfel is fascinated by the intriguing ways of how species interact with each other. Within that topic his research addresses ecological and evolutionary processes and their outcome in plant populations and communities. The leading question is whether communities are more than simple chance assemblies. Perturbed systems - systems that are altered from their pristine state - are ideal study objects to address such a question, since

here possible coevolved interactions are likely disrupted. Good examples are plant communities that are invaded by non-native organisms or systems otherwise heavily impacted by human activity (climate change, land-use change).

David J. Horntrop

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

Huaxiong Huang

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

Shidong Jiang

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 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 studies on spreading cortical depression, and more generally intercellular communication via ion flows, include analysis and simulations of partial differential equation models. Diffusion of ions in the brain is studied using the lattice Boltzmann method.

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 my research is to uncover and understand the underlying biophysical and dynamic principles that govern the generation of rhythmic activity in the brain. As secondary goals I hope to understand the functional implications for brain functioning of the previous results, the relation between disruption of rhythmic activity and diseases of the nervous system, and the effects that changes at a subcellular level have on rhythms observed at the single cell and network levels.

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

Major Simulation Project on the Gulf of Mexico Oil Leak, Daniel Fuster (Caltech), Stephane Zaleski (Pierre and Marie Curie University), Stephane Popinet (National Institute of Water and Atmospheric Research), and Gretar Tryggvason (WPI)

Numerical Simulations of Elongated Drops in a Microfluidic T-junction, Alex Leshansky (Technion - Israel Institute of Technology)

Deformation of a Hydrophobic Ferrofluid Droplet Suspended in a Viscous Medium under Uniform Magnetic Fields, Yuriko Renardy, Michael Renardy, Judy Riffle (Virginia Tech), and Tim St. Pierre (University of Western Australia)

Computational Study of Drop Deformation in Systems with Two Immiscible Liquids, Yuriko Renardy and Pengtao Yue (Virginia Tech)

John Bechtold

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

Flame Flow Interactions and Flow Reversal, H.G. Im, University of Michigan

Denis Blackmore

Regularity and Chaos in Vortex Dynamics, L. Ting (CIMS), O. Knio (Johns Hopkins), M. Brons (Technical University of Denmark) and B. Shashikanth (New Mexico State)

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

Vortex Breakdown Dynamics, M. Brons (DTU) and A. Goullet (NJIT)

Dynamical Modeling and Analysis of Nonlinear Phenomena, S. Maehlmann (NJIT) and A. Rahman (NJIT)

Acoustic/Flow Field Dynamics, J. Meegoda (NJIT)

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

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

Emergency Scale Modeling and Analysis, E. Rohn (NJIT)

Wooyoung Choi

Two-dimensional Wave Breaking Experiments and Parameterizations, Marc Perlin (University of Michigan)

Numerical Modeling of Large Amplitude Internal Waves, Tae-Chang Jo (Inha University)

Wind-wave Interaction, Zhigang Tian (Korea Advanced Institute of Science and Technology)

Linda Cummings

Model for the Equilibria between Immunoglobulins, Bivalent Ligands, and Monovalent Ligands, R. Perez-Castillejos (NJIT Engineering) and E.T. Mack (B.P.)

Jorge Golowasch

Role of Neuromodulators in Ca Entry into Neurons from the Crab Stomatogastric Ganglion, Farzan Nadim (NJIT)

Regulation of Ion Channel mRNA in Identified Neurons, David Schulz (University of Missouri)

Roy Goodman

Bragg Gratings in Optical Fiber Communications, Michael Weinstein (Columbia University)

Dynamical Systems Modeling of Wave-defect and Wave-wave Interactions, Richard Haberman (Southern Methodist University)

Instabilities of Nonlinear Waves, Denis Blackmore (NJIT)

Peter Gordon

Topics in Fluid Dynamics of Combustion, G.I. Sivashinsky (Tel Aviv University) and L. Kagan (Tel Aviv University)

Convective Combustion in Porous Media: Singular Limit of High Activation Energy, G.S. Weiss (University of Tokyo)

Supercritical Fronts for Reaction Diffusion Equations in Cylinders, C.B. Muratov (NJIT) and M. Novaga (University of Padova)

Stability of Combustion Fronts: Singular Limit of Zero Thermal Diffusivity, A. Ghazaryan (University of Kansas)

David J. Horntrop

Mesoscopic Modeling for Pattern Formation in Materials, M. Katsoulakis (University of Massachusetts) and D. Vlachos (University of Delaware)

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

Huaxiong Huang

Stretching of Heated Viscous Threads, J.J. Wylie (Cty University of Hong Kong) and R.M. Miura

(New Jersey Institute of Technology)

Modeling Cortical Spreading Depression, W. Yao (Fudan University, Shanghai, China), R.M. Miura (New Jersey Institute of Technology), J.J. Wylie (City University of Hong Kong), K.C. Brennan and Josh Chang (UCLA, Los Angeles)

Shidong Jiang

Second Kind Integral Equations for the First Kind Dirichlet Problem of the Biharmonic Equation in Three Dimensions, L. Ying (University of Texas at Austin)

Lou Kondic

Dense Granular Systems and Topology, Robert Behringer (Duke University), Corey O'Hern (Yale University), Konstantin Mischaikow (Rutgers University)

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

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

Victor Matveev

Cooperativity between Distinct Calcium Channels in Neurotransmitter Release, A. Sherman (National Institutes of Health) and R. Bertram (Florida State University)

Calcium Buffers and Calcium Transient Time-course at an Invertebrate Neuromuscular Junction, J.-W. Lin (Boston University)

Role of Short-term Synaptic Plasticity in Rhythmic Neural Network Activity, A. Bose and F. Nadim (NJIT)

Modeling Calcium Microdomains of L-type and N-type Calcium Channels under Physiological Conditions, E.F. Stanley (Toronto Western Research Institute)

Robert M. Miura

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

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

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

Mediators of Mechanotransduction between Bone Cells, S.V. Komarova (McGill University, Montreal, Canada), M. Lopes (McGill University, Montreal, Canada), S. Qazi (Gustavus Adolphus College, St. Peter, MN), and D.J.N. Wall (University of Canterbury, Christchurch, New Zealand)

Exact and Approximate Traveling Waves of Reaction-Diffusion Systems Via a Variational Approach, M.R. Rodrigo (Instituto Tecnologico Autonomo de Mexico, Mexico City, Mexico)

Richard Moore

Analyzing Rare Events in Optical Dynamical Systems, C. McKinstrie (Alcatel-Lucent), T. Schaefer (CUNY-Staten Island), G. Biondini (University at Buffalo)

Studying Thermally Induced Dynamics in Nonlinear Optical Devices, K. Promislow (Michigan State University)

Farzan Nadim

Neuromodulation of Synaptic Dynamics, R.M. Harris-Warrick and B. Johnson (Cornell University)

Configuration of Circuit Dynamics by Modulatory Fibers, M. P. Nusbaum (University of Pennsylvania Medical School)

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

Horacio G. Rotstein

Frequency Preference in Neurons and Neural Systems, Farzan Nadim (NJIT)

Neural Hyperexcitability in the Medial Entorhinal Cortex of the Brain, John White (University of Utah) and Tilman Kispersky (Boston University)

The Canard Phenomenon in Piecewise-linear Dynamical Systems and its Role in Neural Network Dynamics, Steve Coombes (University of Nottingham)

Evolution of Fronts in Reaction Diffusion Systems with Global Inhibitory Feedback, Yassine Boubendir (New Jersey Institute of Technology)

Michael Siegel

Analysis and Numerical Computations of Free Boundaries in Fluid Dynamics: Surfactant Solubility and Elastic Fibers, Michael Booty (NJIT), Yuan Young (NJIT)

Numerics and Analysis of Singularities for the Euler Equations, Russel Caflisch (UCLA)

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

Louis Tao

Dimension-Reduction in Neuronal Networks, A. Sornborger (University of Georgia, Athens, GA) and A. Guillamon (Universitat Polytecnica de Catalunya)

Coding in Insect Antenna Lobe, D. Cai (New York University and Shanghai Jiaotong University)

Adaptation Mechanisms in Early Visual Pathway, Y. Wang (Institute of Biophysics, Beijing, China) and D. Cai (New York University and Shanghai Jiaotong University)

Seizure in Zebrafish, J.D. Lauderdale (University of Georgia) and A.T. Sornborger (University of Georgia)

Sensory Processing in Zebrafish, D. Liu (Peking University) and J. Du (Institute of Neuroscience, Shanghai, China)

Drosophila Flight Behavior, Y. Zhu (Institute of Biophysics, Beijing, China)

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

Victor Matveev, Director of Undergraduate Studies

Computational Science Training for Students in the Mathematical Sciences (CSUMS):

Principal Investigator, Dr. Zoi-Heleni Michalopoulou

Research Mentors: Professors Roy Goodman, David Horntrop, Richard Moore, Yuan-Nan Young

The 2009 cohort of CSUMS participants included mathematical sciences majors Casayndra Basarab, Megha Billimoria, Steven Elliott, Karim Figueroa, Priyanka Shah, and Sandeep Singh. These students formed three groups whose research was mentored by Professors Roy Goodman, David Horntrop, and Yuan-Nan Young. The projects were:

1. The development of high-order adaptive methods for drawing parametric curves (Mentor: Goodman; CSUMS participants: Basarab and Shah).

2. Variance reduction techniques for the numerical simulation of stochastic differential equations (Mentor: Horntrop; CSUMS participants: Billimoria and Singh).

3. Numerical simulation of a Brownian elastic filament in random Stokes flow (Mentor: Young; CSUMS participants: Elliott and Figueroa).

These students have made presentations of their research results at many regional and national meetings. All of these students presented at the Garden State Undergraduate Mathematics Conference at Middlesex County College in Edison, NJ in April 2010. Singh presented at the AMS meeting in San Francisco, CA in January 2010. Elliott presented at the March 2010 APS meeting in Portland, Oregon.

Basarab and Elliott gave lectures while Singh presented a poster at the SIAM Annual Meeting in Pittsburgh, PA in July 2010.

The 2010 cohort of CSUMS participants began their research in January; this cohort consists of Todd Caskey, Nihal Dayal, Albi Kavo, Sean Kilroy, Namrata Patel, Matan Shavit, and Mandeep Singh. The faculty mentors for this group are Horntrop, Moore, and Young. Students in this cohort have attended a series of seminars in which they learned about high performance computing, information literacy, and numerical methods. They have also gained practical experience in problem-solving as well as presentation skills.

The first external student presentation from this cohort occurred in July 2010 when Kavo gave a lecture on his research on variance reduction techniques for stochastic differential equations at the national CSUMS conference at the University of St. Thomas in St. Paul, MN. At this meeting, Kavo also served on a student panel. Horntrop represented the CSUMS mentors at this meeting and served on a panel as well.

Capstone Laboratory Projects:

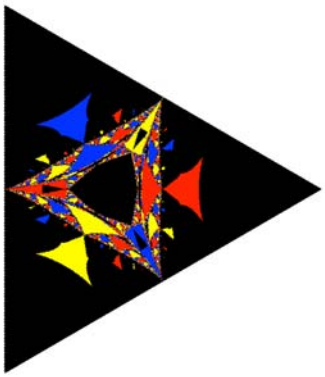
Title: 2½ Problems in Chaotic Scattering

Students: Casayndra Basarab, Michael Bellanich, Sahil Choudhary, Fatima Elgammal, Steven Elliott, Matthew Genberg, Catherine Morrison, Aminur Rahman, Matan Shavit

Assistant: Daniel Cargill Instructor: Roy Goodman

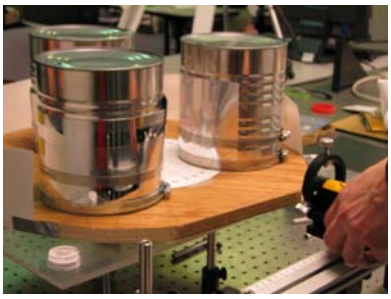
The class projects focused on the phenomenon of chaotic scattering, both theoretically, and in physical experiments. In chaotic scattering, an output value depends in a complicated manner on an input value, due to nonlinear dynamics. Mathematically, the class studied concepts including Lagrangian mechanics, fractal dimensions, and symbolic dynamics---fundamental subjects in modern nonlinear dynamical systems.

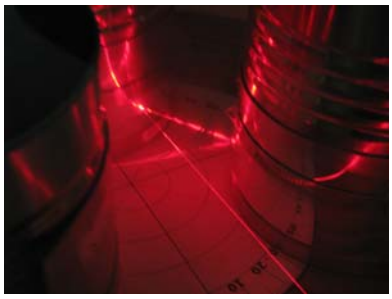
The first project was a physical implementation of a "particle model" of chaotic scattering between solitary waves. In this experiment, a ball was rolled along a specially-designed valley, which was carved into a piece of high-density foam by a three-axis mill in the NJIT architecture department, courtesy of Prof. Richard Garber. Equations of motion for the ball were derived by Casayndra Basarab and Michael Bellanich, and were simulated by Sahil Choudhary. Software for analyzing the physical experiments was written by Catherine Morrison using Matlab. Aminur Rahman and Michael Bellanich read a related paper by Prof. Goodman and adapted it to analyze the equations of motion. Casayndra Basarab used their analysis to study a further simplified version of the model, which reduced the problem from an ordinary differential equation to an iterated map. A group of students, led by Michael Bellanich, conducted and analyzed further experiments over the summer, for inclusion in a paper on this subject.

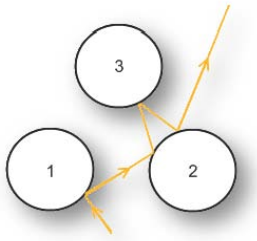


The other, closely related pair of experiments concerned the scattering of light by curved reflective surfaces---cylinders and spheres. For the sphere experiment, four faux-silver Christmas ornaments were arranged in a tetrahedron with three of the faces covered in colored cellophane. When a picture is taken through the fourth opening, one sees an incredibly complicated, in fact fractal, pattern. The physical experiment was performed by Matthew Genberg and Fatima Elgammal, who also used Matlab to analyze the image, and simulated by Matan Shavit. Together, they showed that the fractal properties in the simulation matched those in the experiment very well.

In a similar experiment, performed by the same group, three reflective cylinders (food-service cans with flexible mirrors wrapped around them) were placed at the corners of an equilateral triangle, with a laser beam through the side. Fog was used to follow the laser's path, and to verify basic scaling laws describing how many times the beam reflects off the cylinders before escaping through one of the sides, which were compared with similar laws derived from numerical simulations and from analysis performed by student Steven Elliott.







UBM – Undergraduate Biology and Mathematics Training Program, 2009-10

Research Mentors: Jorge Golowasch, Gareth Russell, Camelia Prodan, Victor Matveev, Farzan Nadim, Daniel Bunker, Alexis Rodriguez

The National Science Foundation-funded UBM program was renewed for a 3-year period, and a new group of six undergraduate students was interviewed and recruited in Fall 2009 to take part in the first year of the renewed Program: Sandhya Venkataraman, Enas Shehadeh, Xavier Lee, Motolani Olarinre, Moustafa Abas Moursy, and Omar Meky.

As in the previous years, the Program started in the Spring semester (2010), with students taking the undergraduate Mathematical Biology course (Math 373), taught by Prof. Daniel Bunker, along with a single-credit Undergraduate Research Seminar (Math 401). The Research Seminar involved one 1.5 hour meeting per week lead by the UBM program co-PIs, and was aimed at educating the student participants in modeling techniques, with an emphasis on the theory of dynamical systems and MATLAB programming.

During Spring 2010, students also rotated through this year's host laboratories: the Neurobiology laboratory of Dr. Jorge Golowasch, the Ecology laboratory of Dr. Gareth Russell, and the Cell Biophysics laboratory of Dr. Camelia Prodan. 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 six 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 2010, and completed the research phase of the program in July 2010. The research projects are:

Lab: Dr Jorge Golowasch
Students: Moustafa Abas Moursy and Omar Meky:
"Role of Passive Leak Currents in Pacemaker Neuronal Activity"

Lab: Dr Gareth Russell
Students: Motolani Olarinre and Xavier Lee:
"Tracking and Modeling Inter-Patch Organismal Movement with Chemotaxis"

Lab: Dr Camelia Prodan
Students: Sandhya Venkataraman and Enas Shehadeh
Models of Dynamic Instability in Microtubule Growth

2010 UBM students Sandhya Venkataraman and Enas Shehadeh in the Laboratory of Dr Camelia Prodan

Apart from the full-time research work, the summer phase of the UBM program involved two weekly group meetings attended by all students and their research mentors: one of the meetings was devoted to weekly presentation of research results, which helped to further develop students' presentation skills, while the second meeting, lead by V. Matveev, continued the training of mathematical and modeling topics, along with programming skill training.

All UBM research activities are documented in the newly updated UBM Program webpage maintained by the program PI, V. Matveev: http://web.njit.edu/~matveev/UBM/

In addition to starting new UBM program activities, this year also saw the conclusion of the first five-year UBM program. The five students who had done their summer research in 2009 finalized their research projects and prepared the research papers in Fall 2009:

Lab: Farzan Nadim (mentored by Dr. Sheibanie)
“The Effect of Neuronal Morphology on Passive Properties of Neurons”
Students: Krutanjali Shah, Yamin Noor

Lab: Daniel Bunker
“An Analysis of LMA, Amax, & Phenolics within the Local Temperate Deciduous Biome”
Student: Timothy Blockus

Lab: Alexis Rodriguez
“Three-dimensional Localization of E-cadherin in Mammalian Cells”
Students: Zehra Sediq and Fatima Elgammal

The papers of Shah, Noor, and Blokus were completed and the former two were submitted as CAMS technical reports (CAMS-0910-8 and CAMS-0910-9). Noor and Blokus have continued their research actively and are currently working on their projects in the Bunker and Nadim labs, respectively.

Timothy Blockus recording maximum rate of photosynthesis using an infrared gas analyzer (IRGA) on location in Maine.

This year one paper from UBM projects was published (UBM student names underlined)

Golowasch, J., Thomas, G., Taylor, A., Patel, A., Pineda, A., Khalil, C., Nadim, F., "Membrane Capacitance Measurements Revisited: Dependence of Capacitance Value on Measurement Method in Non-isopotential Neurons", *Journal of Neurophysiology* 102: 2164-2175 (2009).

Additional UBM activities this year included:

1. UBM student Noor presented at the Joint Mathematics Meeting (JMM) in San Francisco in January 2010.
2. UBM students presented their work at Annual Provost's Research Day and the Mathematical Biology Seminar (January 2010).

Pi Mu Epsilon Induction Ceremony on April 19, 2010

The Pi Mu Epsilon honor society inducted 9 new members this year.

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.

B. GRADUATE STUDENT RESEARCH PROGRAMS

Michael Booty, Director of the Graduate Program

Ph.Ds Awarded August 2009:

Ye Yang
Thesis: *Reduced Order Models for Fluid-Structure Interaction Systems by Mixed Finite Element Formulation*
Advisor: Sheldon Wang

Ph.Ds Awarded January 2010:

Manmeet Kaur
Thesis: *Perturbed Spherical Objects in Acoustic and Fluid Flow Fields*
Advisors: Denis Blackmore and Jay Meegoda

Bo Ren
Thesis: *Modeling and Quasi-Monte Carlo Simulation of Risk in Credit Portfolios*
Advisors: David Horntrop and William Morokoff

Qiming Wang
Thesis: *Nonlinear Evolution of Annular Layers and Liquid Threads in Electric Fields*
Advisor: Demetrius Papageorgiou

Ph.Ds Awarded May 2010:

Jing Li
Thesis: *Modeling with Bivariate Geometric Distributions*
Advisor: Sunil Dhar

Publications, Presentations, and Conference Participation

Rudrani Banerjee

Poster Presentation: May 2010: Frontiers in Applied and Computational Mathematics (FACM'10), New Jersey Institute of Technology, Newark, NJ
A Usage Rate Sensitive Warranty Servicing Strategy with Imperfect Repairs (with Manish Bhattacharjee)

Co-author of CAMS Technical Report #0910-17

Daniel Cargill

Presentations:

Poster: "Bandwidth Dependence of Soliton Phase Distribution in Simulations of Stochastic Nonlinear Schrödinger Equations", GSA Research Day, November 11th 2009

Poster: "Bandwidth Dependence of Soliton Phase Distribution in Simulations of Stochastic Nonlinear Schrödinger Equations", NJIT Dana Knox Student Research Showcase at NJIT, April 14, 2010

Poster: "Bandwidth Dependence of Soliton Phase Distributions in Simulations of Stochastic Dispersion Managed Nonlinear Schrödinger Equations", FACM'10 Conference, NJIT, May 21-23, 2010

Summer Internship: Alcatel-Lucent, Bell Laboratories at Crawford Hill, Photonics Group, June 1, 2010 - August 6, 2010

Daniel Fong

Participated in the Princeton-CEFRC Summer Program on Combustion in June 2010 Session.

Xinxian Huang

Presentations:
June 15, DMS Summer Program at NJIT, "Using Feed-forward Networks to Infer the Activity of Feedback Neuronal Networks"

December 1, Mathematical Biology Seminar, Department of Mathematical Sciences, NJIT, "Using Feed-forward Networks to Infer Activity of Feedback Neuronal Networks"

Rashi Jain

Presentations:

November 2009: Meeting of the Acoustical Society of America, San Antonio, TX
Particle Filtering for Sequential Multipath Arrival Time and Amplitude Estimation (with Zoi-Heleni Michalopoulou)

April 2010: Meeting of the Acoustical Society of America, Baltimore, MD
A Particle Filtering Approach for Multipath Arrival Time Estimation from Acoustic Time Series (with Zoi-Heleni Michalopoulou)

She received the Best Student Paper in Signal Processing Award for the first presentation.

Dongwook Kim

Award: "Excellence in Service", Department of Mathematical Sciences, 2009.

Talks:

Mechanistic Aspects Underlying the Effects of in-vivo like Synaptic Inputs on an Entorhinal Eortex Stellate Cell Model. Graduate Summer Program. Department of Mathematical Sciences, August 4, 2009.

The Effects of Periodic and Non-periodic Inputs on the Dynamics of Medial Entorhinal Cortex Layer II Stellate Cells. Graduate Summer Program. Department of Mathematical Sciences, June 1, 2010.

Poster: The Effects of Periodic and Non-periodic Inputs on the Dynamics of Medial Entorhinal Cortex Layer II Stellate Cells. FACM Conference, NJIT, May 21-23, 2010.

Jing Li

Publication: “Modeling with Bivariate Geometric Distributions” (with Sunil Dhar), submitted in May.

Poster Presentations:
“Modeling with Bivariate Geometric Distributions”, Frontiers in Applied and Computational Mathematics (FACM '10), NJIT, May 2010.

“Modeling with Bivariate Geometric Distributions”, Fifth Annual Graduate Student Research Day, NJIT, November 2009.

Te- Sheng Lin

Publication: "Thin Hanging Films with Fronts: Two Dimensional Flow" (with L. Kondic), Phys. Fluid, 22, 052105, 2010.

Presentations:

May 2010: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Poster: Thin Hanging Films with Front: Two Dimensional Flow (with L. Kondic)

March 2010: Applied Math. Days, RPI
Thin Films Flowing Down Inverted Substrates: Two Dimensional Flow (with L. Kondic)

November 2009: APS Division of Fluid Dynamics, Minneapolis, MN
On Contact Line Induced Instability in Flow of Hanging Fluid Films (with L. Kondic)

Matt Malej

Presentations:
Naval Research Laboratory (Stennis Space Center, Mississippi) March 16, 2010 (Invited Talk).

Poster Session, FACM 2010, May 2010, NJIT.

Internship: Naval Research Laboratory (Stennis Space Center, Mississippi), as a Research Scientist from May to September, 2010.

Hui Wu

Poster: Oscillatory Patterns in Piece-wise Linear Relaxation Oscillators of FitzHugh-Nagumo type with Inhibitory Global Feedback. FACM Conference, NJIT, May 21-23, 2010.

Kuan Xu

Presentations:

November 2009: American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, Minneapolis, MN
Efficient Numerical Computation of Fluid Interfaces with Soluble Surfactant (part II)

March 2010: Rensselaer Polytechnic Institute Applied Math Days, RPI, Troy, NY
Efficient Numerical Computation of Fluid Interfaces with Soluble Surfactant

April 2010: The Dana Knox Student Research Showcase, NJIT
The Evolution of a Two-Dimensional Cartesian Drop in an Imposed Linear Flow: The Influence of Surfactant and Surfactant Solubility

Peixin Zhang

Presentation: November 2009: The Fifth Annual Graduate Student Research Day, New Jersey Institute of Technology, Newark, NJ, A Generalized Inverse Censoring Weighted Survival Function Estimator (with S. Subramanian)

Poster: May 2010: Frontiers in Applied and Computational Mathematics 2010 Conference (FACM 10), New Jersey Institute of Technology, Newark, NJ, "Confidence Bands for Survival Functions under Semiparametric Random Censorship Models" (with S. Subramanian)

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. As such, 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

July and August 2009

July 2 **Dr. Linda J. Cummings**, *Mathematical Modeling of a Tissue Engineering Bioreactor*

July 7 **Xiaoni Fang**, *Signal Propagation in Dense Granular Systems*

July 9 **Dr. Victor Matveev**, *Intracellular Calcium Diffusion and Synaptic Neurotransmitter Release*

July 13 **Xiaoni Fang**, (1 hour presentation)

July 14 **Manmeet Kaur**, *Acoustic and Fluid Forces on Perturbed Spherical Objects*

July 16 **Dr. Chung Chang**, *Statistical Analysis in Brain Imaging*

July 20 **Daniel Cargill**, *Modeling Behavior of Parameters in Nonlinear Schrödinger Solitons* and **Te-Sheng Lin**, *On Contact Line Induced Instability in Flow of Hanging Fluid Films*

July 21 **Matt Malej**, *A Reduced Uni-Directional Model for the Evolution of Nonlinear Ocean Surface Waves*

July 23 **Dr. Shidong Jiang**, *Introduction to Fast Numerical Algorithms and Some Examples*

July 27 **Jacek Wrobel** and **Xing Zhong**, (45 minute presentation) and (30 minute presentation)

July 28 **Lianzhe Xu**, *Worm Propagation Modeling and Analysis Using a Stochastic Epidemic Model*

July 30 **Dr. Yassine Boubendir**, *Acceleration of an Iterative Method for the Evaluation of High-Frequency Multiple Scattering Effects*

August 3 **Daniel Fong** and **Juhyung Yi**, (30 minute presentation each)

August 4 **Dongwook Kim**, *Mechanistic Aspects Underlying the Effects of In-Vivo like Synaptic Inputs on an Entorhinal Cortex Stellate Cell Model*

August 6 **Dr. Michael Siegel**, *Efficient Numerical Computation of Interfacial Fluid Flow*

May and June 2010

May 25 **Matt Causley**, *An Efficient Numerical Method for Anomalously Dispersive Dielectrics*

June 1 **Dongwook Kim**, *The Effects of Periodic and Non Periodic Inputs on the Dynamics of a Medial Entorhinal Cortex Layer II Stellate Cell Model*

June 3 **Dr. Linda Cummings**, *Problems in Thin Film Fluid Dynamics*

June 8 **Hui Wu**, *Pattern Formation in Oscillatory Systems*

June 10 **Dr. Yuan Nan Young**, *Viscous Drops and Vesicles in Stokes Flow*

June 15 **Xinxian Huang**, *Using Feed-forward Networks to Infer the Activity of Feedback Neuronal Networks*

June 17 **Dr. Horacio G. Rotstein**, *The Role of Nonlinearities and Time Scale Separation in The Generation of Abrupt Transitions between Firing Frequency Regimes in Stellate Cells*

June 22 **Te-Sheng Lin**, *Contact Line Induced Instabilities in Two Cases: Thin Films Flowing Down Inverted Substrates and Liquid Crystal Spreading*

June 24 **Dr. Shidong Jiang**, *Introduction to Fast Algorithms and Integral Equations*

June 29 **Rudrani Banerjee**, *A Usage Rate Sensitive Warranty Servicing Strategy With Imperfect Repairs*

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