CAMS

Center for Applied Mathematics
and Statistics

ANNUAL REPORT

2007-2008

NJIT
New Jersey's Science &
Technology University

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I. FROM THE DIRECTOR

This is the fourth year that the Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) have benefited from the generous support of a university-wide strategic initiative. DMS is one of a select number of departments at NJIT to receive such funding, which supports the departmental mission of research and training in the applied mathematical sciences with a particular focus on fluid dynamics and mathematical biology, two areas of strength within the department.

We are excited to report the latest departmental accomplishment. DMS has been ranked in the top ten national programs in mathematics, as assessed by Academic Analytics and announced in the Chronicle of Higher Education on 11/16/07. The ranking measures scholarly productivity in categories including publications, citations, federal grant funding, and faculy honors and awards. We are pleased that the top ten ranking helps quantify the department's rise to national prominence in the mathematical sciences.

We are also happy to report that DMS faculty have had a very successful year in acquiring new funding from government and other agencies. DMS receives substantial funding from sources such as the National Science Foundation, National Institutes of Health, National Aeronautics and Space Administration, Office of Naval Research, Department of Energy, the Air Force, the Howard Hughes Medical Institute, and private industry.

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

- The initiation of two exciting new programs: (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 continuing funding of four major educational grants from the National Science Foundation:

    1. 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.

    2. 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.

    3. 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, and will prepare DMS majors for graduate studies in mathematical sciences with an emphasis on scientific computing, or industrial careers requiring strengths in both mathematics and computation.

    4. Undergraduate Biology and Mathematics Training Program Proposal (UBMTP). This award aids the department's efforts to provide innovative training and research experiences at the interface of mathematics and biology. Upon graduation, UBMTP students will be in a unique position to pursue doctoral studies in either mathematics or biology programs, as well as opportunities in bio-tech and pharmaceutical companies.

- The hosting of five postdoctoral fellows and two sabbatical visitors. This number puts us in the company of other leading departments of mathematical sciences nationwide.

- The continuing funding of a Major Research Instrumentation (MRI) grant from the National Science Foundation for a 134 processor parallel computer cluster, one of the largest of its kind contained within a mathematics department nationwide.

- The placement of DMS in the top 47 mathematical science programs nationwide, as ranked by total expenditure of federal funds on research and development.

- The hosting of the fifth annual "Frontiers in Applied and Computational Mathematics (FACM)" conference in May 2008. This three day meeting attracted over 250 participants, and for the first time included talks by graduate student and postdoctoral researchers selected for their outstanding research achievements.

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, Priscilla Nelson, Provost and Sr. Vice President for Academic Affairs, and Donald Sebastian, Sr. Vice President for Research and Development, 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 - 2008

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
Choi, Wooyoung
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.
Maehlmann, Stefan
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
Tao, Louis
Tlupova, Svetlana
Venkateswaran, Venkat
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
Lott, Dawn	Delaware State University, Dover
Mauri, Roberto	Università degli Studi di Pisa, Italy
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 7 **Carson Chow**, National Institutes of Health
A Kinetic Theory for Coupled Oscillators

September 14 **Ken Miller**, Columbia University
Feedforward and Recurrent Processing in Cat Primary Visual Cortex

September 21 **William Schultz**, University of Michigan
Viscoelastic Effects in Glass Fiber Forming

September 28 **Farzan Nadim**, New Jersey Institute of Technology
The Role of Anatomical Structure in Determining Activity in Electrically Coupled Neuronal Networks

October 5 **Konstantin Mischaikow**, Rutgers University
Database for Multiparameter Dynamical Systems

October 12 **Mary Silber**, Northwestern University
Controlling Pattern Formation

October 19 **Irving Epstein**, Brandeis University
Differential and Cross-Diffusion Effects on Pattern Formation in Reaction-Diffusion Systems

October 26 **Mark Holmes**, Rensselaer Polytechnic Institute
Computational Modeling of the Ear

November 2 **Philip Holmes**, Princeton University
Collective Neuronal Dynamics and Drift-Diffusion Models for Decision Making

November 9 **Stephen Childress**, New York University
Hovering of Passive Bodies in an Oscillating Airflow

November 16 **Michael Weinstein**, Columbia University
Coherent Structures and Energy Transfer in Conservative Nonlinear Systems

November 30 **Klaus Lackner**, Columbia University
Energy Options for the 21st Century

December 7 **Iain Couzin**, Princeton University
Collective Motion and Decision-Making in Animal Groups

January 25 **James D. Murray**, University of Washington and University of Oxford
On the Virtues of Simple Models: From Resolving a Prostate Cancer Diagnostic Anomaly to Enhancing Imaging Techniques for Brain Tumours to Highlighting the Inadequacies of Current Therapies

February 1 **George Papanicolaou**, Stanford University
Imaging in Clutter

February 8 **Ricardo Cortez**, Tulane University
Regularization Methods for Fluid Flow Simulations

February 15 **Michael Renardy**, Virginia Polytechnic Institute
Stability of Viscoelastic Shear Flow in the Limit of High Reynolds and Weissenberg Numbers

February 29 **Louis J. Gross**, University of Tennessee, Knoxville
Mathematics as a Mechanism for Cohesion in Biology

March 7 **Demetrios Papageorgiou**, New Jersey Institute of Technology
Some Problems in Interfacial Electrohydrodynamics

March 14 **Ashwani Kapila**, Rensselaer Polytechnic Institute and National Science Foundation
Detonation Failure in the Ignition-and-Growth Model

March 28 **Thomas Powers**, Brown University
`Life at Low Reynolds Number' Revisited

April 4 **Greg Baker**, Ohio State University
Some Topics in Water Waves

April 11 **Igor Aronson**, Argonne National Laboratory
Onset of Collective Behavior in Colonies of Swimming Microorganisms

April 18 **Mac Hyman**, Los Alamos National Laboratory
Emerging Paradigms in Large-Scale Science-Based Simulations

April 25 **Ruben Rosales**, Massachusetts Institute of Technology
Facet Evolution on Supported Nanostructures: The Effect of Finite Height

May 2 **Gregory A. Kriegsmann**, New Jersey Institute of Technology
Propagation in Periodic Dielectric Media

Applied Statistics Seminar

September 20 **Sundar Subramanian**, New Jersey Institute of Technology
Estimation of A Survival Function When There Are Missing Censoring Indicators

September 27 **Zhezhen Jin**, Columbia University
Nonproportional Semiparametric Regression Models

October 4 **Zhiqiang Peter Chen**, William Paterson University
Randomly Trimmed Mean

October 31 **Sanat Sarkar**, Fox School of Business, Temple University
Generalizing the False Discovery Rate

November 29 **Tom Alberts**, Courant Institute of Mathematical Sciences, New York University
Boundary Correction Methods in Kernel Density Estimation

March 27 **Dr. Srini Maloor**, Rutgers University and UMDNJ
Statistical Strategies for Scaling and Weighting Variables for Cluster Analysis

April 10 **K. B. Athreya**, Iowa State University
Growth of Preferential Attachment Random Graphs

May 1 **Manish C. Bhattacharjee**, New Jersey Institute of Technology
Shock Models, a Family of Discrete Laws and Corresponding Strongly Decreasing Failure Rate Laws in Continuous Time

Mathematical Biology Seminar

September 11 **Horacio G. Rotstein**, New Jersey Institute of Technology
The Transition from Normal to Hyper-excitable Epileptic Activity in a Medial Entorhinal Cortex Layer II Stellate Cell Model

September 18 **Remus Osan**, Center for BioDynamics, Boston University
Hippocampal Network-level Coding Units for Real-Time Representation of Episodic Experiences

September 25 **Martin Wechselberger**, School of Mathematics and Statistics, University of Sydney
The Canard Phenomenon and Unexpected Slow Firing Rates in a Neural Network with Excitatory Synaptic Coupling

October 2 **Esteban Tabak**, Courant Institute of Mathematical Sciences, New York University
Combining Gene Expression and Clinical Data for Diagnosis

October 9 **Pablo Jercog**, New York University
Bilateral Asymmetry of Excitatory Synaptic Properties Shapes Interaural Time Delay Processing in Gerbil Medial Superior Olive

October 16 **Daniel Ben Dayan Rubin**, Center for Theoretical Neuroscience, Columbia University
Retrieving Noise-based Memories by Reading Heterogeneous Neurons

October 23 **Nathaniel Daw**, Center for Neural Science, New York University
Neural Mechanisms for Reinforcement Learning in Humans: Combining Neural, Behavioral, and Computational Approaches

October 30 **Fernando Tohme**, National Council for Scientific and Technological Research (CONICET), Argentina, and Department of Economics, Universidad Nacional del Sur, Bahia Blanca (Buenos Aires) Argentina
Rational Decision Making under the Light of BioMathematics: on the Future Perspectives of Neuroeconomics

November 13 **Gustavo Stolovitzky**, IBM Computational Biology Center and Biomed Informatics, Columbia University
Topology and Dynamics of Cyclic Motifs in Directed Complex Networks

November 27 **Bijan Pesaran**, Center for Neural Science, New York University
Free Choice Activates a Decision Circuit between Frontal and Parietal Cortex

January 22 **Ani Chintalapani** and **Matthew Hanna**, Undergraduate Biology and Math Training Program, New Jersey Institute of Technology
Arf1 Dynamics in Coxsackievirus Infected cells

January 22 **Ikemefuna Agbanusi** and **Alborz Yarahmadi**, Undergraduate Biology and Math Training Program, New Jersey Institute of Technology
Phase Response Curves of Square Wave Bursting Oscillator

February 5 **Odelia Schwartz**, Albert Einstein College of Medicine
Natural Image Statistics and Contextual Visual Processing

February 12 **Einat Fuchs**, Department of Zoology, Tel Aviv University
Developmental Patterns and Modulations of Neuronal Circuits

February 19 **Eduardo Sontag**, Department of Mathematics, Rutgers University
Qualitative/Quantitative Analysis of Biomolecular Network Dynamics

March 4 **Trine Krogh-Madsen**, Division of Cardiology, Weill Medical College of Cornell University
T*ermination and Resetting of Reentrant Cardiac Activity*

March 11 **Adam Kepecs**, Cold Spring Harbor Laboratory
Computational Algorithms and Neural Mechanisms for Estimating Decision Uncertainty

March 18 **Adam Taylor**, Volen Center for Complex Systems, Brandeis University
Understanding the Relationship between Maximal Conductances and Behavioral Properties in a Neuronal Model

March 25 **Nickolas Kintos**, Department of Mathematics, Fordham University
Investigating How Feedback to a Descending Projection Neuron Influences Rhythmic Pattern Generation in the Target Network: A Modeling Study

April 1 **Eric Sherwood**, Department of Mathematics, Boston University
Phase Response in Bursting Neurons

April 3 **Daniel Bunker**, Columbia University
Global Change, Community Composition, and Ecosystem Functioning

April 8 **Carina Curto**, Center for Molecular & Behavioral Neuroscience, Rutgers University
Dynamics of Neural Activity in Auditory Cortex

April 14 **Victoria Booth**, University of Michigan
A Novel Population Model for NREM/REM Sleep Regulation

April 17 **Mac Hyman**, Los Alamos National Laboratory
New Approaches to Mathematical Models for the Spread of Epidemics

April 22 **Filippo Posta**, New Jersey Institute of Technology
Signal Transmission in Epithelial Layers

April 29 **Yogesh Joshi**, New Jersey Institute of Technology
Dynamical Behavior of Pioner and Climax Models

Fluid Mechanics Seminar

September 17 **David Saintillan**, Courant Institute of Mathematical Sciences, New York University
Instabilities and Dynamics in Active Suspensions: Direct Numerical Simulations and Kinetic Theory

October 1 **Xiaoyu Luo**, University of Glasgow
The Cascade Structure of Linear Stability in Collapsible Channel Flows

October 15 **Navida Gupta**, University of New Hampshire
Marangoni Stresses at Deforming Interfaces

October 22 **Amy Shen**, Washington University in St Louis
Hydrodynamics of Complex Fluids at Small Length-Scales

October 29 **Erik Hobbie**, NIST, Gaithersburg, Maryland
Shear Banding in Carbon Nanotube Networks

November 5 **Bin Liu**, Courant, New York University
Two Problems in the Dynamics of Thermal Feedback

November 12 **Prosenjit Bagchi**, Rutgers University
Computational Modeling and Simulation of Cell Transport, Deformation, Adhesion, and Rolling in Flowing Blood

November 20 **Norman Zabusky**, Rutgers University
Waves and Fluids: Simulation, Visualization and Analytics

November 26 **Robert Krasny**, University of Michigan, Ann Arbor
Lagrangian Simulations of Fluids and Plasmas

February 11 **Peng Zhang**, Princeton University
Bouncing, Coalescence and Interface Evolution

March 3 **Banavara N. Shashikanth**, New Mexico State University
Hamiltonian Models for the Coupled Dynamics of Vortices and Neutrally Buoyant Rigid Bodies

March 10 **Pino Martin**, Princeton University
Turbulent Hypersonic Flows: Physics and Simulation

March 31 **Louis F. Rossi**, University of Delaware
High Order Vortex Methods and Field Interpolation Problems

April 14 **Mahesh Bandi**, Center for Nonlinear Studies, Los Alamos National Laboratories
Lagrangian Power Fluctuations in Two-dimensional Turbulence

April 16 **Mikko Haataja**, Department of Mechanical Engineering, Princeton University
Heterogeneous Lipid Bilayers: Evolving Microstructures in Biology

April 28 **Saverio Spagnolie**, Courant Institute of Mathematical Sciences, New York University
Direction Reversal in Flapping Flight and Shape Changing Locomotion

May 5 **Mark Shattuck**, City College of New York, CUNY
Shaken, Not Stirred: Granular Equilibrium

Waves on Wednesdays Seminar

October 3 **Christian Stucchio**, Courant Institute, New York University
Open Boundaries for the Nonlinear Schrödinger Equation: Numerical Analysis in Phase Space

October 10 **Yi Li**, Stevens Institute of Technology
Existence of Global Solutions to a System of Nonlinear Dispersive Equations

October 29 **Weizhu Bao**, National University of Singapore
Mathematical Analysis and Numerical Simulation of Bose-Einstein Condensation

November 14 **Ricardo Barros**, NJIT
Two-Layer Flows with Free Surface

November 20 **Norman J. Zabusky**, Rutgers University
Waves and Fluids: Simulation, Visualization and Analytics
(joint seminar with fluid mechanics)

February 6 **Jeremy Marzuola**, Columbia University
Fast Soliton Scattering by Delta Impurities

March 12 **Sanjeeva Balasuriya**, Connecticut College
Wavespeed in Perturbed Combustion Waves

March 26 **Yassine Boubendir**, New Jersey Institute of Technology
High-Frequency Multiple Scattering Problem: Acceleration of the Iterative Procedure

April 2 **Horacio Rotstein**, New Jersey Institute of Technology
Evolution of Fronts in Reaction Diffusion Systems with Global Inhibitory Feedback

April 9 **Gideon Simpson**, Columbia University
The Solid Earth: Coherent Structures and Constitutive Relations

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

John Bechtold

A Multi-Scale Approach to the Propagation of Non-Adiabatic Premixed Flames (with M. Matalon), J. Eng. Math., published online April 2008.

Forced Oscillations in Diffusion Flames near Diffusive-Thermal Resonance (with H. Wang and C.K. Law), Int. J Heat Transfer., Vol. 51, Issues 3-4, pp. 630-639, 2008.

Denis Blackmore

The Cartan-Monge Geometric Approach to the Characteristic Method for Nonlinear Partial Differential Equations of the First and Higher Orders (with N. Prykarpatska, V. Samoilenko, E. Wachnicki, and M. Pytel-Kudela), Nonlinear Oscillations, Vol. 10, pp. 22 -31, July 2007.

Transient and Steady State Motion of a Rising Bubble in a Viscoelastic Fluid (with S. Pillapakkam, P. Singh, and N. Aubry), Journal of Fluid Mechanics, Vol. 589, pp. 215-252, November 2007.

On Kinetic Boltzmann Equations and Related Hydrodynamic Flows with Dry Viscosity (with N. Bogolubov, Jr., V. Samoilenko, and A. Prykarpatsky), Opuscula Mathematica, Vol. 27, pp. 187-195, November 2007.

Michael Booty

Influence of Insoluble Surfactant on the Deformation and Breakup of a Bubble or Thread in a Viscous Fluid (with M. Hameed, M. Siegel, Y.-N Young, J. Li, and D.T. Papageorgiou), J. Fluid Mech., Vol. 594, pp. 307-340, January 2008.

Modeling of Magnetic Field Assisted Assembly of Semiconductor Devices (with R.D. Rivero, S. Shet, A.T. Fiory, and N.M. Ravindra), Journal of Electronic Materials, Vol. 37, pp. 374-378, April 2008.

Amitabha Bose

Capturing the Bursting Dynamics of a Two-cell Inhibitory Network using a One-dimensional Map (with V. Matveev and F. Nadim), Journal of Computational Neuroscience, Vol. 23, pp. 169-187, October 2007.

Yassine Boubendir

An Analysis of the BEM-FEM Non-overlapping Domain Decomposition Method for a Scattering Problem, J. Comp. Appl. Math, Vol. 204, Issue 2, pp. 282-291, July 2007.

Coupling of a Non-overlapping Domain Decomposition Method for a Nodal Finite Element Method with a Boundary Element Method (with A. Bendali and M.B. Fares), Int. J. Num. Meth. Eng., Vol. 73, Issue 11, pp. 1624–1650, July 2007.

Wooyoung Choi

Nonlinear Waves over Highly Variable Topography, Euro. Phys. J.-ST, Vol. 147, pp. 113-132, August 2007.

Evolution of Internal Waves near a Turning Point in the South China Sea using SAR Imagery and Numerical Models, (D. J. Kim, D. R. Lyzenga and Y. Kim), Korean J. of Remote Sensing, Vol. 23, pp. 385-391, Nov. 2007.

An Explicit Formulation for Nonlinear Waves Interacting with a Submerged Body, (with C. P. Kent), International Journal of Numerical Methods in Fluids, Vol. 55, pp. 1019-1038, December 2007.

On Stabilizing the Strongly Nonlinear Internal Wave Model, (with T.-C. Jo), Studies in Applied Math., Vol. 120, pp. 65-85, January 2008.

Sunil Dhar

Log-linear Modeling under Generalized Inverse Sampling Scheme (with Soumi Lahiri), Communications in Statistics--Theory and Methods, Vol. 37(8), pp. 1237-1244, 2008.

Javier Diez

On Breakup of Fluid Films of Finite and Infinite Extent (with L. Kondic), Phys. Fluids, Vol. 19, 072107, 2007.

Stability Study of a Constant-Volume Thin Film Flow (with J. Gomba, R. Gratton, A. G. Gonzalez, L. Kondic), Phys. Rev. E, Vol. 76, 046308, 2007.

Rose Dios

Contributions to Orthogonal Arrays of Strength Six (with D.V. Chopra and R.M. Low), Congressus Numerantium, Vol. 186, pp. 193-198, 2007.

Thomas Erneux

Approximating Small and Large Amplitude Periodic Orbits of the Oscillator x" + (1 + x'2)x = 0 (with T. Kalmar-Nagy), Journal of Sound and Vibration, Vol. 313, pp. 806-811, 2008.

Time Scales and Relaxation Oscillation Dynamics in Quantum Dot Lasers (with A. Viktorov and P. Mandel), Phys. Rev. A, Vol. 76, 023819, 2007.

Delayed Polarization Dynamics in Nd3+ -Doped Yttrium-Aluminum-Garnet Lasers (with G. Verschaffelt, G. Van der Sande, J. Danckaert, B. Ségard, and P. Glorieux), Phys. Rev. A, Vol. 77, 063801, 2008.

Vladislav V. Goldberg

Differential Geometry of Veronese-like Webs, (with M. A. Akivis), Russian Math. (Iz. VUZ), Vol. 51, No. 10, pp. 1-28, October 2007.

Abelian Equations and Rank Problems for Planar Webs, (with V. V. Lychagin), Russian Math. (Iz. VUZ), Vol. 51, No. 11, 39-75, October 2007.

Differential Geometry of Lagrange-like Webs, (with M. A. Akivis), Russian Math. (Iz. VUZ), Vol. 51, No. 12, pp. 17-29, December 2007.

On the Existence of Paratactical Three-webs, Russian Math. (Iz. VUZ), Vol. 52, No. 4, pp. 19-23, April 2008.

Maks A. Akivis. On the Occasion of his 85th Birthday and 65 Years of Scientific Activity, (with A. T. Fomenko, V. F. Kirichenko, V. V. Lychagin, and A. M. Shelekhov), J. Generalized Lie Theory and Appl., Vol. 2, No. 1, pp. 1-18, February 2008.

On Grassmannizable Group Webs, (with A. M. Shelekhov), Acta Appl. Math., Vol. 101, No. 1-3, pp. 53-57, April 2008.

Jorge Golowasch

Sustained Rhythmic Activity in Gap-Neurons Depends on the Diameter of Coupled Dendrites (with J. Gansert, and F. Nadim), J. Neurophysiology, Vol. 98, pp. 3450-3460, 2007.

Neuromodulators, Not Activity, Control Coordinated Expression of Ionic Currents (with O. Khorkova), J. Neuroscience, Vol. 27, pp. 8709-8718, 2007.

Roy Goodman

Chaotic Scattering in Solitary Wave Interactions: A Singular Iterated- Map Description, Chaos, Vol. 18, 023113, May 2008.

Peter Gordon

On Flame-Flow Interaction in Forward Smoldering, (with I. Brailovsky and G. Sivashinsky), Combustion and Flame, Vol. 153, pp. 490-495, May 2008.

KPP Type Flame Fronts in Porous Media, (with A.Ghazaryan), Nonlinearity, Vol. 21, pp. 973-992, May 2008.

Fingering Instability in Immiscible Displacement, (with A. Babchin, I. Brailovsky and G. Sivashinsky), Physical Review E, Vol. 77, Art. 026301, February 2008.

Traveling Waves in Porous Media Combustion: Uniqueness of Waves for Small Thermal Diffusivity, (with A. Ghazaryan and C.K.R.T. Jones), Journal of Dynamics and Differential Equations, Vol. 19, pp. 951-966, December 2007.

Recent Mathematical Results on Combustion in Hydraulically Resistant Porous Media, Mathematical Modelling of Natural Phenomena, Vol. 2, No. 2, pp. 56-76, December 2007.

A Reduced Model for Flame-Flow Interaction, (with M.L. Frankel and G.I. Sivashinsky) Mathematical Modelling of Natural Phenomena, Vol. 2, No. 2, pp. 1-12, December 2007.

Claus Holzapfel

Testing the Enemy Release Hypothesis: A Comparison of Foliar Insect Herbivory of the Exotic Norway Maple (Acer platanoides L.) and the Native Sugar Maple (A. saccharum L.), (with C. Cincotta, C. and J.M. Adams J.M), Biological Invasions, electronic publication DOI 10.1007/s10530-008-9255-9, April 2008

David J. Horntrop

Three-Dimensional Monte Carlo Simulations of Density Relaxation, (with O. Dybenko and A. Rosato), KONA Powder and Particle, Vol. 25, pp. 133-144, December 2007.

Aridaman Jain

Evaluating Electronic Voting Systems Equipped with Voter-Verified Paper Records (with N. Ansari, P. Sakarindr, E. Haghani, C. Zhang, and Y.Q. Shi), IEEE Security and Privacy, Vol. 6, No. 3, pp. 30-39, May/June 2008.

Shidong Jiang

Efficient Representation of Nonreflecting Boundary Conditions for the Time-Dependent Schrodinger Equation in Two Dimensions, (with L. Greengard), Comm. Pure & Appl. Math., Vol. 61, pp. 261-288, March 2008.

Lou Kondic

Stability Study of a Constant-Volume Thin Film Flow (with J. Gomba, J. Diez, R. Gratton, A. Gonzalez), Phys. Rev. E, Vol. 76 046308, pp. 1-12, November 2007.

On the Breakup of Fluid Films of Finite and Infinite Extent (with J. Diez), Phys. Fluids, Vol. 19, 072107, pp. 1-22, November 2007.

Gregory A. Kriegsmann

Electric Discharge Sintering: A Mathematical Model, SIAM Journal on Applied Mathematics, Vol. 68, No. 6, pp. 1503-1517, 2008.

Victor Matveev

On Properties of the Ising Model for Complex Energy/Temperature and Magnetic Field (with R. Schrock), J Physics A: Math and Gen, Vol. 44, pp. 135002-135024, March 2008.

Roberto Mauri

Spinodal Decomposition of Binary Mixtures with Composition-Dependent Heat Conductivities (with D. Molin), Chem. Engng. Sci., Vol. 63, pp. 2402-2407, 2008.

Enhanced Heat Transport during Phase Separation of Liquid Binary Mixtures (with D. Molin), Phys. Fluids, Vol. 19, pp. 074102-1-10, 2007.

Experimental Evidence of the Motion of a Single Out-of-Equilibrium Drop (with D. Molin and V. Tricoli), Langmuir, Vol. 23, pp. 7459-7461, 2007.

Fluctuations of Non-Conservative Systems (with D. Leporini), J. Stat. Mech. P03002, 2007.

Jay Meegoda

Closure to Microscopic Modeling of Colloidal Silica Stabilized Granular Contaminated Soils (with Netnapid Tantemsapya), ASCE Journal of Materials in Civil Engineering, Vol. 20, No. 6, p. 457, June 2008.

Zoi-Heleni Michalopoulou

Detection of Explosives by Terahertz Synthetic Aperture Imaging--Focusing and Spectral Classification (with A. Sinyukov, I. Zorych, D. Gary, R. Barat, J. Federici), Comptes Rendus Physique, Vol. 78, pp. 1-14.

Petronije Milojevic

Homeomorphisms and Finite Solvability of their Perturbations for Fredholm Maps of Index Zero with Applications, Facta Universitatis, Vol. 22, No 2, pp. 104-136, December 2007.

Robert M. Miura

Cortical Spreading Depression: An Enigma, (with H. Huang and J.J. Wylie), Eur. Phys. J. Special Topics, Vol. 147, pp. 287-302, August 2007.

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 J. Appl. Math., Vol. 67, pp. 1418-1439, July 2007.

Cyrill Muratov

Front Propagation in Infinite Cylinders. II. The Sharp Reaction Zone Limit (with M. Novaga), Calc. Var. PDE, Vol. 31, pp. 521–547, August 2007.

Noise-Induced Mixed-Mode Oscillations in a Relaxation Oscillator near the Onset of a Limit Cycle (with E. Vanden Eijnden),Chaos, Vol. 18, 015111 pp. 1-11, March 2008.

Existence of Traveling Wave Solutions for Ginzburg-Landau-type Problems in Infinite Cylinders (with M. Lucia and M. Novaga), Archive Rat. Mech. Anal., Vol. 188, pp. 475–508, April 2008.

Boundary Homogenization for Periodic Arrays of Absorbers (with S. Y. Shvartsman), Multiscale Model. Simul., Vol. 7, pp. 44–61, April 2008.

Farzan Nadim

Describing the Bursting Dynamics of a Two-Cell Inhibitory Network using a One-Dimensional Map (with V. Matveev and A. Bose), J. Computational Neuroscience, Vol. 23, pp. 169-187, September 2007.

Sustained Rhythmic Activity in Gap-Junctionally Coupled Networks of Model Neurons depends on the Diameter of Coupled Dendrites (with J. Gansert and J. Golowasch), J. Neurophysiology, Vol. 98, pp. 3450-3460, October 2007.

A Modeling Comparison of Projection Neuron- and Neuromodulator-Elicited Oscillations in a Central Pattern Generating Network (with N. Kintos and M.P. Nusbaum), J. Computational Neuroscience, Vol. 24, pp. 374-397, June 2008.

A Newly Identified Extrinsic Input Triggers a Distinct Gastric Mill Rhythm via Activation of Modulatory Projection Neurons (with D. Blitz, R.S. White, S.R. Saideman, A. Cook, A. Christie and M.P. Nusbaum), J. Expermental Biology, Vol. 211, pp. 1000-1011, March 2008.

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Demetrios T. Papageorgiou

Linear Stability of a Two-Fluid Interface for Electrohydrodynamic Mixing in a Channel (with O. Ozen, F. Li, N. Aubry and P.G. Petropoulos), J. Fluid Mech., Vol. 583, pp. 347-377, July 2007.

Numerical and Analytical Studies of Nonlinear Gravity Capillary Waves in Fluid Layers under Normal Electric Fields (with J.-M. Vanden-Broeck), IMA J. Applied Math., Vol. 72, pp. 832-853, December 2007.

Influence of Surfactant on the Deformation and Breakup of a Bubble in a Viscous Surrounding (with M. Hameed, Y.-N. Young, M. Booty, J. Li and M. Siegel), J. Fluid Mech., Vol. 594, pp. 307-340, January 2008.

Electrified Viscous Thin Film Flow over Topography (with D. Tseluiko, M.G. Blyth and J.-M. Vanden-Broeck), J. Fluid Mech., Vol. 597, pp. 449-475, February 2008.

Effect of an Electric Field on Film Flow down a Corrugated Wall at Zero Reynolds Number (with D. Tseluiko, M.G. Blyth and J.-M. Vanden-Broeck), Phys. Fluids, Vol. 20, Article No. 042103, April 2008.

Horacio G. Rotstein

Formation of Gamma Coherent Cell Assemblies by Oriens Lacunosummoleculare Interneurons in the Hippocampus: A Modeling Study (with A. B. L. Tort, T. Dugladze, T.Gloveli and N. Kopell), Proc. Nat. Acad. Science. U.S.A., Vol. 104, pp. 13490-13495, August 2007.

Mixed Mode Oscillations: Experiment, Computation, and Analysis (with M. Brøns and T. J. Kaper), Chaos, Vol. 18, pp. 015101 (1-4), March 2008.

Mixed Mode Oscillations in a Three Time-Scale Model for the Dopaminergic Neuron (with M. Krupa, N. Popovic and N. Kopell), Chaos, Vol. 18, pp. 015106 (1-19), March 2008.

Michael Siegel

Influence of Insoluble Surfactant on the Deformation and Breakup of a Bubble or Thread in a Viscous Fluid (with M. Hameed, Y.-N. Young, J. Lie, M.R. Booty and D.T. Papageorgiou), J. Fluid Mech., Vol. 594, pp. 307-340, January 2008.

Sundar Subramanian

Censored Median Regression and Profile Empirical Likelihood, Statistical Methodology, Vol. 4, pp. 493-503, October 2007.

Jean-Marc Vanden-Broeck

Influence of Rapid Changes in a Channel Bottom on Free-Surface Flows (with B. Binder and F. Dias), IMA J. Appl. Math., Vol. 73, pp. 254-273, February 2008.

Electrified Viscous Thin Film over Topography (with D. Tseluiko, M. Blyth and D.T. Papageorgiou), J. Fluid Mech., Vol. 597, pp. 449-475, February 2008.

Effect of an Electric Field on Film Flow Down a Corrugated Wall at Zero Reynolds Number (with D. Tseluiko, M. Blyth and D.T. Papageorgiou), Phys. Fluids, Vol. 20(4), 042103, April 2008.

Surface Tension Effects on Interaction Between Two Fluids Near a Wall (with F.T. Smith), Quat. J. Mech. and Appl. Math. , Vol. 61, pp. 117-128, May 2008.

The Effect of Gravity on the Flow Past a Semi-Circular Cylinder with a Constant Pressure Wake (with G.C. Hocking), Appl. Math. Model., Vol. 32, pp. 677-687, May 2008.

Jonathan Wylie

Anomalous Behavior of a Single Particle Falling Through a Funnel (with Y. Fang, M. Gao, and Q.Zhang), Physical Review E 77, 041302, 2008.

Drag-Induced Particle Segregation with Vibrating Boundaries (with Q. Zhang, H.Y. Xu, and X.X. Sun), Europhysics Letters 81, 54001, 2008.

Change-Point Detection for Continuous Processes with High-Frequency Sampling (with G.M. Wang, S. Ben Hariz, and Q. Zhang), Comptes Rendus Mathematique 346,467, 2008.

Cortical Spreading Depression: An Enigma (with R.M. Miura and H. Huang), European Physical Journal, Special Topics 147, 287, 2007.

Stretching of Heated Threads with Temperature-Dependent Viscosity: Asymptotic Analysis (with P.D. Howell, H. Huang, and R.M. Miura), Discrete and Continuous Dynamical Systems B 7, 553, 2007.

Extensional Flows with Viscous Heating (with H.Huang), Journal of Fluid Mechanics 571, 359, 2007.

On the Formation of Glass Microelectrodes (with H. Huang, R.M. Miura, and P.D. Howell), SIAM Journal on Applied Mathematics 67, 630, 2007.

Optimal Rate of Convergence for Nonparametric Change-Point Estimators for Non-Stationary Sequences (with S. Ben Hariz and Q. Zhang), Annals of Statistics 35, 1802, 2007.

Thermal Instability in Drawing Viscous Threads (with H. Huang and R.M. Miura), Journal of Fluid Mechanics 570, 1, 2007.

Yuan-Nan Young

Hysteretic and Chaotic Dynamics of Viscous Drops in Creeping Flows with Rotation (with J. Blawzdziewicz, V. Cristini, and R. Goodman), J. Fluid Mech., Vol. 607, pp. 209-234, 2008.

Influence of Insoluble Surfactant on the Deformation and Breakup of a Bubble or Thread in a Viscous Fluid (with M. Hameed, M. Siegel, J. Li, M. R. Booty, and D. T. Papageorgiou), J. Fluid Mech., FM, Vol. 594, pp. 307-340, January 2008.

Stretch-Coil Transition and Transport of Fibers in Cellular Flows (with M. J. Shelley), Phys. Rev. Lett., Vol. 99, 058303, 2007.

BOOKS AND BOOK CHAPTERS

Roman I. Andrushkiw

Computer-aided Cytogenetic Method of Cancer Diagnosis (with N. V. Boroday, D.A. Klyushin, Y.I. Petunin), Nova Science Publishers Inc., New York, August 2007.

Vladislav V. Goldberg

Maks A. Akivis. Selected Papers, Edited by V. V. Goldberg, Heldermann Verlag, January 2008.

Proceedings of the International Conference Geometry in Odessa-2008, Editors: V. Goldberg, A. Kushner, V. Kuzakon, and V. Lychagin, Science Foundation, Odessa, May 2008.

Multidimensional Three-webs that are Formed by Surfaces of Different Dimensions, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 215-240, January 2008.

The Four-web and the Local Differential Ternary Quasigroup that are Determined by a Quadruple of Surfaces of Codimension Two, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 251-261, January 2008.

A Conformal Differential Invariant and the Conformal Rigidity of Hypersurfaces, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 413-422, January 2008.

Conformal and Grassmann Structures, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 423-449, January 2008.

Semiintegrable Almost Grassmann Structures, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 451-488, January 2008.

On the Theory of Almost Grassmann Structures, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 489-525, January 2008.

On the Structure of Submanifolds with Degenerate Gauss Maps, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 527-548, January 2008.

An Affine Analogue of the Hartman-Nirenberg Cylinder Theorem, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 549-558, January 2008.

Smooth Lines on Projective Planes over Two-Dimensional Algebras and Submanifolds with Degenerate Gauss Maps, (with M. A. Akivis), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 559-572, January 2008.

Linearizability of d-webs, d >= 4, on Two-Dimensional Manifolds, (with M. A. Akivis and V. V. Lychagin), in the book "Maks. A. Akivis. Selected Papers", edited by V. V. Goldberg, Heldermann Verlag, pp. 573-593, January 2008.

Claus Holzapfel

Ecosystems: Deserts, Encyclopedia of Ecology, Elsevier.

Populations Dynamics: Sex Ratio (with Y. Sapir and S. Mazer), Encyclopedia of Ecology, Elsevier.

Zoi-Heleni Michalopoulou

Detection of Explosives by Terahertz Imaging In Counter-Terrorism Detection Techniques of Explosives (with J. F. Federici, D. Gary, R. Barat) in Counter-Terrorism Detection Techniques of Explosives Jehuda Yinon, ed., pp. 323-366, Elsevier, July 2007.

Matched-field Processing in the Presence of Environmental Uncertainties: A Bayesian Approach (with L. W. Nolte) in Important Elements in Geoacoustic Inversion, Signal Processing, and Reverberation in Underwater Acoustics, Alexandra Tolstoy, ed., pp. 79-104, Research Signpost, June 2008.

Horacio G. Rotstein

Neurons and Neural Networks: Computational Models (with F. Nadim), In: Encyclopedia of Life Sciences. John Wiley & Sons, Ltd: Chichester http://www.els.net/ [DOI: 10.1002/9780470015902.a0000089.pub2], December 2007.

X. Sheldon Wang

Fundamentals of Fluid-Solid Interactions: Analytical and Computational Approaches, Elsevier, 2008.

PROCEEDINGS PUBLICATIONS

Roman I. Andrushkiw

Nonparametric Tests of Unimodality, (with D.A. Klyushin, Y.I. Petunin), Proceedings of the 2007 International Conference on Scientific Computing, Vol. 1, pp. 87-92, H. Arabnia and J. Yang, Eds., Las Vegas, July 2007.

Manish Bhattacharjee

A Family of Probability Generating Functions Induced by Shock models (with Satrajit Roychoudhury), IMS Collection, Vol. 1, Festchrift in honor of P.K. Sen. Mervyn Sylvapulle and N. Balakrishnan (Eds), Institute of Mathematical Statistics, Hayward, CA, pp. 78-88, February 2008.

Using Dynamic Programming Methods in Repair and Replacement Problems. Encyclopedia of Statistics in Quality and Reliability, Fabrizio Ruggeri, Ron S. Kenett, and Frederick W. Faltin (Eds.), December 2007.

Denis Blackmore

CAD/CAM for a Musical Cymbal Generated from a Fractal Geometry Model (with G. Zhou, A. Vas, R. Mulero, J. Tan, J. Lyman, and D. Roukous), Proc. ASME MSEC Sympos. On Advances in Rapid Manufacturing Technologies for Metal Parts, Vol. 4, pp. 53-60, September 2007.

Bruce Bukiet

Three Dimensional Mathematical Models for the Deformation of Human Fascia (with Hans Chaudhry, Huang Chien, Zhiming Ji, Robert Schleip, and Miriam Maney), Proceedings of the First International Fascia Research Conference, Boston, MA, Elsevier, Munich, p. 135, 2007.

Computation and Communication (with R. Friedman and F. P. Deek), Proceedings of the 19th International Conference of the Society for Information Technology & Teacher Education, Las Vegas, Nevada, 2008.

Thomas Erneux

Asymmetric Square-Waves in Mutually Coupled Semiconductor Lasers (with D.W. Sukow, A.T. Gavrielides), SPIE Proc 6997 on Semiconductor Lasers and Laser Dynamics, Strasbourg, France, April 2008.

Lou Kondic

Breakup of Finite Fluid Films (with J. Diez), Proceedings in Applied Mathematics and Mechanics, Vol. 7, p. 1090601-2, May 2008.

Signal Propagation through Dense Granular Systems (with R.P. Behringer), Proceedings in Applied Mathematics and Mechanics, Vol. 7, p. 1090931-2, May 2008.

Instabilities of Volatile Drops (with N. Murisic), Proceedings in Applied Mathematics and Mechanics, Vol. 7, p. 1091021-2, May 2008.

Jay Meegoda

Estimation of the Remaining Service Life of Culverts (with Thomas Juliano and Sameer Wadhawan), Transportation Research Board, Washington DC, Paper # TRB 08-1523, 2008.

Sustainable Agricultural Practices for Developing Nations (with S.A.S. Perera, P. Ratnaweera), Proceedings of the Sri Lankan Geotechnical Society's First International Conference on Soil & Rock Engineering, Colombo, Sri Lanka, P. H.S.W. Kulatilake, Editor, 2007.

Towards the Development of Sustainable Landfills (with A. Borgaonkar, H. N. Hsieh, S. El Haggar, P. A. Hettiaratchi and R. I. Stressel), Proceedings of the Sri Lankan Geotechnical Society's First International Conference on Soil & Rock Engineering, Colombo, Sri Lanka, P. H.S.W. Kulatilake, Editor, 2007.

Sustainable Use of Waste, the International Symposium on Geo-environmental Engineering for Sustainable Development, Xuzhou, China, L. Hu and B. Han, Eds., 2007.

Conversion of Chromium Ore Processing Residue to Chrome Steel (with Wiwat Kamolpornwijit and Zhengbo Hu), International Conference on Waste Engineering and Management, Hong Kong, Irene Lo and Catherine Mulligan, Eds., 2008.

Conversion of Chromium Ore Processing Residue to Chrome Steel (with Wiwat Kamolpornwijit and Zhengbo Hu), 9th International Symposium on Environmental Geotechnology and Global Sustainable Development, Hong Kong, Albert T. Yeung and Irene Lo, Eds., 2008.

Conversion of Chromium Ore processing Residue to Chrome Steel (with Wiwat Kamolpornwijit and Zhengbo Hu), WasteEng08, Patras, Greece, Gerasimos Lyberatos, Ed., 2008.

Cyrill Muratov

A Variational Approach to Front Propagation in Reaction-Diffusion Problems, Proceeding of the SNP 2007 Workshop, Kansai Seminar House, Kyoto, Japan, November 2007.

B. PRESENTATIONS

Roman I. Andrushkiw

June 2008: The 2008 International Conference on Bioinformatics and Computational Biology (BIOCOMP'08), Las Vegas, NV
1) Correlation Algorithm for Cytogenetic Method of Breast Cancer Diagnosis
2) Combined Correlation-Proximity Test for Breast Cancer and Fibroadenomatosis

Manish Bhattacharjee

May 2008: Statistics Seminar Series, Department of Mathematical Sciences, NJIT, Newark, NJ
Shock Models, a Family of Discrete Laws and Corresponding Strongly Decreasing Failure Rate Laws in Continuous Time

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
On Shape Duality of Failure Rate and Mean Remaining Life Functions

Denis Blackmore

July 2007: Industrial and Applied International Conference on Mathematics'07, Zürich, Switzerland
Invariant Tori in Perturbed Three Vortex Motion

Victoria Booth

July 2007: CNS*2007 16th Annual Computational Neuroscience Meeting, Toronto, Canada
5-HT Neuromodulation of Hippocampal Pyramidal Cells: Effects of Increased Ih on Cell Excitability

November 2007: 37th Annual Meeting of the Society for Neuroscience, San Diego, CA
Possible Effects of Membrane Dynamics on Network Spatio-Temporal Pattern Formation during Epileptogenesis

April 2008: Dynamical Systems in Biology: Workshop in Honor of the 70th birthday of Frank C. Hoppensteadt, New York University, NY
A Novel Population Model for NREM/REM Sleep Regulation

April 2008: Mathematical Biology Seminar, New Jersey Institute of Technology, Newark, NJ
A Novel Population Model for NREM/REM Sleep Regulation

June 2008: NSF/NIH Collaborative Research in Computational Neuroscience 2007 Annual PIs Meeting, University of Southern California, Los Angeles, CA
REM-relevant Serotonergic Effects on Synaptic Transmission and Plasticity in Hippocampal Input Pathways

Michael Booty

July 2007: Sixth International Congress on Industrial and Applied Mathematics (ICIAM 07), Zurich, Switzerland
The Effect of Surfactant on Bubble and Thread Dynamics

February 2008: Eleventh Annual CUNY Conference in Science and Engineering, Graduate School, CUNY, NY
Magnetic Field Assisted Assembly-A Two Dimensional Model (Poster)

March 2008: Department of Mathematics, Rowan University, NJ
Drops, Bubbles, and Surfactants

March 2008: TMS (The Minerals, Metals and Materials Society) 2008 Annual Meeting and Exhibition, New Orleans, LA
Magnetic Field Assisted Assembly - Theory and Experiments

March 2008: 2008 American Physical Society March Meeting, New Orleans, LA
Modeling of Magnetic Field Assisted Assembly (Poster)

April 2008: Department of Mathematics, College of Staten Island, CUNY, NY
Drops, Bubbles and Surfactants

April 2008: Fourth Annual Provost's Student Research Showcase, NJIT, NJ
A Two Dimensional Model for Magnetic Field Assisted Assembly (Poster)

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
The Influence of Surfactant and Surfactant Solubility on Drops and Bubbles (Poster)

May 2008: Department of Mathematics and Mechanics, IIMAS, UNAM, Mexico City
The Influence of Surfactant and Surfactant Solubility on Drops and Bubbles

Amitabha Bose

September 2007: Mathematical Neuroscience Workshop, CRM Montreal, Canada
Determining Firing Phase in CPG Networks

June 2008: Case Western University, Cleveland, OH
Roles for Short-term Synaptic Plasticity in Neuronal Networks

Yassine Boubendir

May 2008: Frontiers in Applied and Computational Mathematics'08, NJIT, Newark, NJ
Non-Overlapping Domain Decomposition Method and Boundary Element Method for Helmholtz Equation

Wooyoung Choi

October 2007: Seminar at the University of Delaware, Newark, DE
Evolution of Large Amplitude Internal Solitary Waves and Their Surface Signatures

November 2007: Seminar at the Virginia Technology, Blacksburg, VA
Asymptotic and Numerical Modeling of Highly Nonlinear Water Waves

March 2008: NSF Internal Wave Workshop, MBARI, Moss Landing, CA
Asymptotic and Numerical Modeling of Large Amplitude Internal Waves

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Short-wave Instability of Internal Solitary Waves and a Regularized Long Wave Model

June 2008: The International Conference on Nonlinear Waves-Theory and Applications, Beijing, China
Modeling of Strongly Nonlinear Internal Waves Interacting with Bottom Topography

June 2008: Seminar at the Korean Advanced Institute of Science and Technology, Korea
Theoretical and Experimental Studies on the Evolution of Nonlinear Water Waves

Sunil K. Dhar

July 2007: Joint Statistical Meeting 2007, Salt Lake City, Utah
Modified Simon's Two-Stage Design with a Control Group

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark
A Log-Linear Model under the Generalized Inverse Sampling Scheme

Javier Diez

August 2007: Pan-American Advanced Studies Institute (PASI) on Interfacial Fluid Dynamics: From Theory to Applications, Mar del Plata, Argentina
Experimental Techniques in Free Surface Flows

Rose Dios

October 2007: 21st Midwest Conf. on Combinatorics, Cryptography, and Computing, Charleston, SC
Strength Six Orthogonal Arrays and Their Non-Existence

Thomas Erneux

July 2007: Dynamics days Europe, Loughborough, UK
1) Strongly Nonlinear Oscillators Subject to Delay
2) The Dynamics of Quantum Dot Lasers

November 2007: CINBIOS, ULB, Belgium
Delay Dynamics in Gene Expression

November 2007: Workshop on Nonlinear Dynamics in Semiconductor Lasers, Berlin, Germany
Asymmetric Square-Waves in Polarization Rotated Coupled Semiconductor Lasers

Vladislav V. Goldberg

August 2007: Geometry and Algebra of PDEs, University of Tromso, Norway
Local Algebras of a Differentiable Quasigroup

August 2007: Colloquium on Variations, Geometry and Physics in honour of Demeter Krupka's 65th birthday, Palacky University, Olomouc, Czech Republic
Differential Geometry of Veronese–like and Lagrange–like Webs

August 2007: 10th International Conference Differential Geometry and Its Applications, Olomouc, Czech Republic
Local Algebras of a Differentiable Quasigroup

May 2008: Geometry in Odessa-2008, Odessa, Ukraine
Grassmannizable Webs

May 2008: International Conference Geometry in Odessa-2008, Odessa, Ukraine
Geodesic Planar Webs and Euler Equations

June 2008: The Abel Symposium 2008, Tromso, Norway
Abelian Equations and Differential Invariants of Planar 4-Webs

Jorge Golowasch

February 2008: GSU
Co-regulation of Ionic Currents: Regulation and Possible Role in Nervous System Function

January 2008: Biology Department, Facultad de Ciencias, Universidad de Chile
Co-regulación de corrientes iónicas y su posible rol en la función del sistema nervioso (Co-regulation of Ionic Currents and Its Possible Role in Nervous System Function)

November 2007: MDC / Axon Instruments User Meeting (Satellite of the Annual Meeting of the Society for Neuroscience, San Diego, CA
Voltage-Dependent Ion Channels Talk to Each Other with Many Voices

March 2008: 34th East Coast Annual Nerve Net Meeting, Woods Hole, MA
1) Ionic Current Cross-Talk Between Pyloric Neurons in Cancer Borealis
2) Dissecting the Phase Response Curve of a Bursting Neuron

Roy Goodman

May 2008: AIMS International Conference on Dynamical Systems and Differential Equations, Arlington TX
Fractal Structures in Solitary Wave Interactions

March 2008: AMS Sectional Meeting, New York, NY
Stability of Trapped Light in Bragg Grating Optical Fiber Defects

December 2007: Lefschetz Center for Dynamical Systems seminar, Brown University
Fractal Structures in Solitary Wave Interactions

November 2007: Dynamical Systems and Nonlinear Science Colloquium, Georgia Tech
Fractal Structures in Solitary Wave Interactions

Peter Gordon

December 2007: SIAM Conference on Analysis of Partial Differential Equations, Mesa
Propagation of a KPP-Type Fronts in a Model of Pressure Driven Flames

July 2007: 6th International Congress on Industrial and Applied Mathematics, Zurich
Quenching, Propagation and Blow up in Porous Media Combustion

Arnaud Goullet

March 2008: American Mathematical Society 2008 Spring Eastern Meeting, New York
Numerical Studies on the Evolution of Nonlinear Water Waves and their Validation with Laboratory Experiments

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Numerical Studies on the Evolution of Nonlinear Water Waves and their Validation with Laboratory Experiments (poster)

Claus Holzapfel

August 2007: Ecological Society of America, San Jose, CA
1) Temporal Fuctuations in Shrub-Associated Annual Plant Communities in the Mojave Desert
2) Understanding Invasions: A Multi-Garden Approach
3) Self-Shading and Physiological Integration in Phragmites Australis: Factors Leading to Division of Labor
4) A Break in the Drought or Just More of the Same Stress? Interaction Among Shrubs and Annuals in the Mojave Desert

April 2008: Ecological Society of America, Midatlantic Chapter Meeting, Wilkes-Barre, PA
1) Using Passerine Nestlings as Bioindicators of Heavy Metal Accumulation at a Former Brownfield Site
2) Niche Divergence: Root-Level Competition, Scale, and Implications for Invaded Plant Communities
3) Studying the Effects of Passer Domesticus on Native Sparrows in Newark, NJ: Resource Competition and Migratory Costs

David J. Horntrop

March 2008: SIAM Sectional Meeting, Orlando, FL
Simulation of Mesoscopic Models for Self-Organization in Materials

May 2008: SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA
Simulation of Self-Organization in Surface Processes

May 2008: Frontiers in Applied and Computational Mathematics, Newark, NJ
1) Mesoscopic Simulation of Ostwald Ripening
2) Multistep Simulation Methods for Collateralized Debt Obligations
3) Self-Organization in Density Relaxation by Tapping
4) Aliasing and Convolutions in Fourier Series

Aridaman Jain

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Modeling of Sediment Chemistry and Biophysical Measurements Based on Remote-Sensor Images

Lou Kondic

May 2008: Frontiers in Applied and Computational Mathematics, Newark, NJ
Octopus Shaped Instabilities of Evaporating Drops

April 2008: Colloquium, Levich Institute of CCNY
Stability of Finite and Infinite Fluid Rivulets

November 2007: American Physical Society-Division of Fluid Dynamics Annual Meeting, Salt Lake City, UT
1) Signal Propagation in Dense Granular Systems
2) Stability of Finite and Infinite Fluid Rivulets
3) Curiously Shaped Instabilities at the Fronts of Volatile Drops
4) How do Drops Evaporate?
5) On Barodiffusion in Thin Binary Falling Fluid Films
6) Flow of an Infinite Fluid Strip Down an Incline Plane: Contact Line Stability

November 2007: Fifth International Surface Cleaning Workshop, Boston, MA
To the Origin of the Watermarks Formation

September 2007: Euromech 490, London, UK
1) Finite Size Effects on Stability of Fluid Films and Rivulets
2) Evaporative Instabilities of Liquid Films and Drops
3) On Dimpled Thin Falling Liquid Films

August 2007: Pan American Study Institute on Interfacial Fluid Dynamics: From Theory to Applications, Mar del Plata, Argentina
1) Evaporative Instabilities of Liquid Films and Drops
2) Octopus-shaped Instabilities of Evaporating Droplets

July 2007: 6th International Congress on Industrial and Applied Mathematics, Zurich, Switzerland
1) Signal Propagation through Dense Granular Media
2) Breakup of Finite Fluid Films
3) Octopus-shaped Instabilities of Evaporating Droplets

July 2007: 5th Conference on Applied Mathematics and Scientific Computing, Brijuni, Croatia
Octopus-shaped Instabilities of Evaporating Droplets

July 2007: Colloquium, LAM Research, Fremont, CA
Instabilities of Thin Liquid Films

July 2007: Colloquium, IBM Almaden Research Center, San Jose, CA
Instabilities of Photoresist Films

Gregory A. Kriegsmann

February 2008: Department of Mathematical Sciences, RPI, Troy, NY
Electromagnetic Propagation in Periodic Porous Structures

May 2008: Department of Mathematical Sciences, NJIT, Newark, NJ
Electromagnetic Propagation in Periodic Porous Structures

Dawn A. Lott

February 2008: Joint Mathematics Meeting, San Diego, CA
Mathematical Predictions for Aneurysm Repair

February 2008: American Physical Society Division of Fluid Dynamics, New Orleans, LA
Mathematical Predictions for Aneurysm Repair

Victor Matveev

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Non-Synchronous Dynamics in Non-Weakly Coupled Inhibitory Networks of Type-I Oscillators

February 2008: Drexel University Mathematics Colloquium, Philadelphia, PA
Neural Circuits and Coupled Oscillator Dynamics

June 2007: Workshop on Synaptic Modeling, USC, Los Angeles, CA
Mechanisms of Short-term Synaptic Facilitation: Computational Modeling using CalC

Zoi-Heleni Michalopoulou

June 2008: Acoustical Society of America Meeting, Paris, France
Dispersion Curve Estimation with Particle Filters for Geoacoustic Inversion

Robert M. Miura

June 2008: International Conference on Applied Mathematics: Modeling, Analysis, and Computation, City University of Hong Kong, Hong Kong
Stretching of Heated Threads: Glass Microelectrodes

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Mathematical Modeling of Spreading Depression (poster)

January 2008: American Mathematical Society Special Session on Dynamics and Stability of Coherent Structures, Joint Mathematics Meetings, San Diego, CA
Solitons and the Inverse Scattering Method

July 2007: Summer Seminar Series, Department of Mathematical Sciences, NJIT, Newark
Accurate Solitary Wave Solutions

Richard O. Moore

March 2008: AMS Spring Eastern Meeting, New York, NY
Nonlocal Stabilization of Localized Solutions to Damped-Dispersive Equations

May 2008: AIMS International Conference on Dynamical Systems and Differential Equations, Arlington, TX
Nonlocal Stabilization of Localized Solutions to Damped-Dispersive Equations

June 2008: Universidad Torcuato Di Tella, Buenos Aires, Argentina
Applied Mathematics Colloquium

Cyrill Muratov

July 2007: Mini-Symposium Talk, 6th International Congress on Industrial and Applied Mathematics, Zurich, Switzerland
A Variational Approach to Front Propagation in Infinite Cylinders

July 2007: Invited Talk, Department of Computer Science, University of Verona, Verona, Italy
Interfacial Patterns in Systems with Long-Range Interactions of Coulomb Type

November 2007: Analysis Seminar, Department of Mathematics, Universityof Pisa, Pisa, Italy
A Variational Approach to Front Propagation in Infinite Cylinders

November 2007: Invited Mini-Course, a Workshop on Singularities Arising in Nonlinear Problems, Kyoto, Japan
A Variational Approach to Front Propagation in Reaction-Diffusion Problems

February 2008: Applied Mathematics Colloquium, Department of Applied Mathematics and Physics, Columbia University, New York, NY
Self-Induced Stochastic Resonance: How New Non-Random Behaviors Canarise from the Action of Noise

February 2008: Applied Mathematics Colloquium, Graduate Center, City University of New York, New York, NY
Self-Induced Stochastic Resonance: How New Non-Random Behaviors Can Arise from the Action of Noise

February 2008: PDE Seminar, Department of Mathematics, University of Chicago, Chicago, IL
A Variational Approach to Front Propagation in Reaction-Diffusion Problems

March 2008: American Mathematical Society Sectional Meeting, Courant Institute of MathematicalScience, New York, NY
A Variational Approach to Front Propagation in Reaction-Diffusion Equations and their Singular Limits

March 2008: Analysis Seminar, Courant Institute of Mathematical Science, New York, NY
A Variational Approach to Front Propagation in Reaction-Diffusion Equations and their Singular Limits

Farzan Nadim

July 2007: Computational Neuroscience Meeting, Toronto
1) Determining the Effect of the A-Current on the Activity Phase of a Follower Neuron in an Inhibitory Network
2) Maintaining Phase of the Tri-Phasic Crab Pyloric Rhythm
3) Systematic Computational Exploration of the Parameter Space of the Multi-Compartment Model of the Lobster Pyloric Pacemaker Kernel Suggests that the Kernel can Achieve Functional Activity under Various Parameter Configurations

August 2007: 8th International Congress of Neuroethology, Vancouver
Contributions of Synaptic and Intrinsic Firing Properties to Activity in a Model Motor Network

September 2007: NJIT, Applied Mathematics Colloquium, Newark
The Role of Anatomical Structure in Determining Activity in Electrically Coupled Networks

November 2007: Society for Neuroscience Annual Meeting, San Diego
1) Feedback to Descending Projection Neurons can Override the Mechanisms Underlying Rhythmic Pattern Generation in the Target Network: A Modeling Study
2) Maximum Spike Timing Reliability Occurs at the Intrinsic Resonance Frequency
3) Neuromodulators alter the Relative Contributions of Synaptic Strength and Intrinsic Firing Properties to Rhythmic Activity of the Lobster Pyloric Network
4) Constraining the Parameters of Model Neurons: How Good is Good Enough?

April 2008: Fordham University, Seventh Annual Computer Science Day, New York
The Role of Anatomical Structure in Determining Activity in Electrically Coupled Networks

April 2008: Rutgers-Newark Center for Molecular and Behavioral Neuroscience Colloquium, Newark
The Role of Descending Projection Neurons and Feedback in Rhythmic Motor Pattern Generation

April 2008: East Coast Nerve Net, Woods Hole
1) How do Pyloric Synapses Respond to Co-Released Neuromodulators?
2) Determining the Effect of the A-Current on the Activity Phase of a Follower Neuron in an Inhibitory Network

May 2008, NJIT Frontiers in Applied & Computational Mathematics, Newark
The Role of Anatomical Structure on Activity in a Gap-Junctionally Coupled Network

May 2008, EITC-Bio 2008, Princeton
Comparing Projection Neuron- and Neuromodulator-Elicited Network Oscillations: A Modeling Study

Demetrios T. Papageorgiou

August 2007: Pan-American Advanced Studies Institute (PASI) on Interfacial Fluid Dynamics: From Theory to Applications, Mar de Plata, Argentina
Interfacial Electrohydrodynamics

September 2007: Euromech 490 Workshop on Dynamics and Stability of Thin Liquid Films and Slender jets, Imperial College London
Mathematical Problems in Interfacial Electrohydrodynamics

October 2007: Applied Mathematics Laboratory Seminar, Courant Institute of Mathematical Sciences, New York University
Problems in Interfacial Electro-Hydrodynamics

November 2007: American Physical Society, 60th Annual Meeting of the Division of Fluid Dynamics, Salt Lake City, Utah
Electrified Viscous Thin Film Flow over Topography

February 2008: Institute for Mathematical Sciences, Imperial College of Science, Technology and Medicine
Problems in Interfacial Electrohydrodynamics

March 2008: Applied Mathematics Colloquium, Department of Mathematical Sciences, NJIT
Some Problems in Interfacial Electrohydrodynamics

May 2008: NSF/CBMS Conference on Water Waves: Theory and Experiment, Howard University, Washington DC
Wave Dynamics in Electrified Viscous Film Flows

Horacio G. Rotstein

July 2007: Second Argentine School of Mathematics and Biology, La Falda, Cordoba, Argentina
Mechanistic Aspects of the Generation of Subthreshold Oscillations, the Onset of Spikes, and Related Phenomena in a Medial Entorhinal Cortex Stellate Cell Model

August 2007: Department of Economics, Universidad Nacional del Sur, Bahia Blanca, Buenos Aires, Argentina
Challenges and Difficulties in Interdisciplinary Research

August 2007: Department of Mathematics, Universidad Nacional del Sur, Bahia Blanca, Buenos Aires, Argentina
The Role of the Three-Dimensional Canard Phenomenon in the Mechanism of Generation of Mixed-Mode Oscillations in Neural Models

April 2008: Center for Behavioral and Molecular Neuroscience, Rutgers University
Rhythmic Activity in Layer II of the Medial Entorhinal Cortex: Mechanistic and Dynamic Aspects

April 2008: Waves Seminar Series, Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, NJ
Evolution of Fronts in Reaction Diffusion Systems with Global Feedback

May 2008: Department of Mathematical Sciences Colloquium, Drexel University, Philadelphia, PA
Dynamic Aspects of Medial Entorhinal Vortex Stellate Cell Activity

May 2008: Twelfth International Conference on Cognitive and Neural Systems (ICCNS), Boston, MA
Rhythmic Oscillations in Layer II of the Medial Entorhinal Cortex

May 2008: Frontiers in Computational and Applied Mathematics (FACM), Newark, NJ
Dynamic Aspects of a Decision-Making Process in a Hot/Cool System

May 2008: Network Synchronization: From Dynamical Systems to Neuroscience, Leiden, Holland
The Abrupt Transition from Theta to Hyperexcitable Spiking Activity in Stellate Cells from Layer II of the Medial Entorhinal Cortex

Michael Siegel

July 2007: International Congress of Industrial and Applied Mathematics, Zurich, Switzerland
The Effect of Surfactant on Bubble and Thread Dynamics

August 2007: Pan-American Study Institute on Interfacial Fluid Dynamics, Mar del Plata, Argentina
1) Singularities in Interfacial Fluid Dynamics
2) Singularity Formation in the 3D Euler Equations

October 2007: Analysis Seminar, Clemson University, Clemson, SC
Modeling, Analysis, and Computations of the Breakup of Bubbles and Drops in a Viscous Fluid

November 2007: Applied Math Lab Seminar, Courant Institute, NY
Modeling, Analysis, and Computations of the Influence of Surfactant on the Breakup of Bubbles and Drops in a Viscous Fluid

November 2007: APS Division of Fluid Dynamics Annual Meeting, Salt Lake City, UT
Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations

May 2008: Transitions Workshop on Interfaces and Random Media, SAMSI, Raleigh, NC
Modeling, Analysis, and Computations of the Influence of Surfactant on the Breakup of Bubbles and Drops in a Viscous Fluid

June 2008: Free Boundary Problems 2008, Stockholm, Sweden
Complex Singularities in Interfacial Fluid Flow and 3D Incompressible Euler Equations

Sundar Subramanian

March 2008: ENAR Meeting, Arlington, VA
Censored Median Regression and Profile Empirical Likelihood

June 2008: SRCOS Summer Research Conference, Charleston, SC
Semiparametric Left Truncation and Right Censorship Models with Missing Censoring Indicators (poster)

Louis Tao

June 2008: International Bioinformatica Workshop 2008, Yunan University, Kunming, China
Low-Dimensional Characterization of Neuronal Network Activity in a Large-Scale Model of the Visual Cortex

December 2007: Seminar, Center for Theoretical Biology, Peking University, Beijing, China
A Large-Scale Network Model of the Visual Cortex: Mechanisms of Orientation Selectivity

Svetlana Tlupova

February 2008: Applied Math Lab Seminar, Courant Institute, NYU
Numerical Solutions of Coupled Stokes and Darcy Flows Based on Boundary Integrals

March 2008: AMS Eastern Sectional Meeting, Courant Institute of New York University, NY
The Boundary Integral Method for Stokes-Darcy Problems

March 2008: Applied Mathematics and Analysis Seminar, Duke University
Numerical Solutions of Coupled Stokes and Darcy Flows Based on Boundary Integrals

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Domain Decomposition Methods for Solving Stokes-Darcy Systems Based on Boundary Integrals

Jean-Marc Vanden-Broeck

July 2007: 6th International Congress on Industrial and Applied Mathematics, Zurich
Three Dimensional Gravity Capillary Solitary Waves and Related Problems

July 2007: Dynamics Days, Loughborough, UK
Nonlinear and Weakly Nonlinear Free Surface Flows Past Submerged Obstacles

July 2007: Waves 2007, Reading, UK
Nonlinear Three Dimensional Free Surface Flows

October 2007: Second International Congress in Applied and Computational Mathematics, Cumana, Venezuela
Two and Three Dimensional Gravity Capillary Solitary Waves

March 2008: Workshop on Slaming, Oxford, UK
Self Similar Free Surface Flows

May 2008: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Studies of Nonlinear Three Dimensional Free Surface Flows

June 2008: Free Boundary Conference on Theory and Application, Stockholm, Sweden
Numerical Investigations of Three Dimensional Waves

Yuan-Nan Young

May 2008: SIAM/Material Science Meeting, Philadelphia, PA
Dynamics of Semi-Flexible Filaments under Polar Forcing

March 2008: APS March Annual Meeting, New Orleans, LA
Hysteretic and Chaotic Dynamics of Viscous Drops in Creeping Flows with Rotation

March 2008: Colloquium, Department of Engineering, Rutgers University, NJ
Novel Dynamics in Stokes Flow

February 2008: Polymer Division Seminar, NIST
Novel Dynamics in Stokes Flow

February 2008: Applied Mathematics Laboratory Seminar, Courant Institute of Mathematical Sciences, New York University
Novel Dynamics in Stokes Flow

January 2008: Applied and Computational Mathematics Seminar, Department of Mathematics, Dartmouth College
Novel Fluid Dynamics in Stokes Flow

November 2007: APS Fluid Division/Salt Lake City, UT
Dynamics of Semi-Flexible Filaments under Polar Forcing

September 2007: Department of Mechanical Engineering Seminar, Columbia University
Novel Fluid Dynamics in Simple Flow Due to Fluid-Structure Interaction or Surfactant Mass Transport

C. TECHNICAL REPORTS

REPORT 0708-1: *Dynamics of a Closed Rod with Twist and Bend in Fluid*
Sookkyung Lim, Anca Ferent, X. Sheldon Wang, and Charles S. Peskin

REPORT 0708-2: *Maintaining Phase of the Crustacean Tri-phasic Pyloric Rhythm*
Christina Mouser, Farzan Nadim, and Amitabha Bose

REPORT 0708-3: *A Newly Identified Extrinsic Input Triggers a Distinct Gastric Mill Rhythm via Activation of Modulatory Projection Neurons*
Dawn M. Blitz, Rachel S. White, Shari R. Saideman, Aaron Cook, Michael P. Nusbaum, Andrew E. Christie, and Farzan Nadim

REPORT 0708-4: *Optical Fiber Drawing and Dopant Transport*
H. Huang, R.M. Miura, and J.J. Wylie

REPORT 0708-5: *On Properties of the Ising Model for Complex Energy/Temperature and Magnetic Field*
Victor Matveev and Robert Shrock

REPORT 0708-6: *Loss of Phase-Locking in Non-Weakly Coupled Inhibitory Networks with Finite Synaptic Decay Time*
Myongkeun Oh and Victor Matveev

REPORT 0708-7: *Electric Discharge Sintering: A Mathematical Model*
G. A. Kriegsmann

REPORT 0708-8: *Electromagnetic Wave Propagation in Periodic Porous Structures*
I. David Abrahams and G. A. Kriegsmann

REPORT 0708-9: *Complete Transmission through a Periodically Perforated Rigid Slab*
Lin Zhou and G. A. Kriegsmann

REPORT 0708-10: *Hazard Estimation from Right Censored Data with Missing Censoring Indicators*
Sundarraman Subramanian and Derek Bean

REPORT 0708-11: *Homeomorphisms and Finite Solvability of Their Perturbations for Fredholm Maps of Index Zero with Applications*
P. S. Milojevic

REPORT 0708-12: *Proximity Measure between Samples with Repetition Factor Greater than One*
R.I. Andrushkiw, D.A. Klyushin, and Yu.I. Petunin

REPORT 0708-13: *On Explicit/Implicit and Incompressible/Compressible Issues of Immersed Boundary/Continuum Methods*
Xiaodong (Sheldon) Wang

REPORT 0708-14: *Computer-Aided Cytogenetic Method of Breast Cancer Diagnosis*
R.I. Andrushkiw, Yu.I. Petunin, D.A. Klyushin, N.V. Boroday, and I.V. Dosenko

REPORT 0708-15: *Mathematical and Computational Analysis of the Effect of the A-current in a Follower Neuron in an Inhibitory Network*
Yu Zhang, Amitabha Bose, and Farzan Nadim

REPORT 0708-16: *Internet Search Result Probabilities Heaps' Law and Word Associativity*
Jonathan C. Lansey and Bruce Bukiet

REPORT 0708-17: *How Do Drops Evaporate?*
N. Murisic and L. Kondic

REPORT 0708-18: *Signal Propagation through Dense Granular Systems*
L. Kondic, O. M. Dybenko, and R. P. Behringer

REPORT 0708-19: *Instabilities and Taylor Dispersion in Isothermal Binary Thin Fluid Films*
Z. Borden, H. Grandjean, A.E. Hosoi, L. Kondic, and B.S. Tilley

REPORT 0708-20: *Systems of Coupled Diffusion Equations with Degenerate Nonlinear Source Terms: Linear Stability and Traveling Waves*
Jonathan J. Wylie, Huaxiong Huang, and Robert M. Miura

REPORT 0708-21: *Bootstrap Bandwidth for Estimation in the Missing Censoring Indicator Model*
Sundar Subramanian and Derek Bean

REPORT 0708-22: *Semiparametric Models for Left Truncation and Right Censoring with Missing Censoring Indicators*
Sundar Subramanian and Dipankar Bandyopadhyay

REPORT 0708-23: *Predicting the Activity Phase of a Follower Neuron with A-current in an Inhibitory Network*
Yu Zhang, Amitabha Bose, and Farzan Nadim

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES AND AWARDS

Daljit S. Ahluwalia

Editorial Board Member, Mathematical Sciences Research Hot-Line International Journal.

Manish Bhattacharjee

Member, Organizing Committee for Frontiers in Applied and Computational Mathematics Conference (FACM'08), NJIT, May 2008.

Denis Blackmore

Associate Editor, Mechanics Research Communications.

Editorial Board, Regular and Chaotic Dynamics.

Editorial Board, Mathematical Bulletin of the Shevchenko Scientific Society.

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

Co-organizer of Minisymposium, Recent Advances in Vortex Dynamics: Theory and Computation; and Recent Advances in Vortex Dynamics: Applications, Sixth International Congress on Industrial and Applied Mathematics (ICIAM' 07), Zürich, Switzerland, July 2007.

Co-organizer of Minisymposium, Computational and Experimental Studies of Vortex Dominated Flows, International Conference on Computational and Experimental Engineering and Science (ICCES'08), Honolulu, Hawaii, March 2008.

Listed in Top 100 Educators 2008 by IBC.

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

Nominated for Master Diploma, World Academy of Letters.

Victoria Booth

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

Michael Booty

Co-organizer of Mini-Symposium, Influence of Surfactants on Interfacial Flows, at the Sixth International Conference on Industrial and Applied Mathematics, Zurich, Switzerland, July 2007.

Bruce Bukiet

Mathematical Association of America: 2008 New Jersey Award for Distinguished College of University Teaching of Mathematics, April 2008.

Robert W. Van Houten Award for Teaching Excellence (NJIT), June 2007.

Wooyoung Choi

NSF-DMS Review Panel, March 5-7, 2008.

Javier Diez

Chair of the Local Organizing Committee, Pan American Study Institute on Interfacial Fluid Dynamics: From Theory to Applications, Mar del Plata, Argentina, August 2007.

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 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.

Member, Organizing Committee of the International Conference Geometry in Odessa - 2008, Odessa, Ukraine.

Jorge Golowasch

July 2007: Co-Director and Faculty at the Marine Biological Laboratories, Woods Hole, MA. Neural Systems and Behavior course.

March 2008: Member of the Organizing Committee of the 34th East Coast Annual Nerve Net Meeting, Woods Hole, MA.

Aridaman Jain

Chair of the American Society for Quality (ASQ) Writing Committee for Chain Sampling Procedures for Inspection by Attributes, May 2008.

Judge at the Twenty-Fifth Annual North Jersey Regional Science Fair at Rutgers University, New Jersey, March 14-15, 2008.

Lou Kondic

Organizer, Pan American Study Institute on Interfacial Fluid Dynamics: From Mathematical Theory to

Applications, Mar del Plata, Argentina, August 2007.

Scholar, The Kavli Institute for Theoretical Physics, University of California at Santa Barbara, 2006-2008.

Organizer, Minisymposium on Granular Matter at ICIAM 2007, Zurich, Switzerland, July 2007.

Member, Specialist Review Committee for Fulbright Scholar Program.

Gregory A. Kriegsmann

Associate Editorships:
1) Wave Motion
2) IMA Journal of Applied Mathematics
3) European Journal of Applied Mathematics
4) SIAM Journal on Applied Mathematics
5) Journal of Engineering Mathematics

Dawn A. Lott

Manchester Who's Who Computational Biomathematician of the Year, August 2007.

Robert M. Miura

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

Member (2008-2010), Board of Trustees, Mathematical Biosciences Institute, Ohio State University.

Organizing Committee, SIAM Conference for Mathematics in Industry: Challenges and Frontiers, 2009.

Co-Organizer, Fourth Pacific Rim Conference on Mathematics, Hong Kong, December 7-11, 2007.

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

Editorial Board, Monographs on Mathematical Modeling and Computation, Society for Industrial and Applied Mathematics.

Editorial Board, Canadian Applied Mathematics Quarterly, Canadian Applied and Industrial Mathematics Society.

Co-Program Director, HHMI-NIBIB Interfaces Initiative Doctoral Training Program in Quantitative Neuroscience.

Richard O. Moore

A Method to Compute Statistics of Large, Noise-Induced Perturbations of Nonlinear Schrodinger Solitons selected by the SIAM Editors as "an exceptional paper, chosen for its readability and wide appeal to the SIAM community," to appear in the SIGEST section of the SIAM Review.

Farzan Nadim

Associate Editor, Journal of Neuroscience.

Demetrios T. Papageorgiou

Fellow of the Institute of Mathematics and its Applications.

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

Editorial Board, Computational and Applied Mathematics.

Horacio G. Rotstein

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

"Chaos (An Interdisciplinary Journal of Nonlinear Science). Editor of the Focus Issue on Mixed-Mode Oscillations" (with Tasso Kaper and Morten Brons).

Michael Siegel

Co-editor of the Focus Issue on Mixed Mode Oscillations, Chaos, 2008.

Member of Editorial Board, SIAM Journal of Applied Mathematics.

Chair of Organizing Committee, Frontiers in Applied and Computational Mathematics, NJIT, May 2008.

Co-organizer of Minisymposium, Influence of Surfactant on Interfacial Flows, International Congress of Industrial and Applied Mathematics, Zurich, July 2007.

Louis Tao

June 2008, Principal lecturer, weeklong short course on Mathematical Modeling, Center for Bioinformatics, Peking Unviersity, Beijing, China.

Jean-Marc Vanden-Broeck

Fellow of the Institute of Mathematics and its Applications.

Director of the Centre for Interdisciplinary Mathematical Research, University of East Anglia, UK.

Editor, Quarterly Journal of Mechanics and Applied Mathematics.

Editor, ANZIAM Journal.

B. CONFERENCE ON FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS (FACM '08)

Daljit S. Ahluwalia Honored at FACM'08 on May 19, 2008

The fifth conference on Frontiers in Applied and Computational Mathematics was held at NJIT on May 19-21, 2008. The three-day conference 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 difficult problems in the biomedical, physical and social sciences, engineering and technology. A new aspect of the meeting was a panel discussion on 'Future Challenges in Applied Mathematics and Scientific Computation.' The distinguished panel included Stuart S. Antman (University of Maryland), G. Bard Ermentrout (University of Pittsburgh), Joseph B. Keller (Stnaford University), and John Lowengrub (University of California, Irvine). The session featured a lively discussion among panel members and other conference attendees.

Daljit S. Ahluwalia, the longtime chair of NJIT's Department of Mathematical Sciences, was honored during the conference for his pivotal role in dramatically raising the department's status on campus and in the nation. The honor was awarded on the occasion of his 75th birthday before more than 200 leading academics from around the world. An endowed fund for the newly-established D.S. Ahluwalia Doctoral Fellowship in Mathematical Sciences was announced at a Celebration Dinner in his honor on May 19, 2008.

Dr. Ahluwalia arrived at NJIT in 1986 to lead the department, following more than two decades of work at the famed Courant Institute for the Mathematical Sciences at New York University. Since then, the mathematical sciences faculty has increased in numbers by 100%, the physical space has grown 300% and the computing power has increased by factor of one million. The department annually receives more than $2 million in federal funding, a notable sum for mathematical research. Today, mathematics is the NJIT's largest department and in 2004 it was selected to receive strategic priority funding to achieve national prominence within a five-year period. Last year, Academic Analytics, as reported in the Chronicle of Higher Education (Nov. 7, 2007), ranked the department based on faculty productivity number 10 in the nation.

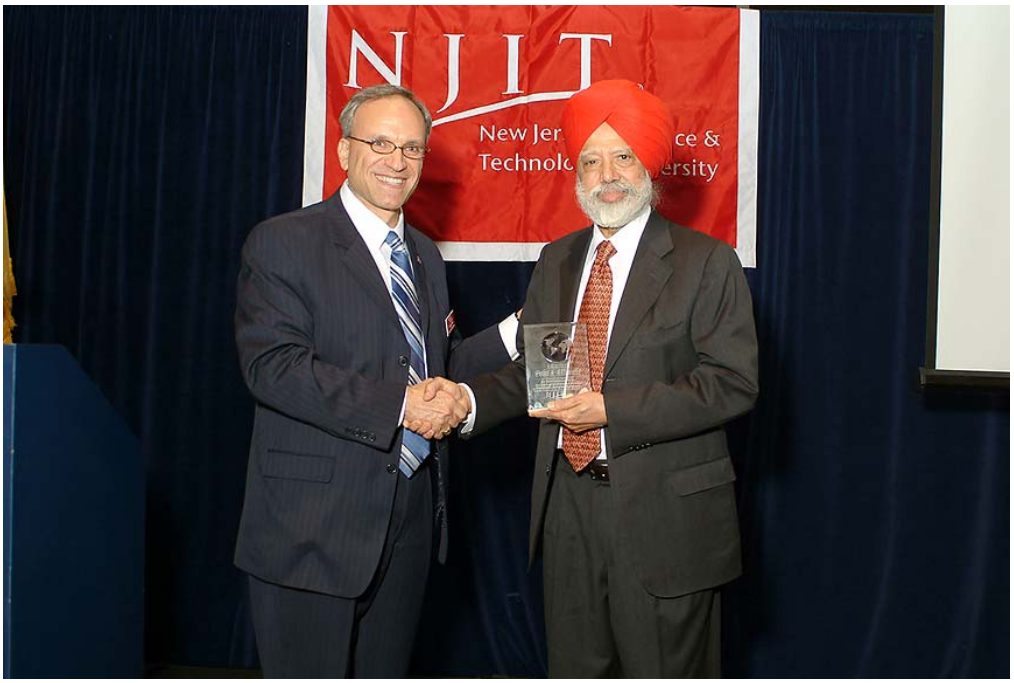
NJIT faculty, administrators, and family members spoke about Dr. Ahluwalia's achievements during the celebration dinner. "We all thank Daljit for his many contributions in building one of the most accomplished teams in applied mathematics in the world today," said NJIT President Robert A. Altenkirch. "Professor Ahluwalia's imprints are evident on the entire success story of the department of mathematical sciences," said Fadi P. Deek, Dean of the College of Science and Liberal Arts at NJIT. "He has made innumerable contributions not only to his department, but also to our college and the university. Under his leadership, the mathematical sciences department transitioned from a teaching department to one of the leading venues for applied mathematics research in the country. This success has been accomplished by a steady and persistent emphasis on hiring and grooming young faculty, as well as established leading researchers in applied areas of mathematics."

Conference highlights included 57 symposia plus six plenary lectures. The plenary lectures featured: Jean-Marc Vanden Broeck, of University College, London; Frank Hoppensteadt of Courant Institute of Mathematical Sciences at New York University; G. Bard Ermentrout, of University of Pittsburgh; I. David Abrahams, University of Manchester, UK; Pranab K. Sen, University of North Carolina at Chapel Hill; and Michael Shelley of Courant Institute of Mathematical Sciences at New York University. The National Science Foundation, Society for Mathematical Biology, and NJIT have provided support for the event.

Daljit S. Ahluwalia Celebration Dinner at FACM'08

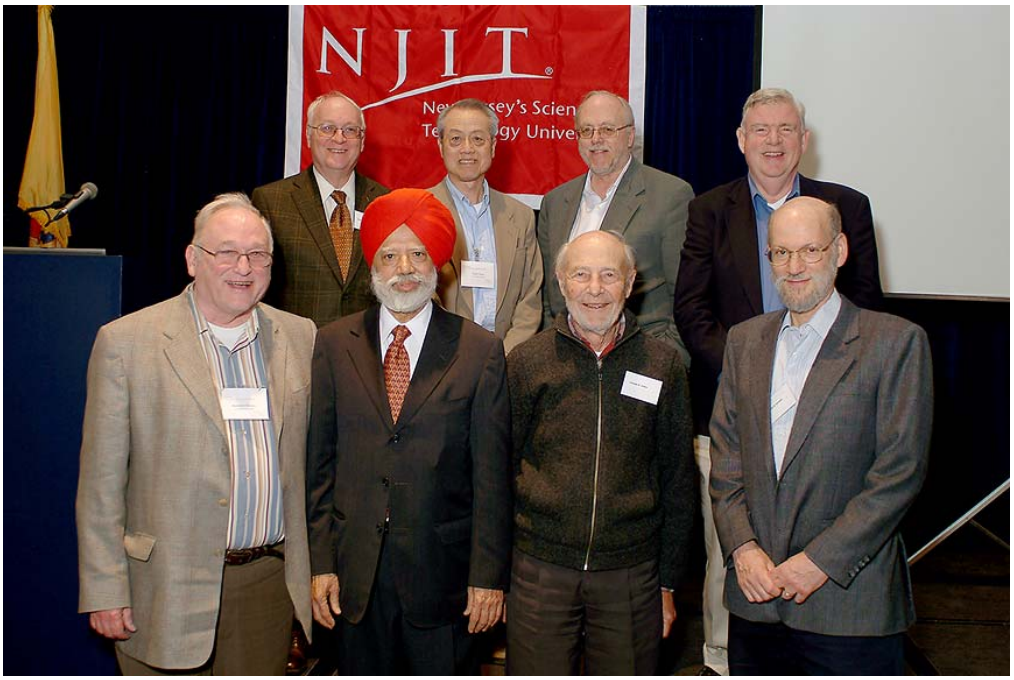
Ahluwalia Family

President Robert A. Altenkirch



Dean Fadi Deek and Professor Daljit S. Ahluwalia

Professor Joseph B. Keller



Front row from left: Bob O'Malley, Daljit S. Ahluwalia, Joseph B. Keller, Stuart Antman
Back row from left: David McLaughlin, Paul Chow, Frank Hoppensteadt, Donald Drew

Professor Zoi-Heleni Michalopoulou

Professor Amitabha Bose

Professor Michael Siegel, FACM'08 Chair

Professor Jonathan Luke

Professor Gregory A. Kriegsmann

Professor Robert M. Miura

Professor Denis Blackmore

Professor Martin Katzen

C. RANKING

NJIT MATHEMATICS RANKED IN TOP TEN NATIONALLY

A national study of faculty productivity conducted in conjunction with the National Research Council study of doctoral programs has ranked NJIT Mathematics in the top 10 nationally. The ranking by Academic Analytics is reported on the web site of The Chronicle of Higher Education (http://chronicle.com/). The 2007 index compiles overall institutional rankings on 375 universities that offer the Ph.D. degree.

D. OTHER CAMS SPONSORED ACTIVITIES

Pan-American Study Institute (PASI) on Interfacial Fluid Dynamics: From Theory to Applications

The National Science Foundation and the Department of Energy were the main sponsors of this Institute. The grant was awarded to NJIT as the sponsoring institution with Lou Kondic from the Department of Mathematical Sciences of NJIT as a PI and George `Bud' Homsy from the Department of Mechanical Engineering of UCSB as a Co-PI. The Institute has brought together the scientists from more than 10 countries from the Americas, Europe and other continents. They spent two weeks in August 2007 in Mar del Plata, Argentina. The details of the scientific program and more information about the Institute can be found at http://m.njit.edu/Events/PASI/.

August 2007 PASI group photo

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

1. *Conference on Frontiers in Applied and Computational Mathematics (FACM): May 14-16, 2007*

   National Science Foundation: June 1, 2007 - May 31, 2008
   Daljit S. Ahluwalia
   Peter G. Petropoulos

2. *Optimization Methodology for Telecommunication Network Design*

   VPI Systems Corp: June 1, 2006 – March 31, 2008
   Daljit S. Ahluwalia
   Venkat Venkateswaran

3. *Statistical Data Analysis*

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

4. *Accuracy and Stability of Computational Representations of Swept Volume Operations*

   NSF/DARPA: August 1, 2003 - December 31, 2007
   Denis Blackmore
   Ming Leu
   William Regli
   Wei Sun

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

   National Science Foundation: September 2006 - August 2008
   Amitabha Bose

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

   National Science Foundation: September 2004 - August 2009
   Amitabha Bose
   Jorge Golowasch
   Farzan Nadim

7. *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

8. *Surface Expressions of Nonlinear Internal Wave*

Office of Naval Research: January 1, 2005 - March 31, 2008
Wooyoung Choi
Dave Lyzenga

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

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

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

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

11. *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

12. *Mathematical Methods for Wave Interactions*

National Science Foundation-Mathematical Sciences Division: July 1, 2005 - June 30, 2008
Roy Goodman

13. *Propagation of Fronts in Porous Media Combustion*

National Science Foundation-Mathematical Sciences Division: August 1, 2005 - June 30, 2008
Peter Gordon

14. *Spectral Schemes for Stochastic Partial Differential Equations for Surface Processes*

National Science Foundation: July 1, 2004 - June 30, 2008
David J. Horntrop

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

National Science Foundation September 1, 2005 - August 31, 2008
Lou Kondic
Michael Booty
Bruce Bukiet
Michael Siegel

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

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

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

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

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

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

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

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

20. *Presynaptic Ca2+ Dynamics, Ca2+ Buffering and Mechanisms of Synaptic Facilitation*

National Science Foundation - Mathematical Sciences Division: August 15, 2004 - July 31, 2008
Victor Matveev

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

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

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

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

23. *Efficient Inversion in Underwater Acoustics*

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

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

Howard Hughes Medical Institute - National Institute of Biomedical Imaging and BioEngineering Interfaces Initiative: January 1, 2006 - December 31, 2008
Robert M. Miura
Joshua Berlin, NJMS-UMDNJ
James Tepper, Rutgers-Newark

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

National Science Foundation: July 15, 2005 - June 30, 2009
Richard O. Moore

26. *Simulation of Rare Events in Lightwave Systems*

National Science Foundation University-Industry Cooperative Research Program: April 1, 2006 - March 31, 2009
Richard O. Moore

27. *Collaborative Research: Multiscale Analysis of Epithelial Patterning: Modeling and Experiments*

National Institutes of Health: August 1, 2005 - July 31, 2008
Joseph Duffy
Cyrill Muratov
Stanislav Shvartsman

28. *Regulation of Neuronal Oscillations by Synaptic Dynamics*

National Institutes of Health: August 1, 2006 - July 31, 2011
Farzan Nadim

29. *Mathematical Problems in Electrohydrodynamics*

National Science Foundation-Mathematical Sciences Division: July 1, 2004 - June 31, 2008
Demetrios T. Papageorgiou

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

National Science Foundation: July 1, 2007 - June 30, 2010
Gareth J. Russell

31. *Focused Research Group: Singularity Formation for the Three-Dimensional Euler Equations and Related Problems*

National Science Foundation: July 1, 2004 - June 30, 2008
Michael Siegel

32. *Cortical Processing Across Multiple Spatial and Time-Scales*

National Science Foundation: August 1, 2005 - July 31, 2008
David Cai
Gregor Kovacic
David McLaughlin
Michael Shelley
Louis Tao

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. *Conference on Frontiers in Applied and Computational Mathematics (FACM): May 19-21, 2008*

Society for Mathematical Biology: May 1, 2008 – June 30, 2009
Daljit S. Ahluwalia

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

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

4. *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

5. *Nonlinear Waves and Dynamical Systems*

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

6. *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

7. *Efficient inversion in Underwater Acoustics*

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

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

National Science Foundation: June 1, 2007 - May 31, 2010
Robert M. Miura

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

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

10. *Interaction Between Flow and Topography in Interfacial Electrohydrodynamics*

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

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

National Science Foundation: July 1, 2008 - June 31, 2011
Horacio G. Rotstein

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

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

13. *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 15, 2010
Michael Siegel
Michael Booty
Yuan-Nan Young

B. PROPOSED RESEARCH

PROJECTS PROPOSED 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. *Learning Enhanced through Active Research Networks (LEARN) in the Computational Sciences*

National Science Foundation: August 1, 2008 - July 31, 2010
John Bechtold
James McHugh
Fadi Deek

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

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

4. *Integrative Vascular Regulation in Conscious Animals*

National Institutes of Health: FY 2007 - FY 2012
Dorothy Vatner
Sunil K. Dhar (Consultant)

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

National Institutes of Health: April 2008 - April 2013
Dorothy Vatner
Sunil K. Dhar (Consultant)

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

NIMH: July 1, 2008 - June 30, 2013
Jorge Golowasch

7. *Gap Junction Role in Embryonic Spinal Cord Rhythm Generation*

National Science Foundation: July 1, 2008 - June 30, 2011
Jorge Golowasch

8. *Nonlinear Waves and Dynamical Systems*

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

9. *Reactive Fronts in Porous Media*

National Science Foundation: July 1, 2008 - June 30, 2011
Peter Gordon

10. *Asymptotic Theory of Fingering Instability in Immiscible Displacement: Reduced Geometrical Models and Numerical Simulations*

The Petroleum Research Fund:
Peter Gordon

11. *Development and Application of Spectral Schemes for Stochastic Partial Differential Equations*

National Science Foundation: July 1, 2008 - June 30, 2011
David J. Horntrop

12. *CDI-Type II: Cyber-based Inverse Method for Dynamical Analysis of Complex Material Phenomena*

National Science Foundation: July 1, 2008 - June 30, 2012
Anthony Rosato
David J. Horntrop
Pushpendra Singh
Denis Blackmore
Thomas Peters

13. *Finite Size Effects on Instabilities of Fluid Films and Rivulets*

National Science Foundation: July 1, 2007 - June 30, 2010
Lou Kondic

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

National Science Foundation: September 1, 2007 - August 31, 2010
Lou Kondic
Robert P. Behringer (Duke University)
Corey O'Hern (Yale University)

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

National Science Foundation: October 1, 2008 - September 31, 2012
Lou Kondic
Robert P. Behringer (Duke University)
Corey O'Hern (Yale University)
Konstantin Mischaikov (Rutgers University)

16. *Dense Granular Materials: From Microstructure to New Constitutive Models*

Department of Energy: January 1, 2009 - December 31, 2011
Lou Kondic
Robert P. Behringer (Duke University)
Corey O'Hern (Yale University)
Konstantin Mischaikov (Rutgers University)

17. *Calcium Dynamics in Exocytosis and Synaptic Facilitation*

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

18. *Quantitative Neuroscience Doctoral Training Program*

National Institute of Biomedical Imaging and Bioengineering: April 1, 2009 - March 31, 2014
Joshua Berlin (UMDNJ)
Robert M. Miura

19. *AMC-SS: Collaborative Research: Stochastic Resonance-Type Phenomena in Infinite Dimensions*

National Science Foundation: July 1, 2008 - June 30, 2011
Cyrill Muratov
Eric Vanden-Eijnden

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

National Science Foundation/National Institutes of Health: July 1, 2008 - June 30, 2013
Farzan Nadim
Amitabha Bose
Nickolas Kintos
Michael P. Nusbaum

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

National Science Foundation: July 1, 2008 - June 31, 2011
Horacio G. Rotstein

22. *Career: Analysis and Simulation of Visual Cortex Dynamics*

National Science Foundation: August 1, 2008 - July 31, 2013
Louis Tao

23. *Analysis and Dimension-Reduction of Visual Cortex Network Dynamics*

National Science Foundation: August 1, 2008 - July 31, 2011
Louis Tao

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. *Phenolics-Oxidizing Root Enzymes of Bromus Grasses and Their Possible Role in Restoration and Bioremediation*

MERI (Meadowlands Environmental Research Institute) Fellow Program Grant: 2007/2008
Claus Holzapfel
David Kafkewitz

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

MERI Fellow Program Grant 2007/2008
Claus Holzapfel

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

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

7. *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

8. *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)

9. *Instabilities of Photoresist Films*

KLA-Tencor Corporation: September 1, 2006 - August 31, 2007
Lou Kondic

10. *Computers and Laboratories Integrated with Mathematics to Enhance Biosciences (The CLIMB Project)*

National Science Foundation: September 1, 2006 - August 31, 2008
Dawn A. Lott
Melissa Harrington

11. *Delaware State University Applied Mathematics Research Center*

Department of Defense: July 1, 2005 - June 30, 2009
Dawn A. Lott
Fengshan Liu
Mazen Shahin
Dragoljub Pokrajac
Xiquan Shi

12. *Delaware State University Center for Research and Education in Optical Sciences and its Applications (CREOSA)*

National Science Foundation Septmber 1, 2006 - August 11, 2011
Noureddine Melikechi
Anjan Biswas and Dawn A. Lott
Dragoljub Pokrajac
Essaid Zerrad
Vesna Zeljkovic
Aristides Marcano

13. *Conversion of Chromium Ore processing Residue to Chrome Steel*

New Jersey Department of Environmental Protection: May 2006 - April 2008
Jay Meegoda

14. *Salt Runoff Collection System*

US Department of Transportation/NJ Department of Transportation: January 2005 – September 2007
G. Golub
B. Dresnack
J. Meegoda
T. Harhaba
W. Konon
E. Filippone

15. *Culvert Information Management System-Demonstration Project*

US Department of Transportation/NJ Department of Transportation: January 2007 – June 2008
J. Meegoda
T. Juliano
C. Tang

16. *Sustainable Biocell Technology for Energy and Resource Recovery*

Natural Science and Engineering Research Council of Canada (NSERC Strategic Grants Program): November 2004 - October 2007
P. Hettiaratchi
A. Mehrotra
G. Achari
M. Warith
J. Wilson
J. N. Meegoda
City of Calgary and Stantech Consulting

17. *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

18. M*anagement of Environmental Problems in Egypt and REU Supplement*

National Science Foundation: September 2004- August 2008
Meegoda
Hsieh
Abdel-Malek
Ezeldin
El Haggar

19. *Non-Contact Skid Resistance Measurement*

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

20. *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

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

US Army - Picatinny Arsenal: November 1, 2006 – October 31, 2007
Bob Barat
John Federici
Dale Gary
Zoi-Heleni Michalopoulou

22. *An Urban Refuge for Pollinators? A Comparative Study of Bee Communities in the NJ Meadowlands*

Meadowlands Environmental Research Institute: August 1, 2002 - October 31, 2007
Gareth J. Russell

23. *Chinese Academy of Sciences Wang Kuan Cheng Research Award*

Chinese Academy of Sciences, Kunming Institute of Zoolong: May 1, 2007 – December 31, 2007
Xintian Hu
Louis Tao

24. *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

25. Novartis Pharmaceuticals Corporation, East Hanover, New Jersey
Provided training in Biostatistics to Clinicians: August – September, 2007

26. Novartis Pharmaceuticals Corporation, East Hanover, New Jersey
Provided training in Biostatistics to Clinicians: May – June, 2008

27. Pan-American Advanced Studies Institute (PASI) on Interfacial Fluid Dynamics: From Theory to Applications, Mar del Plata, Argentina, August 6-17, 2007
Javier Diez
Grants awarded by
1) Centro Latinoamericano de Fisica (CLAF), $1,000
2) Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICET, Argentina), $3,300
3) Agencia Nacional de Promocion de la Ciencia y la Tecnologia (ANPCyT, Argentina), $3,000

28. *Inestabilidades en flujos de recubrimiento*
Agencia Nacional de Promocion de la Ciencia y la Tecnologia (Argentina), $80,000
June 2008- June 2010
Javier Diez

29. Travel Grant for participation in the Abel Symposium 2008 University of Tromso, Norway
June 18-22, 2008
Vladislav V. Goldberg

30. *Water Movements in Biological Tissue and Diffusion-Weighted Imaging Focussed Research Group*

Banff International Research Station, Banff, Alberta, Canada: May 11-18, 2008
Jin Cheng (Fudan University)
Huaxiong Huang (York University)
Robert M. Miura

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

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

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

CERG (Hong Kong) 2007-2010
Jonathan Wylie

33. *The Role of Fluid Drag in Controlling Driven Dissipative Particle Systems*

CERG (Hong Kong) 2005-2008
Jonathan Wylie

34. *Understanding Anomalous Fingering Processes in Granular Materials*

CERG (Hong Kong) 2005-2008
Jonathan Wylie

35. *Deflection of Granular Jets*

CERG (Hong Kong) 2008-2011
Jonathan Wylie

PROPOSED PROJECTS — NOT THROUGH CAMS

Professional Development Workshop for Math and Science Teachers

Roche: November 2007 - November 2008
Bruce Bukiet

Equipment for a Teaching Lab

Gladys Brooks Foundation: January 2008 - January 2009
Bruce Bukiet
James Lipuma

Newark Interactive Science Education Resource Center

Wachovia Foundation: July 2008 – July 2011
Bruce Bukiet
James Lipuma

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: January 2008 Client: Hongyu Qiu, MD, PhD, (Department of Cell Biology and Molecular Medicine, University of Medicine and Dentistry, New Jersey)
Description: Role of cell cycle related kinase in cardiac cell growth and survival.
Mortality rate comparisons are made between wild type and transgenic mice under the acute coronary occlusion/reperfusion studies and in the chronic myocardial infraction studies. The scientist needs to know the optimal number of mice to have in the experiments in order to ensure a significant difference between the control group and the treatment group, with enough power in the study.
Consultant: Professor Sunil K. Dhar

Date: July 2007 - June 2008 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Analyzed the results for the data collected for the Near-Road Air Quality Study near the New Jersey Turnpike during September '07 - January '08 to estimate the effects of season, weekday/weekend, traffic volume, and environmental conditions. Further data are being collected for a period of 18 months, as per the designed experiments.
Consultants: Professors Ken Johnson and Aridaman Jain

Date: July 2007 - February 2008 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Conducted a statistical analysis of the Benthics organism data from the two studies of sediments from 25 sampling sites in the Lower Hackensack River estuary and its major tributaries during 1987-88 and 2003. Prepared a scheme for analyzing data separately for each of the 25 sites. Completed analysis of the organism counts across seasons and compared the summaries of the 2003 data with those of 1987-88 data.
Consultants: Professor Ken Johnson

Date: July 2007 - February 2008 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Conducted a statistical analysis of the air sample data collected from 15 volunteers in eight municipalities in the vicinity of the Teterboro airport to examine the effect of several environmental variables and the frequency of landings/take-offs of airplanes on four Volatile Organic Compounds (VOCs). Developed general linear models to describe the concentrations of Benzene, Ethyl benzene, Toluene, and Xylene as functions of environmental variables and other factors such as the distance from the airport and time spent indoor and outdoor.
Consultants: Lianzhe Xu, Professors Ken Johnson and Aridaman Jain

Date: July 2007 - February 2008 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Analyzed the data collected from experiments designed to examine the hypothesis that hyperspectral images of wetland vegetation alone can be used as a surrogate for mapping wetland relative elevation and sediment chemistry measurements. Developed regression models for predicting the sediment chemistry and relative elevation measurements as a function of only remotely collected images; these models explain 30% to 65% of the total variability and do not have any lack-of-fit.
Consultant: Professor Aridaman Jain

Date: July 2007- December 2007 Client: Attorney General of New Jersey
Description: Designed the ballots and voting scenarios for evaluating three Electronic Voting Systems Equipped with Voter-Verified Paper Records. The voting scenarios, based on fractional-factorial designs, are completely balanced with respect to two political parties for each of seven positions and yes/no votes for seven questions and are designed to test all kinds of possibilities including write-ins and undervotes. Non-compliances were identified and the test procedures were described at public hearings.
Consultant: Professor Aridaman Jain

Date: February 2008- June 2008 Client: Attorney General of New Jersey
Description: Designed the ballots and voting scenarios for evaluating the Sequoia 400-C optical scanner system to determine whether this centralized optical scanner voting equipment will operate accurately and consistently by testing a high volume of ballots. The voting scenarios, based on fractional-factorial designs are completely balanced with respect to two political parties, two towns, 2 districts, and mixes of candidates from different columns and are designed to test all kinds of possibilities including write-ins and undervotes. A report on the test results is in preparation.
Consultant: Professor Aridaman Jain

IX. CURRENT AND COLLABORATIVE RESEARCH

A. RESEARCH AREAS IN CAMS

Mathematical Biology

Researchers in CAMS working on problems related to Mathematical Biology: Booth, Bose, Bukiet, Dhar, Georgieva, Golowasch, Holzapfel, Lott, 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. Historically, applications have arisen in a number of disparate areas such as population ecology, pattern formation, blood flow in mammals, and nerve impulse propagation in the central nervous system. More 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). The main focus of Nadim's research is to understand how synaptic dynamics, such as short-term depression and facilitation contribute to the generation and control of oscillatory neuronal activity. Experiments in Nadim's lab involve characterizing the synaptic dynamics in the STNS and studying the contributions of these dynamics, through mathematical modeling, to the output from the biological network. Using both electrophysiological and computational tools, Golowasch studies mechanisms of neuronal plasticity and homeostasis of the ionic currents that determine the excitability and electrical activity of neurons and simple neural networks in the STNS. Currently, he also is screening several neuropeptides for their possible involvement in trophic regulation of dissociated adult neurons in culture and in long term organotypical culture. These neuropeptides are known to have short-term neuromodulatory effects.

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. Also, he is working on developing a theory for the formation of glass microelectrodes, which are used daily in electrophysiology laboratories around the world.

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. He is developing new immersed boundary/continuum methods which will provide a platform for effective modeling of highly deformable shells/beams and solids immersed in biological fluids. These methods will facilitate further research in multi-scale and multi-physics coupling of complex fluid-solid systems with microscopic models. 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, 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, thin films, nanofluidics, electrohydrodynamics, hydrodynamic stability theory, sedimentation, and combustion. A particular focus for six of the faculty members 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.

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.

For obvious reasons, water waves have been studied the longest, and are still regarded as the point of reference for wave phenomena in other fields. George Stokes' notoriously intractable equations describing the motion of water waves were rendered far more accessible by the various small-amplitude limits considered by Joseph Boussinesq, D. J. Korteweg, and Gustav de Vries. Their explorations laid the groundwork for a discovery that would prove to have far-reaching consequences in several fields: the soliton, a solitary wave with special self-preserving properties. This exotic ``soliton'' propagates as a solitary wave without spreading due to the competing influences beween nonlinearity and dispersion, but preserves its shape and speed through collisions with other solitons. Even more important than the solitons themselves is the structure that makes their existence possible. Their study and the study of equations that support them now fall generally under the heading of ``integrable systems'', and have given rise to such mathematical tools as the inverse scattering transform.

One field that has been affected very profoundly by the relatively new science of nonlinear waves is optical communications. Pulse-like waveforms that maintain their shape for long times and over great distances are of obvious interest to an industry seeking to ensure error-free transmission of digital information. Every environment is subject to some form of noise, whether it be thermal noise, electronic noise, or quantum noise, so these pulses must also be tested for their resistance to external influences. 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. The same nonlinear and dispersive properties that give rise to solitons can be manipulated to condition light for use in novel devices that will ultimately replace the electronics upon which telecommunications and computing still depend. Dr. 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 simple cylindrical geometry of an optical fiber lends itself to analytical treatment of the electromagnetic wave propagating inside of it; however, the vast majority of electromagnetic scattering problems have far more complexity due to complicated geometries and inhomogeneous material properties with disparate spatial scales. 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, through the analysis of information gathered by receivers placed strategically or at random within the same medium, 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. In optics, this can lead to the generation of self-guided optical beams and, given the difference in time scales dominating the hyperbolic and parabolic behaviors, bistability. In the case of microwave heating of ceramics, it can lead to the formation of weak spots that compromise the quality of the material. 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, such as Newton, the Bernoullis, Euler, Lagrange, Laplace, Legendre, Gauss, Cauchy, Abel, Fourier, Liouville, Weierstrass, Dirichlet, Hamilton, and Riemann. But we have come a long way since the middle of the nineteenth century in terms of our understanding and the variety of applications of both finite-dimensional dynamical systems (ordinary differential equations) and infinite-dimensional dynamical systems (partial differential equations).

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. One of the most appealing aspects of research in dynamical systems is the wealth of opportunities it provides for interdisciplinary studies, and our dynamical systems group is one of the most active in such efforts.

CAMS research in dynamical systems can be described briefly as follows: Denis Blackmore 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. Amitabha Bose employs dynamical systems techniques in his studies of coupled neuronal oscillators; in particular, he uses geometric singular perturbation theory to effect reductions in dimension of high dimensional systems, so that they can be more readily analyzed using such techniques as Poincare maps. Recently, he has studied the global effects of localized neuronal activity with regard to phase relationships and multi-stability. Jorge Golowasch employs approaches from nonlinear dynamics to investigate the cellular mechanism of activity-dependent regulation of ionic currents, neuronal excitability, and neural network activity. 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.

Shidong Jiang applies methods from nonlinear dynamics in his research on mathematical fluid dynamics, and wave propagation. Jay Kappraff has used dynamical systems techniques to uncover interesting relationships among regular geometric figures, matrix groups, chaotic regimes, and fractal geometry. Lou Kondic employs a variety of dynamical systems approaches in his research on interfacial fluid dynamics, and granular flows. Gregory Kriegsmann's research in applied mathematics has involved the application of bifurcation theory and differential equation techniques in several problems related to wave propagation and electromagnetics. Victor Matveev's work in computational neuroscience, stochastic process theory, and statistical mechanics has employed several methods from nonlinear dynamics. In his research on the kinetic theory of gases, mathematical biology, interfacial surface tension, and direction reversal in Brownian motion, Robert Miura has employed a variety of techniques from dynamical systems theory. For example, some of his recent work in mathematical biology has made use of the theory of Hopf bifurcations and saddle-node bifurcations.

Richard Moore studies nonlinear wave equations with both deterministic and stochastic perturbations with the aid of a variety of techniques from dynamical systems theory. Cyrill Muratov studies, among other things, traveling wave solutions and propagation phenomena in gradient reaction-diffusion systems using both variational and dynamical systems methods. He also studies several other types of infinite-dimensional dynamical systems arising from such areas as mathematical biology and fluid dynamics. Farzan Nadim makes liberal use of techniques from nonlinear dynamics in his research in computational and analytical neuroscience. Demetrius Papageorgiou employs ideas from infinite-dimensional dynamical systems theory, such as inertial manifolds and chaotic dynamics, in his research in fluid dynamics. Nonlinear dynamical techniques related to vortex dynamics play a key role in some of Michael Siegel's research in fluid dynamics. Louis Tao employs methods from dynamical systems theory in his work in neuroscience and mathematical biology. Sheldon Wang has made several contributions to the literature in applications of dynamical systems, and is currently working on the development of methods for capturing periodic orbits of finite-dimensional dynamical systems. Yuan-Nan Young uses a variety of nonlinear dynamics approaches in his research in fluid dynamics and complex systems.

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, Dhar, Dios, Jain, Johnson, and Subramanian.

Applied Probability and Statistics, as a discipline, is concerned with the study and analysis of processes in which uncertainty plays a significant role. The need for uncertainty modeling and statistical analysis is assuming increasing importance in virtually every field of human activity, e.g., 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 research in Probability and Statistics is driven by the need to solve applied problems, its progress and development comes from basic research and from their application to solve specific problems arising in practice. This interplay of basic and applied research has benefited both. Real life problems have often posed new theoretical challenges which had to be overcome by developing new methods (e.g., survival analysis, adaptive randomization in clinical trials). Conversely, new theoretical ideas and methods which were developed in a specific applied context were later seen to be of much broader applicability to other areas (e.g., nonparametric aging ideas which owe their origins to research in stochastic modeling of hardware reliability of physical systems were later seen as useful constructs in many other areas including queuing systems, stochastic scheduling, and branching processes.)

The Statistical Consulting Laboratory (SCL), which operates under the umbrella of CAMS, provides methodological/data analysis consulting services to the University community on request, as well as to external clients. Consulting activities channeled through the SCL, are under the overall administrative supervision of a statistics faculty member (currently, A. Jain).

The current research interests of the Statistics faculty are in the following areas: distribution theory and statistical inference (Bhattacharjee, Dhar), minimum distance estimation (Dhar), Bayesian modeling (Bhattacharjee), orthogonal arrays in experimental designs (Dios), applied probability models (Bhattacharjee, Dhar), statistical theory of reliability and survival analysis (Bhattacharjee), stochastic orders and their applications (Bhattacharjee), discrete multivariate distribution/reliability statistical issues in clinical trials (Dhar), and non-traditional applications of reliability theory (Bhattacharjee).

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

The research of Manish Bhattacharjee has focused on applied probability models and related problems of statistical inference. Such work includes the use of various stochastic orders to investigate aging and degradation concepts. Current research includes work on (i) some strong versions of the 'decreasing failure rate' property and their ramifications, (ii) some problems of statistical inference in discrete time branching processes.

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 analytical and approximate solution techniques (i.e., asymptotic and numerical techniques). Most of the applications he has considered are in the areas 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 and collaboration 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, slow localized thermal waves in material processing, the direction of small-scale objects via magnetic fields, and a two-dimensional potential flow model for the near-field interaction of a pair of flexible lifting membranes, or sails.

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.

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.

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.

Dawn A. Lott

The research of Dawn A. Lott focuses on the numerical computation of partial differential equations which model physical phenomena in solid and fluid mechanics and biomechanics. Her studies in solid mechanics cover the topics of strain, thermo-viscoplastic, and strain gradient localization, and antiplane motions of nonlinearly elastic bodies. Her research in fluid mechanics covers the use of boundary element methods for slender bubbles subject to Stokes flow. In the area of biomechanics, her research covers convolution methods for calcium ion release and nonlinearly elastic/viscoelastic models for the deformation of human skin. Numerical methods utilized include spectral methods, Godunov-type schemes, and finite elements methods. Her current projects include the analysis of optimal patterns of wound closure based on stress analysis, nonlinear viscoelastic models for wound closure, simulations of slender bubbles with surfactants, determination of the release of calcium ions from intracellular storage sites in skeletal and cardiac muscle, and two dimensional viscoplastic localization as a result of strain gradient regularization.

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.

Louis Tao

The research of Louis Tao focuses on large-scale scientific computation, through a combination of numerical simulations, bifurcation theory, and asymptotics. He is mainly interested in the modeling and analysis of the dynamics of networks, with applications to specific problems in neuroscience and mathematical biology. His work in computational neuroscience has been in two distinct areas: a) how neurons in the visual cortex process elementary features of the visual scene and b) how recurrent networks perform computations. His current projects include the modeling of orientation selectivity in cortex and the analysis of the network dynamics that arises.

Jean-Marc Vanden-Broeck

Jean-Marc Vanden-Broeck's research is concerned with fluid mechanics and the theory of free boundary problems. He uses a combination of numerical and asymptotic methods to investigate new properties of nonlinear solutions. A large part of his research focuses on the effects of surface tension and on the computations of waves of large amplitude. Interfacial flows generated by moving disturbances, three dimensional solitary waves, waves on electrified fluid sheets, and the stability of Stokes flows in the presence of electric fields are among his recent interests.

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. See "Selected Research Results" section for details.

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-proximity Recognition Algorithm for Differential Diagnosis of Breast Cancer and Fibroadenomatosis, 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).

Patent for Computer-aided Cytogenetic Method and Apparatus of Cancer Diagnosis (with N. V. Boroday, D.A. Klyushin, and Y.I. Petunin), Provisional Patent 60-936,215, July 2007.

John Bechtold

Dynamics of Flames at High Pressure, C.K. Law and Grunde Jomaas (Princeton University).

Numerical Studies of Premixed Flames in Oscillating Flow Fields, H.G. Im (University of Michigan).

Multi-Scale Analysis of Premixed Combustion Systems, M. Matalon (University of Illinois).

Denis Blackmore

Regularity and Chaos in Vortex Dynamics, L. Ting (Courant Institute of Mathematical Sciences), O. Knio (Johns Hopkins), and B. Shashikanth (New Mexico State).

Effectively Computable Equivalence of Non-manifold Geometric Objects, R. Kopperman (CCNY) and T.J. Peters (University of Connecticut).

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

Vortex Breakdown Dynamics, M. Brons (Denmark Technical University) and A. Goullet (NJIT).

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

Accoustic/Flow Field Dynamics, J. Meegoda (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 X. Wang (Beijing Univ.).

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

Amitabha Bose

Bursting Through Resonance, Jon Drover (Cornell Medical School)

Multistability in Globally Inhibitory Networks, Lakshmi Chandrasekaran, Victor Mateev (NJIT)

Role of A-currents in Neuronal Networks, Yu Zhang, Farzan Nadim (NJIT)

Effect of Feedback on Pacemaker Neurons, Lian Zhou (Rutgers-Newark), Shunbing Zhao (Rutgers-Newark), Farzan Nadim (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)

Numerical Modeling of Internal Waves Propagating over Bottom Topography, Taechang Jo (Inha

University, Korea)

Instability and Regularization of Interfacial Waves in Two-layer System, Lyudmyla Barannyk (University of Idaho) and Robert Krasny (University of Michigan)

Vladislav V. Goldberg

Grasmannizable Group Webs, A. M. Shelekhov (Tver State University, Tver, Russia)

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

Jorge Golowasch

Analysis of Gap Junction Coupling between Neurons and Role in Network Function, Farzan Nadim (NJIT), Pierre Meyrand (Bordeaux University)

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

Dimension Reduction in Complex Systems, Astrid Prinz and Andrei Olifer (Emory University)

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)

Fluid Mixing and Chaos in Viscous Bubbles, Yuan Nan Young (New Jersey Institute of Technology), Jerzy Blawzdiewicz (Yale University), Vittorio Cristini (University of Texas School of Health Information Sciences)

Peter Gordon

Supercritical KPP Waves in Cylinders, Cyrill Muratov (NJIT)

Stability of Fronts for Systems, Anna Ghazaryan (University of North Carolina at Chapel Hill)

Free Interface Models in Combustion and Related Topics, Gregory Sivashinsky (Tel Aviv University, Israel)

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)

Lou Kondic

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

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

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

Dawn A. Lott

Dynamics of Gaussian Optical Solitons by Collective Variables Method, A. Biswas and P. Green (Delaware State University) and D. Milovic (University of NIS)

Victor Matveev

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

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

Modeling Calcium-dependent Inactivation of L-type Calcium Channels, R. Shirokov (UMDNJ - New Jersey Medical School)

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

Thermodynamics of Lattice Spin Models in Complex Temperature and Magnetic Field, R. Shrock (Stony Brook University)

Robert M. Miura

Thermal Effects on the Dynamics of Singularity Formation in Viscous Threads, Huaxiong Huang (York University, Toronto, Canada) and Jonathan Wylie (City University of Hong Kong, Hong Kong)

Models for Cortical Spreading Depression, Huaxiong Huang (York University, Toronto, Canada), Jonathan Wylie (City University of Hong Kong, Hong Kong), and Andrew Charles (University of California at Los Angeles)

Mathematical Modeling and Simulations of CstF-77 Alternative Polyadenylation, Yiming Cheng (NYU Medical School)

Diffusion-Weighted Imaging, Huaxiong Huang (York University, Toronto, Canada), Jonathan Wylie (City University of Hong Kong, Hong Kong), Christopher Sotak (Worchester Polytechnic Institute), Shu Takagi (University of Tokyo), Greg Lewis (University of Ontario Institute of Technology), and Wei Yao (Fudan University)

Richard O. Moore

Collective Coordinate Reductions for Nonlocal Damped, Dispersive Equations, K. Promislow (Michigan State University)

Simulation of Rare Events in Lightwave Systems, C. J. McKinstrie (Alcatel-Lucent Technologies)

Techniques for Stochastic Problems with Scale Separation, T. Schaefer (CUNY-Staten Island)

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), Eric Vanden Eijnden (CourantInstitute of Mathematical 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 ofVerona, Italy), 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), Vitaly Moroz (Department ofMathematics, University of Bristol, 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)

Exploration of Pacemaker Kernel Neuron Models, A. Prinz (Emory University)

Dominant Ionic Mechanisms in Spiking and Bursting Neurons, R. Clewley (Georgia State University)

Horacio G. Rotstein

The Transition from Theta to Hyperexcitable (Epileptic) Spiking Activity in Stellate Cells from Layer II of the Medial Entorhinal Cortex, John White (University of Utah) and Tilman Kispersky (Boston University)

The Mechanism of Generation of Subthreshold Oscillations and the Onset of Spikes in Stellate Cells from Layer II of the Medial Entorhinal Cortex, Martin Wechselberger (University of Sidney, Australia) and Nancy Kopell (Boston University)

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

Michael Siegel

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

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

Louis Tao

Dimensional Reduction and Principal Components Analysis of Neuronal Networks, Andrew Sornborger (U Georgia)

Modeling of Brainstem Saccade Generation, Hu Xintian (Kunming Institute of Zoology, Chinese Academy of Sciences)

Bifurcations in Fluctuation-Controlled Critical Networks, Antoni Guillamon (Universitat Politecnica de Catalunya, Barcelona)

Dynamics of Visual Cortical Neuronal Networks, David Cai (CIMS, NYU), Adityaa Rangan (CIMS, NYU), Dario Ringach (UCLA), Robert Shapley (CNS, NYU) and Michael Shelley (CIMS, NYU)

Dynamics and Pattern Formation in Recurrent Neuronal Networks, Gregor Kovacic (RPI) and Christina Lee (RPI)

Bifurcations and Pattern Formation in Kuramoto Oscillators, Hui Wu (NJIT)

Fokker-Planck Analysis and Numerical Simulation of Neuronal Networks, Jose Antonio Carrillo (Universitat Autonoma Barcelona)

Stochastic Gene Expression, Sanjay Tyagi (Public Health Research Institute)

Wave Generation and Maintainence in Zebrafish Retinogenesis, Cheng Shuk Han and Sarah Choy (City University of Hong Kong)

Yuan-Nan Young

Dynamics of Semi-Flexible Filaments under Polar Forcing, Michael J. Shelley (NYU)

Mixing in Chaotic Viscous Drops, Petia Vlahovska (Dartmouth College)

X. STUDENT ACTIVITIES

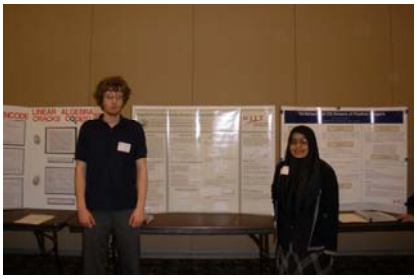
A. UNDERGRADUATE ACTIVITIES

Zoi-Heleni Michalopoulou, Director of Undergraduate Studies

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

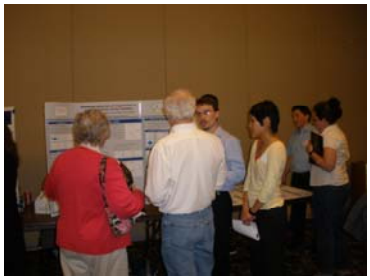
Mathematical sciences majors Mariana Cassimiro, Fatima Elgammal, Brian Emmanuel, Michael Lam, Nan Maung, Matthew Peragine, and Alex Virodov, divided in three groups, were awarded three out of the first four places (including first) among all presenting four year colleges at the Garden State Undergraduate Mathematics Conference, joint with the MAA meeting, on Saturday, April 12, 2008. The students were recognized for their posters, presenting research conducted under the NSF funded CSUMS program. Professors Roy Goodman, David Horntrop, and Michael Siegel were the students' research mentors.

Poster Presentations:



Fatima Elgammal and Matthew Peragine

Mariana Cassimiro, Brian Emmanuel, and Michael Lam



Nan Maung and Alex Virodov

UBM: Undergraduate Biology and Mathematics Training Program

Amitabha Bose, Jorge Golowasch, and Farzan Nadim

Six students joined the National Science Foundation funded UBM program in January of 2007. Four completed research projects that spanned the entire calendar year while the other two worked through the summer of 2007. These students, Ikemefuna Agbanusi, Anirudh Chintalapani, Matthew Hanna, Catherine Morrison, Natasha Pandya and Alborz Yarahmadi spent the summer of 2007 working in the labs of Profs.

Alton-Bonet, Golwasch, Nadim, and Russell on problems that arise at the interface of mathematics and biology. In the fall, the students presented their research at the Mathematical Biology Seminar. They also presented at the 2008 East Coast Nerve Net Meeting, the 2007 Society for Mathematical Biology meeting, the 2007 Cell Biology Meeting, the 2008 Computational Neuroscience Meeting and many other local meetings. The projects which the students worked on were: Dynamics of the Coxsackie virus - Anirudh Chintalapani and Matthew Hanna (Alton-Bonet lab), Phase response curves of bursting neurons - Ikemefuna Agbanusi and Alborz Yarahmadi (Nadim/Golowasch lab), and Environmental fragmentation and metapopulations - Catherine Morrison and Natasha Pandya (Russell lab).

Pi Mu Epsilon Induction Ceremony on April 23, 2008

The Pi Mu Epsilon honor society inducted 10 new members this year on April 23, 2008: Zakariya Abbassi, Ikemefuna (Ike) Agbanusi, Michael Bellanich, Daniel Cicala, Michael Lam, Matthew Peragine, Vishagan Ratnaswamy, Alexander Sheppard, Chris Verdon, and Tamara Vivens. Several of the students inducted into Pi Mu Epsilon have participated in CSUMS (Bellanich, Peragine, Lam, Vivens) and UBM (Agbanusi).

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.

Back Row from left: Prof. Daljit S. Ahluwalia, Michael Bellanich, Michael Lam, Matthew Peragine, Prof. Roy Goodman
Front Row from left: Daniel Cicala, Zakariya Abbasi, Tamara Vivens, and Christopher Verdon

B. GRADUATE STUDENT RESEARCH PROGRAMS

Lou Kondic, Director of the Graduate Program

Ph.Ds Awarded May 2008:

Lakshmi Chandrasekaran
Thesis: The Role of Short-Term Synaptic Plasticity in Temporal Coding of Neuronal Networks
Advisor: Amitabha Bose

Joon Ha
Thesis: Roles of Gap Junctions in Neuronal Networks
Advisor: Amitabha Bose

Nebojsa Murisic
Thesis: Instabilities of Volatile Films and Drops
Advisor: Lou Kondic

Filippo Posta
Thesis: Signal Transmission in Epithelial Layers
Advisor: Cyrill Muratov

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

Publications, Presentations, and Conference Participation

Shuchi Agrawal:

Poster presentation: May 19-21, 2008, Frontiers in Applied and Computational Mathematics, NJIT
Stability and Bifurcation Analyses of Microwave Heated Ceramic Cylinders and Slabs

Leonardo Espin:

April 18, 2008: Saint Joseph's University Sigma Xi Student Research Symposium, Philadelphia, PA

Poster presentation: May 19, 2008: Frontiers in Applied and Computational Mathematics, NJIT
Effect of Inlet Boundary Conditions in Self-Similar Solutions of the Navier-Stokes Equations in Bounded Domains (with D.T. Papageorgiou)

Rashi Jain:

Poster presentation: May 19, 2008, Frontiers in Applied and Computational Mathematics, NJIT
Particle Filtering for Arrival Time Estimation from Sound Signals in the Ocean (with Z.-H. Michalopoulou)

Yogesh Joshi:

Poster Presentation: May 19, 2008: Frontiers in Applied and Computational Mathematics, NJIT
Dynamics of Discrete Population Models: Higher Dimensional Pioneer-Climax Models

Participated in the 2008 PIMS Industrial Problem Solving Workshop and Graduate Industrial Mathematics Modelling Camp held at University of Regina, Canada from June 9-21, 2008

Manmeet Kaur:

Poster Presentation: May 19, 2008: Frontiers in Applied and Computational Mathematics, NJIT
Acoustic and Fluid Flows on Perturbed Spherical Object

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

Kamyar Malakuti:

Presentations:

May 2008: Graduate Center of CUNY, Applied Mathematics Seminar, New York
The Numerical Analysis of Singular Solutions to Partial Differential Equations

May 2008: Communicating Science and Mathematics, NJIT, Newark
Using Manipulative in Geometry

Nebojsa Murisic:

November 2007: APS Division of Fluid Dynamics, Salt Lake City, UT
How Do Drops Evaporate? (with L. Kondic)

November 2007: Gallery of Fluid Motion, APS Division of Fluid Dynamics, Salt Lake City, UT
Curiously Shaped Instabilities at the Fronts of Evaporating Drops (with L. Kondic and Y. Gotkis)

October 2007: SIAM Conference on Mathematics for Industry MI07, Philadelphia, PA
Octopus-shaped Instabilities of Evaporating Drops: Experiments and Theory (with L. Kondic)

September 2007: EUROMECH490 Workshop: Dynamics and Stability of Thin Liquid
Films and Slender Jets, London, UK
Octopus-shaped Instabilities of Evaporating Drops: Experiments and Theory (with L. Kondic)

August 2007: PASI2007: From Theory to Applications, Mar del Plata, Argentina
1) Octopus-shaped Instabilities of Evaporating Drops: Experiments and Theory (with L. Kondic)
2) Interfacial Problems with Phase Change (with A. Oron and L. Kondic)

August 2007: ICIAM07, Zurich, Switzerland
Octopus-shaped Instabilities of Evaporating Drops (with L. Kondic)

Myongkeun Oh:

May 2008: Frontiers in Applied and Computational Mathematics, NJIT
Poster: Alternating-order Dynamics in Non-weakly Coupled Two-cell Inhibitory Networks

November 2007: NJIT Graduate Student Research Day, NJIT, Newark, NJ
Poster: Destabilization of Phase-locking in a Non-weakly Coupled Two-cell Inhibitory Networks with Finite Synaptic Decay Time

Filippo Posta:

February 2008: Attended the Spatial Dynamics of Growth and Signaling Conference at University of California-Irvine

Bo Ren:

May 2008: Frontiers in Applied and Computational Mathematics, NJIT
Poster: Multi-step Simulation Methods for Collateralized Debt Obligations (with W.J. Morokoff and D.J. Horntrop)

Qiming Wang:

May 2008: Frontiers in Applied and Computational Mathematics, NJIT
Poster: Dynamics of Liquid Jets and Threads under Action of Radial Electric Fields: Microthread Formation and Touchdown Singularities

Xinli Wang:

May 2008: Frontiers in Applied and Computational Mathematics, NJIT
Poster: Simulation of Drops Rolling on an Inclined Superhydrophobic Plane

March 2008: Presentation: AMS Sectional Meetings, Courant Institute of New York University
Simulation of Viscous Drops Rolling on an Inclined Super-hydrophobic Plane

November 2007: Presentation: American Physical Society, Division of Fluid Dynamics, Annual Meeting, Salt Lake City, UT
Computation of the Rolling Motion of a Viscous Drop

July 2007: Workshop, 13th Industrial Mathematical and Statistical Modeling Workshop, NC State Univ.

Kuan Xu:

Attended Graduate Student Mathematical Modeling Camp-08 (GSMMC'08) held at Rensselaer Polytechnic Institute, June 10-13, 2008. Title of Project: Turning Gels into Cartilage: Modeling Tissue Regeneration in Cell-Seeded Scaffolds. Supervision of Mansoor Haider

Attended Mathematical Problems in Industry'08 (MPI'08) held at Worcester Polytechnic Institute, June 16-20, 2008. Title of Project: Evolution of an Elliptical Bubble in an Accelerating Extensional Flow Field.

Ye Yang:

May 2008: Frontiers in Applied and Computational Mathematics, NJIT
Poster: A Three-Field Mixed Finite Element Formulation for Acoustoelastic Fluid- Structure Interaction Systems

Yu Zhang:

Publication:

Determining the Effect of the A-Current on the Activity Phase of a Follower Neuron in an Inhibitory Network (with A. Bose and F. Nadim), 8-P48, BMC Neuroscience 2007.

Presentations:

May 2008: Frontiers in Applied and Computational Mathematics, NJIT
Using Recursive and Genetic Algorithms to Explore How Intrinsic Properties of Neurons Affect Their Activity Phase Following Inhibitory Input (with A. Bose and F. Nadim)

April 2008: 34th Annual East Coast Nerve Net, Woods Hole, MA
Using Recursive and Genetic Algorithms to Explore How Intrinsic Properties of Neurons Affect Their Activity Phase Following Inhibitory Input (with A. Bose and F. Nadim)

July 2007: 16th Annual Meeting for Computational Neuroscience (CNS), Toronto, Canada
The Effect of the A-Current on the Activity Phase of Follower Neurons in an Inhibitory Network (with A. Bose and F. Nadim)

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

The Math Club has hosted many activities during the academic year 2007-2008 which were funded by the GSA. Games day was held on Oct 17, 2007, in the NJIT Games room where students entertained themselves with unlimited games of bowling, ping-pong, pool, and cards. To further enhance the interaction amongst students, a student lunch was organized on Nov 21, 2007.

MSG has also been responsible for funding a number of Mathematical Colloquiums throughout the year. One such talk was held on October 12, 2007 wherein Mary Siber from Northwestern University gave a talk on Controlling Pattern Formation. On February 29, 2008, Louis J. Gross from University of Tennessee gave a talk on Mathematics as a Mechanism for Cohesion in Biology.

A trip to the Bell Laboratories was organized on May 22, 2008. Here, students got a chance to speak to people working at the Lab and get a fair idea of the work environment and type of research conducted at Bell Labs.

Soccer Match

On May 15th 2008, the NJIT Department of Mathematical Sciences hosted their fifth annual soccer match between the Faculty/Graduate Students and Undergraduate Students. Despite many time restrictions and schedule conflicts they were able to make this year's game another success event. This year, however, since the undergraduate side was lacking players and the Faculty/Graduate Students had an abundance of them (as always) we were forced to mix up the teams. Hence, the faculty-student distinction was not possible. Nevertheless, at the end of regulation time the final score was 6:3. We look forward to another game next year.

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.

July and August 2007

July 2	**Dr. Peter Petropoulos**, *Absorbing Boundary Conditions for the Numerical Simulation of Wave Propagation*
July 5	**Joon Ha**
July 9	**Dr. Robert Miura**, *Accurate Solitary Wave Solutions*
July 12	**Kamyar Malakuti**
July 16	**Dr. Wooyoung Choi**, *Asymptotic and Numerical Modeling of Nonlinear Water Waves*
July 19	**Ye Yang**
July 23	**Dr. Lou Kondic**, *Finite And Infinite Fluid Strips*
July 26	**Filippo Posta**, *Compensated Optimal Grids*
July 30	**Dr. Michael Siegel**, *Singularities in Fluid Dynamics*
August 2	**Lakshmi Chandrasekaran**, *The Role of Synaptic Depression in Coincidence Detection in the Avian Auditory Brainstem*
August 6	**Dr. Eliza Michalopoulou**, *Inverse Problems in Underwater Acoustics*
August 9	**Anisha Banerjee**, *Mathematical Modeling of Spreading Depression*

May and June 2008

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

May 28	**Dr. Peter Gordon**, *Reaction Diffusion Equations 101*
June 2	**Leo Espin**, *Self Similar Solutions of the Navier Stokes Equations: A Review of Results*
June 4	**Dr. Michael Booty**, *Bubble and Drop Deformation and Breakup; The Influence of Surfactant and Surfactant Solubility*

June 16 **Kamyar Malakuti**, *The Numerical Analysis of Singular Solutions to Partial Differential Equations*

June 18 **Dr. Roy Goodman**, *Fractal Structures in Solitary Wave Interactions*

June 16 **Myongkeun Oh**

June 25 **Dr. Jonathan Luke**, *Particle and Continuum Modeling of Suspensions*

June 30 **Yogesh Joshi**, *Dynamics of Discrete Population Models: Higher Dimensional Pioneer – Climax Models*

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