CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT

2008-2009

NJIT New Jersey's Science & Technology University

TABLE OF CONTENTS

I. FROM THE DIRECTOR

The Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) have received the generous support of a university-wide strategic initiative, with a particular focus on fluid dynamics and mathematical biology, two areas of strength within the department. Strategic initiative funds have helped the department significantly enhance nationally prominent research groups in these areas through the hosting of an annual conference on "Frontiers in Applied and Computational Mathematics." The conference has become an important forum for the dissemination of research in mathematical fluid dynamics, mathematical biology, wave propagation, and applied statistics.

We are pleased that DMS has recently been listed by NSF in the top 37 mathematical science programs nationwide, as ranked by total expenditure of federal funds on research and development. This is up an impressive ten places from last year's ranking. DMS receives substantial funding from sources such as the National Science Foundation, National Institutes of Health, Office of Naval Research, Department of Energy, the Howard Hughes Medical Institute, NJ Meadowlands Commission, and private industry.

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

- The induction of DMS faculty and CAMS members Gregory Kriegsmann and Robert Miura into the first group of Fellows named by the Society of Industrial and Applied Mathematics.

- The initiation of a new Masters degree in Mathematical and Computational Finance. Two other new programs just completed their first year: (1) A B.S. degree in Computational Sciences, with tracks in Computational Mathematics, Computational Physics, Computational Biology, and Computational Chemistry; (2) An M.S. degree in Biostatistics.

- The renewal of funding for an Undergraduate Biology and Mathematics Training Program Proposal (UBMTP) from the National Science Foundation. DMS was awarded an additional three years of support for this program, which provides innovative training and research experiences at the interface of mathematics and biology. The department's proposal was rated by the NSF panel as one of the strongest submissions.

- The continuing funding of three major educational grants from the National Science Foundation:

  - The Teacher Education Collaboration for High-Need Schools-New Jersey Robert Noyce Scholarship Program (TECHS-NJ) with partners Rutgers University-Newark, the Newark Public Schools and the Newark Museum. This program provides academic, financial and professional support to 26 future math and science teachers in the city of Newark.

  - Computation and Communication: Promoting Research Integration in Science and Mathematics (C2PRISM). This program places eight PhD Fellows conducting computational dissertation research in Newark, NJ high school classrooms.

  - Computational Science Training for Undergraduates in the Mathematical Sciences (CSUMS). This program establishes significant group research experiences in computational science for undergraduates majoring in mathematical sciences.

- The hosting of the sixth annual "Frontiers in Applied and Computational Mathematics

(FACM)" conference in June 2009. This two-day meeting with a focus on mathematical biology and biostatistics attracted over 130 participants.

As always, 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 Donald Sebastian, Interim Provost and Sr. Vice President for Academic Affairs, for encouraging CAMS through their strong support of scientific research. Finally, we thank President Robert A. Altenkirch, who has been a constant source of support for CAMS and its mission. We look forward to working with all 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 - 2009

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
Dr. Patrick S. Hagan	Bloomberg LP
Dr. Zahur Islam	Novartis Pharmaceuticals
Dr. James McKenna	Bell Laboratories (formerly)
Ms. Krystyna J. Monczka	Hewitt Associates
Dr. Richard Silberglitt	Rand Corporation
Dr. James W. Watson	AT&T Laboratories (formerly)
Dr. Benjamin White	Exxon Research & Engineering

III. MEMBERS AND VISITORS

Department of Mathematical Sciences

Ahluwalia, Daljit S.
Andrushkiw, Roman
Barros, Ricardo
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
Goldberg, Vladislav
Golowasch, Jorge
Goodman, Roy
Gordon, Peter
Goullet, Arnaud
Horntrop, David
Jain, Aridaman
Jiang, Shidong
Johnson, Kenneth
Kappraff, Jay
Kondic, Lou
Kriegsmann, Gregory A.
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
Tlupova, Svetlana
Wang, X. Sheldon
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
Mauri, Roberto	Università degli Studi di Pisa, Italy
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 5 **Naomi Leonard**, Princeton University
Mobile Sensor Networks: Cooperative Sensing and Control

September 12 **Gregory Chirikjian**, Johns Hopkins University
Stochastic Models and Lie Groups

September 19 **Joyce McLaughlin**, Rensselaer Polytechnic Institute
Shear Stiffness Imaging as an Early Diagnostic Tool: New Applications and New Imaging Algorithms

September 26 **Andrew Bernoff**, Harvey Mudd College
Domain Evolution and Relaxation in Langmuir Films

October 3 **Doron Levy**, University of Maryland
Group Dynamics in Phototaxis

October 10 **Grétar Tryggvason**, Worcester Polytechnic Institute
Computational Studies of the Dynamics of Heterogeneous Continuum Systems

October 17 **Linda Cummings**, New Jersey Institute of Technology
Bistability in Liquid Crystal Display (LCD) Devices

October 24 **Lou Kondic**, New Jersey Institute of Technology
Instabilities of Thin Fluid Films and Rivulets

October 31 **John McLaughlin**, Clarkson University
Lattice Boltzmann Methods for Single and Two Phase Flows

November 7 **Peter Howell**, University of Oxford
Retraction of a Thin Fluid Sheet

November 14 **Peter Miller**, University of Michigan
On the Semiclassical Limit for the Sine-Gordon Equation

November 21 **Pierre Colinet**, Université Libre de Bruxelles
Thin Liquid Films, Droplets and Contact Lines with Evaporation and Condensation

December 5 **Salvatore Torquato**, Princeton University
Can Disordered Sphere Packings Ever Be Maximally Dense?

January 23 **Björn Sandstede**, Brown University
Localized Patterns in the Swift-Hohenberg Equation

January 30 **Cyrill Muratov**, New Jersey Institute of Technology
A Variational Approach to Front Propagation in Infinite Cylinders

February 6 **John Pelesko**, University of Delaware
Soap Films, Droplets, Electric Fields, Magnetic Fields, and Elasticity

February 13 **John Schotland**, University of Pennsylvania
Optical Tomography

February 20 **Marcus Felson**, Rutgers University
Modeling Crime with Super-Simple Mathematics

February 27 **Hernán Makse**, City College of New York
Theory of Random Packings

March 6 **Oscar Bruno**, California Institute of Technology
Accurate Solution of Highly Oscillatory Wave Propagation and Scattering Problems

March 13 **Yuji Kodama**, The Ohio State University
Two Dimensional Solitons in Shallow Water

March 27 **Harvey Segur**, University of Colorado
The Explosive Instability

April 3 **Mark Alber**, Notre Dame University
Connection between Discrete Stochastic and Continuous Models in Biology

April 17 **Arthur Cohen**, Rutgers University
New Multiple Testing Methods in the Dependent Case

April 24 **Michael Shearer**, North Carolina State University
Particle Size Segregation in Granular Flow

May 1 **Ka Yee Lee**, University of Chicago
Beyond Wrinkles: Stress and Fold Localization in Thin Elastic Membranes

Applied Statistics Seminar

September 11 **Kaifeng Lu**, Merck Laboratories
Sample Size Calculations for the Constrained Longitudinal Data Analysis Model

September 25 **Ying Wei**, Columbia University
Quantile Regression and its Application in Medical Sciences

November 13 **Bin Cheng**, Columbia University
Statistical Assessment and Sample Size Calculation in QT/QTc Prolongation Studies

December 4 **Nan Kong**, Educational Testing Services
K-Dependence Coefficient and L-Multivariate Association Coefficient

March 5 **Yujun Wu**, Sanofi-Aventis
Approaches to Handling Data When a Phase II Trial Deviates from the Pre-specified
Simon's Two-Stage Design

April 30 **Ganesh K. (Mani) Subramaniam**, AT&T Labs - Research, Florham Park, NJ
Some Approaches to Mine Time Series Data

Mathematical Biology Seminar

September 16 **Frances Chance**, U.C. Irvine
Is Multiplication Required for Gain Modulation?

September 23 **Shunbing Zhao & Farzan Nadim**, NJIT / Rutgers
Flattening the PRC: Inhibitory Feedback to Pacemaker Neurons Promotes Oscillation Stability

September 30 **Andrew Hill**, Department of Biological Sciences, NJIT
Modeling Rhythmic Neuronal Networks

October 7 **Myongkeun Oh**, Department of Mathematical Sciences, NJIT
Loss of Synchrony in Non-weakly Coupled Inhibitory Networks of Type-I Oscillators

October 14 **Dan Bunker**, Department of Biological Sciences, NJIT
Quantifying Species Functional Diversity with Convex Hull Volume

October 21 **Moran Furman**, Yale University
A Recurrent Spiking Neuron Model of Multiple-choice Decisions

October 28 **Horacio G. Rotstein**, Mathematical Sciences, NJIT
The Mechanism of Abrupt Transition from Normal to Epileptic Spiking Activity in Medial Entorhinal Cortex Layer II Stellate Cells

November 4 **Michael Kreissl**, Max Planck Institute for Dynamics and Self-organization, Goettingen, Germany
Chaotic Dynamics in Balanced Neural Networks

November 11 QNS talk - **John Rinzel**, New York University
Dynamics of Visual Bistable Perception

December 10 UBM Student Presentations:
Joseph Hanna & Karina Aliaga
Identifying Resonance in the PY Neurons of the Stomatogastric Ganglion of Cancer Borealis
David Hamoui & Catherine Morrison
Predicting Plant Succession

February 3 **Vladimir Itskov**, Center for Theoretical Neuroscience, Columbia University
Stimulus Space Representations by Recurrent Networks: the Geometry of Fixed Points

February 10 **Ali Abdi**, Department of Electrical and Computer Engineering, NJIT
Fault Diagnosis Engineering of Digital Circuits Can Identify Vulnerable Molecules in Complex Cellular Networks

February 17 **Xinxian Huang**, Department of Mathematical Sciences, NJIT
The Activity Phase of Neurons in a Reciprocally Inhibitory Network

February 24 **Michiel Remme**, Center for Neural Science, NYU
Implementing Entorhinal Grid Fields in Biophysical Neuronal Models

March 3 **Dongwook Kim**, Department of Mathematical Sciences, NJIT
The Effects of Synaptic Inputs on the Activity of Medial Entorhinal Cortex Layer II Stellate Cell: Work in Progress

March 10 **Alfonso Renart**, Center for Molecular and Behavioral Neuroscience, Rutgers University
The Asynchronous State in the Cerebral Cortex

March 24 **Iva Jancigova**, Department of Mathematical Sciences, NJIT
Bursting, Horseshoes and Chaos in Piecewise Continuous Maps

March 31 **Asohan Amarasingham**, Center for Molecular and Behavioral Neuroscience, Rutgers University
Nonparametrics for Spike Train Analysis

April 7 **Viji Santhakumar**, Department of Neurology & Neurosciences, UMDNJ
Topological Determinants of Epileptogenesis

April 21 **Ernest Montbrio**, Center for Neural Science, NYU
A Model of the Primary Auditory Cortex Response to Auditory Streaming Sound Sequences

April 28 **Peter Thomas**, Department of Mathematics, Case Western Reserve University
Stochastic Phenomena in Chemotaxis

Fluid Mechanics Seminar

September 24 (Joint Waves Seminar)
Ehud Yariv, Faculty of Mathematics, Technion - Israel Institute of Technology
Electrokinetic Flows about Polarizable Particles

September 29 **Mark Borden**, Department of Chemical Engineering, Columbia University
Lipid-Coated Microbubbles: Fundamentals and Biomedical Applications

October 6 **Petia Vlahovska**, Thayer School of Engineering, Dartmouth College
Electrohydrodynamic Deformation of Lipid Bilayer Membranes

October 27 **Shawn Walker**, Courant Institute of Mathematical Sciences, New York University
Modeling, Analysis, and Simulation for Electrowetting Driven Hele-Shaw Flow with Contact Line Friction

November 10 **Nina Shapley**, Department of Chemical and Biochemical Engineering, Rutgers University
Flow of Concentrated Suspensions in Asymmetric Bifurcations

December 1 **X. Sheldon Wang**, New Jersey Institute of Technology
From Molecular Dynamics for Proteins to Immersed Method for Fluid-Solid Systems - A Hierarchical Multi-Scale and Multi-Physics Model of Soft Biological Materials

February 9 **Leo Espin**, New Jersey Institute of Technology
Accelerating Wall Flows: A Comparison between Exact Solutions and Navier-Stokes Computations in Bounded Domains

March 9 **Tai-Hsi Fan**, Department of Mechanical Engineering, University of Connecticut
Hydrodynamic Interactions between Colloids in Nonadsorbing Polymer Solutions

March 30 **Shomeek Smukhopadhyay**, CCNY, City University of New York
Dynamics of Circular Contact Lines

April 13 **Biyue Liu**, Department of Mathematics, Monmouth University
Computer Simulations of Blood Flows in Atherosclerotic Arteries

April 20 **David Ambrose**, Department of Mathematics, Drexel University
Two Problems in Interfacial Fluid Dynamics

April 27 **Kuan Xu**, Department of Mathematical Sciences, NJIT
The Evolution of a Two-dimensional Cartesian Drop in an Imposed Linear Flow: The Influence of Surfactant and Surfactant Solubility

Waves on Wednesdays Seminar

September 24 (Joint Fluid Mechanics Seminar)
Ehud Yariv, Technion
Electrokinetic Flows about Polarizable Particles

October 1 **Leon Cohen**, City University of New York
Why do Pulses Sometimes Contract?: A Phase Space Approach to Wave Propagation

November 5 **Jason Fleischer**, Princeton University
Towards Optical Hydrodynamics

March 4 **Mark Hoefer**, Columbia University
Hydrodynamics in the Small Dispersion Limit

April 1 **Mikael Rechtsman**, Courant Institute
Upper Bounds on Photonic Bandgaps

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Roman Andrushkiw

A New Test for Unimodality (with D.A. Klyushin and Yu.I. Petunin), Theory of Stoch. Processes (ISSN 0321-3900), Vol. 14, pp. 1-6, November 2008.

Ricardo Barros

Inhibiting Shear Instability Induced by Large Amplitude Internal Solitary Waves in Two-layer Flows with Free Surface (with W. Choi), Studies in Applied Mathematics, Vol. 122, pp. 325-346, April 2009.

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

John Bechtold

A Multi-Scale Approach to the Propagation of Non-Adiabatic Premixed Flames (with M. Matalon), J. Eng. Math, Vol. 63, pp. 309-326, April 2009.

Denis Blackmore

A Coaxial Vortex Ring Model for Vortex Breakdown (with M. Brøns and A. Goullet), Physica D, Vol. 237, pp. 2817-2844, November 2008.

Victoria Booth

Interaction of Cellular and Network Mechanisms in Spatiotemporal Pattern Formation in Neuronal Networks (with A. Bogaard, J. Parent, and M. Zochowski), Journal of Neuroscience, Vol. 29, pp.1677-1687, February 2009.

Amitabha Bose

Predicting the Activity Phase of a Follower Neuron with A-current in an Inhibitory Network (with Y. Zhang and F. Nadim), Biol. Cyber., Vol. 99, pp. 171-184, August 2008.

Multistability of Clustered States in a Globally Inhibitory Network (with L. Chandrasekaran and V. Matveev), Physica D, Vol. 238, pp. 253-263, February 2009.

Yassine Boubendir

An Integral Preconditioner for Solving the Two-dimensional Scattering Transmission Problem using Integral Equations (with X. Antoine), I. J. Comp. Math., Vol. 85, pp. 1473-1490, October 2008.

Analysis of Open Waveguides using the Finite-element Method and Boundary Integral Equations (with H. Yoo and A. Gopinath), IEEE, J. Quantum Electronics, Vol. 44, pp. 476-480, July 2008.

Bruce Bukiet

Internet Search Result Probabilities: Heaps' Law and Word Associativity (with J. Lansey), J. of Quantitative Linguistics, Vol. 16, pp. 40-66, February 2009.

Chung Chang

Robust Fitting for Neuroreceptor Mapping (with R. Todd Ogden), Statistics in Medicine, Vol. 28, pp. 1004-1016, March 2009.

Bootstrapping Sums of Independent but Not Identically Distributed Continuous Processes with Applications to Functional Data (with R. Todd Ogden), J. Multivariate Analysis, Vol. 100, pp. 1291-1303, July 2009.

Wooyoung Choi

Large Amplitude Internal Solitary Waves in a Two-layer System of Piecewise Linear Stratification (with A. Goullet), Phys. Fluids, Vol. 20, pp. 096601, August 2008.

A Higher-order Internal Wave Model Accounting for Large Bathymetric Variations (with A. R. De Zarate, D. G. A. Vigo, A. Nachbin), Studies in Applied Mathematics, Vol. 122, pp. 275-294, April 2009.

Inhibiting Shear Instability Induced by Large Amplitude Internal Solitary Waves in Two-layer Flows with Free Surface (with R. Barros), Studies in Applied Mathematics, Vol. 122, pp. 325-346, April 2009.

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

Linda Cummings

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

Comparison of Methods for Evaluating Functions of a Matrix Exponential (with H.A. Ashi and P.C. Matthews), Appl. Num. Math., Vol. 59, pp. 468-486, 2009.

Mathematical Modelling of Fibre-enhanced Perfusion inside a Tissue-engineering Bioreactor (with R.J. Whittaker, R. Booth, R. Dyson, C. Bailey, L. Parsons-Chini, S. Naire, S. Payvandi, Z. Rong, H. Woollard, S.L. Waters, L. Mawasse, J.B. Chaudhuri, M.J. Ellis, V. Michael, N.J. Kuiper, and S. Cartmell), J. Theor. Biol., Vol. 256, pp. 533-546, 2009.

Ureteric Stents: Investigating Flow and Encrustation (with S.L. Waters, K. Heaton, J.H. Siggers, R. Bayston, M. Bishop, D.M. Grant, J.M. Oliver, and J.A.D. Wattis), J. Eng. Med., Vol. 222, pp. 551-561, 2008.

Fadi P. Deek

Pair Dynamics in Team Collaboration (with K. Choi and I. Im), Journal of Computers in Human Behavior, Vol. 25, no. 4, pp. 844-852, 2009.

An Empirical Evaluation of a Methodology-Tailoring Information System Development Model (with T. Burns and R. Klashner), Journal of Software Process Improvement and Practice, Vol. 13, no. 5, pp. 387-395, 2008.

Exploring the Underlying Aspects of Pair Programming: The Impact of Personality (with K. Choi

and I. Im), Journal of Information and Software Technology, Vol. 50, no. 11, pp. 1114-1126, 2008.

Sunil K. Dhar

Proteasome Inhibition Decreases Cardiac Remodeling after Initiation of Pressure Overload (with Nadia Hedhli, Paulo Lizano, Chull Hong, Luke F. Fritzky, Huasheng Liu, Yimin Tian, Shumin Gao, Kiran Madura, Stephen F. Vatner, and Christophe Depre), American Journal of Physiology: Heart and Circulatory Physiology, Vol. 295, pp. H1385 - H1393, October 2008.

Log-linear Modeling under Generalized Inverse Sampling Scheme (with Soumi Lahiri), J. Title Communications in Statistics-Theory and Methods, Vol. 37, pp. 1237-1244, July 2008.

Medical Statistics: A Textbook for the Health Sciences, Fourth Edition, by D. Machin, M. J. Campbell, and S. J. Walters, 2007 J. of Biopharmaceutical Statistics, Vol. 18, pp. 1036 - 1038, September 2008.

Statistical Thinking for Non-Statisticians in Drug Regulation, by R. Kay, 2007 J. Biopharmaceutical Statistics, Vol. 19, pp. 220 - 222, February 2009.

Javier Diez

Nanoparticle Assembly via the Dewetting of Patterned Thin Metal Lines: Understanding the Instability Mechanisms (with L. Kondic, P. D. Rack, Y. Guan, J. D. Fowlkes), Phys. Review E, Vol. 79, pp. 026302, January 2009.

Thomas Erneux

Limit-cycle Oscillators Subject to a Delayed Feedback (with J. Grasman), Phys. Rev. E, Vol. 78, pp. 026209, August 2008.

Synchronization Properties of Network Motifs: Influence of Coupling Delay and Symmetry (with O. D'Huys, R. Vicente, J. Danckaert, and I. Fischer), Chaos, Vol. 18, pp. 037116, September 2008.

Routes to Chaos and Multiple Time Scale Dynamics in Broadband Bandpass Nonlinear Delay Electro-optic Oscillators (with M. Peil, M. Jacquot, Y. Kouomou Chembo, L. Larger), Phys. Rev. E, Vol. 79, pp. 026208, February 2009.

Intradot Dynamics of InAs Quantum Dot Based Electroabsorbers (with T. Piwonski, G. Huyet, J. Pulka, G. Madden, J. Houlihan, E.A. Viktorov, and P. Mandel), Appl. Phys. Lett., Vol. 94, pp. 123504, March 2009.

The Fast Recovery Dynamics of a Quantum Dot Semiconductor Optical Amplifier (with E.A. Viktorov, P. Mandel, T. Piwonski, G. Huyet, and J. Houlihan), Appl. Phys. Lett., Vol. 94, pp. 113501, March 2009.

Anna Georgieva

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

Vladislav V. Goldberg

Geodesic Webs on a Two-dimensional Manifold and Euler Equations (with V. V. Lychagin), Acta Appl. Math. DOI 10.1007, March 2009.

Geodesic Webs of Hypersurfaces (with V. V. Lychagin), Doklady Akademii Nauk, Vol. 425, pp. 737-740, May 2009.

Geodesic Webs of Hypersurfaces (with V. V. Lychagin), Doklady Mathematics, Vol. 79, pp. 284-286, Pleiades Publishing, Ltd., 2009.

Hyperplanar Webs and Euler Equations (with V. V. Lychagin), Proceedings of the Institute of Mathematics of NAS of Ukraine, 73-81, April 2009.

On a Class of Linearizable Planar Geodesic Webs (with V. V. Lychagin), Proceedings of Intern. Geometry Center d-omega, Vol. 1, pp. 1-6, December 2008.

Roy Goodman

Hysteretic and Chaotic Dynamics of Viscous Drops in Creeping Flows with Rotation (with Y. N. Young, J. Bławzdziewicz, V. Cristini), J. Fluid Mech., Vol. 607, pp. 209-234, July 2008.

Stability and Instability of Nonlinear Defect States in the Coupled Mode Equations-Analytical and Numerical Study (with M. I. Weinstein), Phys. D, Vol. 237, pp. 2731-2760, November 2008.

Arnaud Goullet

Large Amplitude Internal Solitary Waves in a Two-layer System of Piecewise Linear Stratification (with W. Choi), Phys. Fluids, Vol. 20, September 2008.

A Coaxial Vortex Ring Model for Vortex Breakdown (with D. Blackmore and M. Brøns), Physica D, Vol. 237, pp. 2817-2844, November 2008.

Huaxiong Huang

An Immersed Boundary Method for Restricted Diffusion with Permeable Interfaces (with K. Sugiyama and S. Takagi), J. Comp. Physics, Vol. 228, pp. 5317-5322, May 2009.

A Front-Tracking Method for Motion by Mean Curvature with Surfactant (with M.-C. Lai and C.-W. Hsu), Advance Applied Math. Mech., Vol. 1, pp. 288-300, March 2009.

Hydrophobic Effect in a Continuum Model of the Lipid Bilayer (with P. Wilson and S. Takagi), Comm. Comp. Physics, Vol. 6, pp. 655-672, February 2009.

Systems of Coupled Diffusion Equations with Degenerate Nonlinear Source Terms: Linear Stability and Travelling Waves (with J.J. Wylie and R.M. Miura), Discrete and Continuous Dynamical Systems A, Vol. 23, pp. 561-569, January/February 2009.

A Different Perspective on Retirement Income Sustainability: Introducing the Ruin Contingent Life Annuity (RCLA) (with M. Milevsky and T.S. Salisbury), Journal of Wealth Management, Vol. 11, pp. 89-96, Spring 2009.

Optical Fiber Drawing and Dopant Transport (with R.M. Miura and J.J. Wylie), SIAM Journal on Applied Mathematics, Vol. 69, pp. 330-347, October 2008.

A Thermal Elastic Model for Directional Crystal Growth with Weak Anisotropy (with J.-B. Wu and C. S. Bohun), SIAM J. Applied Math., Vol. 69, pp. 283-304, October 2008.

Semi-Analytic Solution for Thermoelastic Problem with Cubic Anisotropy (with J.-B. Wu and C. S. Bohun), J. Crystal Growth, Vol. 310, pp. 4373-4384, September 2008.

An Immersed Boundary Method for Interfacial Flows with Insoluble Surfactant (with M.-C. Lai and Y.-H. Tseng), J. Comp. Physics, Vol. 227, pp. 7279-7293, July 2008.

Portfolio Selection and Life Insurance (with M. Milevsky and J. Wang), Journal of Risk and

Insurance, Vol. 75, pp. 848-872, December 2008.

Portfolio Choice and Mortality-Contingent Claims: The General HARA Case (with M.A. Milevsky), Journal of Banking and Finance, Vol. 32, pp. 2444-2452, November 2008.

Jay Kappraff

Generalized Genomic Matrices, Silver Means, and Pythagorean Triples (with Gary W. Adamson), Forma, Vol. 24, pp. 1-8, 2009.

Symmetries, Generalized Numbers, and Harmonic Laws in Matrix Analysis (with Sergei Petoukhov), Symmetry: Culture and Science, Vol. 20, Nos. 1-4, pp. 23 - 49 (2009).

The Proportions of the Parthenon: a Work of Musical Inspired Architecture, in Art and Mathematics, edited by Oleg Bodnar, pp. 186 – 204, ISBN: 978-966-8734-10-6.

Lou Kondic

Probing Dense Granular Materials by Space-time Dependent Perturbations (with O. M. Dybenko, R. P. Behringer), Phys. Rev. E, Vol. 79, 041304, pp. 1-5, March 2009.

Nanoparticle Assembly via the Dewetting of Patterned Thin Metal Lines: Understanding the Instability Mechanism (with J. Diez, P. Rack, Y. Guan, J. Fowlkes), Phys. Rev. E, Vol. 79, 026302, pp. 1-6, January 2009.

Modeling Evaporation of Sessile Drops with Moving Contact Lines (with N. Murisic), Phys. Rev. E, Vol. 78, 065301R, pp. 1-4, December 2008.

On Long-wave Instabilities in Isothermal Binary Fluid Films (with Z. Borden, H. Grandjean, A. E. Hosoi, B. S. Tilley), Phys. Fluids, Vol. 20, pp. 102103, 1-22, November 2008.

Gregory Kriegsmann

A Simple Derivation of Microstrip Transmission Line Equations, SIAM J. App. Math., Vol. 70, pp. 353-367, 2009.

Victor Matveev

Loss of Phase-locking in Non-weakly Coupled Inhibitory Networks of Type-I Model Neurons (with M. Oh), J. Comput. Neurosci., Vol. 26, pp. 303-320, August 2008.

Multistability of Clustered States in a Globally Inhibitory Network (with L. Chandrasekaran and A. Bose), Physica D, Vol. 238, pp. 253-263, February 2009.

Zoi-Heleni Michalopoulou

Particle Filtering for Dispersion Curve Tracking in Ocean Acoustics (with I. Zorych), J. Acoustical Society of America Express Letters, Vol. 124, pp. EL45-EL50, July 2008.

Robert M. Miura

Systems of Coupled Diffusion Equations with Degenerate Nonlinear Source Terms: Linear Stability and Traveling Waves (with J.J. Wylie and H. Huang), Disc. Cont. Dyn. Syst. A, Vol. 23, pp. 561-569, January/February 2009.

Optical Fiber Drawing and Dopant Transport (with H. Huang and J.J. Wylie), SIAM J. Appl. Math., Vol. 69, pp. 330-347, August 2008.

Solitons and the Inverse Scattering Method: An Historical View, Sugaku Seminar (in Japanese), Vol. 47, pp. 32-38, August 2008, pp. 44-49, September 2008.

Richard O. Moore

A Method to Compute Statistics of Large, Noise-induced Perturbations of Nonlinear Schrodinger Solitons (with G. Biondini and W. L. Kath), SIAM Rev., Vol. 50, pp. 523-549, August 2008.

The Semistrong Limit of Multipulse Interaction in a Thermally Driven Optical System (with K. Promislow), J. Differ. Equations, Vol. 245, pp. 1616-1655, September 2008.

Cyrill Muratov

Compensated Optimal Grids for Elliptic Boundary Value Problems (with F. Posta and S. Y. Shvartsman), J. Comput. Phys., Vol. 227, pp. 8622–8635, July 2008.

Theory of 360-degree Domain Walls in Thin Ferromagnetic Flms (with V. V. Osipov), J. Appl. Phys., Vol. 104, 053908 pp. 1-14, September 2008.

Front Propagation in Infinite Cylinders. I. A Variational Approach (with M. Novaga), Commun. Math. Sci., Vol. 6, pp. 799-826, December 2008.

Dynamic Condensation Blocking in Cryogenic Refueling (with V. V. Osipov), Appl. Phys. Lett., Vol. 93, 224105 pp. 1-3, December 2008.

Autocrine Signal Transmission with Extracellular Ligand Degradation (with F. Posta and S. Y. Shvartsman), Phys. Biol. Vol. 6, 016006 pp. 1-13, February 2009.

Farzan Nadim

Predicting the Activity Phase of a Follower Neuron with A-current in an Inhibitory Network (with Y. Zhang and A. Bose), Biological Cybernetics, Vol. 99, pp. 171-184, September 2008.

State Dependence of Network Output: Modeling and Experiments (with V. Brezina, A. Destexhe and C. Linster), J. Neuroscience, Vol. 28, pp. 11806-11813, November 2008.

Dominant Ionic Mechanisms Explored in Spiking and Bursting using Local Low-dimensional Reductions of a Biophysically Realistic Model Neuron (with R. Clewley and C. Soto-Trevino), J. Computational Neuroscience, Vol. 26, pp. 75-90, February 2009.

Membrane Resonance in Bursting Pacemaker Neurons of an Oscillatory Network is Correlated with Network Frequency (with V Tohidi), J. Neuroscience, Vol. 29, pp. 6427-6435, May 2009.

D.T. Papageorgiou

Axisymmetric Waves in Electrohydrodynamic Flows (with S. Grandison, J.-M. Vanden-Broeck, T. Miloh and B. Spivak), J. Engng. Maths, Vol. 62, pp. 133-148, October 2008.

Dynamics of Liquid Jets and Threads under the Action of Radial Electric Fields: Microthread Formation and Touchdown Singularities (with Q. Wang and S. Mahlmann), Phys. Fluids, Vol. 21, pp. 032109, March 2009.

Numerical Study of Electric Field Effects on the Deformation of Liquid Drops in Simple Shear Flow at Arbitrary Reynolds Number (with S. Mahlmann), J. Fluid Mech., Vol. 626, pp. 367-393, May 2009.

Nonlinear Dynamics of Core-annular Film Flows in the Presence of Surfactant (with S. Kas-

Danouche and M. Siegel), J. Fluid Mech., Vol. 626, pp. 415-448, May 2009.

Breakup of Surfactant-laden Jets above the Critical Micelle Concentration (with R.V. Craster and O. Matar), J. Fluid Mech., Vol. 629, pp. 195-219, June 2009.

Horacio G. Rotstein

Rhythmic Activity in the Medial Entorhinal Cortex: Dynamical Systems and Biophysical Modeling (with M. Wechselberger), Actas de la Academica Nacional de Ciencias, Cordoba, Argentina, Vol. 14, pp. 23-37, December 2008.

Canard Induced Mixed-mode Oscillations in a Medial Entorhinal Cortex Layer II Stellate Cell Model (2008) (with M. Wechselberger and N. Kopell), SIAM J. Appl. Dyn. Sys., Vol. 7, pp. 1582-1611, December 2008.

Michael Siegel

Nonlinear Interfacial Stability of Core Annular Flows in the Presence of Surfactants (with S. Kas-Danouche and D. T. Papageorgiou, J. Fluid Mech., Vol. 626, pp. 415-448, January 2009.

The Effect of Surfactant on Bubble and Thread Dynamics, PAMM, Vol. 7, Issue 1, pp. 1101603-1101604, Zurich, October 2008.

Sundar Subramanian

Semiparametric Left Truncation and Right Censorship Models with Missing Censoring Indicators (with Dipankar Bandyopadhyay), Statistics and Probability Letters, Vol. 78, pp. 2572-2577, November 2008.

The Missing Censoring Indicator Model and the Smoothed Bootstrap (with Derek Bean), Computational Statistics and Data Analysis, Vol. 53, pp. 471-476, December 2008.

Hazard Function Estimation from Homogeneous Right Censored Data with Missing Censoring Indicators (with Derek Bean), Statistical Methodology, Vol. 5, pp. 515-527, November 2008.

Svetlana Tlupova

Boundary Integral Solutions of Coupled Stokes and Darcy Flows (with R. Cortez), J. Comp. Phys., Vol. 228(1): 158-179, 2009.

Jean-Marc Vanden-Broeck

Film over a Trapped Bubble (with M.G. Blyth), IMA Journal of Applied Mathematics, Vol. 73, pp. 803-814, October 2008.

On Satisfying the Radiation Condition in Free-surface Flows (with B.J. Binder and F. Dias), J. Fluid Mech., Vol. 624, pp. 179-189, April 2009.

Jonathan Wylie

Driven Inelastic Particle Systems with Drag (with Q. Zhang, Y. Li & H.Y. Xu), Phys. Rev. E, Vol. 79, 031301, March 2009.

Detection of Change-points near the End Points of Long-range Dependent Sequences (with W.L. Nie, S. Ben Hariz & Q. Zhang), Comptes Rendus Mathematique, Vol. 347, pp. 425, April 2009.

Trapping Inelastic Particles in Corners (with M. Gao & Q. Zhang), Comm. Pure Applied Analysis, Vol. 8, pp. 275, January 2009.

Systems of Coupled Diffusion Equations with Degenerate Nonlinear Source Terms: Linear Stability and Traveling Waves (with H. Huang & R.M. Miura), Discrete and Continuous Dynamical Systems A, Vol. 23, pp. 561, January 2009.

Dopant Diffusion during Optical Fiber Drawing (with H. Huang & R.M.Miura), SIAM J. Applied Math., Vol. 69, pp. 330, October 2008.

Yuan-Nan Young

Hydrodynamic Interactions between Two Semi-flexible In-extensible Filaments in Stokes Flow, Physical Review E, 79, 046317, 2009.

Influence of Surfactant Solubility on the Deformation and Breakup of a Bubble or Capillary Jet in a Viscous Fluid (with M. R. Booty, M. Siegel, and J. Li), Phys. of Fluids, 21, 072105, 2009.

BOOKS AND BOOK CHAPTERS

Denis Blackmore

Proceedings of FACM'08 dedicated to D. S. Ahluwalia on his Seventy-Fifth Birthday (co-editors: A. Bose and P. Petropoulos), World Scientific, Singapore, December 2008.

Fadi P. Deek

Open Source - Technology and Policy (with J. McHugh), Cambridge University Press, ISBN: 978-0-521-88103-6 - Hard Copy, ISBN: 978-0-521-70741-1 - Soft Copy, (369 pages), 2008.

Validation of e-Learning Courses in Information Sciences and Humanities: A Matter of Context (with R. Friedman and N. Elliot), in E-Learning Technologies and Evidence-Based Assessment Approaches, P. Lajbcygier and C. Sprat (Editors), IGI Global, 2009.

Thomas Erneux

Applied Delay Differential Equations, Springer, March 27, 2009, http://www.springer.com/978-0-387-74371-4.

Anna Georgieva

Modeling and Simulations, Clinical Trials Handbook, p. 1002-1005, edited by S. Cox Gad, Wiley and Sons, June, 2009.

Vladislav V. Goldberg

Proceedings of the International Conference "Geometry in Odessa – 2009", Editors: V. Goldberg, A. Kushner, V. Kuzakon, and V. Lychagin, International Geometry Center d-omega, Odessa, Ukraine, May 2009.

PROCEEDINGS PUBLICATIONS

Roman I. Andrushkiw

Combined Correlation-Proximity Test for Breast Cancer and Fibroadenomatiosis (with Yu. I. Petunin, et al), Proc. Intl. Conf. on Bioinformatics & Computational Biology, Vol. 1, pp. 285-288, H. Arabnia, ed., CSREA Press, July 2008.

Correlation Algorithm for Cytogenetic Method of Breast Cancer Diagnosis (with D.A. Klyushin, et al), Proc. Intl. Conf. on Bioinformatics & Computational Biology, Vol. 1, pp. 324-327, H. Arabnia, ed., CSREA Press, 2008.

Denis Blackmore

Simulation of Dynamics of Binary and Ternary Vortex Clusters, (with L. Ting and O. Knio), Proc. ICCES'08, Honolulu, Hawaii, Tech Science Press, pp. 120-121 (online), August 2008.

Dynamics of Planar Vortex Clusters with Binaries, (with L. Ting and O. Knio), Proc. ICIAM'07, Zurich, Switzerland, PAMM 7, pp. 1101501-1101502 (online), December 2008.

Invariant Tori in Perturbed Three Vortex Motion, (with L. Ting and O. Knio), Proc. ICIAM'07, Zurich, Switzerland, PAMM 7, pp. 1101507-1101508 (online), December 2008.

Michael Booty

The Effect of Surfactant on Bubble and Thread Dynamics (with M. Siegel), Proceedings in Applied Mathematics and Mechanics, Vol. 7, pp. 1101603-1101604, February 2009.

Wooyoung Choi

On the Hyperbolicity of Two-layer Flows (with R. Barros), Proceedings of the FACM Conference, May 19-21, World Scientific, Singapore, ed. by D. Blackmore, A. Bose, and P. Petropoulos, pp. 95-103, 2008.

Linda Cummings

Evolution of an Elliptical Bubble in an Accelerating Extensional Flow (with D.W. Schwendeman and B.S. Tilley), Proceedings of Mathematical Problems in Industry Workshop, Worcester Polytechnic Institute (2008).

Fadi P. Deek

Effective Knowledge Management in Collaborative Software Development (with M. Mohtashami), Proceedings of the 39th Annual Meeting of the Decision Science Institute, Baltimore, Maryland, USA, 2008.

Organizational and Information Systems Factors in Post-Merger Technology Integration (with G. Baro and A. Chakrabarti), Proceedings of the Americas Conference on Information Systems (AMCIS), Toronto, Canada, 2008.

Computation and Communication (with R. Friedman and B. Bukiet), Proceedings of the 19th Conference of the Society for Information Technology and Teacher Education (SITE 2008), Las Vegas, Nevada, USA, 2008.

Peter Gordon

Some Mathematical Problems Arising in Modeling Combustion in Porous Media, Workshop on Singularities Arising in Nonlinear Problems, pp 61-849, Kyoto, December 2008.

Lou Kondic

Evaporative Drops (with N. Murisic), Annali dell'Universita di Ferrara, Vol. 54, 277-284 (November 2008).

On Modeling Evaporation of Sessile Drops (with N. Murisic), The Proceedings of the 2008 Annual Meeting of Aiche, pp. 1-2, ISBN 978-0-816910-1050-2, November 2008.

Stability of Finite-length Rivulet under Partial Wetting Conditions (with J. Diez and A. Gonzalez), Journal of Physics: Conference Series 166, 012009, 2009.

B. PRESENTATIONS

Roman I. Andrushkiw

July 2008: The 2008 International Conference on Bioinformatics and Computational Biology, Las Vegas
1) Correlation Algorithm for Cytogenetic Method of Breast Cancer Diagnosis
2) Combined Correlation-Proximity Test for Breast Cancer and Fibroadenomatosis

Denis Blackmore

October 2008: 2008 ASME Dynamic Systems and Control Conference, University of Michigan
Two-Vortex Models for Vortex Breakdown

February 2009: Joint Mathematics and Mechanical Engineering Colloquium, Carnegie Mellon University
A New Hamiltonian Dynamical Paradigm for Vortex Breakdown

May 2009: SIAM Applied Dynamical Systems Conference, Snowbird, UT
Dynamical Properties of Planar Point Vortex Clusters

June 2009: Second Annual George Bachman Memorial Conference, St. Johns University
Bifurcation of Invariant Manifolds in Discrete and Continuous Dynamical Systems

Victoria Booth

July 2008: CNS*2008, Annual Computational Neuroscience Meeting, Portland, OR
Interaction of Membrane Dynamics with Network Structure and its Effect on Spatio-temporal Network Patterning

November 2008: Biological Physics Seminar, University of Michigan, Ann Arbor, MI
A Novel Population Model for Sleep-wake Regulation

November 2008: 38th Annual Meeting of the Society for Neuroscience, Washington, DC
1) Interaction of Cellular and Network Mechanisms in Spatio-temporal Pattern Formation in Neuronal Networks and its Role in Seizure Generation

2) Simulating Microinjection of GABA Agonists and Antagonists in a Novel Model of the Sleep-wake Regulatory Network
3) Serotonin Prevents LTP Induction in the Temporo-ammonic Pathway of the Anesthetized Rat
4) Auto-scoring Software for Scoring Sleep and Waking States Based on Electrophysiological Recordings in Animals
5) Cortical and Hippocampal EEG Show Different Simultaneous Sleep States after Learning

June 2009: FACM '09, 6th Annual Conference on Frontiers in Applied and Computational Mathematics Conference, New Jersey Institute of Technology, Newark, NJ
Simulating Microinjection of Neurotransmitter Agonists and Antagonists in a Novel Model of the Sleep-wake Regulatory Network

June 2009: Conference on Neural Dynamics and Computation held in honor of John Rinzel, New York University
Dynamics of a Novel Model of the Sleep-wake Regulatory Network: A Fast-slow Analysis

Michael Booty

November 2008: American Physical Society, 61st Annual Meeting of the Division of Fluid Dynamics, San Antonio, TX
Influence of Surfactant Solubility on the Deformation and Breakup of a Bubble or Thread in a Viscous Fluid.

February 2009: TMS (The Minerals, Metals and Materials Society) 2009 Annual Meeting and Exhibition, San Francisco, CA
A Novel Method for Parallel Assembly of Microcomponents

Amitabha Bose

August 2008: Jawaharlal Nehru University, New Delhi, India
Introduction to Neuronal Dynamics

August 2008: Indian Institute of Technology, New Delhi, India
Introduction to Neuronal Dynamics

October 2008: University of Maryland-Baltimore County, MD
Introduction to Neuronal Dynamics

Chung Chang

August 2008: Joint Statistical Meetings, Denver, CO
Permutation Tests and Bootstrap Procedures in Imaging Studies

March 2009: Eastern North American Region (Enar) Spring Meeting, San Antonio, TX
Non-parametric Estimation of a Lifetime Distribution with Incomplete Censored Data

May 2009: Frontiers in Applied and Computational Mathematics, Newark, NJ
Non-parametric Estimation of a Lifetime Distribution with Incomplete Censored Data

Wooyoung Choi

July 2008: Mini-symposium on Waves, Stratified Fluids and Transport at the SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy
Large Amplitude Internal Solitary Waves in a Two-layer System of Piecewise Linear Stratification

August 2008: Workshop on Waves in Fluids II, Paraty, Brazil
Numerical and Experimental Studies on the Evolution of Nonlinear Water Waves

September 2008: Applied Math Seminar at the University of Michigan, Ann Arbor, MI
Modeling Large Amplitude Internal Waves: Kelvin-Helmholtz Instability and a Regularized Long Wave Model

November 2008: Applied Math Seminar at the University of North Carolina, Chapel Hill, NC
Numerical and Experimental Studies on the Evolution of Nonlinear Water Waves

December 2008: Workshop on Large Amplitude Internal Waves, International Center for Mathematical Sciences, Edinburgh, UK
Strongly Nonlinear Internal Wave Models and their Applications

December 2008: Fluid Dynamics Seminar, Institute of Mathematical Sciences, Imperial College, London, UK
Strongly Nonlinear Internal Wave Models and their Applications

January 2009: ONR NLIWI Workshop, Honolulu, HI
An Integrated Approach to Study Surface Expressions of Nonlinear Internal Waves

March 2009: Minisymposium at the 6th IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, GA
A Numerical Method to Solve a Regularized Long Wave Model for Strongly Nonlinear Internal Waves

April 2009: NSF Internal Wave Workshop, University of North Carolina, Chapel Hill, NC
A Regularized Model for Strongly Nonlinear Internal Solitary Waves

April 2009: Seminar at the Korean Advanced Institute of Science and Technology, Daejeon, Korea
Ocean Waves

May 2009: Workshop on Measurement and Simulation of Ocean Waves, Delft, The Netherlands
Combined Numerical and Experimental Studies of the Evolution of Nonlinear Irregular Waves and Energy Dissipation Due to Wave Breaking

Linda Cummings

October 2008: New Jersey Institute of Technology, Newark, NJ
Bistability in Liquid Crystal Display Devices

November 2008: Mathematical Biosciences Institute, Ohio State University, Columbus, OH
Microdomain Formation in Model Cell Membranes: Mathematical Modeling

December 2008: IPAM-UCLA Workshop, UCLA Lake Arrowhead Conference Center, CA
Fiber-enhanced Perfusion in Tissue Engineering Bioreactors

March 2009: Drexel University, Philadelphia, PA
Mathematical Modeling of Bistable Liquid Crystal Display Design

March 2009: IMA Hot Topics workshop "Higher Order Geometric Evolution Equations: Theory and Applications from Microfluidics to Image Understanding", IMA, Minneapolis, MA
Complex Variable Methods Applied to Free Boundary Problems

April 2009: University of Delaware, Newark, DE
Bistability in Liquid Crystal Display (LCD) Devices

Sunil K. Dhar

June 2009: WNAR/IMS Meeting, Portland State University, OR
Inference for Comparing Two Treatments Using Kernel Density Estimation

Javier Diez

November 2008: X Reunion sobre Recientes Avances en Fisica de Fluidos y sus Aplicaciones, Santa Fe, Argentina
Stability of an Infinite Rivulet under Partially Wetting Conditions

Thomas Erneux

October 2008: Journée de Séminaires sur les Dynamiques Non-linéaires et Leurs Applications, Besançon, France
Les Dynamiques Non-linéaires à Retard dans les Sciences Naturelles et de l'Ingénieur

October 2008: Université de Liège, Liège, Belgium
Applications of Delay Differential Equations

November 2008: CENOLI, Université Libre de Bruxelles, Belgium
Nonlinear Delay Dynamics in Science and Engineering

November 2008: University of Exeter, UK
Applications of Delay Differential Equations in Science and Engineering

March 2009: First International Colloquium on Nonlinear Dynamics of Deep Drilling Systems, Château de Colonster, Université de Liège, Liège, Belgium
Delay Induced Canard Explosion in High Speed Machining

Anna Georgieva

August 2009: International Conference for Systems Biology, Stanford University, CA
Disease Modeling and Its Applications in Model-based R&D: Example of the Renin-Angiotensin-Aldsosterone System (RAAS)

December 2008: Sant Antonio Breast Cancer Simposium, San Antonio, TX
Computational Inference of Gene Expression Signatures Differentiating Between Tumors Responding and Resistant to Letrozole

Vladislav V. Goldberg

May 2009: International Conference "Geometry in Odessa-2008", Odesa, Ukraine
Projective and Affine Structures Associated with Geodesic Webs of Hypersurfaces

Roy Goodman

July 2008: SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy
Bifurcations of Nonlinear Defect Modes

January 2009: Dynamical Systems Seminar, Drexel University, Philadelphia, PA
Fractal Structures in Solitary Wave Interactions

March 2009: Mathematics Colloquium, University of Buffalo, Buffalo, NY
Fractal Structures in Solitary Wave Interactions

May 2009: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
An Adaptive Method for Computing Invariant Manifolds of 2-D Maps

Peter Gordon

December 2008: Workshop on Singularities Arising in Nonlinear Problems (SNP 2008), Kyoto, Japan Some Mathematical Problems Arising in Modeling Combustion in Porous Media

February 2009: Ellis B. Stouffer Mathematics Colloquium, The University of Kansas, Lawrence, KS
KPP Type Fronts for Systems

April 2009: Applied Dynamical Systems Seminar, Drexel University, Philadelphia, PA
KPP Type Fronts for Systems

Arnaud Goullet

July 2008: SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy
Theoretical and Experimental Studies of the Evolution of Nonlinear Surface Wave Packets

March 2009: The Sixth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA
Numerical Method to Solve a Regularized Long Wave Model for Strongly Nonlinear Internal Waves

April 2009: NSF Workshop on Nonlinear Internal Waves, NC
Interaction of Large Amplitude Internal Solitary Waves with Bottom Topography

David J. Horntrop

July 2008: SIAM Annual Meeting, San Diego, CA
Simulation of Mesoscopic Models for Self-Organization in Materials

March 2009: SIAM Conference on Computational Science and Engineering, Miami, FL
1) Simulation of Stochastic Mesoscopic Models for Self-Organization in Materials
2) Aliasing in Calculating Convolutions Using Random Fourier Series

Huaxiong Huang

August 2008: Chinese SIAM Annual Meeting, Zhenzhou, China
MITACS, Study Groups and Problem Driven Applied Mathematics

June 2009: Canadian Math Society Annual Meeting, St. John's, Newfoundland
Models for Bread Baking: Moisture Transport and Diffusive Instability

Aridaman Jain

June 2009: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Modeling of Metal and Organic Concentration Measurements in Soil Samples from Secaucus High School

Shidong Jiang

June 2009: International Conference on Spectral and High Order Methods, Norway
Efficient and Accurate Algorithms for Elliptic Boundary Value Problems with Open Surfaces

Lou Kondic

June 2009: Colloquium, Lorenz Institute, Leiden, The Netherlands
Signal Propagation through Dense Granular Materials

May 2009: Eurotherm Seminar, Namur, Belgium
Evaporative Drops

May 2009: Colloquium, University of Bonn, Germany
Instabilities of Fluid Films, Drops and Rivulets

March 2009: IMA Workshop on Higher Order Geometric Evolution Equations: Theory and Applications from Microfluidics to Image Understanding, Minneapolis, MN
On Instabilities of Finite-size Films and Rivulets

February 2009: Colloquium, Worcester Polytechnic University, Worcester, MA
Instabilities of Fluid Films, Drops and Rivulets

November 2008: AIChE Annual Meeting, Philadelphia, PA
Evaporative Drops

November 2008: American Physical Society-Division of Fluid Dynamics Annual Meeting, San Antonio, TX
1) How do Drops Evaporate?
2) Signal Propagation in Dense Granular Systems
3) Stability of Finite and Infinite Fluid Rivulets

Gregory Kriegsmann

July, 2008: Departments of Electrical Engineering and Mathematics, University of Akron, Akron, OH
Electric Discharge Sintering

Victor Matveev

August 2008: SIAM Conference on the Life Sciences, Montreal, Quebec, Canada
Buffer Saturation allows Facilitation of Calcium Transients by Remote Calcium Channels

November 2008: Society for Neuroscience 38th Annual Meeting, Washington, DC
Loss of Synchrony in Non-weakly Coupled Inhibitory Networks of Type-I Model Neurons

March 2009: Annual Meeting of the Biophysical Society, Boston, MA
Calcium Current Cooperativity vs. Calcium Channel Cooperativity of Synaptic Vesicle Exocytosis

June 2009: Conference on the Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Calcium Current Cooperativity vs. Calcium Channel Cooperativity of Synaptic Vesicle Exocytosis

Zoi-Heleni Michalopoulou

November 2008: Acoustical Society of America Meeting, Miami, FL
Arrival Time Estimation from Sound Signals in the Ocean: A Particle Filtering Approach

March 2009: SIAM Conference in Computational Science and Engineering, Miami, FL
Mathematical Sciences and Computation at NJIT: Undergraduate Research and Curriculum

Robert M. Miura

June 2009: Meiji University, Tokyo Japan
Eight Lectures on Mathematical Modeling of Excitable Cells and Neural Tissue

April 2009: Centre for Mathematical Medicine, Fields Institute of Mathematical Sciences, Toronto, Canada
Migraine with Aura: Treat It with Math

September 2008: Seminar at Department of Mechanical Engineering, Tokyo University, Tokyo, Japan
Solitons and the Inverse Scattering Method

July 2008: SIAM Annual Meeting, San Diego, CA
Waves of Cortical Spreading Depression

Richard O. Moore

July 2008: Department of Mathematics, University of Buenos Aires, Argentina
Rare Events in Optical Communications

July 2008: SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy
Anomalous Behaviour in Amplitude and Phase Jitter of Nonlinear Schrodinger Solitons

April 2009: Department of Mathematics, Rowan University, Glassboro, NJ
Rare Events in Optical Communications

Cyrill Muratov

October 2008: MCIAM workshop on Multiscale and Stochastic Modeling, Analysis and Simulation, Michigan State University, East Lansing, MI
Self-induced Stochastic Resonance: How New Non-random Behaviors can arise from the Action of Noise

October 2008: BioMaPS Seminar in Quantitative Biology, Rutgers University, New Brunswick, NJ
Self-induced Stochastic Resonance: How New Non-random Behaviors can arise from the Action of Noise

November 2008: Probability Seminar, Department of Mathematics, University of Maryland, College Park, MD
Self-induced Stochastic Resonance: How New Non-random Behaviors can Arise from the Action of Noise

November 2008: PDEs Seminar, Department of Mathematics, George Washington University, Washington, DC
A Variational Approach to Front Propagation in Infinite Cylinders

January 2009: Applied Dynamical Systems Seminar, Department of Mathematics, Drexel University, Philadelphia, PA
Self-induced Stochastic Resonance: How New Non-random Behaviors can Arise from the Action of Noise

March 2009: PDE Seminar, Department of Mathematics, Swansea University, Swansea, UK
Self-induced Stochastic Resonance: How New Non-random Behaviors can arise from the Action of Noise

April 2009: Applied Mathematics Colloquium, Department of Mathematics, Drexel University, Philadelphia, PA
A Variational Approach to Front Propagation in Infinite Cylinders

May 2009: SIAM Meeting on Applications of Dynamical Systems, Snowbird, UT
Noise-induced Mixed-mode Oscillations in a Relaxation Oscillator near the Onset of a Limit Cycle

Farzan Nadim

July 2008: Computational Neuroscience Meeting, Portland, OR
1) Flattening the PRC: Periodic Inhibitory Feedback Promotes Oscillation Stability
2) The Role of Anatomical Structure in Determining Activity in Electrically-coupled Neuronal Networks
3) Approximating the Phase Response Curves of Square Wave Bursting Neurons
4) Systematic Selection of Model Parameter Values Matching Biological Behavior under Different Simulation Scenarios

August 2008: SIAM Life Sciences 08, Montreal, Canada
Geometric and Analytic Analysis of the Role of the A-Current on the Transient and Long-Term Behavior of a Neuron Receiving Inhibitory Input

September 2008: Dept of Physics Colloquium, Korea University, Seoul, S. Korea
The Role of Descending Projection Neurons and Feedback in Rhythmic Motor Pattern Generation

September 2008: The Meeting of the Korean Society of Mathematical Biology, Seoul, S. Korea
The Role of Anatomical Structure in Determining Activity in Electrically-coupled Neuronal Networks

November 2008: Society for Neuroscience Annual Meeting, Washington DC
1) Switch in the Locus of Activity through Actions of Descending Projection Neurons
2) Conductance Coregulations in a 2-compartment Model of the Anterior Burster (AB) Neuron in the Lobster Pyloric Pacemaker Kernel
3) The Individual Effects of Co-released Neuromodulators on Synaptic Interactions in an Oscillatory Network
4) Prediction of the Activity Phase of a Follower Neuron Determined by the Strength and Distribution of the Intrinsic and Synaptic Currents
5) The Influence of Voltage Range on Membrane and Synaptic Resonance of Neurons in an Oscillatory Network
6) The Role of Neuromodulation in Promoting Stability of Pacemaker Neurons Rhythm Period

April 2009: East Coast Nerve Net, Woods Hole, MA
Membrane Capacitance: It Depends on How It's Measured

D.T. Papageorgiou

December 2008: Applied Mathematics Seminar, School of Mathematics, University of East Anglia, U.K.
On a Class of Exact Solutions of the Navier-Stokes Equations: Applications and an Appraisal using Direct Numerical Simulations

January 2009: Fluid Dynamics Seminar, DAMTP, University of Cambridge, U.K.
Thin Film Electrohydrodynamics

March 2009: Theoretical Mechanics Seminar, School of Mathematics, University of Nottingham, U.K.
Thin Film Electrohydrodynamics

April 2009: British Applied Mathematics Colloquium (Incorporating the 51st British Theoretical Mechanics Colloquium), Nottingham, U.K.
Nonlinear Dynamics of Core-annular Flows in the Presence of Surfactants

June 15 - 19, 2009: International Centre for Mechanical Sciences, Udine, Italy
Multiphase Microfluidics - The Diffuse Interface Model (5 day lecture series)

Horacio G. Rotstein

July 2008: Facultad de Matematica, Astronomia y Fisica (FaMAF), Universidad Nacional de Cordoba, Argentina
Dynamic Aspects of the Creation of Theta Rhythmic Activity in the Hippocampus: A Modeling Study

July 2008: Encuentro Internacional de Ecuaciones Diferenciales (EIED)
Mathematical Biology

July 2008: Laboratorio de Neurociencia Integrativa, Departamento de Fisica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina
The Abrupt Transitions from Theta to Normal (Epileptic) Activity in Medial Entorhinal Cortex Layer II Stellate Cells

October 2008: Mathematical Biology Seminar, Department of Mathematical Sciences, NJIT, Newark, NJ
The Mechanism of Abrupt Transition from Normal to Epileptic Spiking Activity in Medial Entorhinal Cortex Layer II Stellate Cells

November 2008: Annual Meeting of the Society for Neuroscience (SFN)
1) The Transition to Hyperexcitability in Stellate Cells from Layer II of the Medial Entorhinal Cortex during Temporal Lobe Epilepsy: A Modeling Study
2) The Role of Kv7 Mediated Potassium Currents and Recurrent Excitation in Stellate Cells of the Entorhinal Cortex in a Dynamic Clamp Based Model of Temporal Lobe Epilepsy

March 2009: Mathematical Neuroscience Meeting, Royal Society of Edinburgh, Scotland, UK.
The Dynamic Transition from Theta to Hyper-excitable (Gamma) Rhythmic Activity in Medial Entorhinal Cortex Layer II Stellate Cells

March 2009: Reduced Dynamical Models with Biological Applications Study Group. University of Edinburgh, Scotland, UK
Rhythmic Oscillations in Medial Entorhinal Cortex Layer II Stellate Cells

Michael Siegel

May 2009: Seminar, Department of Chemical Engineering, Cornell University, Ithaca, NY
Efficient Numerical Computation of Interfacial Flow with Soluble Surfactant

March 2009: Seminar, Department of Mathematics, Drexel Univeristy, Philadelphia, PA
Efficient Numerical Computation of Interfacial Flow with Soluble Surfactant

March 2009: IMACS Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, GA
Efficient Numerical Computation of Interfacial Flow with Soluble Surfactant

February 2009: Seminar, Department of Mathematics, Duke University, Durham, NC
Efficient Numerical Computation of Interfacial Flow with Soluble Surfactant

January 2009: Workshop on Geometric Singularities and Singular Geometries, Institute for Mathematics and its Applications, Minneapolis, MN
Calculation of Complex Singular Solutions to the 3D Euler Equations

Sundar Subramanian

July 2008: Summer Program Seminar Series, Department of Mathematical Sciences, NJIT, Newark, NJ
Survival Analysis: An Overview

August 2008: Joint Statistical Meetings, Denver, CO
Bootstrap Bandwidth Selection for Estimating a Conditional Probability

March 2009: Aachen University of Applied Sciences, Aachen, Germany
The Missing Censoring Indicator Model

Svetlana Tlupova

November 2008: APS 61st Annual Meeting of the Division of Fluid Dynamics, San Antonio, TX
Domain Decomposition Methods for Solving Stokes-Darcy Systems Based on Boundary Integrals

February 2009: Applied Dynamical Systems Seminar, Department of Mathematics, Drexel University, Philadelphia, PA
Solution of Stokes-Darcy Problems Using DDM

Jean-Marc Vanden-Broeck

August 2008: Workshop on Waves, Perati, Brazil
Three Dimensional Gravity Capillary Solitary Waves

August 2008: International Congress of Theoretical and Applied Mechanics, Adelaide, Australia
Nonlinear Gravity Capillary Waves

March 2009: Oxford, UK
Three-dimensional Gravity-capillary Solitary Waves

April 2009: British Applied Mathematics Colloquium
1) On Satisfying the Radiation Condition in Free-surface Flows
2) How can Exponential Asymptotics be used to Reveal the Hidden Surface Waves of Low-speed Flows
3) Steady and Unsteady Gravity-capillary Flows in Three Dimensions and Related Flows

Yuan-Nan Young

November 2008: APS Division of Fluid Dynamics, San Antonio, TX
Direct Numerical Simulations of the Large-amplitude Internal Waves

March 2009: SIAM Conference on Computational Science and Engineering, Miami, FL
Dynamics of Suspension of Semi-flexible Filaments

May 2009: Applied Math Colloquium, Department of Mathematics, University of Delaware
Dynamics of Suspension of Semi-flexible Filaments

June-July 2009: Softflow 2009: Complex and Bio-fluids, Miami, FL
Dynamics of Suspension of Semi-flexible Filaments

July 2009: Applied Math Colloquium, Department of Applied Mathematics, National Chiao-Tung University, Taiwan
Influence of Soluble Surfactant on Bubble Dynamics in Stokes Flows

C. TECHNICAL REPORTS

REPORT 0809-1: *Multistability of Clustered States in a Globally Inhibitory Network Fluid*
Amitabha Bose, Lakshmi Chandrasekaran, and Victor Matveev

REPORT 0809-2: *State Dependence of Network Output: Modeling and Experiments*
Farzan Nadim, Vladimir Brezina, Alain Destexhe, and Christiane Linster

REPORT 0809-3: *Multiple Imputations Based Estimation of Survival Functions*
Sundaraman Subramanian

REPORT 0809-4: *A Generalized Inverse Censoring Weighted Survival Function Estimator*
Sundaraman Subramanian and Peixin Zhang

REPORT 0809-5: *An Augmented Inverse Probability Weighted Survival Function Estimator*
Sundarraman Subramanian and Dipankar Bandyopadhyay

REPORT 0809-6: *Dynamics of One- and Two-dimensional Fronts in a Bistable Equation with Delayed Global Coupling: Localization and Control*
Yassine Boubendir, Vicenc Mendez, and Horacio G. Rotstein

REPORT 0809-7: *A Statistical Approach to RDX Detection with THz Reflection Spectra*
Ivan Zorych, Yew Li Hor, Alexander M. Sinyukov, Zoi-Heleni Michalopoulou, Robert B. Barat, Dale E. Gary, and John F. Federici

REPORT 0809-8: *Membrane Resonance in Bursting Pacemaker Neurons of an Oscillatory Network is Correlated with Network Frequency*
Vahid Tohidi and Farzan Nadim

REPORT 0809-9: *On the Breakup of Fluid Rivulets*
Javier A. Diez, Allejandro G. Gonzalez, and Lou Kondic

REPORT 0809-10: *Nanoparticle Assembly via the Dewetting of Patterned Thin Metal Lines: Understanding the Instability Mechanism*
Lou Kondic, Javier A. Diez, Philip D. Rack, Yingfeng Guan, and Jason D. Fowlkes

REPORT 0809-11: *Stability of a Finite-Length Rivulet under Partial Wetting Conditions*
Javier A. Diez, Allejandro G. Gonzalez, and Lou Kondic

REPORT 0809-12: *Generalized Genomic Matrices, Silver Means, and Pythagorean Triples*
Jay Kappraff and Gary W. Adamson

REPORT 0809-13: *Influence of Surfactant Solubility on the Deformation and Breakup of a Bubble or Capillary Jet in a Viscous Fluid*
Y.-N. Young, M.R. Booty, M. Siegel, and J. Li

REPORT 0809-14: *Median Regression using Inverse Censoring Weights*
Sundar Subramanian and Gerhard Dikta

REPORT 0809-15: *Hydrodynamic Interactions between Two Semi-Flexible In-Extensible Filaments in Stokes Flow*
Y.-N. Young

REPORT 0809-16: *Nonlinear Hydrodynamic Phenomena in Stokes Flow Regime*
R. H. Goodman, Y.-N. Young, N. Khurana, J. Blawzdziewicz, and E. Wajnryb

REPORT 0809-17: *Generalized DNA matrices, Silver Means, and Pythagorean Triples*
Jay Kappraff1 and Gary W. Adamson

REPORT 0809-18: *Symmetries, Generalized Numbers and Harmonic Laws in Matrix Genetics*
J. Kappraff and S. Petoukhov

REPORT 0809-19: *Ancient Harmonic Law (version 2)*
Jay Kappraff

REPORT 0809-20: *The Influence of the A-current on the Dynamics of an Oscillator-follower Inhibitory Network*
Yu Zhang, Amitabha Bose, and Farzan Nadim

REPORT 0809-21: *Regulation of Motor Patterns by the Central Spike Initiation Zone of a Sensory Neuron*
Nelly Daur, Farzan Nadim, and Wolfgang Stein

REPORT 0809-22: *Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations*
M. Siegel and R. Caflisch

REPORT 0809-23: *Stokes-Darcy Boundary Integral Solutions Using Preconditioners*
Yassine Boubendir and Svetlana Tlupova

REPORT 0809-24: *Discovery and Assessment of New Target Sites for Anti-HIV Therapies*
C. Breward, J. Heffernan, N. Madras, R.M. Miura, and M.P. Sorensen

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES AND AWARDS

Daljit S. Ahluwalia

Member Committee of Meetings and Conferences, AMS.

Roman I. Andrushkiw

Invited member, Organizing Committee, Ukrainian Mathematical Congress, Kyiv, Ukraine, 2009.

Honorary member, Kyiv Mathematical Society (since 2008).

Patent Application: Computer-Aided Cytogenetic Method of Cancer Diagnosis (coinventors: N. V. Boroday, D.A. Klyushin, Y.I. Petunin), Non-provisional Patent Application, July 2008.

John Bechtold

Invited by the New Jersey Department of Education to participate on a Math Task Force to assist in developing effective solutions to improve student achievement in K-12 mathematics.

Manish Bhattacharjee

Editorial Board of the Journal Oriental J. Math.

External member/examiner of Ph.D. dissertations in Statistics for Calcutta University, India.

Member of the Round Table Group expert consortium for consulting.

Biostatistics-I Session Chair, FACM'09, June 1-2, 2009 at NJIT.

Denis Blackmore

Associate Editor, Mechanics Research Communications (2007-).

Editorial Board, Regular and Chaotic Dynamics (2006-).

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

Editorial Board, Differential Equations and Applications (2008-).

Served on NSF Dynamical Systems Panel (April, 2009).

Member of International Scientific Committee for First Trans-Carpathian Ukrainian-Polish-Hungarian Workshop on Modern Analysis and Nonlinear Mathematics, Drohobych, Ukraine, Sept. 18 – 21, 2008.

Organized (with B. Shashikanth) minisymposium on Dynamics of Vortical Flows at the 2009 SIAM Applied Dynamical Systems Conference, Snowbird, Utah, May 17-21, 2009.

Advisor during 2008-2009 to: sophomore student, Aminur Rahman on a project on chaotic discrete and continuous dynamical systems modeling of certain types of electrical circuits; Gerardo Santacruz, a talented high school student, on a project involving algebra and topology; and Applied Physics student, Kevin Urban, on a project on fractional differential representation of field theories.

Invited to become a Charter Member of the Leading Intellectuals of the World by ABI (2008).

International Plato Award for Educational Achievement by IBC (2008).

Victoria Booth

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

Bruce Bukiet

The Journal of the American Osteopathic Association awarded its 2009 George W. Northup, DO, Medical Writing Award to the article "Three-Dimensional Mathematical Model for Deformation of Human Fasciae in Manual Therapy (with R. Schleip, Z. Ji, M. Maney, and T. Findley)" which appeared in the JAOA's August 2008 issue. The Northup Award recognizes contributions to the JAOA that have the potential to change the way osteopathic physicians think, practice medicine, and conduct research. It is on this basis that the article was recognized as the best article published in the JAOA in 2008.

Member, Franz Edelman Award Committee, INFORMS (Institute for Operations Research and Management Science).

NSF-GK-12 Review Panel, Aug. 21-22, 2008.

Wooyoung Choi

Co-organizer of Mini-symposium on Waves, Stratified fluids and Transport at the SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy, July 2008.

Linda Cummings

Awarded OCCAM (Oxford Centre for Collaborative Applied Mathematics) Visiting Fellowship, to be held at OCCAM, University of Oxford, UK.

Sunil Dhar

Member, Organizing Committee for Frontiers in Applied and Computational Mathematics Conference
(FACM'09), NJIT, June, 2009.

Fadi P. Deek

The NJIT Alumni Association's Alumni Achievement Award, 2009.

Javier Diez

Secretary of Science, Art and Technology, Universidad Nacional del Centro, Tandil, Argentina (Dec/07-Dec/08).

Vladislav V. Goldberg

Editorial Board Member, Webs and Quasigroups (Tver, Russia).

Editorial Board Member, Rendiconti del Seminario Matematica di Messina.

Editorial Board Member, Journal of Generalized Lie Theory and Applications.

Deputy of the Editor-in-Chief, Proceedings of the International Geometry Center.

Member, Scientific Bureau of the Geometry Series, Contemporary Mathematics and its Applications.

Member, Bureau of the International Geometry Center, Odessa, Ukraine.

Peter Gordon

Excellence in Advising Award by the Senate of NJIT.

Huaxiong Huang

Visiting Scientist, Riken Institute, Japan, October 1, 2008 - March 31, 2010.

Visiting Professor, Shanghai Jiaotong University, China, November 2006 - November 2009.

Erskine Visiting Fellow, University of Canterbury, New Zealand, July - August, 2009.

Aridaman Jain

Chair of the American Society for Quality (ASQ) Writing Committee for Chain Sampling Procedures for Inspection by Attributes: ANSI/ASQ S3. A revised draft of this document was circulated in April 2009 for public comments.

Judge at the Twenty-Sixth Annual North Jersey Regional Science Fair at Rutgers University, New Jersey, March 20-21, 2009.

Lou Kondic

Member, Specialist Review Committee for Fulbright Scholar Program.

Discussion Leader, Gordon Conference on Nonlinear Science, June 2009.

Gregory Kriegsmann

Elected Fellow of the Society for Industrial and Applied Mathematics (May 2009).

Associate Editorships:
1) IMA Journal of Applied Mathematics
2) European Journal of Applied Mathematics
3) Journal of Engineeding Mathematics

Robert M. Miura

Chair, Board of Governors, Mathematical Biosciences Institute (NSF Funded), Ohio State University, Columbus, Ohio, 2008-2010.

Chair, SIAM Activity Group on Life Sciences (2007-2008).

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

SIAM Book Editorial Board.

Elected Fellow of the Society for Industrial and Applied Mathematics (May 2009).

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, Conference on Applied Mathematics, City University of Hong Kong, June 2010.

Organizing Committee, SIAM Conference on Mathematics for Industry 2009.

Farzan Nadim

Review Editor, Journal of Neuroscience.

Review Editor, Frontiers in Neural Circuits.

Symposium Chair and Talk, Society for Neuroscience Annual Meeting, Washington, DC.

D.T. Papageorgiou

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

Editorial Board Member, Computational and Applied Mathematics.

Fellow of the Institute of Mathematics and its Applications.

Horacio G. Rotstein

Subsidio Cesar Milstein (Cesar Milstein Fellowship). Programa Raices, Ministerio de Ciencia, Tecnologia e Innovacion Productiva, Argentina.

Michael Siegel

Member of Editorial Board, SIAM Journal of Applied Mathematics.

Jean-Marc Vanden-Broeck

Fellow of the Institute of Mathematics and its Applications.

Editor, Quarterly Journal of Mechanics and Applied Mathematics.

Editor, ANZIAM Journal.

Yuan-Nan Young

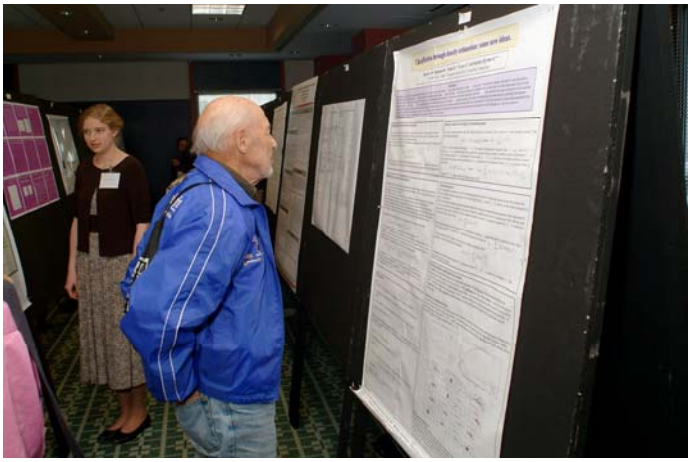
Reviewing activities for peer reviewed journals: JFM, PRE, PRL, and Journal of Physics A.

Reviewing activities for funding agencies: National Science Foundation.

B. CONFERENCE ON FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS (FACM '09)

The sixth conference on Frontiers in Applied and Computational Mathematics was held at NJIT on June 1-2, 2009. The two-day event for leading mathematical minds provided an unusual forum for a collegial exchange of ideas and results at the frontier of research in the mathematical sciences. More than 50 symposia and lectures focused on problems in mathematical biology and biostatistics, areas of research strength at NJIT.

Conference highlights included 4 plenary talks, 44 invited talks, and 10 contributed talks. Forty posters were presented by faculty, postdocs, and graduate and undergraduate students. The plenary lectures featured: Larry Abbott (Columbia University College of Physicians and Surgeons), Martine Ben Amar (LPS, Paris), Stuart Pimm (Duke University), and John Rinzel (New York University). The National Science Foundation, Howard Hughes Medical Institute, Mathematical Biosciences Institute, and Society for Mathematical Biology have provided support for the conference.



Dr. Joseph Keller at poster session

June 1st Dinner

Front row L-R: CSLA Dean Fadi Deek, Interim Provost Donald Sebastian, Stuart Pimm, Martine Ben Amar, President Robert Altenkirch

Back row L-R: Linda Cummings, John Rinzel, Daljit S. Ahluwalia, Robert M. Miura

June 1st Dinner
Front row L-R: Berton Earnshaw, Duane Nykamp, Victoria Booth, Farzan Nadim
Back row L-R: Horacio Rotstein, Eric Shea-Brown, Ernest Barreto, Kresimir Josic

Left to right: President Altenkirch, Interim Provost Sebastian, and Dr. Ahluwalia, DMS Chair and CAMS Director

Left to right: Dr. Ramaswamy, Dr. Ahluwalia, Dean Deek, Dr. Bose

The invited speakers were from the academia, as well as from the corporate R&D division of pharmaceutical companies such as Novartis, and Merck Research Laboratories. Additionally, to encourage young scientists working in Biostatistics and related public health research; several post-doctoral fellows working in national laboratories such as the National Institutes of Health (NIH) were invited to present and share their research. Apart from lectures, the conference featured an NSF sponsored panel discussion.

"Future Roles for Mathematics and Statistics within the Biological Sciences"
National Science Foundation-funded Panel Discussion, Monday June 1, 2009

Panelists: Carson Chow (NIH), Robert M. Miura (NJIT), Stuart Pimm (Duke U.), and Daniel Zelterman (Yale U.). Moderator: Farzan Nadim (NJIT).

A panel discussion entitled “Future roles for mathematics and statistics within the biological sciences” was held as part of the Frontiers in Applied and Computational Mathematics (FACM 09) meeting at the New Jersey Institute of Technology. The meeting and the panel discussion were attended by over 100 participants. Below is a brief summary of the discussion.

The moderator, Farzan Nadim, started by posing two questions to the panelists and asked each to respond. He then opened the floor to questions and comments from the audience. The first question posed by Nadim was:

1. Mathematics is the structural framework in many sciences but not biology. Does biology need mathematics as a framework, and what are the challenges in producing the fundamental theoretical frameworks in the life sciences?

While there was wide agreement that mathematics can help to provide a theoretical framework for the life sciences, there was considerable disagreement over whether any framework had already been established. Indeed one of the panelists argued that the framework had already been established, at least in the field of ecology, and had been enormously influential in guiding research in that field. On the other hand, a different panelist argued that the success that mathematicians had in providing a framework for the physical sciences may not necessarily translate over to the life sciences. His primary concern was that biological systems are terribly complex, with many interacting components that are not necessarily governed by a fundamental set of "laws" in the way that physical systems are. He did see a role for mathematicians in organizing the enormous amounts of data being generated. A third panelist strongly suggested that statisticians, in particular, had unique opportunities in shaping the research agendas in the biomedical field.

The second question posed by Nadim was:

2. How can we educate biology students in mathematics and statistics?

The panelists parsed this question into several different categories based on what kind of student was being considered, i.e., an undergraduate student intending to go to medical school, an undergraduate student intending to pursue doctoral work, or a graduate student already enrolled in a Ph.D. program. In all cases, it was agreed that students should have enough mathematical and quantitative skills to be able to understand the types of experimental or clinical data being generated and whether the conclusions inferred from that data are correct and meaningful. How to bring students to this level yielded considerable differences of opinion. In particular, one panelist argued very strongly that courses in Calculus and Statistics alone was not sufficient preparation. He argued that every student, not just biology students, should take math courses through the differential equations level and even consider taking linear algebra. Another panelist argued that there needs to be math courses specifically targeted to biology students, such as a "Calculus for Life Sciences" class. Yet a third panelist was firmly against this idea, which he termed the current dogma and stated that instead biology students should learn the same math and statistics that others are getting. They should then specialize into mathematical biology and biostatistics courses as needed. All panelists agreed that mathematics and the critical type of thinking provided in this discipline needs to be integrated at a very early stage into the teaching of biology. The suggestion was made that the undergraduate stage was far too late to begin the process and they advocated for a more fundamental marriage of mathematics and biology at the elementary and secondary school levels.

There were many questions and comments from the audience. In particular, there were a few from some current students who asked about what they should be doing now to enhance their abilities to work in an interdisciplinary field. The overwhelming response, perhaps not surprisingly, was "Learn more math"! Others shared their positive and negative experiences with trying to create mathematical biology programs or courses at their respective institutes.

Overall the session was very lively and informative. The participants appeared to be satisfied with the discussion.

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

1. *Statistical Data Analysis*

   NJ Meadowlands Commission: November 1, 2006 – December 31, 2009
   Daljit S. Ahluwalia
   Aridaman Jain

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

   National Science Foundation: August 2006 - August 2010
   Bruce Bukiet
   Arthur B. Powell
   Ismael Calderon
   Gayle Griffin

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

   Office of Naval Research: May 1, 2005 - April 30, 2010
   Wooyoung Choi
   Robert Beck
   Marc Perlin

4. *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

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

   Office of Naval Research: January 15, 2008 - December 31, 2009
   Wooyoung Choi

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

   National Science Foundation: September 2006 - August 2010
   Amitabha Bose

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

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

8. *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

9. *Fast and Accurate Numerical Algorithms for Boundary Value Problems of Elliptic Partial Differential Equations on Open Surfaces in Three Dimensions*

National Science Foundation: July 15, 2007 - June 30, 2009
Shidong Jiang

10. *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

11. *Bridging the Spatial and Temporal Scales in Dense Granular Systems*

National Science Foundation: August 15, 2006 - August 15, 2009
Lou Kondic

12. *Pan American Study Institute on Interfacial Fluid Dynamics: From Mathematical Theory to Applications*

National Science Foundation: September 1, 2006 - August 31, 2008
Lou Kondic (PI)
George (Bud) Homsy, UCSB (Co-PI)

13. *Applied Mathematical Problems in Microwave Processing of Ceramics*

Department of Energy: September 15, 2004 - September 15, 2008
Gregory A. Kriegsmann

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

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

15. *Efficient Inversion in Underwater Acoustics*

Office of Naval Research: January 1, 2008 - December 31, 2009
Zoi-Heleni Michalopoulou

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

ONR: June 1, 2007 - May 31, 2010
Zoi-Heleni Michalopoulou

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

National Science Foundation: January 1, 2007- December 31, 2009
Zoi-Heleni Michalopoulou
Roy Goodman
David J. Horntrop
Michael Siegel

18. *Stretching of Heated Threads*

National Science Foundation: August 15, 2007 – July 31, 2010
Robert M. Miura

19. 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, 2009
Robert M. Miura
Joshua Berlin, NJMS-UMDNJ
James Tepper, Rutgers-Newark

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

National Science Foundation: July 15, 2005 – July 4, 2009
Richard O. Moore
Keith Promislow (Michigan State University)

21. Simulation of Rare Events in Lightwave Systems

National Science Foundation University-Industry Cooperative Research Program: September 1, 2007 - August 31, 2009
Richard O. Moore

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

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

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

National Science Foundation-Mathematical Sciences Division: August 15, 2007 - August 14, 2010
Demetrios T. Papageorgiou

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

National Science Foundation: July 1, 2007 - June 30, 2010
Michael Siegel
Russel Caflisch

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

National Science Foundation - Division of Mathematical Sciences: July 1, 2007 - June 30, 2010
Michael Siegel
Michael Booty
Yuan-Nan Young

PROJECTS FUNDED DURING PRESENT FISCAL YEAR

1. *Conferences on Frontiers in Applied and Computational Mathematics (FACM): May 19-21, 2010*

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

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

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

3. *Fulbright Travel Award*
   Amitabha Bose

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

   Roche: October 2008 - October 2009
   Bruce Bukiet
   Eric Blitz

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

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

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

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

7. *Nonlinear Waves and Dynamical Systems*

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

8. *CDI-Type II: Collaborative Research: Computational Homology, Jamming, and Force Chains in Dense Granular Flows*

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

9. *Calcium Dynamics in Exocytosis and Synaptic Facilitation*

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

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

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

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

1. *Computer-Aided Cytogenetic Method of Cancer Diagnosis, Council for International Exchange of Scholars (CIES)*

   Fulbright Scholar Program
   Roman Andrushkiw

2. *Collaborative Research: Dynamical Analysis, Simulation and 3D X-Ray Imaging of Density Relaxation in Granular Systems*

   National Science Foundation: August 1, 2009 - July 31, 2012
   Anthony Rosato
   Denis Blackmore
   Theodore Heindel
   Song Zhang

3. *Innovations in Dynamic Modeling and Analysis of Vortex Breakdown Flows*

   National Science Foundation: September 1, 2009 - August 31, 2012
   Denis Blackmore

4. *The Role of Descending Projection Neurons and Feedback in Rhythmic Motor Pattern Generation*

   National Science Foundation/National Institutes of Health: July 1, 2009 - June 30, 2014
   Farzan Nadim
   Amitabha Bose
   Nickolas Kintos
   Michael P. Nusbaum

5. *Mobile Science Teaching Lab*

   Hyde and Watson Foundation: July 2009 - June 2010
   Bruce Bukiet
   Eric Blitz

6. *CMG: Collaborative Research: Understanding, Modeling and Detecting Surface Signatures of Nonlinear Internal Wave Dynamics*

   National Science Foundation: September 1, 2009 - August 31, 2012
   Wooyoung Choi
   Roberto Camassa
   David Lyzenga

7. *FRG: Collaborative Research: Modeling Forcing and Dissipation in the Sea Surface Energy Balance with Application to Microwave Remote Sensing of the Sea Surface and Oceanography*

National Science Foundation: August 1, 2009 - July 31, 2012
Greg Baker
Wooyoung Choi
Joel Johnson
Mark Sussman

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

National Science Foundation: January 1, 2010 - December 31, 2012
Peter Petropoulos
Michael Booty
Linda Cummings
Lou Kondic

9. *Modeling and Analysis of Nematic Liquid Crystals in Thin Geometries: Bistable Configurations and Free Surface Instabilities*

National Science Foundation: July 1, 2009 - June 30, 2012
Linda Cummings
Lou Kondic

10. *Molecular and Pathophysiological Mechanisms of Cardioprotection*

National Institute of Health: April 2010 - March 2015
Junichi Sadoshima
Sunil Dhar

11. *QNS training grant to NIBIB T32 National Institutes of Health*

National Institute of Health: April 2009 - March 2014
Robert M. Miura
Sunil K. Dhar

12. *Problems Arising in Modeling of Porous Media*

National Science Foundation: August 1, 2009 - July 31, 2012
Peter Gordon

13. *Development of Spectral Schemes for Stochastic Partial Differential Equations with Application to Materials*

National Science Foundation: July 1, 2009 - June 30, 2012
David J. Horntrop

14. *Stable, Accurate, and Efficient Algorithms for Linear and Nonlinear Schrodinger Equations on Unbounded Domains*

National Science Foundation: June 1, 2009 – May 31, 2012
Shidong Jiang

15. *AF: Medium: Collaborative Research: Integral-Equation-Based Fast Algorithms and Graph-TheoreticMethods for Large-Scale Simulations*

National Science Foundation: June 1, 2009 – May 31, 2013
Shidong Jiang
Jingfang Huang
Xiaobai Sun
Nikos Pitsianis

16. *Collaborative Research: Fluctuations in Dense Granular Flows*

National Science Foundation: February 1, 2009 - January 31, 2012
Lou Kondic

17. *Microstructure, Fluidization, and Control of Penetrator Trajectories in Granular Media*

Department of Defense Basic and Applied Sciences Directorate
Lou Kondic
Robert P. Behringer (Duke University)
Corey O'Hern (Yale University)
Wolfgang Losert (University of Maryland)

18. *Instabilities of Fluid Films and Rivulets*

National Science Foundation: July 1, 2009 - June 30, 2011
Lou Kondic

19. *Symposium on Force Chain Fluctuations and Jamming in Dense Granular Flows*

National Science Foundation: May 1, 2009 - April 30, 2010
Lou Kondic

20. *Group Undergraduate Biology and Mathematics Training Program at NJIT*

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

21. *Interdisciplinary Undergraduate Program in Nanotechnology*

National Science Foundation: January 1, 2010 – December 31, 2011
Raquel Perez-Castillejos
Ismael Calderon
Haim Grebel
Zoi-Heleni Michalopoulou
Leonid Tsybeskov

22. *DynSyst Specia Topics: Collaborative Research: Stochastic Dynamical Systems in Nonlinear Optics*

National Science Foundation: July 1, 2009 - June 30, 2012
Richard O. Moore
Tobias Schaefer (CUNY-Staten Island)
Gino Biondini (University at Buffalo)

23. Winding Domain Walls in Thin Ferromagnetic Films

National Science Foundation: July 1, 2009 - June 30, 2012
Cyrill Muratov

24. Semiparametric Random Censorship Models in Cancer Survival Studies

National Cancer Institute: April 1, 2009 – March 31, 2011
Sundar Subramanian
Gerhard Dikta

25. Semiparametric Methods for Competing Risk Analysis in Cancer Research

National Cancer Institute: January 1, 2010 – December 31, 2011
Sundar Subramanian
Gerhard Dikta

26. *Direct Numerical Simulations of Elastic Filament Suspensions and Multi-scale Modeling of Soft-particle Suspensions*

National Science Foundation-CBET: September 1, 2009 - August 31, 2011
Yuan-Nan Young

27. *Hydrodynamic Interactions of Lipid Vesicles*

National Science Foundation-CBET: July 1, 2009 – June 30, 2012
Yuan-Nan Young (co-PI with P. Vlahovska, Dartmouth College and George Biros, Georgia Tech)

CONTINUING PROJECTS — NOT THROUGH CAMS

1. *Collaborative Research in Computational Neuroscience-Modeling Neuromusculoskeletal Alterations after Spinal Cord Injury*

National Institutes of Health – National Institute of Neurological Disorders and Stroke:
August 1, 2005 – May 31, 2009
Ranu Jung
James Abbas
Thomas Hamm
Victoria Booth
Gary Yamaguchi

2. *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

3. *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

4. *Succession and Community Development on Restored Wetland and Uplands in Liberty State Park*

NJ Department of Environmental Protection Grant, 2008-2010
Claus Holzapfel

5. *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

6. *Numerical Methods for Incompressible Flows with (Moving) Interfaces: Algorithm, Error Analysis and Biological Application*

Chinese National Science Foundation: January 1, 2005 - December 31, 2008
Huaxiong Huang (Joint with C. Lu in Shanghai Jiatong University)

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

US Department of Transportation/New Jersey Department of Transportation:
July 2007- June 2009
Steven Chien
Jay Meegoda

8. *Non-Contact Skid Resistance Measurement*

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

9. *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

10. *Nonlinear Electrified Viscous Free Surface Flows over Topography*

Engineering and Physical Sciences Research Council, UK: August 15, 2006 - August 14, 2008
Mark Blyth
Jean-Marc Vanden-Broeck

11. *Inestabilidades en Flujos de Recubrimiento*

Agencia Nacional de Promocion de la Ciencia y la Tecnologia (Argentina)
June 2008- June 2010

Javier Diez

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

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

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

CERG (Hong Kong) 2007-2010
Jonathan Wylie

14. *Deflection of Granular Jets*

CERG (Hong Kong) 2008-2011
Jonathan Wylie

15. *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

16. *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

17. *Nonlinear Electrified Viscous Free Surface Flows over Topography*

Engineering and Physical Sciences Research Council, UK
August 15, 2006 - August 14, 2008
Mark Blyth
Jean-Marc Vanden-Broeck

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: December 2008, Client: Stephen F. Vatner and Lin Yan, Department of Cell Biology and Molecular Medicine, UMDNJ.
Description: Woodchucks in winter are compared with woodchucks in summer for the number of them that experience arrhythmia. A rate of woodchucks experiencing arrhythmia in summer is given. The optimal number of woodchucks that need to be observed in winter is obtained based on a significant difference for a given fixed number of woodchucks experiencing arrhythmia in winter.
Consultant: Professor Sunil K. Dhar

Date: July 2008, Client: Ken Beyer, Department of Unique Wire Weaving Company.
Description: ASTM Standard E11 for the inspection of sieve openings in the warp and weft directions was revised to include an appendix on the 99% and 99.73% confidence intervals for the sample variances used for making acceptance/rejection decisions. These confidence intervals were derived by using the normal distribution as an approximation to a Chi-square distribution for sample variance, when sample size is at least 15.
Consultant: Professor Aridaman Jain

Date: July 2008, Client: Attorney General of New Jersey
Description: Computed the minimum number of votes to be audited in a close election between two candidates X and Y to achieve specified confidence levels that the true difference between the proportions of votes cast is within pre-determined margin of the difference between the estimated audit proportions of votes for the candidates for several sets of values of confidence levels and error margins.
Consultant: Professor Aridaman Jain

Date: July 2008 – August 2008, Client: Francisco Artigas (New Jersey Meadowlands Commission – Meadowlands Environmental Research Institute)
Description: Conducted a statistical analysis of the data from 10 sites in Kearney Marsh to test the effect of AquaBlok on the level of metal and organic contaminates. These measurements were obtained from 3 sources: sediment, water and benthics organisms. The following effects

were estimated: pre-post total, pre-post by site, pre- post seasonal, pre-post seasonal by site, post seasonal total. In Phase I, the following interrelationships were also examined: between the sediment observations and the benthics data, between the water observations and the benthics data, and between the water observations and the sediment observations.
Consultants: Professor Ken Johnson

Date: January 2009 – April 2009, Client: Francisco Artigas (New Jersey Meadowlands Commission – Meadowlands Environmental Research Institute)
Description: Conducted a Phase II statistical analysis of the data from 10 sites in Kearney Marsh when a calibration error was discovered after the completion of Phase I and the data was reprocessed with the new calibration. The effects of two types of AquaBlok – with Peat Moss and without Peat Moss - on the level of metal and organic contaminates were estimated. The statistical analysis of Phase I was repeated and the statistically significant - effects for each type of AquaBlok were identified.
Consultants: Feiyan Chen and Professor Ken Johnson

Date: July 2008 – June 2009, Client: Francisco Artigas (New Jersey Meadowlands Commission – Meadowlands Environmental Research Institute)
Description: Analyses of the data collected for the Near-Road Air Quality Study near the New Jersey Turnpike during September '07 - September '08 to estimate the effects of season, weekday/weekend, wind direction, wind speed, distance from turnpike, traffic volume, and environmental conditions on the selected air pollutants. Preliminary analysis of the one-year data has been completed to identify the variables that have statistically significant effects on TSP, PM2.5, and PAH. Currently, MERI is re-examining the definition of wind direction and incorporating metals data in the database after which we will do further data analysis and modeling.
Consultants: Lianzhe Xu, Professors Ken Johnson and Aridaman Jain

Date: November 2008 – June 2009, Client: Francisco Artigas (New Jersey Meadowlands Commission – Meadowlands Environmental Research Institute)
Description: Conducted a statistical analysis of the metal concentration and organic composites data collected from clean wetland soils in Northeast marsh and the Southeast marsh in October '07 and June '08. Estimated the effects of 2 levels of elevation, 2 marshes, 2 depths, and 2 time period on metal and organic concentration. The statistically significant effects – both main and interaction – have been identified.
Consultants: Professor Aridaman Jain

IX. CURRENT AND COLLABORATIVE RESEARCH

A. RESEARCH AREAS IN CAMS

Mathematical Biology

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

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. Sheldon Wang uses techniques of fluid dynamics to study various biological phenomenon including the development of immersed boundary/continuum methods for highly deformable shells/beams and solids immersed in biological fluids. 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: Bechtold, Booty, Bukiet, Choi, Cummings, Diez, Gordon, Huang, Jiang, Kondic, Luke, Mauri, 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 (Booty, Cummings, Huang, Kondic, Papageorgiou, Siegel, Vanden-Broeck), thin films (Cummings, Diez, Kondic), electrohydrodynamics (Papageorgiou, Petropoulos, Vanden-Broeck), hydrodynamic stability theory (Papageorgiou), sedimentation (Luke, Mauri), granular flow (Kondic, Rosato) and combustion (Bechtold, Booty, Bukiet, Gordon). A particular focus for several of the faculty members (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, Petropoulos, and Wang.

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 investigation 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, Wang, 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: Bhattacharjee, Bukiet, Choi, Goodman, Horntrop, Jiang, Kondic, Luke, Matveev, Michalopoulou, Moore, Muratov, Papageorgiou, Petropoulos, Rosato, Siegel, Tao, Wang, 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 (e.g., Sunil Dhar, Ari Jain and Kenneth Johnson on statistical consulting – in AY 2008-09). The current coordinator of the SCL is Ari Jain. Examples of recent consulting projects, in which graduate students were involved to gain valuable hands-on experience are: (i) survey design to assess the reliability of electronic voting machines, as part of a study commissioned by the Attorney General of the State of New Jersey, and (ii) a statistical analysis of the data from 3 sources (sediment, water and benthics organisms) in 10 sites in Kearney Marsh to test the effect of AquaBlok on the level of metal and organic contaminates and (iii) statistical modeling of the metal concentration and organic composites in clean wetland soils in Northeast/Southeast marsh in October ’07 and June ’08 as a function of levels of elevation, marshes, depths, and time period: as part of several projects with the Meadowlands Environmental Research Institute. An example of biostatistics consulting is: the determination of optimal number of woodchucks that need to be observed in winter based on a specified significant difference for a given fixed percentage of woodchucks experiencing arrhythmia in summer.

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

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 principal research interests are in mathematical modeling and asymptotic analysis, and most of the applications he has considered are in the area of fluid mechanics and combustion. His main studies in combustion have focused on the time-dependent and multidimensional dynamics of propagating reaction waves in gas mixtures, solid phase mixtures, and porous media, analyzed by a combination of multiple scale, stability, and bifurcation techniques. His other studies have included prototype reaction-diffusion models, the dynamics of fast reaction waves, and time-dependent effects in droplet burning. He has also collaborated (with members of the Department of Chemistry and Environmental Science at NJIT) on experimental studies for conditions that minimize pollutant formation in the thermal oxidation of common materials.

His current research interests include: studies on interfacial flows and surfactants (with Michael Siegel and Yuan-Nan Young), localized thermal waves in microwave heating and processing of materials (with Greg Kriegsmann), and studies of the interaction of flexible membranes (or sails) in two-dimensional 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.

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.

Vladislav V. Goldberg

The research of Vladislav V. Goldberg is in the field of differential geometry: projective differential geometry, conformal differential geometry, and the theory of webs. In the first field, he studies submanifolds with degenerate Gauss maps in a multidimensional projective space; in the second one, he studies the theory of lightlike submanifolds; and in the third one, his studies concern the local theory of webs and the algebraic aspects of this theory. His current projects include an investigation of the structure of varieties with degenerate Gauss maps and their singularities, finding conditions of linearizability of d-webs on a two-dimensional differentiable manifold, and writing the book Differential Geometry of Varieties with Degenerate Gauss Maps for Springer-Verlag.

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.

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").

Roberto Mauri

Roberto Mauri's research focuses on two areas. In the first, the transport of heat, mass, and momentum in two phase systems is studied, both experimentally and theoretically. Familiar examples include the flow of suspensions through pipes and the heat and mass conduction through composite materials. Recent results include the determination of the effective velocity and diffusivity of solutes in porous media and in turbulent flow fields and the shear-induced diffusivity of suspensions of rigid spheres. In the second research effort, the phase separation and mixing of liquid mixtures into two phases is studied. Since the phase transition process can be triggered by changing either the temperature or the composition of the system, separation can be achieved either by heating and cooling the solvent mixtures across their miscibility curve, or by adding a solubility modifier. Using this second approach, a new process has been developed to obtain monodisperse distributions of nanoparticles for bioengineering applications.

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.

Svetlana Tlupova

Svetlana Tlupova's research interest lies in numerical methods with some mathematical modeling and applications in fluid dynamics. The main focus is on solving a Stokes-Darcy problem using boundary integral and singularity methods. Her recent research involves applying relatively new techniques to this problem, such as domain decomposition methods and preconditioning approaches. Currently, she is interested in problems that range from studies of free-surface water waves modeled by the Euler equations to the spreading of a micro- scale drop on a porous substrate modeled by Stokes and Darcy flows, and include biological applications such as modeling anticancer drug delivery.

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.

X. Sheldon Wang

The research of Sheldon Wang focuses on combining computational fluid and solid mechanics with various models of physical and chemical phenomena at different temporal and spatial scales. He has successfully implemented his implicit solution strategy based on Newton-Krylov iterations for compressible solids immersed within compressible fluids.

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

Roman I. Andrushkiw

Correlation Algorithm for Cytogenetic Method of Breast Cancer Diagnosis, D.A. Klyushin, Yu.I. Petunin (Kyiv National Taras Shevchenko University) and N.V. Boroday (R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiology, National Academy of Sciences of Ukraine, Kyiv)

John Bechtold

Mathematical Modeling of Premixed Flames at High Pressure, C. K. Law (Princeton University) and G. Jomaas (Technical University of Denmark)

Flame-Flow Interactions and Flow Reversal, H. G. Im and G. Bansal (University of Michigan)

Generalized Mathematical Theories of Premixed Flames, M. Matalon (University of Illinois)

Manish Bhattacharjee

On the Bath-tub vs. U-shape Duality between Mean Remaining Life vs. Hazard Rate Functions without Strong Smoothness Conditions on the Survival Distributions, S. Balaji (George Washington University).

Denis Blackmore

Regularity and Chaos in Vortex Dynamics, L. Ting (CIMS), O. Knio (Johns Hopkins), and B. Shashikanth (New Mexico State)

Effectively Computable Equivalence of Non-manifold Geometric Objects, T. Peters (UConn) and Y. Mileyko (Georgia Tech)

Dynamical Analysis of Granular Flows, A. Rosato (NJIT)

Vortex Breakdown Dynamics, M. Brøns (DTU), A. Goullet (NJIT), and X. Tricoche (Purdue)

Population Dynamics, Y. Joshi (NJIT)

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

Accoustic/Flow Field Dynamics, J. Meegoda and M. Kaur (NJIT)

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

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

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

Wooyoung Choi

Surface Expression for Nonlinear Internal Waves, David Lyzenga (University of Michigan)

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

Dynamics of Nonlinear Internal Waves, Roberto Camassa (University of North Carolina)

Vladislav V. Goldberg

Geodesic Planar Webs and Euler Equations, V. V. Lychagin (University of Tromso, Norway)

Geodesic Webs of Hypersurfaces, V. V. Lychagin (University of Tromso, Norway)

Hyperplanar Webs, V. V. Lychagin (University of Tromso, Norway)

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)

Peter Gordon

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

Stability of Fronts for Systems, A. Ghazaryan (The 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)

Shidong Jiang

Generalized Poincare-Bertrand Formula on a Hypersurface, F. Hang (New York University, Courant Institute of Mathematical Sciences)

Lou Kondic

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

Stability of Isothermal Binary Fluid Mixtures, Burt Tilley (Olin College) and Anette Hosoi (MIT)

Victor Matveev

Interaction between Microdomains of Individual Calcium Channels during 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 Activity, A. Bose and F. Nadim (NJIT)

Robert M. Miura

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

Modeling of Cortical Spreading Depression, H. Huang (York University, Toronto, Canada) and W. Yao (Fudan University, Shanghai, China)

Richard O. Moore

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

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

Cyrill Muratov

Modeling and Computational Analysis of Cell Communication in Development, S. Y. Shvartsman (Princeton University)

Self-induced Stochastic Resonance Phenomena, Weinan E (Princeton University) and Eric Vanden Eijnden (Courant Institute of Mathematical Sciences)

Pattern Formation in Micromagnetics, H. Knupfer and R. V. Kohn (Courant Institute of Mathamatical Sciences)

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

Strong Segregation Limit Energetics in Block Copolymer Systems, M. Novaga (University of Pisa, Italy), G. Orlandi (University of Verona, Italy), and C. Garcia-Cervera (UCSB)

Structure and Simulations of Domain Walls in Thin Film Micromagnetics, V. Osipov (NASA Ames Research Center)

Modeling and Fault Prediction of Liquid Hydrogen Fueling of the Space Shuttle, V. Osipov and V. Smelyanskiy (NASA Ames Research Center)

Non-classical Nucleation Droplets, Eric Vanden-Eijnden (Courant Institute of Mathematical Sciences) and Vitaly Moroz (Department of Mathematics, Swansea University, UK)

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)

Sensory Feedback to Pattern Generators, Wolfgang Stein (University of Ulm, Germany)

D.T. Papageorgiou

Using Electric Fields in the Control of Multi-fluid Flows, P.G. Petropoulos (NJIT) and L. Barannyk (University of Idaho)

Direct Numerical Simulations of Multi-fluid Flows in the Presence of Electric Fields, S. Mahlmann (Germany)

Electrokinetic Effects in Multi-fluid Flows, R.V. Craster (U. Alberta), O. Matar (Imperial College London), and Q. Wang (NJIT)

Numerical Analysis of Semilinear Parabolic Systems, G. Akrivis (U. Ioannina, Greece) and Y.S. Smyrlis (U. Cyprus)

Diffuse Interface Methods for Moving Contact Line Problems, R. Mauri (U. Pisa, Italy)

Horacio G. Rotstein

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)

Rhythmic Activity (Subthreshold and Mixed-mode Oscillations) in the Medial Entorhinal Cortex of the Brain, Martin Wechselberger (University of Sidney, Australia) and Nancy Kopell (Boston University)

Evolution of Fronts in Reaction Diffusion Systems with Global Inhibitory Feedback, Yassine Boubendir (NJIT)

Michael Siegel

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

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

Small Scale Decomposition for 3D Interfacial Fluid Flow, David Ambrose (Drexel University)

Yuan-Nan Young

Extensible Filament Dynamics and Transport, M. Shelley (NYU, Courant)

Many-body Interactions in Stokes Flow, J. Blawzdziewicz (Yale University)

Vesicle Dynamics and Rheology of Vesicle Suspensions, P. Vlahovska (Dartmouth College)

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

Zoi-Heleni Michalopoulou, Associate Chair of Undergraduate Studies

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

Mathematical sciences majors Paul Accisano, Matthew Albano, Michael Bellanich, Tao Lin, Dawid Midura, and Tamara Vivens were the 2008 CSUMS participants. Luke, Michalopoulou, and Siegel were the students' research mentors. Students were divided in three groups and worked on the following projects:

- Computation of the density distribution from velocity field measurements in sedimenting suspensions (mentor: Luke)
- Solving the non-linear problem of geoacoustic inversion using sound measurements in the ocean (mentor: Michalopoulou)
- A hybrid numerical method for fluid flow coupled to advection diffusion (mentor: Siegel) (Figure 1)

Fig. 1 Paul Accisano presenting his CSUMS research

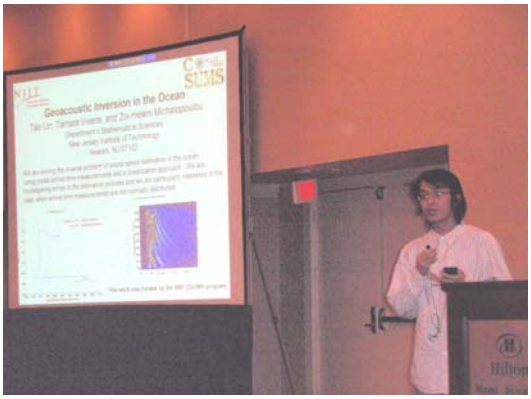


Fig. 2 Tao Lin at SIAM CSE Meeting in Miami

CSUMS participants were very active in presenting their work at national and regional conferences. The NJIT CSUMS program was represented at the SIAM Conference on Computational Science and Engineering (CSE) in March 2009, Miami, FL, with four posters (Figures 2-4).

Fig. 3 Jacek Wrobel at SIAM CSE Meeting in Miami

Fig. 4 Michael Bellanich and Dawid Midura at SIAM CSE Meeting in Miami

At the same conference, Michalopoulou and Luke presented an invited lecture describing the NJIT CSUMS activities and other DMS activities. Two lectures by Accisano (CSUMS 2008) and Lam (CSUMS 2007) were presented at the Garden State Undergraduate Mathematics Conference at Monmount University, NJ, in March 2009. Virodov (CSUMS 2007) gave a lecture on his research at the Annual SIAM Conference in Denver, CO, in July. Another lecture followed in August at the University of St. Thomas, St. Paul, MN, by Bellanich (CSUMS 2008), who represented the NJIT program at a meeting for students from institutions with similar programs. Horntrop represented the CSUMS mentors and participated at two panels at the same meeting.

Basarab, Billimoria, Elliott, Figueroa, Shah, and Singh joined CSUMS as the 2009 cohort in January. The students have already undertaken research projects under project leaders Goodman, Horntrop, and Young. The 2009 cohort interacted extensively with the 2008 CSUMS participants, who continued actively working on their projects in 2009. Interactions were very beneficial to both cohorts.

During Summer 2009, CSUMS participants attended a series of interactive CSUMS seminars. Students were exposed to topics in applied mathematics, numerical methods, and information literacy, and formulated questions and hypotheses. Students also presented their work regularly and attended their peers' presentations, honing their communication skills.

Capstone Laboratory Projects:

This year the number of graduating majors in Mathematical Sciences was sufficiently large for two sections of the second-semester Capstone project course to be given.

Title: Deformation and Break-up of a Soap Film in an Imposed Electric Field

Students: Karina Aliaga, Daniel Bautista, Philip Bowden, David Hamoui, Clifford Hilaire, Tao Lin, Dawid Midura, and Jesse Slavicek

Assistant: Daniel Cargill Instructor: Michael Booty

Eight students worked under the direction of Michael Booty on the deformation and break-up of a soap film in an imposed electric field. This area of research can be traced back in time to Benjamin Franklin's early studies on the detection of an electric field in the atmosphere, right up to the modern day-design design of micro electrical-mechanical systems or MEMS. Determining the steady-state deformation of the soap film requires solution of a free boundary problem.

The students modeled and analyzed a basic experiment that consists of a circular soap film suspended in the top plate of a pair of two electrically conducting plates subjected to an applied voltage difference. The soap film deforms under the action of electrostatic forces while surface tension tends to keep it flat.

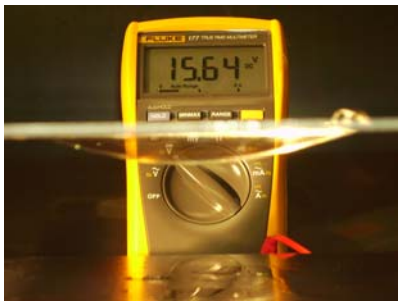
The electric field strength needed to observe deflection of the soap film is about 10kV across 5 cm, which is sufficient for the soap film to behave as though it is electrically a perfect conductor.

David Hamoui and Clifford Hilaire estimated the surface tension of the soap film mixture that was used for the experiments by analysing experimental data for the shape of a pendant drop of the same mixture at the end of a capillary tube. This involved study of existing, widely-used models for the estimation of surface tension, and required numerical implementation of shooting methods and optimization schemes for solution of two point boundary value problems.

Mathematical models for elecrostatic deformation of a soap film can be formulated with increasing levels of physical realism and expectation of quantitative accuracy. Daniel Bautista and Karina Aliaga successfully developed computational studies using shooting methods for two point boundary value problems of a simplified or small-amplitude ODE model for the response of deflection versus applied voltage. From a study by John Pelesko (University of Delaware), we used the fact that the equations had a specific mathematical structure that could be analyzed by a different approach, referred to as "exact shooting", and this was studied by Jesse Slavicek and Philip Bowden.

Tao Lin and Dawid Midura analyzed and solved a more exact formulation of the problem, which coupled Laplace's equation for the electrostatic field with the Laplace-Young equation for arbitrary-amplitude free boundary deformation. The predictions of each model were compared with each other and with results of the experiment.

Supported by NSF grant no. 0511514.



Title: Topology and Dense Granular Matter

Students: Paul Accisano, Matthew Albano, Temitope Brotherson, Andrew Christie, Kelly Cosman, Michael Lam, Arif Patel, Matthew Peragine, Thomas Perrella, Andrew Pskowski, and Alexander Sheppard

Assistant: Daniel Cargill Instructor: Lou Kondic

This project explored the use of computational homology in understanding structure formation in dense granular materials. Experimental, theoretical, modeling, and computational components were implemented. The experimental group set up and carried out table-top experiments with photo-elastic cylindrical particles and explored their response to applied pressure. Figure 1 shows a snapshot of an experiment. This group has been also involved in developing software

for image processing, leading to grey scale images, such as Fig. 2, which were consequently processed by the computational group.

Main effort of the computational group consisted of analyzing the images using computational homology and in particular extracting the quantities describing their topological properties. Theoretical group learned about the background beyond the tools implemented in computational homology and supported other groups by providing theoretical background for the computational analysis. The modeling group worked on relating the topological methods to other approaches used in analysis of granular matter, such as correlation functions and the tools developed within the framework of percolation theory. Supported by NSF grant no. 0511514.

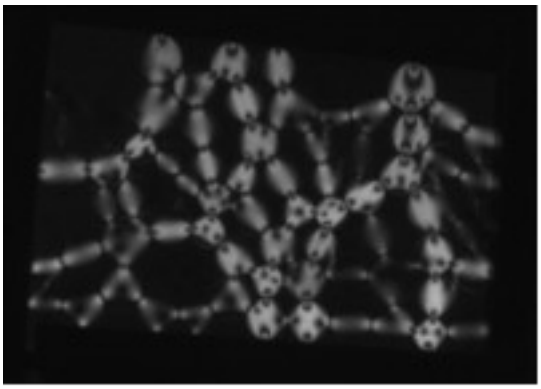


Figure 1

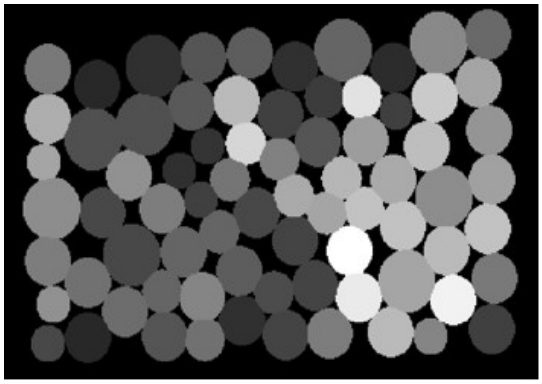


Figure 2

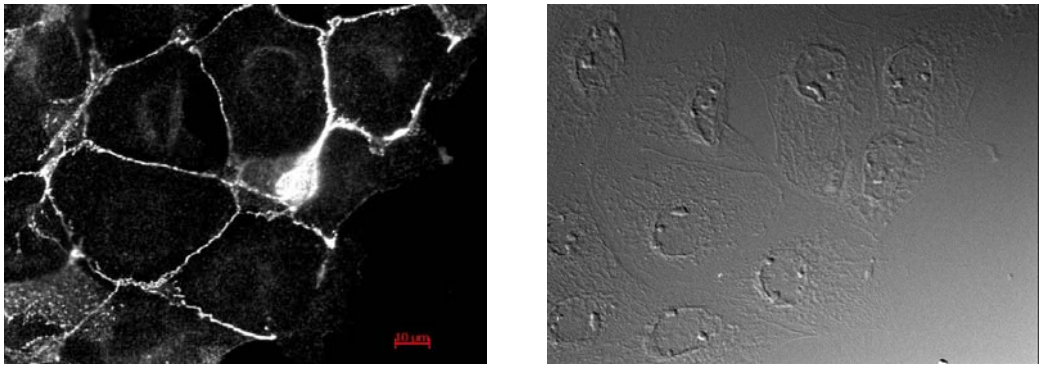
UBM – Undergraduate Biology and Mathematics Training Program, 2008-09

Research Mentors: Amitabha Bose, Jorge Golowasch, and Farzan Nadim

The National Science Foundation-funded UBM program was in its fifth and final year of funding at NJIT. Fortunately the renewal UBM application (see below; additional activities) has been funded by the NSF and the program will continue at NJIT. This year the program recruited six students who started in January of 2008. The project spans a period of one year so the students are continuing on their research until December 2009. The students recruited to the program were Krutanjali Shah, Yamin Noor, Zehra Sediq, Fatima Elgammal, Timothy Blokus and Tin Vo. Tin Vo withdrew from the UBM program later in the spring due to his heavy course load. He may re-apply for the UBM program in 2009-10.

All students were required to take the undergraduate Mathematical Biology course (Math 373), taught by Nadim in Spring 08. They also took a 1-credit course intended to train and open only to UBM students. This course consisted of a weekly 1.5-hour meeting with Bose, Nadim and Golowasch as well as occasional lectures by other Investigators of the UBM training grant. During this 1.5 hour meetings the students were given small mathematical modeling projects that they would do on the spot, together or individually, and describe at the whiteboard or on their computers. During Spring 08 the students also rotated among several biology labs (Nadim, Golowasch, Friedman, Rodriguez and Bunker labs) and were exposed to a variety of biology experimental techniques.

In the summer of 09, the students were divided into three groups. Sediq and Elgammal worked in the Rodriguez lab, Noor and Shah worked with Dr. Sheibanie (Nadim lab) and Blokus worked in the Bunker lab. The projects that the students worked on were “The effect of neuronal morphology on passive properties of neurons” (Shah and Noor), “Total phenolics in plant species” (Blokus) and “Three-dimensional localization of E-cadherin in mammalian cells” (Sediq and Elgammal).



From the Project of Sediq and Elgammal (Rodriguez Lab). MDCK cells stained a monoclonal anti-E-cadherin antibody and an anti-mouse CY3 labeled secondary antibody.

This year two papers from UBM projects were accepted for publication (UBM student names underlined): Russell, G. and Rosales, A., "Sociability leads to instability: Site-switching cascades in a colonial species", Theoretical Ecology (2009). In Press, DOI: 10.1007/s12080-009-0048-2; 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 (2009). In Press, DOI: 10.1152/jn.00160.2009.

Additional UBM activities this year included the following:

1. 07-08 UBM student Aliaga attended the Nebraska Undergraduate Women's Math Conference in January/February of 2009 and presented research done with Joseph Hanna (07-08 UBM student) and Andrew Hill (UBM Investigator).
2. Two new NJIT/Rutgers-Newark faculty members joined UBM as senior researchers. They are Dan Bunker (Ecology) and Alex Rodriguez (Cell Biology).
3. Applied for renewal of UBM grant: Victor Matveev (PI), Gareth Russell (co-PI), and Jorge Golowasch (co-PI). Bose, Nadim, and other NJIT and Rutgers-Newark faculty are Investigators on the renewal. The renewal was funded by the NSF in August 09.
4. UBM students presented their work at Annual Provost's Research Day and the FACM 09 Conference at NJIT.

Pi Mu Epsilon Induction Ceremony on April 22, 2009

The Pi Mu Epsilon honor society inducted 11 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

Lou Kondic, Director of the Graduate Program

Ph.Ds Awarded August 2008:

Xinli Wang
Thesis: *On the Rolling Motion of Viscous Fluid on a Rigid Surface*
Advisor: Michael Siegel

Yu Zhang
Thesis: *A Mathematical and Computational Exploration of the Effect of the A-Current in Determining the Activity Phase of Follower Neurons*
Advisor: Farzan Nadim

Ph.Ds Awarded January 2009:

Myongkeun Oh
Thesis: *Loss of Synchrony in an Inhibotory Network of Type-I Oscillators*
Advisor: Victor Matveev

Ph.Ds Awarded May 2009:

Leonardo Espin
Thesis: *Self-similar Flows in Finite or Infinite Two-dimensional Geometries*
Advisor: Demetrios Papageorgiou

Yogesh Joshi
Thesis: *Discrete Dynamical Population Models: Higher Dimensional Pioneer-Climax Models*
Advisor: Denis Blackmore

Kamyar Malakuti
Thesis: *Numerical Detection of Complex Singerlarities in Two and Three Dimensions*
Advisor: Michael Siegel

Publications, Presentations, and Conference Participation

Daniel Cargill:

Talks and posters:

Undergraduate research projects by mathematics majors at NJIT (poster), The 15th Annual Saint Joseph's University Sigma Xi Student Research Symposium, April 17th, 2009, Philadelphia, PA.

Workshops: Graduate Student Mathematical Modeling (GSMM) Camp at RPI, June 9-12, 2009, RPI, Troy, NY.

Xinxian Huang:

February 2009: Mathematical Biology Seminar Series, NJIT
Presentation: The Activity Phase of Neurons in a Reciprocally Inhibitory Network

April 2009: Saint Joseph's University Sigma Xi Student Research Symposium, Philadelphia, PA

Poster: The Activity Phase of Neurons in a Reciprocally Inhibitory Network

Yogesh Joshi:

Awards**:** Received recognition for Outstanding efforts and accomplishments on behalf of the SIAM Chapter at New Jersey Institute of Technology.

Poster**:** Discrete Dynamical Population Models: Higher Dimensional Pioneer Climax Models at The Dana Knox Student Research Showcase, April 8, 2009 held at New Jersey Institute of Technology.

Poster: Dynamics of Discrete Population Models: Higher Dimensional Pioneer Climax Models at Frontiers in Applied and Computational Mathematics 2008 Conference (FACM'08), May 19-21, 2008

Workshop: Participated in The Annual Industrial Mathematical and Statistical Modeling Workshop for Graduate Students (ISMS-2008) held at North Carolina State University, July 21-29, 2008

Participated in The PIMS Industrial Problem Solving Workshop and Graduate Industrial Mathematics Modeling Camp held at University of Regina, Canada, June 9-21, 2008.

Manmeet Kaur:

Posters:

Acoustic and Fluid Flows on Perturbed Spherical Objects at The Dana Knox Student Research Showcase, April 8, 2009 held at New Jersey Institute of Technology.

Acoustic and Fluid Flows on Perturbed Spherical Objects at Frontiers in Applied and Computational Mathematics 2009 Conference (FACM'09), June 1-2, 2009, New Jersey Institute of Technology.

Workshops attended:

The Annual Industrial Mathematical and Statistical Modeling Workshop for Graduate Students (ISMS-2008) held at North Carolina State University, July 21-29, 2008.

The PIMS Industrial Problem Solving Workshop and Graduate Industrial Mathematics Modeling Camp held at the University of Regina, June 9-21, 2008.

Jing Li:

Presentation: April 2009: 2009 NJIT ADVANCE Research Showcase, Newark, New Jersey Modeling with Bivariate Geometric Distribution.

Qiming Wang:

Awards and Honors: College of Science and Liberal Arts Award: Outstanding Graduate Student (May 4, 2009).

Publication: Qiming Wang, S. Mahlmann and D.T. Papageorgiou, Dynamics of Liquid Jets and Threads under the Action of Radial Electric Fields: Microthread Formation and Touchdown Singularities, Phys. Fluids, Vol. 21-032109, 2009.

Jacek Wrobel:

Awards and Honors: The Dana Knox Student Research Showcase: 3rd award, April 8, 2009

Talks and posters:

An Adaptive Method for Computing Invariant Manifolds of 2-D Maps (talk), Applied Math Days, Oct 30 -Nov 1, 2008, Rensselaer Polytechnic Institute, Troy, NY.

Algorithms for Recursively Rendering Parametric Curves (poster), SIAM Conference on Computational Science and Engineering (CSE09), March 2-6, 2009, Miami, FL.

An Adaptive Method for Computing Invariant Manifolds of 2-D Maps (poster) SIAM Conference on Application of Dynamical Systems (DS09), May 17-21, 2009, Snowbird, Utah.

Workshops:

Graduate Student Mathematical Modeling (GSMM) Camp at RPI, June 9-12, 2009, Troy, NY.

Mathematical Problems in Industry (MPI) at University of Delaware, June 15-19, 2009, Newark, DE.

Kuan Xu:

Talks and Posters:

April 2009: The Evolution of a Two-Dimensional Cartesian Drop in an Imposed Linear Flow: The Influence of Surfactant and Surfactant Solubility, Fluid Dynamics Seminar Series, Mathematical Sciences Department, NJIT.

April 2009: The Evolution of a Two-Dimensional Cartesian Drop in an Imposed Linear Flow: The Influence of Surfactant and Surfactant Solubility, The Dana Knox Student Research Showcase, NJIT.

Mathematical Sciences Group (MSG) and Graduate Student Association (GSA) activities

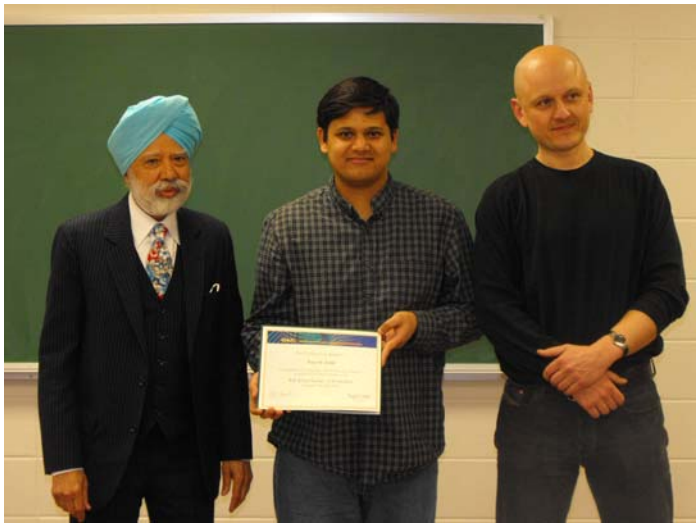
The Math Club organized a number of events for the 2008-2009 academic year which were funded by the GSA. The most noteworthy of these events was the trip to Brookhaven labs in Long Island, NY on May 14, 2009. Students and faculty that attended received a tour of the facilities, including talks on the latest techniques in computational fluid dynamics, translational neuro imaging, and computational biology. MSG also hosted a colloquium on April 1, 2009 where Dr. Matthew Andrews, a distinguished member of the technical staff from Bell Laboratories Alcatel-Lucent, enlightened the graduate students on the latest advances and challenges of wireless networks and data distribution.

Soccer Match

On May 15, 2009 the Department of Mathematical Sciences hosted the sixth annual soccer match between the faculty/graduate students and undergraduate students. As is becoming customary, the undergraduates had fewer players and the faculty/graduate students had an abundance of them, so the teams were a mixture of older and younger players. Nonetheless, all had fun and at the end of regulation time the final score was 2 to 0. We look forward to another game next year.

SIAM Student Recognition Award

The SIAM (Society for Industrial and Applied Mathematics) Award recognizes the student's hard work, encourages students to join and work with SIAM, and gives students direct exposure to SIAM leadership.



The recipient of the award was Yogesh Joshi, PhD candidate in the Dept. of Mathematical Sciences, for his contribution to the SIAM chapter. In above photo, Yogesh (center) is joined by Daljit S. Ahluwalia, DMS Department Chair (left), and Lou Kondic, Director of the Graduate Program (right).

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 2008

July 2 **Dr. Sundar Subramanian**, *Survival Analysis: An Overview*

July 7 **Qiming Wang**, *Modeling, Analysis, Computation of Electrified Liquid Jets*

July 9 **Dr. Cyrill Muratov**, *Front Propagation in Reaction-Diffusion Problems: A Variational Approach*

July 14 **Matt Causley**, *Plane Wave Analysis for Anisotropic Materials*

July 16 **Dr. Shidong Jiang**, *Introduction to Analysis-Based Fast Numerical Algorithms*

July 21 **Ye Yang**, *A Three-field Finite Element Formulation for Fluid-structure Interaction Systems*

July 23 **Dr. Yassine Boubendir**, *Some Ideas about Numerical Techniques for Wave Propagation Problems*

July 28 **Shuchi Agrawal**, *Stability of Microwave Heated Ceramic Cylinders and Slabs*

July 30 **Dr. Peter Petropoulos**, *Wave Propagation in Dielectrics that Exhibit Fractional Relaxation*

August 4 **Rashi Jain**, *Particle Filtering For Arrival Time Estimation from Sound Signals In Ocean*

August 6 **Dr. Yuan Young**, *Novel Fluid Dynamics in Stokes Flows*

June 2009

June 9 **Qiyi Zhou**, *A Numerical Method for Solving Strongly Nonlinear Free-Surface Waves and the Corresponding Transverse Instability Analysis*

June 11 **Dr. Yuan N. Young**, *Dynamics of Elastic Filaments in Stokes Flow*

June 16 **Bo Ren**, *Monte Carlo Simulation of Credit Portfolios*

June 18 **Dr. John K. Bechtold**, *Mathematical Models of Combustion*

June 23 **Jing Li**, *Modeling with Bi-variate Geometric Distributions*

June 25 **Dr. Denis L. Blackmore**, *A Planar Hamiltonian Model for Vortex Breakdown*

June 29 **Ye Yang**, (1 hour presentation)

June 30 **Xinxian Huang**, *The Activity Phase of Neurons in a Reciprocally Inhibitory Network*

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