CAMS

Center for Applied Mathematics
and Statistics

ANNUAL REPORT

2006-2007

NJIT
New Jersey's Science &
Technology University

TABLE OF CONTENTS

I. FROM THE DIRECTOR

This is the third year that I have the good fortune of reporting on the successes of the Department of Mathematical Sciences (DMS) and Center for Applied Mathematics and Statistics (CAMS) under 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. The strategic initiative funds have aided the department's rise to national and international prominence in the applied mathematical sciences. As reported last year, one measure of this prominence is the substantial funding that members of the department and CAMS continue to receive 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 United States Air Force, the Howard Hughes Medical Institute, and private industry.

Strategic initiative funds have also increased the departmental presence by aiding in the funding of postdoctoral scientists. Each year, the initiative provides funds for one postdoctoral researcher. This as a good starting point, and has given us incentive to work hard to gain further funds from grant agencies to support more postdocs and visiting researchers. We are happy to report that in 2007-08 DMS will host at least 5 postdoctoral fellows and 2 sabbatical visitors. This number puts us in the company of other leading departments of mathematical sciences nationwide.

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

- The awarding of three new major educational grants from the National Science Foundation this year: (1) The Teacher Education Collaboration for High-Need Schools-New Jersey Robert Noyce Scholarship Program (TECHS-NJ). This is a collaborative project among the New Jersey Institute of Technology, Rutgers University -Newark, the Newark Public Schools and the Newark Museum. The four year program provides academic, financial and professional support to 26 future math and science teachers in the city of Newark and other high-need districts in the state. (2) Computation and Communication: Promoting Research Integration in Science and Mathematics (C2PRISM). This program places eight PhD Fellows conducting computational dissertation research in Biology, Chemistry, Mathematical Sciences and Physics in Newark, NJ high school classrooms. The goal is to enhance math and science education by infusing computational methods and tools into the math and science curriculum in high schools. (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.

- The continuing funding of an Undergraduate Biology and Mathematics Training Program Proposal (UBMTP) from the National Science Foundation. 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 continuing funding of a Major Research Instrumentation (MRI) grant from the National Science Foundation for a 134 processor parallel computer cluster. The cluster, online as of April

2005, is the most powerful computer on campus and one of the largest of its kind contained within a mathematics department nationwide. The cluster is being used for research projects in interfacial fluid dynamics, granular flow, molecular dynamics, mathematical neuroscience and other areas. The cluster will no doubt serve as a first-rate computational tool for many years to come.

- The placement of DMS in the top 45 mathematical science programs nationwide, as ranked by total expenditure of federal funds on research and development.

- The hosting of the fourth annual "Frontiers in Applied and Computational Mathematics (FACM)" conference in May, 2007. This year's meeting was attended by over 247 participants and for the first time included an "Undergraduate Research Day," in which 58 students from around the nation participated and 27 presented their state-of –the-art research.

As always, the accomplishments of CAMS have been built with the support, inspiration, 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 are sure that under his capable leadership at NJIT, CAMS will continue to prosper.

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 - 2007

Dr. John S. Abbott	Corning Incorporated
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Dr. Peter E. Castro	Eastman Kodak Company (formerly)
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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
Bechtold, John
Bhattacharjee, Manish
Blackmore, Denis
Booty, Michael
Bose, Amitabha
Bukiet, Bruce
Choi, Wooyoung
Deek, Fadi
Dhar, Sunil
Dios, Rose
Drover, Jonathan
Ghosh, Kaushik
Goldberg, Vladislav
Golowasch, Jorge
Goodman, Roy
Gordon, Peter
Goullet, Arnaud
Horntrop, David
Jain, Aridaman
Jiang, Shidong
Johnson, Kenneth
Kappraff, Jay
Kondic, Lou
Kriegsmann, Gregory A.
Matveev, Victor
Michalopoulou, Zoi-Heleni
Milojevic, Petronije
Miura, Robert M.
Moore, Richard
Muratov, Cyrill
Nadim, Farzan
Papageorgiou, Demetrios
Perez, Manuel
Petropoulos, Peter
Rotstein, Horacio
Russell, Gareth
Siegel, Michael
Stickler, David
Tao, Louis
Venkateswaran, Venkat
Wang, 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 8 **Qing Nie**, University of California, Irvine
Specificity and Robustness in Cell Signaling

September 15 **Michael Loewenberg**, Yale University
Drop Coalesence in Stoke Flows

September 22 **Stephen Shipman**, Louisiana State University
Nonrobust Guided Modes in Periodic Structures

September 29 **Alex Kiselev**, University of Wisconsin
Enhanced Relaxation for Passive Scalar

October 6 **Jeff Morris**, City College of New York
Mixture Shear Flows as Dynamical Systems: Non-Newtonian Rheology and Other Irreversible Phenomena in Liquid-Solid Dispersions

October 13 **Bard Ermentrout**, University of Pittsburgh
Mind the Gap: Synchrony and Gap Junctions

October 20 **James Gunton**, Lehigh University
Condensation of Globular Proteins from Solution

October 27 **George Biros**, University of Pennsylvania
Fast Algorithms for the Solution of Optimal Control, Design, and Inverse Problems

November 3 **Purnima Ratilal**, Northeastern University
Spatial and Temporal Behaviour of Atlantic Herring Spawning on Georges Bank Revealed by Ocean Acoustics Waveguide Remote Sensing

November 10 **Roberto Camassa**, University of North Carolina
Spinning Rods, Microfluidics, and Mucus Propulsion by Cilia in the Lung

November 17 **Weiqing Ren**, New York University
The Moving Contact Line Problem

December 1 **James Glimm**, SUNY Stonybrook
Turbulent Mixing in Real (Nonideal) Fluids

December 8 **Michael Vogelius**, Rutgers University
Electromagnetic Imaging of Small Inhomogeneities

January 19 **Andrea Liu**, University of Pennsylvania
Jamming

January 26 **Andy Norris**, Rutgers University
Crack Front Waves and Matched Asymptotic Expansions

February 2 **Tobin Driscoll**, University of Delaware
Living Off the Grid: Radial Basis Functions for Meshless PDE Computations

February 9 **Annette Hosoi**, Massachusetts Institute of Technology
Optimizing Low Reynolds Number Locomotion

February 16 **Louis Tao**, New Jersey Institute of Technology
Orientation Selectivity in Visual Cortex

February 23 **Clancy Rowley**, Princeton University
Simple Dynamics from Complex Data: Model Reduction for Control of Fluids

March 2 **Marcelo Magnasco**, Rockefeller University
Sparse Time-Frequency Representation

March 9 **Cyrus R. Mehta**, Cytel Inc. and Harvard University
Flexible Adaptive Clinical Trials: Methods, Software and Case Studies

March 23 **Aaditya Rangan**, New York University
Spatiotemporal Dynamics of the Line-Motion Illusion in Primary Visual Cortex

March 28 **Andrew Noymer**, University of California at Irvine
Mortality Selection: The 1918 Influenza Pandemic's Role in the Decline of Tuberculosis in the US

March 30 **S. Lakshmivarahan**, University of Oklahoma
Dynamic Data Assimilation: An Overview

April 13 **Andrew Gelman**, Columbia University
Red State, Blue State: What's the Matter with Connecticut? A Demonstration of Multilevel Modeling

April 20 **Jerry Nedelman**, Novartis
Types of Models

April 27 **Andrea Prosperetti**, Johns Hopkins University
Stability of Rising Bubbles

Statistics Seminar

November 16 **Das Purkayastha**, Novartis Pharmaceuticals
A Statistical Model for Inter-temporal Causal Dynamics of Glucose Production and Disposal with Insulin Level in Diabetic Patients

November 30 **Gang Li**, Johnson & Johnson
Adaptive Design in Antibiotic Trials

January 29 **Sundar Subramanian**, University of Maine
Censored Median Regression Models

February 6 **Inyoung Kim**, Department of Epidemiology and Public Health, Yale University
Bayesian Semiparametric Method for Pathway Analysis

February 8 **Chong Wang**, Cornell University
ROC Analysis For Longitudinal Disease Diagnostic Data Without A Gold Standard Test

March 7 **Kaushik Ghosh**, Department of Mathematical Sciences, NJIT
Some Recent Developments In Ranked Set Sampling And Their Applications

April 18 **David Kim**, Manhattan College-Riverdale, NY
Rank Adapted Kernel Density Estimation

April 25 **Alejandro Jaramillo**, Data Means Corp.
On The Application Test & Control Matching Methods Used In The Pharmaceutical Industry To Measure Promotion Response

Mathematical Biology Seminar

September 19 **Joshua C. Brumberg**, Department of Psychology, Queens College, CUNY
The Barrel Cortex: A Window into Cortical Circuitry and Its Development

September 26 **Jaime de la Rocha**, Center for Neural Science, New York University
Correlation between Neural Spike Trains Increases with Firing Rate

September 29 **Nickolas Kintos**, Department of Mathematical Sciences, NJIT
Modeling Projection Neuron and Neuromodulatory Effects on a Rhythmic Neural Network

October 3 **Nicolas Brunel**, CNRS, Laboratory of Neurophysics and Physiology, Université Paris 5
Oscillations in Networks of Noisy Spiking Neurons

October 10 **Horacio Rotstein**, Department of Mathematical Sciences, NJIT
Canard Induced Mixed-Mode Oscillations in a Medial Entorhinal Cortex Layer II Stellate Cell Model: Work in Progress

October 24 **Lora Billings**, Department of Mathematical Sciences, Montclair State University
Multi-Strain Disease Models with Antibody-Dependent Enhancement

October 31 **Anton Sirota**, Center for Molecular and Behavioral Neuroscience, Rutgers University
Integration and Segregation of Activity in Neocortex-Hippocampus by Slow Oscillations

November 7 **Tim Vogels**, Columbia University School of Medicine
Signal Gating and Detailed Balance in Networks of Model Neurons

November 14 **Horacio Rotstein**, Department of Mathematical Sciences, NJIT
Mechanistic Aspects of the Creation of Theta Rhythmic Activity in the Hippocampus: A Modeling Study

November 21 **Emre Aksay**, Weill Medical College, Cornell University
Functional Roles of Excitation vs. Inhibition in a Neural Integrator

November 28 **Caroline Geisler**, Center for Molecular and Behavioral Neuroscience, Rutgers University
Hippocampal Place Cells are Speed-Controlled Oscillators

December 13 **Abraham Rosales**; **Chris Khalil**, **Arif Patel**, and **Arlene Pineda**; **Janeet Kaur** and **Tao Lin**
UBM Program Student Presentations

January 23 **Oreste Piro**, Mediterranean Institute for Advanced Studies and the Rockefeller University
Left or Right? Go with the Flow!

January 30 **Jonathan D. Victor**, Weill Medical College of Cornell University
Neural Coding and Representation of Visual Information

February 13 **Stefano Fusi**, Columbia University School of Medicine
The Importance of Neural Diversity in Complex Cognitive Tasks

March 20 **Maria Uriarte**, Columbia University
Potential Impacts of Increased Severity and Frequency of Tropical Storms on Caribbean Forests

April 10 **Adriano Tort**, Center for Biodynamics, Boston University
Formation of Gamma Coherent Cell Assemblies by Oriens Lacunosum-Moleculare Interneurons in the Hippocampus: A Modeling Study

Fluid Mechanics Seminar

August 28 **Linda Cumming**, University of Nottingham, UK
"Lipid Raft" Formation: Experiments and Mathematical Modelling

September 18 **Boguk Kim**, Department of Mathematical Sciences, NJIT
On the Two-Dimensional (2D) Benjamin Model Equation

October 9 **Michael Siegel**, Department of Mathematical Sciences, NJIT
Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations

October 23 **Silas Alben**, DEAS, Harvard University
Fin Ray Design and Use in Fish Swimming

October 30 **Jerry Shan**, Mechanical and Aerospace Engineering Department, Rutgers University
Structure, Rheology, and Thermal Conductivity of Nanotube and Nanoparticle Suspensions under Electric/Magnetic Fields

November 6 **Yongsam Kim**, Courant Institute of Mathematical Sciences, New York University
Vortex-Induced Vibrations by the Immersed Boundary Method

November 13 **Arnaud Goullet**, Department of Mathematical Sciences, NJIT
Chaotic Advection and Control for Mixing Purposes in Laminar Flows

November 27 **Stefan Maehlmann**, Department of Mathematical Sciences, NJIT
Numerical Simulation of Disturbance Waves in Supersonic Flow Over a Blunt Flat Plate

December 4 **David Hu**, AML, Courant Institute, NYU
The Mechanics of Slithering

December 13 **Ehud Yariv**, Department of Mechanical Engineering, Technion, Israel
On the Paradox of Thermocapillary Flow about a Stationary Bubble

January 22 **Kausik Sarkar**, Department of Mechanical Engineering, University of Delaware
Ultrasound Contrast Agents: A Problem in Fluid Mechanics

February 5 **Darko Volkov**, Department of Mathematics, WPI
An Inverse Problem for the Recovery of Active Faults from Surface Observations

February 12 **Jerzy Blawzdziewic**, Department of Mechanical Engineering, Yale University
Distributions of Particle Packings in Static and Slowly Driven Amorphous Materials: Does the Concept of Edwards Entropy Make Sense?

February 19 **Becca Thomases**, Courant Institute, New York University
Analysis and Computations for Viscoelastic Fluids

March 5 **Gerardo Callegari**, TRI, Princeton University
Spontaneous Absorption of Droplets into Single Pores and Fibrous Porous Materials

March 20 **Petia Vlahovska**, Thayer School of Engineering, Dartmouth College
Microhydrodynamics of Soft Particles

April 2 **Arnaud Goullet**, Department of Mathematical Sciences, NJIT
Chaotic Advection and Control for Mixing Purposes in Laminar Flows

April 30 **Roman Grigoriev**, School of Physics, Georgia Institute of Technology
The Role of Resonance Phenomena in Chaotic Mixing

Waves on Wednesdays Seminar

September 6 **André Nachbin**, IMPA
The Eddy Viscosity for Nonlinear Waves over a Turbulent Surface

September 20 **J. Nathan Kutz**, University of Washington
Soliton Lasers

October 18 **Agissilaos Athanassoulis**, Princeton University
Homogenization of Wave Propagation with the Use of Nonlinear Phase-Space Densities: The Wigner Transform Method and Generalizations

November 8 **Edward D. Farnum**, Kean University
Theory and Simulation of Multi-Frequency Mode-Locked Lasers

November 15 **Maxim Shkarayev**, The University of Arizona
Large Deviation Principles in Optical Communication Systems: Theoretical and Experimental Study

January 31 **Philippe Guyenne**, University of Delaware
Solitary Water Wave Interactions

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Roman I. Andrushkiw

Interface Dynamics for Quasi-Stationary Stefan Problem (with V. Gafiychuk, B. Datsko), Mathematical and Computer Modeling, Vol. 45, pp. 892-898, April 2007.

John Bechtold

Spiral Waves in Expanding Hydrogen-Air Flames: Experiment and Theory (with G. Jomaas and C. K. Law), Proc. Combust. Inst, 31, pp. 1039-1046, September 2006.

Denis Blackmore

Swept Volumes: Foundations, Perspectives and Applications (with K. Abdel-Malek, J. Yang, and K. Joy), Int. J. Shape Modeling, vol. 12, pp. 87-127, July 2006.

Pitchfork Bifurcations of Invariant Manifolds (with J. Champanerkar), Topology and Its Applications, vol. 154, pp. 1650-1663, April 2007.

Computational Differential Topology (with Y. Mileyko), Appl. Gen. Topology, vol. 8, pp. 35-92. May 2007.

Studies of Perturbed Three Vortex Dynamics (with L. Ting, L. and O. Knio), J. Math. Phys., vol. 48, pp. 053601-1 – 31, June 2007.

Victoria Booth

Neuronal Models for Sleep-Wake Regulation and Synaptic Reorganization in the Sleeping Hippocampus (with J. Best, C. Diniz Behn, and G. R. Poe), Journal of Biological Rhythms, Vol. 22, pp.220-232, 2007.

Causal Entropies - A Measure for Determining Changes in the Temporal Organization of Neural Systems (with J. Waddell, R. Dzakpasu, B. T. Riley, J. Reasor, G. R. Poe, and M. Zochowski), Journal of Neuroscience Methods, Vol. 162, pp.320-332, 2007.

Amitabha Bose

The Geometry of Neuronal Recruitment (with J. Rubin), Physica D, Vol 221, pp. 37-57, September 2006.

Newspaper Article: Dynamics of Central Pattern Generating Networks: Locus of Control (with F. Nadim), SIAM News, Vol 40, March 2007.

Combining Synaptic and Cellular Resonance in a Feed-Forward Neuronal Network (with J. Drover, V. Tohidi and F. Nadim), Neurocomputing Vol. 70 pp. 2041-2045, June 2007.

Bruce Bukiet

A Mathematical Modelling Approach to One-Day Cricket Batting Orders (with M. Ovens), Journal of Sports Science and Medicine, Vol. 5, pp. 495-502, 2006.

Methods of Applied Mathematics: Honors Mathematics 450 and 451 (with R. Goodman), Honors in Practice, Vol. 3, pp. 171-173, 2007.

Viscoelastic Behavior of Human Fasciae under Extension in Manual Therapy (with H. R. Chaudhry, C-Y. Huang, R. Schleip, Z. Ji, and T. Findley), Journal of Bodywork and Movement Therapies Vol. 11, pp. 159-167, April, 2007.

Sunil K. Dhar

Teaching Statistics to Clinical Research Staff in a Pharmaceutical Company (with Farid Kianifard), Pharmaceutical Statistics, Volume 5(2), pp. 225-229, 2006.

A review of, "Statistical Evidence in Medical Trials: What Do the Data Really Tell Us?" by S. D. Simon, New York: Oxford University Press, 2006, Journal of Biopharmaceutical Statistics, Volume 17, No. 5, 2007.

Javier Diez

Rupture of a fluid strip under partial wetting conditions (with A. G. Gonzalez, R. Gratton, J. Gomba), Europhysics Letters 77, 44001-1/5, April 2007.

Jonathan Drover

Phase Boundaries as Electrically Induced Phosphenes (with G.B. Ermentrout), SIADS Vol 5 No. 4, pp. 529-551, 2006.

Combining Cellular and Synaptic Resonance in a Feed Forward Network (with V. Tohidi, A. Bose, and F. Nadim), Neurocomputing, 70, 2041-2045, 2007.

Thomas Erneux

Fast Optical Self-Pulsing in a Temporal Analog of the Kerr-Slice Pattern-Forming System (with G. Kozyreff, M. Haelterman and P. Kockaert), Phys. Rev. A 73, 063815, June 2006.

Square-Wave Self-Modulation in Diode Lasers with Polarisation-Rotated Optical Feedback (with A. Gavrielides, D.W. Sukow, G. Burner, T. McLachlan, J. Miller, and J. Amonette), Optics Letters 31, pp. 2006-2008, July 2006.

Optical Bistability in Traveling Wave SOA's Connected to a DFB Laser Diode: Theory and Experiment (with W. D'Oosterlinck, G. Morthier, R. Baets), IEEE J. Quantum Electronics 42, pp. 739-746, July 2006.

Spatio-Temporal Behaviors of a Clock Reaction in an Open Gel Reactor (with K. Benyaich, S. Métens, S. Villain, and P. Borckmans), Chaos 16, 037109, September 2006.

Rescue of the Quasi-Steady State Approximation in a Model for Oscillations in an Enzymatic Cascade (with A. Goldbeter), SIAM J. on Appl. Math. 67, pp. 305-320, December 2006.

Nonlinear Stability of a Delayed Feedback Controlled Container Crane (with T. Kalmar-Nagy),

Journal of Vibration and Control 13, pp. 606-616, May 2007.

Anna Georgieva

Integrative Preclinical Cardiosafety Assessment and Alternative Methods to Animal Experimentation (with B. Dumotier), Cell Biol Toxicol, Vol. 23, pp. 293-302, 2007.

Kaushik Ghosh

A Semiparametric Bayesian Model for Circular-Linear Regression (with B. J. George), Comm. Stat. Simula. Comp., Vol. 31, No. 4, pp. 911-923, November 2006.

Extreme-Rank Selection for Linkage Analysis of Quantitative Trait Loci using Selected Sib-Pairs (with G. Zheng, Z. Chen and Z. Li), Ann. Hum. Gen., Vol. 70, pp. 857-866, December 2006.

Prediction of U.S. Cancer Mortality Counts using Semiparametric Bayesian Techniques (with R. C. Tiwari), Jour. Amer. Statist. Assoc., Vol. 102, No. 477, pp. 7-15, January 2007.

Jorge Golowasch

Ionic Mechanism Underlying Recovery of Rhythmic Activity in Adult Isolated Neurons (with R. Haedo), J. Neurophysiology Vol. 96, pp. 1860-1876, 2006.

Signal Transmission Between Gap-Junctionally Coupled Passive Cables is Most Effective at an Optimal Diameter (with F. Nadim), J. Neurophysiology Vol. 95 (6), pp. 3831-3843, 2006.

Modeling Recovery of Rhythmic Activity: Hypothesis for the Role of a Calcium Pump (with Y. Zhang), Neurocomputing Vol. 70, pp. 1657-1662, 2007.

Roy Goodman

Chaotic Scattering and the n-bounce Resonance in Solitary Wave Interactions, (with R. Haberman) Phys. Rev. Lett., 98 pp. 104103:1-4, March 2007.

Peter Gordon

Travelling Fronts in Porous Media Combustion: Existence and a Singular Limit (with L.Ryzhik), Proceedings of the Royal Society A, Vol. 462, pp. 1965-1985, July 2006.

A Stretch-Temperature Model for Flame-Flow Interaction (with M.Frankel and G. Sivashinsky), Physics Letters A, Vol. 361, pp. 356-359, February 2007.

Claus Holzapfel

The Invasion of the Common Myna (Acridotheres tristis L.) in Israel and the Middle East (with S. Kark, O. Hatzofe, and N. Levin), Sandgrouse 28, pp. 44-51, 2006.

David J. Horntrop

Mesoscopic Simulation of Ostwald Ripening, J. Comput. Phys., Vol. 218, pp. 429-441, October 2006.

A Spectral Method Study of Domain Coarsening, Phys. Rev. E, Vol. 75, 046703, April 2007.

Huaxiong Huang

Extensional Flow with Viscous Heating (with J. Wylie), Journal of Fluid Mechanics, 570, pp. 359-370, Jan. 2007.

Thermal Instability in Drawing Viscous Threads (with J. Wylie and R.M. Miura), Journal of Fluid Mechanics, 570, pp. 1-16, Jan. 2007.

On the Formation of Glass Microelectrode (with J. Wylie, R.M. Miura and P. Howell), SIAM Journal on Applied Mathematics, 67 (3), pp. 630-666, Feb. 2007.

A Numerical Study of Mass Transfer of Ozone Dissolution in Bubble Plumes with an Euler-Lagrange Method (with X. Gong, S. Takagi, and Y. Mastumoto), Chemical Engineering Science, 62, pp. 1081-1093, Feb. 2007.

Stretching of Heated Threads with Temperature-Dependent Viscosity: Asymptotic Analysis (with P.D. Howell, J.J. Wylie, and R.M. Miura), Discrete and Continuous Dynamical Systems, 7 (3), pp. 553-572, May 2007.

Aridaman Jain

Liposuction Breast Reduction: A Prospective Trial in African American Women (with Martin J. Moskovitz, Sherwood A. Baxt, and Robert E. Hausman), Journal of Plastic and Reconstructive Surgery, February, 2007.

Shidong Jiang

Breaking of the Overall Permutation Symmetry in Nonlinear Optical Susceptibilities of One-Dimensional Periodic Dimerized Hueckel Model, (with M. Xu), J. Phys.: Condens. Matter, Vol. 18, pp. 8987-8993, September 2006.

Size Dependence of Second-Order Hyperpolarizability of Finite Periodic Chains Under Su-Schrieffer-Heeger Model, (with M. Xu), Europhys. Letter, Vol. 76, no. 4, pp. 670-676, November 2006.

Jump Relations of the Quadruple Layer Potential on a Regular Surface in Three Dimensions, Appl. Comput. Harmon. Anal., Vol. 21, pp. 395-403, November 2006.

Jay Kappraff

Chaos and Complexity in Art, In Chaos and Complexity in the Arts and Architecture, ed. By N. Salas, New York: Nova Science Publ., 2007.

Lou Kondic

Long-Wave Linear Stability Theory for Two-Fluid Channel Flow Including Compressibility Effects (with T. Segin and B. S. Tilley), IMA J. Appl. Math., Vol. 71, pp. 715-739, October 2006.

Dynamic Structure Formation at the Fronts of Volatile Liquid Drops (with Y. Gotkis, I. Ivanov, and N. Murisic), Phys. Rev. Lett., Vol. 93, 186101, pp. 1-4, November 2006.

On Velocity Profiles and Stresses in Sheared and Vibrated Granular Systems under Variable Gravity (with O. Baran), Phys. Fluids, Vol. 18, 121509, pp. 1-9, November 2006.

Gregory A. Kriegsmann

Complete Transmission Through a Periodically Perforated Slab (with L. Zhou), Journal of the Acoustical Society of America, Vol. 121, No. 6, pp. 3288-3299, 2007.

Dawn A. Lott

Mathematical Model for the Rupture of Cerebral Saccular Aneurysm through Three-Dimensional Stress Distribution in the Aneurysm Wall (with H.R. Chaudhry, C.J. Prestigiacomo, and T.W. Findley), Journal of Mechanics in Medicine and Biology, Vol. 6, pp. 325-335, September 2006.

Victor Matveev

Residual Bound Ca2+ can Account for the Effects of Ca2+ Buffers on Synaptic Facilitation (with R. Bertram and A. Sherman), J. Neurophysiol., Vol 96, pp. 3389-3397, December 2006.

Capturing the Bursting Dynamics of a Two-Cell Inhibitory Network using a One-Dimensional Map (with A. Bose and F. Nadim), J. Comp. Neurosci., DOI 10.1007/s10827-007-0026, April 2007.

Ca2+-dependent Inactivation of CaV1.2 Channels Prevents Gd3+ Block: Does Ca2+Block the Pore of Inactivated Channels? (with O. Babich, A.L. Harris, and R. Shirokov), J. Gen. Physiol., Vol. 129, pp. 477-483, May 2007.

Roberto Mauri

Effects of Quenching Rate and Viscosity on Spinodal Decomposition (with P. Poesio, G. Cominardi, M. Lezzi, and G.P. Beretta), Phys. Rev. E, Vol. 74, No. 1, pp. 011507/1-13, July 2006.

Violation of the Fluctuation-Dissipation Theorem in Confined Driven Colloids (with D. Leporini), Europhys. Lett., Vol. 76, No. 6, pp. 1022-1028, December 2006.

Fluctuations of Non-Conservative Systems (with D. Leporini), J. Stat. Mech., Vol. 2007, No. 3, pp. P03002/1-11, March 2007.

Jay Meegoda

A Framework for Automatic Condition Assessment of Culverts (with T. Juliano and Amit Banerjee), Journal of Transportation Research Board, #1948, pp. 26-36, October 2006.

Microscopic Modeling of Colloidal Silica Stabilized Granular Contaminated Soils (with Netnapid Tantemsapya), ASCE Journal of Materials in Civil Engineering, Vol. 19 #1, pp. 91-98, January 2007.

Numerical Model to Predict Settlements Coupled with Landfill Gas Pressure in Bioreactor Landfills (with Chamil H. Hettiarachchi, John Tavantzis, and Patrick Hettiaratchi), Journal of Hazardous Materials, Vol. B139 514-522, 2007.

Leaching of Heavy Metals Stabilized in Asphalt Matrix (with M.Cervinkova and A. Blaha), ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management, Vol. 11, #2, pp 1-14, April 2007.

Zoi-Heleni Michalopoulou

Standoff Sensing of Explosives using Terahertz Radiation, American Laboratory, (with J. Federici, R. Barat, D. Gary), pp. 28-33, June-July 2006.

Artificial Neural Network Analysis in Interferometric Terahertz Imaging for Detection of Lethal Agents, (with A. Bandyopadhyay, A. Sengupta, R, Barat, R., D. Gary, J. Federici) International Journal of Infrared and Millimeter Waves, Vol. 27, pp. 1145-1158, August 2006.

Multiple Source Localization using a Maximum a Posteriori-Gibbs Sampling Approach, Journal of the Acoustical Society of America, Vol.120(5), pp. 2627-2634, November 2006.

Robert M. Miura

Traveling Waves in Coupled Reaction-Diffusion Models with Degenerate Sources (with J.J. Wylie), Phys. Rev. E, Vol. 74, 021909, August 2006.

Prediction of mRNA Polyadenylation Sites by Support Vector Machine (with Y. Cheng and B. Tian), Bioinformatics, Vol. 22, pp. 2320-2325, October 2006.

Thermal Instability in Drawing Viscous Threads (with J.J. Wylie and H. Huang), J. Fluid Mech., Vol. 570, pp. 1-16, January 2007.

On the Formation of Glass Microelectrodes (with H. Huang, J.J. Wylie, and P.D. Howell), SIAM J. Appl. Math., Vol. 67, pp. 630-666, February 2007.

Stretching of Heated Threads with Temperature-Dependent Viscosity: Asymptotic Analysis (with P.D. Howell, J.J. Wylie, and H. Huang), Disc. Cont. Dyn. Syst.-B, Vol. 7, pp. 553-572, May 2007.

Richard O. Moore

Phase-Sensitive Amplification of Chirped Optical Pulses in Fibers, (with C. J. McKinstrie, S. Radic, and R. Jiang), Opt. Exp., Vol. 15, pp. 3737-3758, April 2007.

Cyrill Muratov

Traveling Wave Solutions of Harmonic Heat Flow (with M. Bertsch and I. Primi), Calc. Var. PDE, Vol. 26, pp. 489-509, August 2006.

Optimal Grid-Based Methods for Thin Film Micromagnetics Simulations (with V. V. Osipov), J. Comput. Phys., Vol. 216, pp. 637-653, August 2006.

Non-Meanfield Deterministic Limits in Chemical Reaction Kinetics Far from Equilibrium (with R. E. L. DeVille and E. Vanden-Eijnden), J. Chem. Phys., Vol. 124, p. 231102, August 2006.

Quantitative Models of Developmental Pattern Formation (with G. T. Reeves, G. Schupbach, and S. Y. Shvartsman), Devel. Cell, Vol. 11, pp. 289-300, September 2006.

Noise Can Play an Organizing Role for the Coherent Dynamics in Excitable Media (with E. Vanden-Eijnden and W. E), Proc. Natl. Acad. Sci. USA, Vol. 104, pp. 702-707, January 2007.

Farzan Nadim

Analysis of Biological Neurons via Modeling and Rule Mining (with T.G. Smolinski, P. Rabbah, C. Soto-Trevino and A. Prinz), International J of Info Tech and Intelligent Computing, Vol. 1, pp 293-302, July 2006.

Dynamics of Central Pattern Generating Networks: Locus of Control (with A. Bose), SIAM News, Vol. 40, p 12, March 2007.

Distinct Synaptic Dynamics of Heterogeneous Pacemaker Neurons in an Oscillatory Network (with P. Rabbah), J Neurophysiology, Vol. 97, pp 2239-2253, March 2007.

Neuromodulation of Short-Term Synaptic Dynamics Examined in a Mechanistic Model Based on Kinetics of Calcium Currents (with L. Zhou and S. Zhao), Neurocomputing, Vol. 70, pp. 2050-2054, June 2007.

Combining Synaptic and Cellular Resonance in a Feed-Forward Neuronal Network (with J. Drover, V. Tohidi, and A. Bose), Neurocomputing, Vol. 70, pp. 2041-2045, June 2007.

Demetrios T. Papageorgiou

Theory and Experiment on the Stagnant Cap Regime in the Motion of Spherical Surfactant Laden Bubbles (with R. Palaparthi and C. Maldarelli), J. Fluid Mech., Vol. 559, pp. 1-44, July 2006.

Electrohydrodynamic Linear Stability of Two Immiscible Fluids in a Channel (with O. Ozen, N. Aubry and P.G. Petropoulos), Electrochimica Acta, Vol. 51, pp. 5316-5323, July 2006.

A Global Attracting Set for Nonlocal Kuramoto-Sivashinsky Equations Arising in Interfacial Electrohydrodynamics (with D. Tseluiko), Euro Jnl Applied Mathematics, Vol. 17, pp. 677-703, December 2006.

A New Application of the Kortweg-de Vries Benjamin-Ono Equation in Interfacial Electrohydrodynamics (with H. Gleeson, P.A. Hammerton and J.M. Vanden-Broeck), Physics of Fluids, Vol. 19, Article no. 031703, March 2007.

Interfacial Capillary Waves in the Presence of Electric Fields (with S. Grandison and J.-M. Vanden-Broeck), European Journal of Mechanics D/Fluids, Vol. 26, pp. 404-421, May-June 2007.

Nonlinear Dynamics of Electrified Thin Liquid Films (with D. Tseluiko), SIAM Journal on Applied Mathematics, Vol. 67, pp. 1310-1329, June 2007.

Peter G. Petropoulos

Electrohydrodynamic Linear Stability of Two Immiscible Fluids in Channel Flow, (with O. Ozen, N. Aubry, and D.T. Papageorgiou) Electrochimica Acta, vol. 51, pp. 5316-5323, July 2006.

Louis Tao

Orientation Selectivity in Visual Cortex by Fluctuation-Controlled Criticality (with D. Cai, D. McLaughlin, M. Shelley and R. Shapley), Proc. Natl. Acad. Sci. USA, Vol. 103, pp. 12911-12916, August 2006.

Numerical Method for Solving Moment Equations in Kinetic Theory of Neuronal Networks (with A.

Rangan and D. Cai), J. Comput. Phys., Vol. 221, pp. 781-798, March 2007.

Jean-Marc Vanden-Broeck

Steady Free-Surface Flows Past an Uneven Channel Bottom (with B. Binder and F. Dias), Theoretical and Computational Fluid Dynamic, Vol. 20, pp. 125-144, July 2006.

Exponential Asymptotics and Gravity Waves (with S.J. Chapman), J. Fluid Mech., Vol. 567, pp. 299-326, November 2006.

Monotonicity of Some Modified Bessel Function Products (with R. Penfold and S. Grandison), Integral Transforms and Special Functions, Vol. 18, pp. 139-144, January 2007.

A Note on Solitary Waves with Variable Surface Tension in Water of Infinite Depth (with E. Ozugurlu), ANZIAM J., Vol 48, pp. 225-235, February 2007.

Solitary Waves in Water: Numerical Methods and Results, Solitary Waves in Fluids, pp. 55-78, R.H.J. Grimshaw editor, WIT press, March 2007.

A New Application of the Kortweg - de Vries Benjamin-Ono Equation in Interfacial Electrohydrodynamics,(with H. Gleeson and P.A. Hammerton), Vol. 19, Article no. 031703, March 2007.

Three-Dimensional Gravity and Gravity-Capillary Interfacial Flows (with E. Parau and M. Cooker), Mathematics and Computers in Simulation, Vol. 74, pp. 105-122, March 2007.

The Effect of Disturbances on the Flows Under a Sluice Gate and Past an Inclined Plate (with B. Binder), J. Fluid Mech., Vol. 576, pp. 475-490, April 2007.

A Rapid Boundary Integral Equation Technique for Protein Electrostatics (with S. Grandison and R. Penfold), J. Comp. Physics, Vol 224, pp. 663-680, June 2007.

Three-Dimensional Capillary-Gravity Waves Generated by a Moving Disturbance (with E. Parau and M. Cooker), Phys. Fluids, Vol 19, June 2007.

Interfacial Capillary Waves in the Presence of Electric Fields, (with S. Grandison), European Journal of Mechanics B/Fluids, Vol. 26, pp. 404-421, May-June 2007.

Sheldon Wang

An Iterative Matrix-Free Method in Implicit Boundary/Continuum Methods, Computers & Structures, 2007.

Dynamic Modelling of Prosthetic Chorded Mitral Valves Using the Immersed Boundary Method (with P.N. Watton, X.Y. Luo, G.M. Bernacca, P. Molloy, D.J. Wheatley), Journal of Biomechanics, 40, pp. 613-626, 2007.

From Immersed Boundary Method to Immersed Continuum Method, International Journal for Multiscale Computational Engineering, Vol. 4(1), pp. 127-145, 2006.

Immersed Finite Element Method and Its Applications to Biological Systems (with W.K. Liu, Y. Liu, D. Farrell, L. Zhang, Y. Fukui, N. Patankar, Y. Zhang, C. Bajaj, X. Chen, and H. Hsu), Computer Methods in Applied Mechanics and Engineering, Vol. 195, pp. 1722-1749, 2006.

Yuan-Nan Young

Limits of the Potential Flow Approach to the Single-Mode Rayleigh-Taylor Problem (with P. Ramaprabhu, Guy Dimonte, A. C. Calder and B. Fryxell), Physical Review E, 74, 066308, 2006.

BOOKS AND BOOK CHAPTERS

Denis Blackmore

Computational Topology (with T.J. Peters), Open Problems in Topology II, Ed. Elliott Pearl, Elsevier, Amsterdam, pp. 493-546, March 2007.

Claus Holzapfel

Ecosystems: Deserts, Encyclopedia of Ecology, Elsevier.

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

PROCEEDINGS PUBLICATIONS

Roman I. Andrushkiw

Computer Aided Cytogenetic Method of Breast Cancer Diagnosis, Part I – Decision Rule (with Yu. Petunin, N.V. Boroday, I.V. Dosenko), Proceedings of the 2006 International Conference on Bioinformatics & Computational Biology, Vol. 1, H. R. Arabnia & H. Valafar, eds., CSREA, Las Vegas, pp. 205-209, July 2006.

Computer Aided Cytogenetic Method of Breast Cancer Diagnosis, Part II: Test Criteria (with D.A. Klyushin, K.N. Golubova, A.V. Romanov), Proceedings of the 2006 International Conference on Bioinformatics & Computational Biology, pp. 210-213, H. R. Arabnia & H. Valafar, eds., CSREA, Las Vegas, July 2006.

Denis Blackmore

Analysis of the Motion and Deformation of a Bubble Rising in a Viscoelastic Fluid (with S. Pillapakkam, P. Singh and N. Aubry), Proc. FEDSM2006, pp. 1-6, Miami, FL, July 2006.

Michael Booty

Microassembly Techniques: A Review (with S. Shet, R.D. Revero, A.T. Fiory, M.P. Lepselter and N.M. Ravindra), Proceedings of the Materials Science and Technology Conference 2006, Fundamentals and Characterization: Volume 1, pp. 451-470, 2006.

Bruce Bukiet

A Mathematical Modelling Approach to One-Day Cricket Batting Orders (with M. Ovens), Proceedings of the Eighth Australasian Conference on Mathematics and Computers in Sport (8M\&CS), Coolangatta, Queensland, Australia, pp. 58-67, July 2006.

Wooyoung Choi

Nonlinear Surface Wave Dynamics in Slowly Varying Ocean Environments, Proceedings of the 26th Symposium on Naval Hydrodynamics, Vol. II, 195-203, Sept. 2006.

Thomas Erneux

Polarization Switching in Nd:YAG Lasers by Means of Modulating the Pump Polarization (with G. Verschaffelt, G. Van der Sande, J. Danckaert, B. Ségard, P. Glorieux) SPIE Proc on Semicionductor Lasers and Laser Dynamics II, Vol. 6184, 61841V, April 2006.

Square-Wave Oscillations in Edge-Emitting Diode Lasers with Polarization-Rotated Optical Feedback (with A. Gavrielides, D.W. Sukow, G. Burner, T. McLachlan, J. Miller, and J. Amonette) SPIE Proc on Semicionductor Lasers and Laser Dynamics II, Vol. 6184, 61840T, April 2006.

Optical Frequency Dynamics and Relaxation Oscillations of a Semiconductor Laser Subject to Filtered Optical Feedback (with M. Nizette), SPIE Proc on Semicionductor Lasers and Laser Dynamics II, Vol. 6184, 61840W, April 2006.

Vladislav V. Goldberg

Valentin Vasil'evich Lychagin (On the occasion of his 60th birthday), (with B. Kruglikov, A. Kushner, V. Kuzakon, and V. Rubtsov), Theses of Reports to the International Conference Geometry in Odessa-2007, Odesa, pp. 8-10, May 2007.

Maria Teresa Calapso (On the occasion of her 50 years of scientific activity), (with A. Kushner), Theses of Reports to the International Conference Geometry in Odessa-2007, Odesa, pp. 21-22, May 2007.

Aridaman Jain

Continuous Water Quality Data Modeling for Hackensack River (with Ken Johnson, Francisco Artigas, and Christine Hobble), Proceedings of the Stormwater and Urban Water Systems Modeling Conference, Toronto, Canada, February 2007.

The Prerequisites, Performance and Perceptions of the ACCE/DCE in Emerging DPT Programs (with Pivko, S., Silberman, N., DeMasi, I., and Taylor, M.,), Proceedings of the World Physical Therapy 2007 Conference, Vancouver, BC, Canada, June, 2007.

Ken Johnson

Continuous Water Quality Data Modeling for Hackensack River (with Aridaman Jain, Francisco Artigas, and Christine Hobble), Proceedings of the Stormwater and Urban Water Systems Modeling Conference, Toronto, Canada, February 2007.

Lou Kondic

On Stability of the Interface Between Two Fluids: Undercompressive Shocks, Flow Reversal, and Compressibility Effects (with T. Segin and B. S. Tilley), Proceedings of the International Congress of Mathematicians, pp. 565-566, August 2006.

Jay Meegoda

Hydraulic Capacity of Deteriorated Culverts and Impact on Asset Management (with T. Juliano and Amit Banerjee), Transportation Research Board, Washington DC, Paper # TRB 07-1600, January 2007.

Post Optimality Analysis of a Solid Waste Management System, A Case Study (with S. Olapiriyakul, L. Abdel-Malek, H. N. Hsieh, and S. El Haggar), 1st Global Cleaner Production Conference and Exhibition, Nasr City-Cairo- Egypt, September 2006.

Towards the Development of Sustainable Landfills (with A. Borgaonkar, H. N. Hsieh, S. El Haggar, P. A. Hettiaratchi, and R. I. Stressel), 1st Global Cleaner Production Conference and Exhibition, Nasr City-Cairo- Egypt, September 2006.

The Potential Advantages of Applying Operations Research Techniques to Optimize Waste Management in New Jersey (with S. Olapiriyakul, A. Borgaonkar, L. Abdel-Malek, and H. N. Hsieh), 1st Global Cleaner Production Conference and Exhibition, Nasr City-Cairo- Egypt, September 2006.

A Case Study on the Optimization of Municipal Solid Waste Collection (with Karolina A. Filipiak, Layek Abdel-Malek, and Hsin-Neng Hsieh), The Twenty-Second International Conference on Solid Waste Technology and Management, Philadelphia, PA, USA, March 2007.

Towards The Development Of Sustainable Landfills (with Patrick Hettiaratchi, Hsin-Neng Hsieh, A. Borgaonkar, S. El Haggar, and R. I. Stressel), The Twenty-Second International Conference on Solid Waste Technology and Management, Philadelphia, PA, USA, March 2007.

A Model to Predict Settlements and Landfill Gas Generation In Bioreactor Landfills (with Chamil H. Hettiarachchi and Patrick Hettiaratchi), The Twenty-Second International Conference on Solid Waste Technology and Management, Philadelphia, PA, USA, March 2007.

Zoi-Heleni Michalopoulou

Mached Field Inversion in the East China Sea with Tabu Search (with J. H. Miller and G. R. Potty), Proceedings of the Oceans 2006, CDROM, Boston, September 2006.

Explosive Identification with Terahertz Spectroscopy: A Model Based Approach (with I. Zorych, A. Sinyukov, R. Barat, D. Gary, J. Federici), Proceedings of SAFE 2007, Washington. D.C., pp. 114-117, April, 2007.

B. PRESENTATIONS

Roman I. Andrushkiw

June 2007: The 2007 International Conference on Scientific Computing (CSC'07), Las Vegas, NV
Nonparametric Tests of Unimodality

June 2007: The 2007 International Conference on Skorokhod Space, Kyiv, Ukraine
New Test of Unimodality

John Bechtold

November 2006: APS Division of Fluid Dynamics, Tampa, FL
Spiral Waves over Progagating Hydrogen-Air Flames. Poster (with G. Jomaas and C. K. Law)

May 2007: FACM '07, NJIT, Newark, NJ
Spiral Waves on Spherically Expanding Flames. Poster (with G. Jomaas and C. K. Law)

Denis Blackmore

August 2006: IUTAM Symposium on Hamiltonian Dynamics, Vortex Structures, and Turbulence, Steklov Institute, Moscow, Russia
Nonintegrable Perturbations of Two Vortex Dynamics

October 2006: Algorithms Seminar, Duke University
Categories and Structures for Computational Topology

October 2006: Special Session on Topology and Computing, AMS Meeting #1021, University of Connecticut
Neighborhoods for Computational Geometric Objects

November 2006: Topology Seminar, City College of New York
Equivalence of Computational Geometric Objects

December 2006: Computer Science Colloquium, University of Connecticut
Effective Computability of Equivalence of Stratified Varieties

March 2007: Science Colloquium, Essex County Community College, Newark, NJ
Adventures in Applied Mathematics

March 2007: Mathematics Colloquium, University of South Alabama, Mobile, AL
Perturbations of Integrable Vortex Dynamics

April 2007: General Mathematics Seminar, Technical University of Denmark, Lyngby, Denmark
Computable Topological Consistency of Non-Manifold Objects

May 2007: Fluid Dynamics Seminar, Technical University of Denmark, Lyngby, Denmark
Stability and Chaos in Vortex Dominated Flow Models

May 2007: Aerodynamisches Institüt, RWTH-Aachen, Aachen, Germany
Recent Results on Perturbed Three Vortex Dynamics

Victoria Booth

August 2006: SIAM Life Sciences Meeting joint with the Society for Mathematical Biology Annual Meeting, Raleigh, NC
Modeling Learning and Forgetting in REM Sleep

October 2006: 36th Annual Meeting of the Society for Neuroscience, Atlanta, GA
Network Structure, Neural Synchrony and Plasticity

November 2006: Center for Neural Computation and Neural Engineering Research Seminar, University of Chicago, Chicago
Modeling Learning and Forgetting in REM Sleep

March 2007: Applied and Interdisciplinary Mathematics Seminar, University of Michigan, Ann Arbor
Modeling Learning and Forgetting in REM Sleep

June 2007: NSF/NIH Collaborative Research in Computational Neuroscience
2007 Annual PIs Meeting, University of Maryland, College Park
Effects of Sleep-Relevant Neurotransmitters on Hippocampal Synaptic Efficacy

June 2007: 21st Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN
Evidence that REM Sleep Theta Trough Activity Depotentiates Synapses: Hippocampal Place Field Backward Skewness During Subsequent Waking

Michael Booty

July 2006: 38th SIAM Annual Meeting, Boston, MA
Steady-States and Tip-Streaming of a Slender Bubble with Surfactant in an Extensional Flow

October 2006: Materials Science and Technology Conference 2006, Cincinnati, OH
Microassembly Techniques: A Review

January 2007: Levich Institute Seminar Series, CCNY, CUNY
Steady and Tip-Streaming Behavior of a Slender Surfactant-Coated Bubble in an Extensional Flow

February 2007: TMS (The Minerals, Metals and Materials Society) Annual Meeting and Exhibition, Orlando, FL
Modeling of Magnetic Field Assisted Assembly of Semiconductor Devices

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
The Influence of Surfactant on Bubble Shape and Evolution in an Extensional Flow

May 2007: Seventh Joint Meeting of the AMS and SMM, Zacatecas, Mexico
Microwave Heating of a Fiber

May 2007: Workshop on Nonlinear Equations, IIMAS, UNAM, Mexico City
Steady and Tip-Streaming Behavior of a Slender Surfactant-Coated Bubble in an Extensional Flow

Amitabha Bose

July 2006: Computational Neuroscience Conference, Edinburgh, Scotland
Combining Synaptic and Cellular Resonance in a Feed-Forward Neuronal Network

August 2006: SIAM and SMB Joint Conference on the Life Sciences, Raleigh, NC
1) The UBM Program at NJIT
2) The Role of Feedback to Descending Projection Neurons in Rhythmic Motor Pattern Generation

September 2006: Neuromath 06, Andorra
Multistability and Reduction to One-Dimensional Maps

May 2007: SIAM Conference on Dynamical Systems, Snowbird, UT
Dynamics of Plant Border Formation

Bruce Bukiet

May 2007: Frontiers in Applied and Computational Mathematics Conference, Newark, NJ
Mathematical Analysis of Applied Loads on Skeletal Muscles in Osteopathic Manual Treatment

Wooyoung Choi

September 2006: The 26th Symposium on Naval Hydrodynamics, Rome, Italy
Nonlinear Surface Wave Dynamics in Slowly-Varying Ocean Environments

September 2006: SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA
Dynamics of Nonlinear Water Waves in Slowly-Varying Ocean Environments

September 2006: ONR Sectional Review Meeting, Woods Hole, MA
Interaction of Surface Waves with Nonlinear Internal Solitary Waves

January 2007: Seminar at the Institute of Ocean Technology, Newfoundland, Canada
Short-Term Forecasts of Evolving Nonlinear Wave Fields

February 2007: Seminar at the Department of Mathematics, Ohio State University, OH
Highly Nonlinear Internal Waves in Density Stratified Fluids: Models, Solitary Waves, Instability, and Remote Sensing

March 2007: ONR High Resolution Air Sea Interaction Workshop at Scripps Institution of Oceanography, La Jolla, CA
Short-Term Forecasts of Evolving Nonlinear Wave Fields

March 2007: Workshop on Strongly Nonlinear Internal Waves, NJIT, Newark, NJ
Strongly Nonlinear Asymptotic Models and Their Characteristics

April 2007: Fifth IMACS International Conference on Nonlinear Evolutions and Wave Phenomena, Athens, GA
On Regularizing the Strongly Nonlinear Internal Wave Model

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
1) An Explicit Formulation for the Evolution of Nonlinear Surface Waves Interacting with a Submerged Body (poster)
2) Highly Nonlinear Solitary Waves in a Continuously Stratified Fluid (poster)

June 2007: NIMS International Workshop on Fluid Dynamics, Daejeon, Korea
A Model for Strongly Nonlinear Internal Waves in a Two-Layer System and its Regularization

Sunil K. Dhar

August 2006: Joint Statistical Meeting 2006, Seattle, WA
Teaching Statistics to Clinical Research Staff in a Pharmaceutical Company

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
1) Problems Related to Efficacy Measurement and Analysis
2) Biostatistics Training of Clinical Staff in a Phamaceutical Company

Javier Diez

September 2006: Reunion Nacional de Fisica, Merlo, San Luis, Argentina
1) Inestabilidad del Recubrimiento de una Fibra Cilindrica con un Liquido Viscoso
2) Breakup of a Semi-Infinite Fluid Film

November 2006: 59th Annual Meeting Division of Fluid Dynamics, American Physical Society (APS), Tampa Bay, FL
Breakup of a Finite Length Fluid Film

November 2006: IX Reunion sobre Recientes Avances en Fisica de Fluidos y sus Aplicaciones, Mendoza, Argentina
1) Linear Stability Analysis of Constant Volume Thin Film Flows
2) Resolucion Numerica de Flujos de Lubricacion con Grilla no Uniforme
3) Breakup of a Finite Fluid Film under Partial Wetting Conditions

Jonathan Drover

August 2006: SIAM Life Sciences Conference, Raleigh NC
Combining Cellular and Synaptic Resonance in a Feed Forward Network (poster)

May 2007: FACM 07, NJIT
Periodic Bursting Through Resonance (poster)

May 2007: SIAM Conference on the Applications of Dynamical Systems, Snowbird, UT
Periodic Bursting Through Resonance (poster)

Thomas Erneux

June 2006: 6ème Conférence Internationale AIMS, Poitiers, France
How Lasers Generate New Delay Differential Equation Problems

July 2006: Gordon Conference, Oxford, UK
Delay Differential Equations in the Physical Sciences

September 2006: Workshop on "Complex Dynamics and Delay Effects in Coupled Systems", Berlin, Germany
How Lasers Generate New Delay Differential Equation Problems

October 2006: COBRA Colloquium, TU Eindhoven, The Netherlands
Lasers Dynamics: From Basic Concepts to Applications

February 2007: CORIA Université de Rouen, Ouverture du GDR DYCOEC
Dynamique des Lasers: Passé et Présent

March 2007: PHASE 2007 Workshop Supélec, Metz, France
Nonlinear Stability of Quantum Dot Semiconductor Lasers

Anna Georgieva

October 2006: American Association of Pharmaceutical Sciences Annual Meeting, San Antonio, TX
Mechanistic Cardiac Modeling and Risk Assessment

November 2006: American College of Toxicology, Indian Wells, CA
Integrative Modeling Approach to Cardiotoxicity Risk Assessment, lecture at Continuing Education Course FDA and Critical Path Initiative

May 2007: International Science Forum of Computational Toxicology, EPA, Research Triangle Park, NC
Mechanistic Cardiac Modeling and Risk Assessment

Kaushik Ghosh

August 2006: Joint Statistical Meetings, Seattle, WA
Short-term Prediction of Time Series using Semiparametric Bayesian Techniques

March 2007: ENAR Meeting, Atlanta, GA
Semiparametric BAyesian Models for Short-Term Prediction of Cancer Mortality Series

March 2007: NJIT Statistics Seminar, Newark, NJ
Some Recent Developments in Ranked Set Sampling and their Applications

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Prediction of U.S. Cancer Mortality Counts Using Semiparametric Bayesian Techniques

Vladislav V. Goldberg

September 2006: ICM 2006, Satellite Conference ADVANCES IN PDE's GEOMETRY, Madrid, Spain
Abelian Equations and Differential Invariants of Planar 4-webs

November 2006: Peloritana Pericolanti Academy of Sciences, Messina, Italy
The Solution of Blaschke's Problems on Linearizability and Rank for Planar Webs

November 2006: Department of Mathematics, University of Messina, Italy
Differential Geometry of Veronese-like Webs

May 2007: International Conference Geometry in Odessa - 2007, Odessa, Ukraine
Differential Geometry of Veronese-like and Lagrange-like Webs

Jorge Golowasch

October 2006: 2006 Annual STG Meeting, Atlanta, GA
1) Membrane Capacitance Measurements
2) Estimating the Location of Gap-Junctional Coupling
3) Activity in Gap-Junctionally Coupled Networks Depends on the Diameter of Coupled Processes
4) Co-Regulation of Ion Channel mRNAs does not Translate into Co-Regulation of Currents in Isolated Neurons
5) Decentralization Alters Co-Regulation of Ionic Currents

April 2007: Johns Hopkins University, Mind Brain Institute
Morphology-Dependent Oscillatory Neuronal Network Activity

April 2007: Department of Biomedical Engineering Seminars, NJIT
Activity in Gap-Junctionally Coupled Networks Depends on Dendrite Diameter

April 2007: Third Annual Provost's Student Research Showcase, NJIT
1) Long Term Effects of Neuromodulatory Input on Ionic Current Interactions
2) Measurements of Membrane Capacitance in Neurons

April 2007: 33rd Annual East Coast Nerve Net, Woods Hole, MA
1) Long Term Effects of Neuromodulatory Input on Ionic Current Interactions
2) Method-Dependence of Measured Neuronal Membrane Capacitance
3) Recovery of Pyloric Network Rhythmic Activity Depends on Both Neuronal Activity and Neuromodulators
4) Ionic Current Changes During Pyloric Rhythm Recovery after Decentralization in Crab
5) The Effect of Neuromodulator on the Recovery of Rhythmic Pyloric Activity after Decentralization
6) Gap Junction Position can be Estimated from Somatic Recordings

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Activity in Gap-Junctionally Coupled Networks Depends on Dendrite Diameter

Roy Goodman

July 2006: SIAM Annual Meeting, Boston, MA
Mode Competition in Bragg Grating Defect

September 2006: SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA
The n-bounce Resonance Map

October 2006: Columbia University Applied Mathematics Colloquium
The n-bounce Resonance in Wave Interactions: From PDE's to ODE's to Iterated Maps

December 2006: CMS Winter Meeting, Toronto ON
Fractal Structure in Solitary Wave Interactions

February 2007: Princeton Dynamical Systems / Nonlinear Science Seminar
The n-bounce Resonance in Wave Interactions: From PDE's to ODE's to Iterated Maps

April 2007: AMS Sectional Meeting, Hoboken, NJ
Fractal Structure in Solitary Wave Interactions

May 2007: SIAM Conference on Application of Dynamical Systems, Snowbird, UT
Chaotic Scattering in Solitary Wave Interactions

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
The n-bounce Resonance (poster)

Peter Gordon

July 2006: SIAM Conference on Analysis of Partial Differential Equations, Boston, MA
Propagation and Quenching in Porous Media Combustion

September 2006: SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA
Propagation and Quenching in Porous Media Combustion

October 2006: Conference on Applied Analysis on the Occasion of the 65th Birthday of David Kinderlehrer, Carnegie Mellon University, Pittsburgh, PA
Propagation and Quenching in Porous Media Combustion

April 2007: AMS Eastern Section Meeting, Hoboken, NJ
Propagation and Quenching in Porous Media Combustion

May 2007: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
Propagation and Quenching in Porous Media Combustion

Arnaud Goullet

November 2006: APS Division of Fluid Dynamics, Tampa Bay, FL
Dynamical Study of a Simple Microfluidic Device for Mixing Purposes

March 2007: Workshop on Strongly Nonlinear Internal Waves, NJIT
Solitary Wave Solutions in a Linearly Stratified Fluid

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Highly Nonlinear Solitary Waves in a Continuously Stratified Fluid

Claus Holzapfel

August 2006: Ecological Society of America, Annual Meeting, Memphis, TN
1) Plant, Hawks and Doves: Root Cooperation and Competition Among Clone Mates in Strawberries
2) The Community Ecology of Clonal Growth
3) Sex and Climate Change: Sex Ratio Responses to Experimental Rainfall Scenarios in an Israeli Shrub
4) Soil Seed Banks and Climate Change: An Experimental Approach Along a Climatic Gradient in Israel

May 2007: Meadowlands Symposium, Lyndhurst, NJ
1) Self-Shading and Physiological Integration in Phramites Australis: Factors Leading to Division of Labor
2) Phenolics Oxidizing Enzymes of Roots on Non-Native and Native Plants

David J. Horntrop

July 2006: SIAM Annual Meeting, Boston, MA
Mesoscopic Simulation of Self-Organization in Surface Processes

July 2006: SIAM Conference on Financial Mathematics and Engineering, Boston, MA
Spectral Schemes for Stochastic Partial Differential Equations

September 2006: Granular and Multiphase Flow Colloquium, Department of Mechanical Engineering, New Jersey Institute of Technology, Newark, NJ
Mesoscopic Simulation of Self-Organization in Materials

October 2006: Colloquium, Department of Mathematics, State University of New York, Buffalo, NY
Mesoscopic Simulation of Self-Organization in Surface Processes

February 2007: SIAM Conference on Computational Science and Engineering, Costa Mesa, CA
Mesoscopic Simulation of Self-Organization in Surface Processes

May 2007: Frontiers in Applied and Computational Mathematics, Newark, NJ
Simulation of Self-Organization in Surface Processes

Aridaman Jain

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Continuous Water Quality Data Modeling for Lower Hackensack River

May 2007: 2007 Meadowlands Symposium, Lyndhurst, NJ
Continuous Water Quality Data Modeling for Lower Hackensack River

Shidong Jiang

October 2006: Frontiers in Optics 2006/Laser Science XXII conferences, Rochester, NY
Overall Permutation Symmetry Breakdown in Nonlinear Optical Susceptibilities of One-Dimensional Periodic Systems, poster

January 2007: SIAM Minisymposium on Recent Advances in Computational Scattering, AMS/MAA/SIAM Joint Meetings, New Orleans, LA
Scattering by Open Surfaces

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Generalized Poincare-Bertrand Formula on a Regular Surface in Three Dimensions

Ken Johnson

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Continuous Water Quality Data Modeling for Lower Hackensack River

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Analysis of the Sediment Data from the Lower Hackensack River

May 2007: 2007 Meadowlands Symposium, Lyndhurst, NJ
Continuous Water Quality Data Modeling for Lower Hackensack River

May 2007: 2007 Meadowlands Symposium, Lyndhurst, NJ
Analysis of the Sediment Data from the Lower Hackensack River

Lou Kondic

August 2006: International Congress of Mathematicians, Madrid, Spain
On Stability of the Interface Between Two Fluids: Undercompressive Shocks, Flow Reversal, and Compressibility Effects

November 2006: American Physical Society-Division of Fluid Dynamics Annual Meeting, Tampa, FL
1) Signal Propagation Through Dense Granular Media
2) Octopus-Shaped Instabilities of Evaporating Droplets

May 2007: Frontiers in Applied and Computational Mathematics, Newark, NJ
1) Signal Propagation Through Particulate Systems
2) Octopus-Shaped Instabilities of Evaporating Drops

Gregory A. Kriegsmann

February 2007: Department of Mathematical Sciences, Michigan Tech University, Houghton, MI
Microwave Heating of Materials: A Mathematical Overview

Dawn A. Lott

August 2006: Applied Mathematics Summer Workshop, Delaware State University, Dover, DE
Mathematical Model for the Rupture of Cerebral Saccular Aneurysm through Three-Dimensional Stress Distribution in the Aneurysm Wall

January 2007: Joint Mathematics Meeting, New Orleans, LA
On the Use of Numerical Techniques to Solve Plate Deflection

April 2007: Mathematics Awareness Month: Mathematics and the Brain, New Jersey City University, Jersey City, NJ
Mathematical Model for the Rupture of Cerebral Saccular Aneurysm through Three-dimensional Stress Distribution in the Aneurysm Wall

August 2007: Joint Annual Meetings, HRD, National Science Foundation, Washington, DC
Computers and Laboratories Integrated with Mathematics to Enhance the Biosciences (The CLIMB Project): Year One

Victor Matveev

July 2006: Joint SIAM Life Sciences and the Society for Mathematical Biology Annual Meeting, Raleigh, NC
Multistability of Half-Center Bursting in a Two-Cell Inhibitory Network with T-Currents Analyzed via a Poincare Return Map

May 2007: SIAM Conference on the Applications of Dynamical Systems, Snowbird, UT
Asynchronous Activity in a Non-Weakly Coupled Two-Cell Inhibitory Network with Finite Synaptic Decay Time

May 2007: SIAM Conference on the Applications of Dynamical Systems, Snowbird, UT
Half-Center Bursting in a Two-Cell Inhibitory Network Captured by a Burst Length Return Map

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Capturing the Multistable Anti-Phase Bursting in a Two-Cell Inhibitory Network using a One-Dimensional Map

Jay Meegoda

October 2006: 8th Annual NJDOT Research Showcase, College of NJ, NJ
Culvert Information Management System-Phase I

September 2006: 1st Global Cleaner Production Conference and Exhibition, Nasr City, Cairo, Egypt
Sustainability of Solid Waste Management

Zoi-Heleni Michalopoulou

November 2006: DC ASA Chapter Meeting, Applied Physics Laboratory, Johns Hopkins University, Baltimore
Localization of Weak Sources in Underwater Environments

December 2006: Meeting of the Acoustical Society of America, Honolulu
Robust Source Localization and Geoacoustic Inversion in the Haro Strait Primer

May 2007: Frontiers for Applied and Computational Mathematics 2007, NJIT, Newark
Particle Filtering and TVAR Modeling: Applications to Acoustic Signals in Dispersive Waveguides

May 2007: Frontiers for Applied and Computational Mathematics 2007, NJIT, Newark
Maximum a posteriori Estimation of Bio-Optical Properties of Coastal Water

June 2007: Meeting of the Acoustical Society of America, Salt Lake City
Particle Filtering for Dispersion Curve Estimation from Spectrograms of Acoustic Signals

Petronije Milojevic

April 2007: American Mathematical Society Meeting, Hoboken, NJ
Solvability and the Number of Solutions of Hammerstein Equations (abstract)

May 2007: Frontiers in Applied and Computational Mathematics Conference, NJIT, Newark, NJ
Solvability and the Number of Solutions of Hammerstein Equations with Applications (poster)

Robert M. Miura

July 2006: Joint SIAM-SMB Conference on the Life Sciences, Raleigh, NC
Prediction of Polyadenylation Sites of mRNA using Support Vector Machine

August 2006: Joint SIAM-SMB Conference on the Life Sciences, Raleigh, NC
Waves of Spreading Cortical Depression

September 2006: First Joint CMS/SMM Meeting, Guanajuato, Mexico
Approximate Analytical Expressions for Monotonic Traveling Waves of Reaction-Diffusion Systems

March 2007: Class of '27 Lecture Series in Applied Mathematics, Department of Mathematics, Rensselaer Polytechnic Institute, Troy, NY
Cortical Spreading Depression: An Enigma

March 2007: Class of '27 Lecture Series in Applied Mathematics, Department of Mathematics, Rensselaer Polytechnic Institute, Troy, NY
Solitons and the Inverse Scattering Method: An Historical View

March 2007: 2007 Workshop for Young Researchers in Mathematical Biology, Mathematical Biosciences Institute, Columbus, OH
Cortical Spreading Depression: An Enigma

April 2007: Colloquium, Department of Mathematics and Statistics, York University, Toronto, ON, Canada

Solitons and the Inverse Scattering Method: An Historical View

April 2007: Third Annual Provost's Student Research Showcase, NJIT, Newark, NJ
Mathematical Modeling of Spreading Depression

May 2007: Conference on Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Mathematical Modeling of Alternative Polyadenylation

May 2007: Conference on Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Mathematical Modeling of Spreading Depression

Richard O. Moore

July 2006: SIAM Annual Meeting, Boston, MA
The Evolution of Hot Spots in Optical Parametric Oscillators

November 2006: Department of Mathematical Sciences, Montclair State University, Montclair, NJ
Pulse Interactions in Self-Heated Parametric Gain Devices

December 2006: Instituto de Fisica Arroyo Seco, Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina
Finding Failures in Optical Communications

March 2007: Graduate Student-Faculty Seminar, NJIT, Newark, NJ
Modelling Thermal Effects in Nonlinear Crystals

April 2007: AMS Eastern Sectional Meeting, Hoboken, NJ
Travelling Waves in Damped, Dispersive Media

May 2007: Frontiers in Applied and Computational Mathematics, Newark, NJ
Travelling Waves in Heated Parametric Gain Devices

May 2007: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
Nonlocal Traveling Waves in Heated Parametric Gain Devices

Cyrill Muratov

July 2006: Department of Mathematics, University of Cologne, Cologne, Germany
A Variational Approach to Front Propagation in Infinite Cylinders

July 2006: PDE Seminar, Institute for Applied Mathematics, University of Bonn, Bonn, Germany
A Variational Approach to Front Propagation in Infinite Cylinders

July 2006: Minisymposium Talk, SIAM Conference on Analysis and PDEs, Boston, MA
1) A Variational Approach to Front Propagation in Infinite Cylinders
2) Noice-Induced Target Pattern Formation in Excitable Media

July 2006: Minisymposium talk, SIAM Annual Meeting, Boston, MA
Optimal Grid-Based Method for Thin Film Micromagnetics Simulations

August 2006: GRC Conference on Oscillations and Dynamic Instabilities in Chemical Systems, Oxford University, Oxford, UK

Non-Meanfield Deterministic Limits in Chemical Reaction Kinetics (poster)

October 2006: Invited talk, Workshop on Reaction-Diffusion Processes in Biological and Biomimetic Systems, Bordeaux, France
A Variational Approach to Front Propagation in Infinite Cylinders

January 2007: Department of Mathematics, University of California at Los Angeles, Los Angeles, CA
A Variational Approach to Front Propagation in Infinite Cylinders

January 2007: Department of Mathematics, University of Minnesota, Minneapolis, MN
A Variational Approach to Front Propagation in Infinite Cylinders

January 2007: Department of Mathematics, Rutgers University, New Brunswick, NJ
A Variational Approach to Front Propagation in Infinite Cylinders

May 2007: Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ
Non-Meanfield Deterministic Limits in Chemical Reaction Kinetics (poster)

Farzan Nadim

July 2006: Computational Neuroscience Meeting, Edinburgh, Scotland
1) Neuromodulation of Short-Term Synaptic Dynamics Examined in a Mechanistic Model
2) Combining Synaptic and Cellular Resonance in a Feed-Forward Neuronal Network

August 2006: SIAM Conference on the Life Sciences, Raliegh, NC
1) The Role of Feedback to Descending Projection Neurons in Rhythmic Motor Pattern Generation
2) Multistability of Half-Center Bursting in a Two-cell Inhibitory Network with T-currents Analyzed via a Poincare Return Map
3) Resolving the Bursting Mechanisms in a Two-Compartment Pyloric Dilator Cell Model

November 2006: Society for Neuroscience Annual Meeting, Atlanta, GA
1) Activity in Gap-Junctionally Coupled Networks Depends on the Diameter of Coupled Processes
2) The Functional Role of Membrane Resonance in Pacemaker Neurons of a Rhythmic Network
3) Neuromodulation of Short-Term Synaptic Dynamics Examined in a Mechanistic Model Based on Kinetics of Calcium Currents
4) Estimating the Location of Gap-Junctional Coupling
5) Inhibitory Feedback to Pacemaker Neurons Promotes Oscillation Stability
6) Comparing Projection Neuron and Neuromodulatory Effects on Network Activity using a Computational Model

November 2006: University of Newcastle, Newcastle upon Tyne, UK
Mechanisms Underlying Frequency and Phasing in a Small Oscillatory Neuronal Network

February 2007: University of Charleston, Charleston, SC
The Role of Anatomical Structure in Determining Activity in Electrically-Coupled Neuronal Networks

April 2007: East Coast Nerve Net, Woods Hole, MA
1) Inhibitory Feedback to Pacemaker Neurons Promotes Oscillation Stability
2) Maximum Spike Timing Reliability Occurs at the Intrinsic Resonance Frequency
3) Determining the Effect of the A-Current on the Activity Phase of a Follower Neuron in an Inhibitory Network

Demetrios T. Papageorgiou

November 2006: AIChE Annual Meeting, San Francisco, CA
(1) Instabilities and Saturation of Electrified Thin Liquid Films
(2) The Effect of Surfactant and Surfactant Solubility on the Deformation and Breakup of a Bubble in a Viscous Surrounding

November 2006: APS Division of Fluid Dynamics 59th Annual Meeting, Tampa Bay, FL
Using Remobilizing Surfactants to Increase the Terminal Velocity of Rising Bubbles

January 2007: Department of Mathematical Sciences, Montclair State University, Montclair, NJ
Mathematical Problems in Interfacial Electrohydrodynamics

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
1) A New Application of the Kortweg-de Vries Benjamin-Ono Equation in Interfacial Electrohydrodynamics
2) Numerical Computations of Solute Transport and Solute Reaction in Pulsating Channels
3) Direct Numerical Simulations of Interfacial Electrohydrodynamic Flows
4) Steady Electrified Film Flow Over Topography
5) Breakup of an Infinite Electrified Jet

Manuel Perez

April 2007: 3rd Intersticial Prostate Brachytherapy, Lisbon, Portugal
Onological Outcome of Radical Prostectomy

Peter G. Petropoulos

January 2007: AFOSR Annual Electromagnetics Workshop, San Antonio, TX
Electromagnetic Pulse Propagation in Havriliak-Negami and Cole-Davidson Dielectrics

May 2007: Frontiers in Applied and Computational Mathematics 2007 Conference, Newark, NJ
Wave Propagation in Havriliak-Negami and Cole-Davidson Dielectrics

Horacio G. Rotstein

October 2006: Mathematical Biology Seminar, Department of Mathematical Sciences, NJIT, Newark, NJ
Canard Induced Mixed-Mode Oscillations in a Medial Entorhinal Cortex Layer II Stellate Cell Model: Work in progress.

November 2006: ESAM (Engineering Sciences and Applied Mathematics) Colloquim, Department of Engineering Sciences and Applied Mathematics, Northwestern University, Chicago, IL
Mechanistic Aspects of the Creation of Theta Rythmic Activity in the Hippocampus: A Modeling Study

November 2006: Mathematical Biology Seminar, Department of Mathematical Sciences, NJIT, Newark, NJ
Mechanistic Aspects of the Creation of Theta Rythmic Activity in the Hippocampus: A Modeling Study

December 2006: Dynamics Seminar, Department of Economics, Universidad Nacionaldel Sur, Bahia Blanca, Buenos Aires, Argentina
Economic and Biological Cycles: Dynamic Properties and Emergent Structures

April 2007: Graduate-Faculty Seminar, Department of Mathematical Sciences, NJIT, Newark, NJ
Rhythmic Oscillations in the Hippocampal Formation

May 2007: Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ
Rhythmic Mixed-Mode Oscillatory Activity in Entorhinal Cortex Stellate Cells

May 2007: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
Rhythmic Mixed-Mode Oscillatory Activity in Stellate Cells of the Entorhinal Cortex

June 2007: Center for BioDynamics Seminar, Boston University, Boston, MA
Mechanistic Aspects of the Generation of Subthreshold Oscillations, the Onset of Spikes, and Related Phenomena in a Medial Entorhinal Cortex Stellate Cell Model

Gareth J. Russell

December 2006: Annual Meeting of the Habor Herons Subcommittee, US National Park Service
Sociability Leads to Instability: A Metapopulation Model of the Heron and Egret Nesting Colonies in NY Harbor

April 2007: Departmental Seminar, Columbia University
Sociability Leads to Instability: A Metapopulation Model of the Heron and Egret Nesting Colonies in NY Harbor

May 2007: Minisymposium on Mathematical Biology, Annual Conference on Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Ecological Communities: How Does Nature Construct Them?

May 2007: 50th Annual Conference, International Association for Great Lakes Research
Sociability Leads to Instability: A Metapopulation Model of the (Potential) Heron and Egret Nesting Colonies in New York Harbor and the Meadowlands

May 2007: Meadowlands Symposium II, Meadowlands Environmental Research Institute
Sociability Leads to Instability: A Metapopulation Model of the Heron and Egret Nesting Colonies in NY Harbor

Michael Siegel

July 2006: 38th SIAM Annual Meeting, Boston, MA
Steady-States and Tip-Streaming of a Slender Bubble with Surfactant in an Extensional Flow

October 2006: Program on Analytical and Computational Challenges of Incompressible Flow at High Reynolds Number, Center for Scientific Computation and Mathematical Modelling, University of Maryland
Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations

November 2006: Seminar, Department of Chemical Engineering, NJIT, Newark, NJ
Effect of Surfactant and Surfactant Solubility on the Breakup of a Bubble in a Viscous Surrounding

January 2007: Joint Meeting of the AMS and MAA, New Orleans, LA
Equipment and Modules for a Capstone Course in Applied Mathematics (poster)

March 2007: Seminar, Department of Mathematics, Montclair State University, NJ
Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
The Influence of Surfactant on Bubble Shape and Evolution in an Extensional Flow

Louis Tao

September 2006: Conference on Mathematical Neuroscience (Neuromath06, a satellite meeting of the ICM 2006 in Madrid, Spain), St. Julia de Loria, Andorra
Reverse-Correlation and the Architecture of Neuronal Networks

October 2006: Society for Neuroscience Annual Meeting, Atlanta, GA
Reverse-Correlation and the Architecture of Neuronal Networks

December 2006: Seminar, Center for Bioinformatics, Beijing University, Beijing, China
A Large-Scale Computational Model of Visual Cortex: Mechanisms of Orientation Selectivity

December 2006: Seminar, Department of Mathematics, University of Houston, Houston, TX
Reverse-Correlation and the Architecture of Visual Cortex

December 2006: Invited Speaker, Computational and Theoretical Biology Symposium, Rice University, Houston, TX
Orientation Selectivity by Fluctuation-Controlled Criticality

February 2007: Colloquium, Department of Mathematical Sciences, NJIT, Newark, NJ
Orientation Selectivity in Visual Cortex

March 2007: Seminar, Department of Biology and Chemistry, City University of Hong Kong, Hong Kong, S.A.R., China
An Introduction to Computational Biology: A Large-Scale Neuronal Network Model of Visual Cortex

April 2007: Colloquium, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, N Y
Mechanisms of Contrast Adaptation in Visual Cortex

April 2007: Seminar, Department of Mathematics, University of Georgia, Athens, GA
Orientation Selectivity in Visual Cortex

May 2007: SIAM Conference on Dynamical Systems and Applications, Snowbird, UT
Dynamics of Contrast Adaptation in Visual Cortex

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ
Dynamics of Contrast Adaptation in Visual Cortex

Jean-Marc Vanden-Broeck

October 2006: University College London, UK
Three-Dimensional Gravity-Capillary Solitary Waves

October 2006: Cambridge University, UK
Nonlinear Three-Dimensional Gravity-Capillary Free Surface Flows

November 2006, Workshop on Water Waves, Oberwalfach
Nonlinear Three-Dimensional Free Surface and Interfacial Flows

January 2007: University of East Anglia, UK
The Effects of Electric Fields on Nonlinear Free Surface Flows

February 2007: University College London, UK
Nonlinear Free Surface Flows

May 2007: Frontiers in Applied and Computational Mathematics 2007, NJIT
A New Application of the Kortweg - de Vries Benjamin-Ono Equation in Interfacial Electrohydrodynamics

Sheldon Wang

July 2006: ASME PVP, Vancouver, Canada
PVP2006-ICPVT11-93851 A Simplified Model of Flow-Induced Oscillations of Collapsible Tubes Conveying Viscous Fluids

July 2006: World Congress on Computational Mechanics, Los Angeles, CA
An Iterative Matrix-Free Method for Immersed Methods

July 2006: NSF-DMI Grantee Conference, St. Louis, MI
A New Design for Manufacturing Process of Porous Resorable Implant Materials (poster)

March 2007: Moving Interface Problems and Applications in Fluid Dynamics Workshops, Singapore
From Immersed Boundary Method to Immersed Continuum Method

May 2007: Complexity of Biological & Soft Materials, Santa Fe, NM
An Iterative Matrix-Free Solution Strategy for Immersed Boundary/Continuum Methods (poster)

June 2007: Fourth MIT Conference on Computational Fluid and Solid Mechanics, Cambridge, MA
An Iterative Matrix-Free Method in Implicit Immersed Boundary/Continuum Methods

Yuan-Nan Young

November 2006: AIChE Annual Meeting, San Francisco, CA
Hysteretic Drop Response in a Linear Flow with Rotation

November 2006: APS Division of Fluid Dynamics, Tampa Bay, FL
1) Hysteretic Drop Response in a Linear Flow with Rotation
2) Diffusive Transport of Elastic Filament

March 2007: NSF-CMG Workshop, NJIT, Newark, NJ
Navier-Stokes Simulations of Internal Waves

April 2007: DIMACS Workshop, Rutgers University
Diffusive Transport of Elastic Bio-Filaments

May 2007: Frontiers in Applied and Computational Mathematics, NJIT, Newark, NJ

1) Novel Dynamics of Elastic Filament in Stokes Flow
2) Interesting Dynamics of Viscous Drops in a Straing Flow with Rotation

C. TECHNICAL REPORTS

REPORT 0607-1: *Stretching of Heated Threads With Temperature-Dependent Viscosity: Asymptotic Analysis*
P.D. Howell, J.J. Wylie, H. Huang, and R.M. Miura

REPORT 0607-2: *Neuromodulation Unmasks Short-Term Synaptic Facilitation in a Depressing Synapse*
Pascale Rabbah, Seher Atamturktur, Yair Manor, and Farzan Nadim

REPORT 0607-3: *Regression Level Set Estimation -- The Excess Mass Approach in the Fixed Design Case*
Zailong (Ray) Wang

REPORT 0607-4: *Distinct Synaptic Dynamics of Heterogeneous Pacemaker Neurons in an Oscillatory Network*
Pascale Rabbah and Farzan Nadim

REPORT 0607-5: *Influence of Surfactant on the Deformation and Breakup of a Bubble in a Viscous Surrounding*
M. Hameed, M. Siegel, Y.-N. Young, M. R. Booty, D. T. Papageorgiou, and J. Li

REPORT 0607-6: *Capturing the Bursting Dynamics of a Two-Cell Inhibitory Network Using a One-Dimensional Map*
Victor Matveev, Amitabha Bose, and Farzan Nadim

REPORT 0607-7: *Calculation of Complex Singular Solutions to the 3D Incompressible Euler Equations*
Michael Siegel

REPORT 0607-8: *Dominant Ionic Mechanisms Explored in Spiking and Bursting Using Local Low-Dimensional Reductions of a Biophysically Realistic Model Neuron*
Robert Clewley, Cristina Soto-Treviño, and Farzan Nadim

REPORT 0607-9: *On Breakup of Fluid Films of Finite and Infinite Extent*
Javier A. Diez and Lou Kondic

REPORT 0607-10: *Dynamic Structure Formation at the Fronts of Volatile Liquid Drops*
Y. Gotkis, I. Ivanov, N. Murisic, and L. Kondic

REPORT 0607-11: *On Velocity Profiles and Stresses in Sheared and Vibrated Granular Systems Under Variable Gravity*
Oleh Baran and Lou Kondic

REPORT 0607-12: *Mesoscopic Simulation of Ostwald Ripening*
David J. Horntrop

REPORT 0607-13: *Interface Dynamics for Quasi-Stationary Stefan Problem*
R. Andrushkiw, V. Gafiychuk, and B. Datsko

REPORT 0607-14: *Mathematical Analysis of Applied Loads on Skeletal Muscles in Osteopathic Manual Treatment*
Hans Chaudhry, Bruce Bukiet, and Thomas Findley

REPORT 0607-15: *Dynamics of Central Pattern Generating Networks: Locus of Control*
Farzan Nadim and Amitabha Bose

REPORT 0607-16: *Neurons and Neural Networks: Computational Models*
Horacio Rotstein and Farzan Nadim

REPORT 0607-17: *Cortical Spreading Depression: An Enigma*
Robert M. Miura, Huaxiong Huang, and Jonathan J. Wylie

REPORT 0607-18: *Nonparametric and Semiparametric Bayesian Reliability Analysis*
Kaushik Ghosh

REPORT 0607-19: *Using Dynamic Programming Methods in Repair and Replacement Problems*
Manish Bhattacharjee

REPORT 0607-20: *Ca2+-Dependent Inactivation of CaV1.2 Channels Prevents Gd3+ Block: Does Ca2+Block the Pore of Inactivated Channels?*
Victor Matveev, Olga Babich, Andrew L. Harris, and Roman Shirokov

REPORT 0607-21: *An Iterative Matrix-Free Method in Implicit Immersed Boundary/Continuum Methods*
X. Sheldon Wang

REPORT 0607-22: *A Reduced Model for Flame-Flow Interaction*
Peter Gordon, Michael L. Frankel, and Gregory I. Sivashinsky

REPORT 0607-23: *Influence of Insoluble Surfactant on the Deformation and Breakup of a Bubble or Thread in a Viscous Fluid*
M. Hameed, M. Siegel, Y.-N. Young, J. Li, M. R. Booty, and D. T. Papageorgiou

REPORT 0607-24: *A Stretch-Coil Transition and Transport of Fibers in Cellular Flows*
Y.-N. Young and M. Shelley

REPORT 0607-25: *Comparing Projection Neuron- and Neuromodulator-Elicited Oscillations in an Oscillatory Network*
Nickolas Kintos, Michael P. Nusbaum, and Farzan Nadim

REPORT 0607-26: *Sustained Rhythmic Activity in Gapneurons Depends on the Diameter of Coupled Dendrites*
Juliane Gansert, Jorge Golowasch, and Farzan Nadim

REPORT 0607-27: *Neuromodulators, Not Activity, Control Coordinated Expression of Ionic Currents*
Olga Khorkova and Jorge Golowasch

REPORT 0607-28: *On Regularizing the Strongly Nonlinear Internal Wave Model*
Tae-Chang Jo and Wooyoung Choi

VI. EXTERNAL ACTIVITIES AND AWARDS

A. FACULTY ACTIVITIES AND AWARDS

Daljit S. Ahluwalia

Chair, Organizing Committee for Frontiers in Applied and Computational Mathematics Conference (FACM '07), NJIT, May 2007.

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

John Bechtold

Program Co-chair for the 31st International Symposium on Combustion (laminar flames), Heidelberg, August, 2006.

Manish Bhattacharjee

Elected Member of the International Statistical Institute, The Hague, The Netherlands.

Editorial Board Member, Calcutta Statistical Association (CSA) Bulletin.

Denis Blackmore

Associate Editor, Mechanics Research Communications (2007 -)

Editorial Board, Regular and Chaotic Dynamics (2006 -)

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

Member of Scientific Committee, IUTAM Symposium on Hamiltonian Dynamics, Vortex Structures and Turbulence, Steklov Institute, Moscow, Aug. 27-31, 2006.

Wooyoung Choi

Co-Organizer of Mini-Symposium, Dynamics of Nonlinear Water Waves at the SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA, September 2006

Organizer, Workshop on Strongly Nonlinear Internal Solitary Waves, NJIT, March 2007

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.

Kaushik Ghosh

Member, NIH (NIDCD) Grant Review Panel

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.

Member, Organizing Committee of the International Conference Geometry in Odessa - 2007, Odesa, Ukraine.

Mathematics Prize for 2006 PREMIO ANASSILOAS 2006 (Premio International Renato Calapso) named after the Italian geometer Renato Calapso (1901-1976).

Jorge Golowasch

Co-Director and Faculty at the Marine Biological Laboratories, Woods Hole, MA. Neural Systems and Behavior course, July 2006.

Huaxiong Huang

Fields Institute Fellow, June 2007.

Faculty of Arts Fellow, York University, September 2006-August 2007.

Chair, Organizing committee for the Fields-MITACS Industrial Problems Workshop, Toronto, August 2006.

Member, Organizing committee for the 2nd Workshop on Industrial Applications, City University of Hong Kong, December 2006.

Aridaman Jain

Chair of the American Society for Quality (ASQ) Writing Committees for (i) An Attribute Skip-Lot Sampling Program: ANSI/ASQ S1 and (ii) Chain Sampling Procedures for Inspection by Attributes: ANSI/ASQ S3.

Jay Kappraff

Organized seven NJIT Technology and Society Forums including one concert.

Gregory A. Kriegsmann

Fellow, Institute of Mathematics and its Applications

Fellow, Acoustical Society of America

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

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.

Session Chair at the International Congress of Mathematicians (ICM), Madrid, Spain, August 2006.

Jay Meegoda

Editorial Board member, ASTM Geotechnical Testing Journal.

Associate Editor, ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management.

Zoi-Heleni Michalopoulou

Fellow, Acoustical Society of America

Robert M. Miura

Fellow, Royal Society of Canada

Chair (2007-2008), Vice Chair (2005-2006), SIAM Activity Group on the Life Sciences.

Organizer, The Lee Segel Forum on Non-Academic Careers for Mathematical Life Scientists, SMB/SIAM Conference on Life Sciences, Raleigh, North Carolina, July 3, 2006.

NSF Review Panel Committee, October 10-12, 2006.

Review Panel for the Department of Applied Mathematics, University of Washington, April 22-25, 2007.

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

Editorial Board, Integrative Neuroscience, 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

Richard O. Moore

Organizer, Waves Seminar Series, Department of Mathematical Sciences, NJIT.

Undergraduate Recruitment Committee, Department of Mathematical Sciences, NJIT.

Minisymposium co-chair, SIAM Annual Meeting, Boston, MA.

Minisymposium co-chair, Frontiers in Applied and Computational Mathematics, Newark, NJ.

Farzan Nadim

Albert and Ellen Grass Faculty Fellowship, Marine Biological Laboratory, Woods Hole, MA.

Associate Editor, Journal of Neuroscience.

Demetrios T. Papageorgiou

Fellow, Institute of Mathematics and its Applications.

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

Editorial Board, SIAM Journal on Applied Mathematics.

Editorial Board, Computational and Applied Mathematics.

Horacio G. Rotstein

Organizer, Workshop on Phase Response Curves: Where Theory and Experiments Intersect, Computational Neuroscience Meeting, Edinburgh, UK, July 2006.

Member of the Scientific Committee, NEUROMATH 06 - Conference on Mathematical Neuroscience, Sant Julia de Loria, Andorra, September 2006.

SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 2007:
1) Organizer, Minisymposium on Mixed-Mode Oscillations: Dynamics and Mechanistics, part I
2) Organizer, Minisymposium on Mixed-Mode Oscillations: Dynamics and Mechanistics, part II
3) Organizer, Minisymposium on Rhythms in Neural Dynamics, part I
4) Organizer, Minisymposium on Rhythms in Neural Dynamics, part II

Co-Editor, Focused Issue on Mixed-Mode Oscillations in Chaos (An Interdisciplinary Journal of Nonlinear Science).

Michael Siegel

Editorial Board, SIAM Journal of Applied Mathematics.

Member, Organizing Committee for Frontiers in Applied and Computational Mathematics Conference, NJIT, May 2007.

Member, American Mathematical Society Committee on Science Policy.

Louis Tao

Minisymposium organizer (with Andrew Sornborger, U Georgia) at the SIAM Conference on Dynamical Systems and Its Applications (Minisymposium title) Analysis and Dynamics of Neuronal Systems.

Minisymposium organizer (with David Cai, NYU, and Gregor Kovacic, RPI) at The Fifth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and

Theory (Minisymposium title) Wave Phenomena in Neuronal Systems.

Minisymposium organizer (with Duane Nykamp, U Minnesota) at the SIAM Conference on the Life Sciences (Minisymposium title) Analysis and Dynamics of Neuronal Networks.

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

Editorial Boards, Quarterly Journal of Mechanics and Applied Mathematics

Editorial Board, ANZIAM Journal

Sheldon Wang

Co-Organizer of a Special Symposium on Immersed Boundary Method and Its Extensions in WCCM 2006.

Co-Editor of a Special Issue "Immersed Boundary Method and Its Extensions" in Computer Methods for Applied Mechanics and Engineering.

Yuan-Nan Young

Session Chair of the AIChE annual meeting, November 2006.

B. CONFERENCE ON FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS (FACM '07)

The Fourth Conference on Frontiers in Applied and Computational Mathematics took place at NJIT on May 14-16, 2007, and, for the first time, it contained an Undergraduate Research Day (May 14) during which undergraduate students from around the country were given the opportunity to present their results. Although the conference exhibited an emphasis on the presentation of the latest research in mathematical biology, significant coverage was given to other areas of cutting-edge research in Applied Mathematics such as fluid dynamics, nonlinear optics and computational wave propagation, and applied probability and statistics.

The conference was attended by 147 mathematicians, scientists, and engineers from the US and abroad, many of them renowned in their field, and 60 undergraduate and 38 graduate students from NJIT and other US universities. In particular, the conference brought together 50 speakers, 103 poster presenters, and 24 registered guests. In the main part of the conference (May 15-16), there were four Plenary speakers, twelve minisymposia (6 in mathematical biology, 2 in mathematical fluid dynamics, 2 in wave propagation, and 2 in biostatistics), and 110 poster presentations. For further details please visit the URL: http://m.njit.edu/Events/FACM07/. The Fourth FACM conference was partially funded by the National Science Foundation, the Mathematical Biology Institute at Ohio State University, the Society for Mathematical Biology, and Strategic Initiative Funds of the Department of Mathematical Sciences at NJIT.

The Undergraduate Research Day was a tremendous success. Students from 9 different universities made oral presentations on their work that covered a range of topics including mathematical ecology,

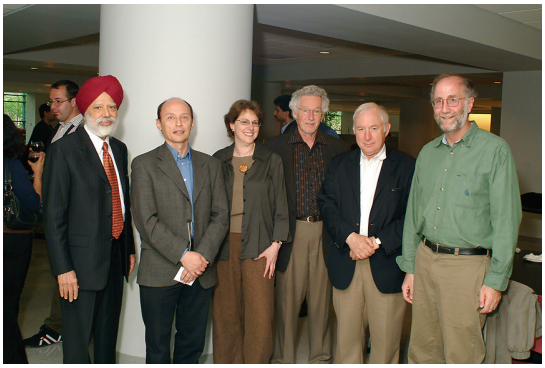
neuroscience, and fluid dynamics. In total there were 24 student presentations made and there were over 60 attendees for this portion of the conference. The day was culminated by a Plenary lecture given by Professor David Terman of Ohio State University who spoke on "Neuronal Dynamics". The undergraduate research day was organized by Amitabha Bose, Tony Macula (SUNY-Geneseo), and Zoi-Heleni Michalopoulou, and included participants from the UBM and CSUMS grants held by their respective institutions.

Plenary speakers included mathematicians Leslie Greengard, Director of the Courant Institute of Mathematical Sciences at New York University, who is a member of both the National Academy of Sciences and the National Academy of Engineering and is a leading figure in modern scientific computing; Nancy Kopell, Department of Mathematics and Statistics at Boston University, and Co-Director of the Center for Biodynamics, who is a member of the National Academy of Sciences and a recipient of a MacArthur Foundation Fellowship in 1990; Sheldon Weinbaum, Distinguished Professor in the Department of Mechanical Engineering at City University of New York, who is a member of the National Institute of Medicine, the National Academy of Sciences, and the National Academy of Engineering; Jack D. Cowan, Professor of Mathematics and of Neurology at the University of Chicago, who is well known for his work on the statistical mechanics of large-scale activity in the human neocortex; and David Terman, Department of Mathematics at the Ohio State University and Senior Associate Director of the Mathematical Biosciences Institute, who works on problems that arise in the understanding of neuronal dynamics. Greengard's talk was entitled “Electromagnetic Scattering and Design” and described current work on a recently developed class of fast, direct electrostatic and electromagnetic solvers that are ideally suited for problems in design environments. Kopell discussed the biophysical origins of the different rhythms and switches in the nervous system and their interaction in her presentation titled “Multiple Rhythms and Switches in the Nervous System”. Weinbaum's presentation, “A New View of the Classic Starling Hypothesis for Microvascular Exchange”, showed how a theoretical model was used to resolve the fundamental paradoxes that arise from the Starling Hypothesis in light of experimental data. The presentation elucidated basic new physiological concepts that were discovered as a result of theoretical models. Cowan presented his recent work on the description of large-scale activity in biological networks in terms of non-equilibrium statistical mechanics. His presentation, “Statistical Mechanics of Activity in Biological Networks”, discussed the major results of this formulation which include a role for critical branching, and the demonstration that there exist non-equilibrium phase transitions in biological network activity which are universality classes such as directed percolation and directed isotropic percolation. Terman's talk entitled “Neuronal Dynamics” described how neuronal systems have been modeled and how mathematical methods, based on dynamical systems theory, have been used to analyze the networks. Also, he described his recent work on modeling neuronal activity within the basal ganglia, a region deep inside the brain that is involved in the generation of movements, whose dysfunction is associated with movement disorders, such as Parkinson's disease and Huntington's disease.

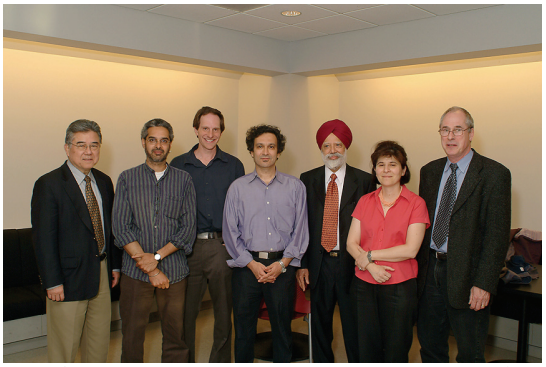
In addition, Henry Warchall, Program Director in Applied Mathematics at the National Science Foundation, described the structure and functioning of the National Science Foundation and outlined current opportunities for funding in Applied Mathematics. He also offered some guidance for writing successful proposals by discussing the distinguishing characteristics of proposals that get funded.

Photos from FACM'07

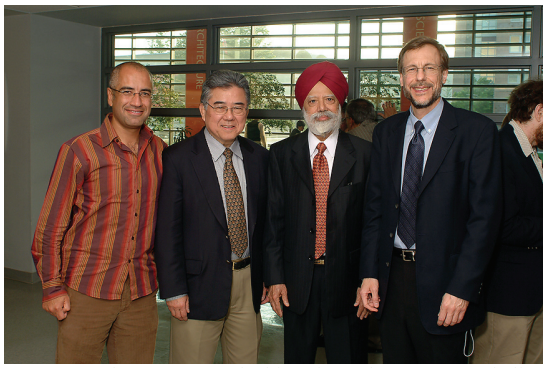
Conference Banquet



Dr. Ahluwalia with plenary speakers Leslie Greengard, Nancy Kopell, Sheldon Weinbaum, Jack Cowan, and David Terman



FACM'07 Organizing Committee: Drs. Miura, Bose, Siegel, Papageorgiou, Ahluwalia, Michalopoulou, and Kriegsmann



Drs. Nadim, Miura, and Ahluwalia with Henry Warchall, Program Director in Applied Mathematics at NSF

Dr. Donald Sebastian, Sr. Vice President for Research and Development, Dr. Fadi Deek, Dean of CSLA, and Henry Mauermeyer, Sr. VP for Admin. & Treasurer

Front row: Drs. Michalopoulou, Sebastian, Ahluwalia, and Vanden-Broeck
Back row: Drs. Weinbaum, Cowan, Greengard, Warchall, Rinzel, and Kriegsmann

Dana Knox, Associate Provost, Dr. Michalopoulou, and Priscilla Nelson, Provost

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

1. *Acquisition of a Computer Cluster for the Center of Applied Mathematics and Statistics at NJIT*

   National Science Foundation, Division of Mathematical Science, Major Research Instrumentation:
   Sept 1, 2004 – August 31, 2007
   Daljit S. Ahluwalia
   Qun Ma
   Michael Siegel

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

   NSF/DARPA: July 1, 2003 - June 30, 2007
   Denis Blackmore
   Ming Leu
   William Regli
   Wei Sun

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

   National Science Foundation: September 1, 2004 - August 31, 2009
   Amitabha Bose
   Jorge Golowasch
   Farzan Nadim

4. *Functional Roles for Short-Term Synaptic Plasticity in Neuronal Networks*

   National Science Foundation: July 2003 - June 2007
   Amitabha Bose
   Victoria Booth

5. *Surface Expressions of Nonlinear Internal Waves*

   Office of Naval Research: January 1, 2005 - December 31, 2007
   Wooyoung Choi
   Dave Lyzenga

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

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

7. *Activity-Dependent Regulation of Ionic Currents*

National Institute of Mental Health (MH64711-01): December 1, 2001 – November 30, 2006
Jorge Golowasch

8. *Mathematical Methods for Wave Interactions*

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

9. *Propagation of Fronts in Porous Media Combustion*

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

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

National Science Foundation: July 1, 2004 - June 30, 2007
David J. Horntrop

11. *Gravity and Granular Materials*

NASA: April 1, 2004 - October 30, 2007
Lou Kondic
Robert P. Behringer (Duke University)

12. *Dynamics of Non-Newtonian Liquid Films Involving Contact Lines*

The Fulbright Foundation: September 1, 2005 - August 31, 2006
Lou Kondic

13. *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

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

Department of Energy: September 15, 2004 - September 15, 2007
Gregory A. Kriegsmann

15. *Presynaptic Calcium Dynamics, Calcium Buffers, and the Mechanisms of Synaptic Facilitation*

National Science Foundation - Mathematical Sciences Division: August 15, 2005 - July 31, 2008
Victor Matveev

16. *Efficient Shallow Water Matched Field Inversion: Extension*

Office of Naval Research: February 1, 2005 - December 31, 2007
Zoi-Heleni Michalopoulou

17. *Development of a Quantitative Neurosciences 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)

18. *Conference on Frontiers in Applied and Computational Mathematics*

National Science Foundation: June 1, 2006 – May 31, 2007
Robert M. Miura

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

National Science Foundation: July 15, 2005 - July 14, 2008
Richard O. Moore
Keith Promislow, Michigan State University

20. *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

21. *Regulation of Neuronal Oscillations by Synaptic Dynamics*

National Institute of Mental Health: December 1, 2000 - November 30, 2006
Farzan Nadim

22. *Mechanisms of Dose- and State-Dependence of Neuromodulation*

United States-Israel Binational Science Foundation: September 1, 2002 - August 31, 2007
Yair Manor
Farzan Nadim
Eve Marder

23. *Mathematical Problems in Electrohydrodynamics*

National Science Foundation-Mathematical Sciences Division: July 1, 2004 - June 30, 2007
Demetrios T. Papageorgiou

24. *Uniform in Time Asymptotic and Numerical Methods for Propagation in Dielectrics Exhibiting Fractional Relaxation, and Efficient and Accurate Impedance Boundary Conditions for High-Order Time-Domain Numerical Schemes for Maxwell's Equations*

Air Force Office of Scientific Research: January 1, 2005 - January 1, 2008
Peter G. Petropoulos

25. *A Spatially Explicit Model of the Cape Sable Seaside Sparrow*

US Fish and Wildlife Service: August 1, 2006 - December 31, 2007
Gareth J. Russell

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

National Science Foundation-Mathematical Sciences Division: July 1, 2004 - June 30, 2008
Michael Siegel
Russel Caflisch
Dale Pullen
Thomas Hou

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

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

PROJECTS FUNDED DURING PRESENT FISCAL YEAR

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

Mathematical Biosciences Institute: May 1, 2007 – June 30, 2007
Daljit S. Ahluwalia

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

Society for Mathematical Biology: May 1, 2007 – May 31, 2007
Daljit S. Ahluwalia

4. *Optimization Methodology for Telecommunication Network Design*

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

5. *Statistical Data Analysis*

NJ Meadowlands Commission: November 1, 2006 – October 31, 2008
Daljit S. Ahluwalia
Aridaman Jain

6. *Functional Roles for Short-Term Synaptic Plasticity in Neuronal Networks*

National Science Foundation: September 2006 – August 2008
Amitabha Bose
Victoria Booth

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

National Science Foundation August 2006 - August 2010
Bruce Bukiet

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

National Science Foundation September 1, 2006 - August 31, 2010
Wooyoung Choi
Yuan-Nan Young
Roberto Camassa
Dave Lyzenga
Steve Ramp

9. *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

10. *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

11. *Institute on Interfacial Fluid Dynamics: From Mathematical Theory to Applications*

International Center for Theoretical Physics, Trieste, Italy
Lou Kondic

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

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

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

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

14. *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

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

National Science Foundation: July 15, 2005 - July 14, 2008
Richard O. Moore
Keith Promislow (Michigan State University)

16. *Simulation of Rare Events in Lightwave Systems*

National Science Foundation University-Industry Cooperative Research Programs in the Mathematical Sciences: September 1, 2007 - August 31, 2009
Richard O. Moore
Colin S. McKinstrie (Lucent Technologies)

17. *Regulation of Neuronal Oscillations by Synaptic Dynamics*

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

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

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

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

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

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

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

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT FISCAL YEAR

1. *Merck Quantitative Sciences Graduate Fellowship*

Merck Research Foundation: Fall 2007 - Summer 2010
Manish Bhattacharjee
Sunil Dhar
Kaushik Ghosh

2. *Research Towards BioStatistics Ph.D.*

National Science Foundation: January 01, 2008 – December 31, 2008
Sunil K. Dhar

3. *Measure the Extent of Limited English Proficiency (LEP) Population and their Need for Mobility Services*

ADVANCE Program NJIT: May 2007 - April 2008
Rongfang (Rachel) Liu
Sunil Dhar
Venkat Venkateswaran

4. *Semiparametric Bayesian Methods for Changepoint Detection*

National Institutes of Health: January 1, 2008 - December 31, 2009
Kaushik Ghosh

5. *Acquisition of Nodes for a Computer Cluster in CAMS at NJIT*

National Science Foundation: September 1, 2007 - August 31, 2009
Kaushik Ghosh
Sunil Dhar
Manish Bhattacharjee
Zoi-Heleni Michalopoulou
Sheldon Wang
Kenneth Johnson
Aridaman Jain
Ivan Zorych

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

NIMH: December 1, 2007 - November 30, 2012
Jorge Golowasch

7. *Gap Junction Role in Network Function*

National Science Foundation: May 1, 2007 – April 30, 2012
Jorge Golowasch
Edward Bonder
Farzan Nadim

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

New Jersey Commission on Spinal Cord Research: December 15, 2007 - December 14, 2009
Jorge Golowasch
Farzan Nadim

9. *Propagation, Quenching and Deflagration to Detonation Transition in Porous Media Combustion*

National Science Foundation-Mathematical Sciences Division: July 1, 2007 – June 30, 2010
Peter Gordon

10. *Spectral Schemes for Stochastic Partial Differential Equations*

National Science Foundation: July 1, 2007 - June 30, 2010
David J. Horntrop

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

National Science Foundation: June 1, 2007 - May 31, 2009
Shidong Jiang

12. *IGERT on Complex Transport at Interfaces and Biofluidic Surfaces: An Interdisciplinary Program in Applied Mathematics and Engineering*

National Science Foundation: July 1, 2008 - June 30, 2013
Lou Kondic
Michael Booty
Demetrios T. Papageorgiou
David Rumschitzki (CCNY of CUNY)
Sheldon Weinbaum (CCNY of CUNY)

13. *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)

14. *Finite Size Effects on Instabilities of Fluid Films andRivulets*

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

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

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

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

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

17. *Modelling and Analysis of Cortical Spreading Depression: A Paradigm for Understanding Basic Brain Mechanisms*

National Science Foundation: July 1, 2007 - June 30, 2010
Robert M. Miura

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

National Science Foundation: July 1, 2007 - June 30, 2010
Cyrill Muratov
Eric Vanden-Eijnden

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

National Science Foundation: July 1, 2007 - June 30, 2010
Cyrill Muratov
Stanislav Shvartsman

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

National Science Foundation-Mathematical Sciences Division: July 1, 2007 - June 30, 2010
Demetrios T. Papageorgiou
Jean-Marc Vanden-Broeck

21. *Dynamic Structures Underlying Theta Frequency Oscillations in the Hippocampal Formation*

National Science Foundation: July 1, 2007 - June 30, 2010
Horacio G. Rotstein

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

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

23. *Career: Analysis and Simulation of the Dynamics of Visual Cortical Network*

National Science Foundation - Division of Mathematical Sciences: August 1, 2007 - July 31, 2012
Louis Tao

24. *Continuous Manufacturing of Synthetic Tissue Scaffolds with Miniaturized Papermaking Techniques*

National Science Foundation: July 1, 2007 – June 30, 2010
Sheldon Wang

25. *Implicit Matrix-Free Iterative Procedure of Mixed Finite Element Formulations for Immersed Methods*

National Science Foundation: July 1, 2007 – June 30, 2010
Sheldon Wang

26. *Collaborative Research: Porous Resorbable Implant Material Manufacturing Using Papermaking Techniques*

National Science Foundation: July 1, 2007 – June 30, 2010
Sheldon Wang

27. *Static and Dynamic Analysis of a Toroidal Gear for Hydroelectric Generators*

Current to Current Corp: July 1, 2006 – February 1, 2007
Sheldon Wang
Ian Fischer

CONTINUING PROJECTS — NOT THROUGH CAMS

1. *ADVANCE Fellows Grant: Theta Phases of Hippocampal Place Cell Firing in REM Sleep and Waking*

National Science Foundation: March 15, 2004 – March 14, 2008
Victoria Booth

2. *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

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

National Institutes of Health – National Institute of Mental Health:
September 1, 2005 – August 31, 2008
Gina Poe
Victoria Booth

4. *Cellular Pathologies and their Effect on Brain Dynamics in Temporal Lobe Epilepsy*

University of Michigan Center for Computational Medicine and Biology:
November 1, 2006 – October 31, 2007
Victoria Booth
Michal Zochowski
Geoffrey Murphy
Gina Poe

5. *Protective Jackets for Multi-Hazard Mitigation Measures (ProJack-M): Proof of Concept*

Multidisciplinary Center for Earthquake Engineering Research: October 1, 2005 - September 30, 2006
A. Saadeghvaziri (NJIT Civil Engineering Department)
B. Bukiet

6. *Training Program in Biostatistics to Clinicians*

Novartis Pharmaceuticals Corporation, East Hanover, NJ: October – November 2006
Sunil Dhar

7. *Flujos con Superficies Libres y Dinamica Superficial*

Agencia Nacional de Promocion de la Ciencia y la Tecnologia (Argentina): July 2004 - July 2007
Javier Diez

8. *Banff International Research Station (BIRS) for Mathematical Innovation and Discovery*

October 14-27, 2007
Vladislav V. Goldberg
Valentin V. Lychagin

9. *The Ecology and Evolution of Novel Communities: Interaction Among Native and Non-Native Plant Species*

Rutgers Research Council Grant: 2007-2008
Claus Holzapfel

10. *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

11. *Clonal Diversity and Resistance to Invasion in Remnant Salt Marsh Patches Dominated by Spartina Patens*

MERI Fellow Program Grant: 2006/2007
Claus Holzapfel

12. *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

13. *Mathematical Modeling of Fibrous Porous Medium Flow with Phase Change*

Mathematics of Information Technology and Complex System: April 1, 2005 - March 31, 2007
Huaxiong Huang

14. *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)

15. *Instabilities of Photoresist Films*

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

16. *Center for Research and Education in Optical Science and Applications (CREOSA)*

National Science Foundation
Noureddine Melikechi, PI
Dragoljub Pokrajac, CoPI
Anjan Biswas, CoPI
Aristides Marcano, CoPI
Dawn A. Lott
Vincent Fondong
Patrick Gleeson
Fred Hartline
Vesna Zeljkovic

17. *Computers and Laboratories Integrated with Mathematics to enhance Biosciences (The CLIMB Project)*

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

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

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

19. *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

20. *Culvert Information Management System-Demonstration Project*

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

21. *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

22. *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

23. *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

24. *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

25. *Mathematical Modeling of mRNA Polyadenylation*

Subcontract from Dr. Bin Tian, Department of Biochemistry and Molecular Biology, New Jersey Medical School, University of Medicine and Dentistry of NJ: July 1 - August 31, 2006
Robert M. Miura

26. *Proprioceptive Feedback to a Motor Pattern Generating Network*

Albert and Ellen Grass Foundation: June 15, 2006-August 15, 2006
Farzan Nadim

27. *US-France Cooperative Research (INRIA): Approximate Boundary Conditions for Computational Wave Problems*

National Science Foundation-Office of International Science and Engineering:
August 1, 2003 - July 31, 2006
Jan Hesthaven
Peter G. Petropoulos
Patrick Joly
Eliane Becache
Houssem Haddar

28. *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

29. *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

30. *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

31. *Travel Grant*

Royal Society, UK: November 2006
Jean-Marc Vanden-Broeck

32. *Nonlinear Electrohydrodynamics*

EPSRC (Engineering and Physical Sciences Research Council in the UK):
October 1, 2004 - September 30, 2006
Jean-Marc Vanden-Broeck

33. *Three Dimensional Gravity Gravity Free Surface Flows*

EPSRC (Engineering and Physical Sciences Research Council in the UK):
October 1, 2003 - September 30, 2006
Jean-Marc Vanden-Broeck

PROPOSED PROJECTS — NOT THROUGH CAMS

1. *Fellowships for Interdisciplinary Research in Science and Technology (The FIRST Scholars Program)*

National Science Foundation: September 1, 2007 - August 31, 2011
Dawn A. Lott
Sabrina McGary
Dragoljub Pokrajac

2. *Promoting Research and Inquiry in Science and Mathematics (PRISM)*

National Science Foundation: January 1, 2008 - December 31, 2012
Beverly Hartline
Dawn A. Lott
Rebecca Fox-Lykens
Dewayne Fox
Patrick Gleeson

3. *Breast Disease Disparity Analysis at an HBCU Research and Training Center (The B-CaRT Center)*

Department of Defense: June 1, 2008 - May 31, 2012
Dawn A. Lott
Stan Ivey
Susan Gamel-McCormick

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.

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: September - November 2006 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Used the new format of the data entries in the MERI website and developed an Excel-macros program that mechanizes the process of preparing summaries of the actual data by listing all the measurements that are found to be outside the control limits.
Consultants: Professors Ken Johnson and Aridaman Jain

Date: October 2006 - February 2007 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Conducted a statistical analysis of the data from the two studies of sediments from 24

sampling sites in the Lower Hackensack River estuary and its major tributaries during 1987-88 and 2003. The significant differences between sites and time periods were identified.
Consultants: Karolina A. Filipiak and Professors Ken Johnson and Aridaman Jain

Date: December 2006 - June 2007 Client: Francisco Artigas (New Jersey Meadowlands Commission - Environmental Research Institute)
Description: Designed experiments for the short-term and long-term study for the Near-Road Air Quality Study near the New Jersey Turnpike for estimating the effects of variables such as distance, metal size, and wind direction. Currently data are being collected as per the designed experiments.
Consultants: Professors Ken Johnson and Aridaman Jain

Date: June 2007 Client: Dennis Annareli (PendoTECH)
Description: Analyzed the pressure measurements of low-cost single-use pressure-sensors that are used in Biopharmaceutical companies from 4 production lots. Based on the sample measurements, developed prediction intervals for future values of the pressure measurements with 99.9% confidence level.
Consultants: Professor Aridaman Jain

Date: May - June 2007 Client: Attorney General of New Jersey
Description: Reviewed New Jersey's criteria for Voter-verified Paper Record for Direct Recording Electronic Voting Machines. Developed two ballots - long and short - and the corresponding voting scenarios, based on fractional-factorial designs. These voting scenarios are being used for casting votes and collecting data generated in both paper records and electronic files.
Consultants: Professor Aridaman Jain

IX. CURRENT AND COLLABORATIVE RESEARCH

A. RESEARCH AREAS IN CAMS

Mathematical Biology

Researchers in CAMS working on problems related to Mathematical Biology: Booth, Bose, Bukiet, Dhar, Drover, 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, 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.

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, Hornstrop, 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, Ghosh, Dios, Jain, and Johnson.

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) and Bayesian inference (Ghosh), 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. COLLABORATIVE RESEARCH

Roman I. Andrushkiw

Interface Dynamics in Quasi-Stationary Stefan Problems, V. Gafiychuk, (Krakow Univ.), B. Datsko (Inst. Appl. Prob. Mech. Math., Nat. Ac. Sc. Ukr., Lviv)

Pattern Recognition Techniques in Cytogenetic Method of Breast Cancer Diagnosis, D.A. Klyushin, Yu.I. Petunin, (Kyiv Nat. Tar.Shev.Univ.), N.V. Boroday, (Kavetsky Inst. Oncology, Pathology and Radiology, Nat. Ac. Sc. Ukr., Kyiv)

John Bechtold

Mathematical Modeling of Experiments on Premixed and Diffusion Flames, C. K. Law, G. Jomaas, and H. Wang (Princeton University)

Mathematical Problems Arising in Combustion, M. Matalon (University of Illinois)

Manish Bhattacharjee

Estimation and Testing Problems in Branching Processes, with Observations Starting at an Unknown Generation Label, P.K. Sen (Dept. of Biostatistics, School of Public Health, University of North Carolina, Chapel Hill) and S. Roychoudhury (Schering Plough Institute, New Jersey)

Denis Blackmore

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

Effectively Computable Equivalence of Non-Manifold Geometric Objects, R. Kopperman (CCNY) and T.J. Peters (UConn)

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

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

Viscoelastic Flow Dynamics, P. Singh (NJIT) and N. Aubry (CMU)

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.)

Global Dynamical Bifurcations, J. Champanerkar (USA)

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

Amitabha Bose

Determining the Activity Phase of Follower Neurons in the Crab STG, Christina Mouser (Medgar Evers College) and Farzan Nadim (New Jersey Institute of Technology)

The Role of Facilitation in Coupled Networks of Neurons with T-Type Currents, Victor Matveev and Farzan Nadim (New Jersey Institute of Technology)

Bursting Through Resonance, Jon Drover (New Jersey Institute of Technology)

Dynamics of Plant Border Formation, Claus Holzapfel (Rutgers University)

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, Robert Krasny and Lyudmyla Barannyk (University of Michigan)

Kaushik Ghosh

Linkage Disequilibrium Mapping of Quantitative Trait Loci by Multiple Extreme Rank Selections, G. Zheng (NIH)

A Mixture Model for Estimating Personal Cure, R. C. Tiwari (NIH) and E. J. Feuer (NIH)

A Semiparametric Bayesian Model for Predicting Cancer Incidence in the U.S., R. C. Tiwari (NIH), E. J. Feuer (NIH) and K. Cronin (NIH)

Vladislav V. Goldberg

Differential Geometry of Veronese-like and Lagrange-like Webs, M.A. Akivis (Jerusalem College of Technology, Israel)

Rank Problems for Planar Webs, V. V. Lychagin (University of Tromso, Norway)

Jorge Golowasch

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

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

Roy Goodman

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

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

Peter Gordon

Stability of Traveling Waves in Porous Media Combustion, Anna Ghazaryan (University of North Carolina at Chapel Hill) and Christopher Jones (University of North Carolina at Chapel Hill)

Free Interface Models in Combustion and Related Topics, Gregory Sivashinsky (Tel Aviv University, Israel) and Claude-Michel Brauner (Universite Bordeaux 1, France)

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)

Dawn A. Lott

Computer Simulation Model to Assess Flow Characteristics of an In-Vitro Cerebral Saccular Aneurysm C.J. Prestigiacomo (UMDNJ), H.R. Chaudhry (NJIT), and M. Siegel (NJIT).

Victor Matveev

Interplay Between Synaptic and Intrinsic Cell Properties in Two-Cell Network Dynamics, Amit Bose and Farzan Nadim (New Jersey Institute of Technology)

Calcium Microdomains and Calcium Cooperativity of Neurotransmitter Release, Richard Bertram (Florida

State University) and Arthur Sherman (National Institutes of Health)

Properties of Endogenous Calcium Buffers at a Crayfish Neuromuscular Junction, Jen-Wei Lin (Boston University)

Mechanism of Inactivation of Voltage-Sensitive Calcium Channels, Roman Shirokov (UMDNJ)

Calcium Dynamics in Spike-Timing Dependent Synaptic Plasticity, John Rubin (University of Pittsburgh)

Jay Meegoda

University of Calgary, Canada, 2004-2007, Sponsored by the Natural Science and Engineering Research Council of Canada.

American University of Cairo, Egypt, 2005-2008, Sponsored by the US National Science Foundation.

Tsinghua University, Peoples Republic of China, 2005-2007, Sponsored by the Asia-link Program of the European Union.

Tomas Bata University in Zlin, Czech Republic, 2004-2006, Sponsored by Foundation Becario, Czech Republic.

Zoi-Heleni Michalopoulou

Terahertz Spectroscopy for Explosive Detection, B. Barat, J. Federici, D. Gary (NJIT)

Remote Sensing for Coastal Water Quality Assessment, L. Axe, S. Bagheri, N. Steffen-Fluhr (NJIT)

Particle Filtering for Propagation Modeling in Dispersive Waveguides, I. Zorych (NJIT)

Robert M. Miura

Thermal Effects on the Dynamics of 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)

Richard O. Moore

Analysis and Computation of Thermally Induced Pattern Formation and Dynamics in Parametric Gain Devices, K. Promislow (Michigan State University)

Development of Methods for Analysis of Stochastic Nonlinear Wave Equations with Multiple Time Scales, T. Schaefer (The College of Staten Island)

Simulation of Rare Events in Optical Communications, C. J. McKinstrie (Lucent Technologies), Gino Biondini (The University at Buffalo) and W. L. Kath (Northwestern University)

Analysis of the Impact of Phase-Sensitivity on Amplification of Different Optical Modulation Formats, C. J. McKinstrie (Lucent Technologies)

Cyrill Muratov

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

Self-Induced Stochastic Resonance Phenomena in Excitable Systems, Weinan E (Princeton University), Eric Vanden Eijnden (Courant Institute 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 of Verona, Italy), C. Garcia-Cervera (UCSB)

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

Non-Classical Nucleation Droplets, Eric Vanden-Eijnden (Courant Institute of Mathematical Sciences), Vitaly Moroz (Department of Mathematics, 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)

Peter G. Petropoulos

Energy Estimates and Stability Issues Pertaining to the Unsplit Perfectly Matched Layer for Hyperbolic Systems of Partial Differential Equations, Eliane Becache (Projet Ondes, INRIA-Rocquencourt, France)

Michael Siegel

Singularity Formation for the Three-Dimensional Euler Equations, Russ Caflisch (UCLA), Tom Hou (Caltech), Dale Pullin (Caltech)

Effect of Surfactant and Surfactant Solubility on the Deformation and Breakup of a Bubble in a Viscous Surrounding, Michael Booty, Demetrious Papageorgiou, Yuan Young (NJIT) Muhammad Hameed, Charles Maldarelli (Levich Institute, CUNY), Jie Li (Cambridge University)

Computer Simulation Model to Assess Flow Characteristics of an In-Vitro Cerebral Saccular Aneurysm C.J. Prestigiacomo (UMDNJ), H.R. Chaudhry (NJIT), and D. Lott (Delaware State University).

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)

Sheldon Wang

Modeling Progressive Collapse of Highway Bridges Subject to Blast Load, M. Ala Saadeghvaziri (NJIT)

Strong/Weak Shock Interaction with Flexible Structures, M. Ala Saadeghvaziri (NJIT)

Integrated Model of Electrospinning Process, G. Collins and M. Jaffe (NJIT)

Ocean Current to Electrical Current Research Project, I. Fischer (NJIT and Current to Current, Co.)

Yuan-Nan Young

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

Hysteretic Drop Dynamics in Straing Flow with Rotation, J. Blawzdziewicz (Yale University)

Effect of Surfactant and Surfactant Solubility on the Deformation and Breakup of a Bubble in a Viscous Surrounding, Michael Booty, Demetrious Papageorgiou, and Michael Siegel (NJIT), Muhammad Hameed and Charles Maldarelli (Levich Institute, CUNY), Jie Li (Cambridge University)

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

Zoi-Heleni Michalopoulou, Director of Undergraduate Studies

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

In January 2007, the Department of Mathematical Sciences launched the Computational Science Training for Students in the Mathematical Sciences (CSUMS) program, funded by the National Sciences Foundation. The program exposes undergraduates in the mathematical sciences to research in two key areas: mathematical modeling and scientific computing. Eight students are participating in CSUMS for 2007: Mariana Cassimiro, Fatima Elgammal, Brian Emmanuel, Michael Lam, Nan Maung, Matthew Peragine, Chris Peterson, and Alex Virodov. The participants are conducting research under the supervision of Professors Roy Goodman, David Horntrop, Zoi-Heleni Michalopoulou, and Michael Siegel. The three projects pursued this year are

a. Aliasing in the calculation of convolutions using stochastic Fourier series.
b. Numerical detection of complex singularities for functions of two or more variables.
c. Adaptive schemes for computing parametric curves and invariant manifolds.

The CSUMS program, in addition to involving undergraduate students in research projects, extends to curriculum development integrating mathematics and computation. Already a course on computational financial derivatives has been developed and is planned to run for the first time in Spring 2008. The new course will be open to all NJIT undergraduates who have the necessary prerequisites. We, thus, expect that many NJIT students, regardless of their major, will benefit from the program. For more information on the NJIT CSUMS program, please visit http://m.njit.edu/~elmich/csums/.

CSUMS Students: Back row: Mathew Peregrine, Chris Peterson, Brian Emmanuel, Michael Lam.
Front row: Fatima Elgammel, Nan Maung, Alex Virodov, Mariana Cassimiro.

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 2006 and completed research projects that spanned the entire calendar year. These students, Jasneet Kaur, Chris Khalil, Tao Lin, Arif Patel, Arlene Pineda, and Abraham Rosales, spent the summer of 2006 working in the labs of Profs Bonder, 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. Some of their work was also presented at the 2006 East Coast Nerve Net Meeting, the 2006 Joint SIAM/SMB meeting on Life Sciences and Rosales and Tao will present their work at the 2007 Society for Mathematical Biology meeting in San Jose in August 2007. A short description of the research projects follows.

Measuring cell capacitance: Chris Khalil, Arif Patel, and Arlene Pineda (Nadim/Golowasch lab)

Several methods exist to determine the capacitance associated with the cellular membrane. Capacitance is proportional to cell surface and measurements are routinely performed during electrophysiological recordings to estimate neuronal surface. In anatomically simple cells all these methods yield identical values. Neurons, however, have a complex anatomical structure and these methods often yield very different results. The students' aim was to understand and quantify neuronal membrane capacitance in order to determine if any of these methods gives accurate values and if the discrepancies between methods can be used to better understand membrane surface distribution along different neuronal compartments (soma, dendritic tree, etc). Students built models of neurons of different anatomical complexity and learned to model different capacitance measuring techniques. They also learned how to use these measuring techniques experimentally using electrophysiological recordings of crab stomatogastric neurons. The modeling results were used to interpret and understand the experimentally measured discrepancies between the methods.

The role of cell shape in determining the orientation of a cell's mitotic spindle: Jasneet Kaur and Tao Lin (Bonder lab)

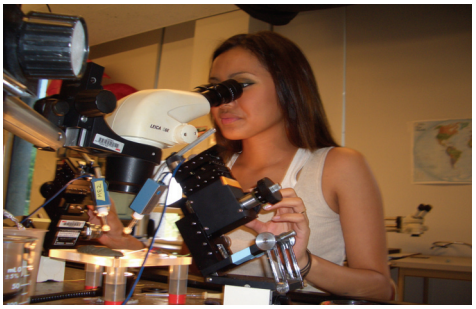
The students investigated the hypothesis that the orientation of the cell mitotic spindle is a directly related to cell shape. The students learned how to grow cultured cells, how to treat them with chemicals that inhibit the activation of a certain protein called RhoA (which is involved in cytoskeleton regulation and cell division), how to image these cells to make measurements of shape and how to determine the orientation of the mitotic spindle. The students used simple geometric measurements to quantify cell shape and spindle angle orientation. Tao Lin is continuing in the summer of 2007 on this project.

Metapopulation models for great egrets in the New Jersey Meadowlands: Abraham Rosales (Russell lab)

The main aim of this project was to derive a mathematical model that can help in the management of bird population of the island in the New Jersey Meadowlands. Several years worth of data has already been collected concerning egret and nest population on various islands. The student working on this project developed a stochastic discrete dynamical systems model to test the affects of bird aggregation behavior and site fidelity characteristics in determining population levels.

Students at work in the UBM laboratories

Tao Lin and Jasneet Kaur



Arlene Pineda

Arif Patel and Chris Khalil

Abraham Rosales

Pi Mu Epsilon Induction Ceremony on April 25, 2007

The Pi Mu Epsilon honor society inducted 15 new members this year on April 25, 2007: Tatyana Bayok, Joe Brachocki, Vincent Carpenter, Afrousima Chaban, Michael Colucci, Kelly Crowe, Donald Grote, Jason Ju, Nan Maung, Felix Mbuga, Michael Pallotta, Abraham Rosales, Christine Stark, Joanna Sudol, and Alexander Virodov. 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.

Pi Mu Epsilon Inductees

Back Row: Prof. Roy Goodman, Vincent Carpenter, Alexander Virodov, Nan Maung, Felix Mbuga, Joe Brachocki, Prof. Zoi-Heleni Michalopoulou, Dean Fadi Deek, and Prof. Daljit S. Ahluwalia
Front Row: Joanna Sudol, Christine Stark, Kelly Crowe, Michael Pallotta, Tatyana Bayok, and Afrousima Chaban
Not pictured: Michael Colucci, Donald Grote, and Abraham Rosales

Capstone Laboratory Projects:

Three groups of undergraduate students presented their Capstone research projects at Undergraduate day of FACM'07 (supervised by Lou Kondic and Nebo Murisic):
(1) J. Hedhli, J. Brachocki, S. Muddam, and D. Fong: Instability of a Fluid Strip;
(2) A. Christian, A. Rosales, and J. Ju: Simulations and Experiments of Evaporative Drops;
(3) A. Aziz, K. Crowe, and M. DeCaro: Shape and Break-up of a Pendant Drop.

Title: Simulations and Experiments of Evaporative Drops

Students: Abraham Rosales, Andrew Christian, Jason Ju
Assistant: Nebo Murisic Instructor: Lou Kondic

This project presents theoretical, computational, and experimental aspects of mass-loss of fluid drops due to evaporation. The theoretical component consists of using basic principles such as conservation of mass, momentum, and energy together with an evaporation model to derive an evolution equation for a fluid drop. This equation is solved and analyzed for comparison with the experimental results for fluids such as water, 70% and 100% isopropyl alcohol. Experiments were performed using a professional grade goniometer which allowed us to precisely measure contact angle and volume as a function of time. The comparison between computational results and experimental results is focused on the change in volume, mass, and contact angle. In addition, we show curious instabilities which developed for 100% isopropyl alcohol drops.

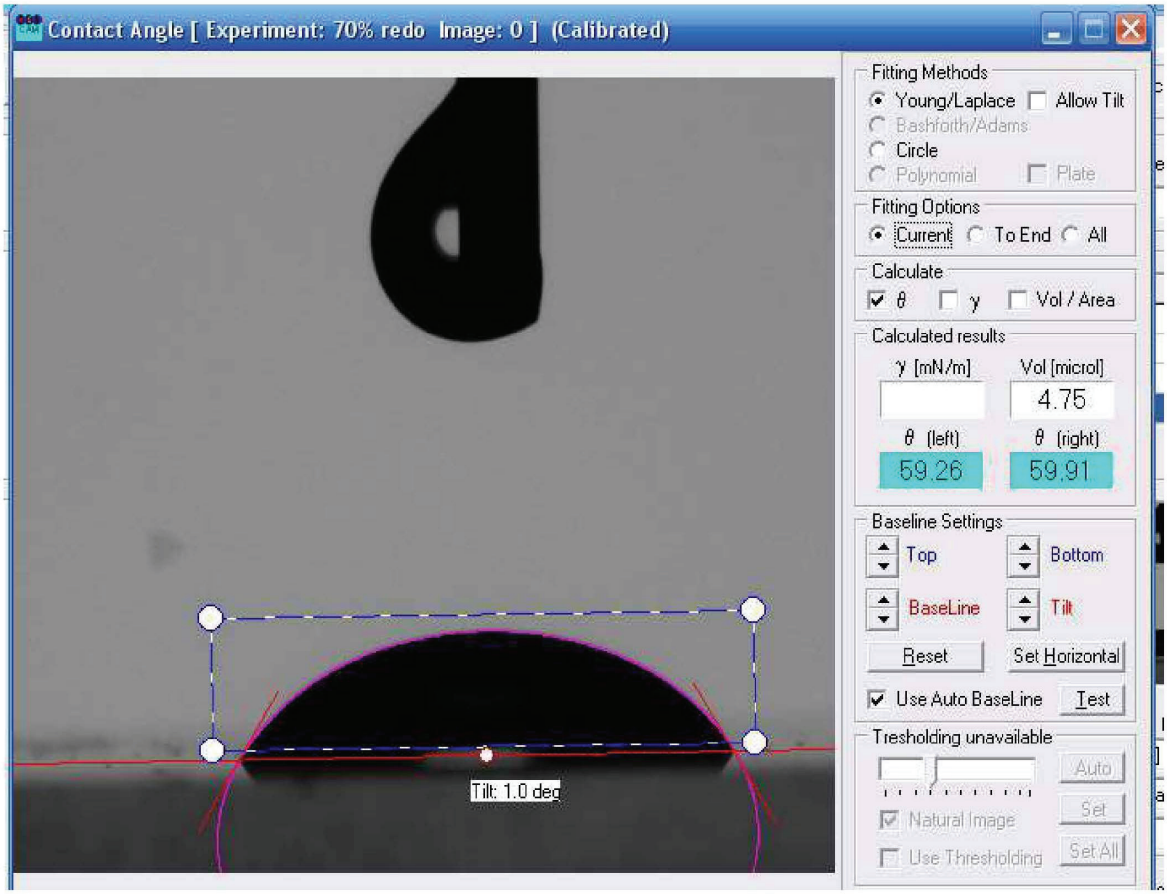


Figure 1: Using goniometer to measure evaporative flux.

Title: Instability of the fluid strip

Students: Jamila Hedhli, Joe Brachocki, Sanjay Muddam, and Daniel Fong
Assistant: Nebo Murisic Instructor: Lou Kondic

Waves on the surface of a thin liquid film have intrigued researchers for several years. Numerous experimental and modeling studies have been reported. Due to the presence of the free surface, governing non-linear Navier-Stokes (N-S) equations are considerably difficult to analyze. Thus effort was made to describe these surface waves using low-dimensional models derived from the N-S equations. Our project is composed of three parts. Experimentally we use a goniometer to record the profile of a strip flowing down an inclined and inverted surfaces, using two types of solids. Computationally, we solve the PDE for the fluid height for the two types of solids. Theoretically, we discuss the similarities and differences between the waves observed on falling films, and the ones present in the case of the flow down an inverted surface.

Figure 2: Profile of a milimetric fluid strip sliding down an incline.

Title: Shape and Break-up of a Pendant Drop

Students: Azfar Aziz, Kelly Crowe, and Michael DeCaro
Assistant: Nebo Murisic Instructor: Lou Kondic

A liquid drop forms a distinct shape as it hangs or breaks up. In the case of a pendant (hanging) drop, its shape is described by a system of ordinary differential equations which define a boundary value problem. Using Runge-Kutta numerical algorithm, we solve these equations. A comparison of the results with the experimental drop shapes, obtained using a goniometer, is then carried out. In addition, we extend our computations in order to calculate surface tension of a pendant drop by minimizing the difference between computed and measured drop shapes (pendant drop method for determining surface tension). Finally, we report the results of the experiments of a drop break-up carried out using a high speed camera. These results are used to analyze the breakup process and compare the experimental results to a self-similar solution.

Figure 3: Snapshot of a break-up process using high speed camera (20,000 frames per second).

B. GRADUATE STUDENT RESEARCH PROGRAMS

Demetrius Papageorgiou, Director of the Graduate Program

Ph.Ds Awarded:

Satrajit Roychoudhury, August 2006
Thesis: Selected Problems of Inference on Branching Processes and Poisson Shock Model
Advisor: Dr. Manish Bhattacharjee
Current Employer: Schering-Plough Corporation

Nickolas Kintos, January 2007
Thesis: Modeling Projection Neuron Neuromodulatory Effects on a Rhythmic Neuronal Network
Advisor: Dr. Farzan Nadim
Current Employer: Fordham University

Sibabrata Banerjee, May 2007
Thesis: Problems Related to Efficacy Measurement and Analyses
Advisor: Dr. Sunil Dhar
Current Employer: Schering-Plough Corporation

Yiming Cheng, May 2007
Thesis: Prediction of MRNA Polyadenylation Sites in the Human Genome and Mathematical Modeling of Alternative Polyadenylation
Advisor: Dr. Robert M. Miura
Current Employer: NYU Medical Center

MS Degrees Awarded:

A total of 4 MS degrees in Applied Mathematics and 15 MS degrees in Applied Statistics were awarded in the academic year 2006-2007.

Publications, Presentations, and Conference Participation

Satrajit Roychoudhury

Poster, Frontiers in Applied and Computational Mathematics, NJIT, May 2007, "Nonparametric Estimators of the Age of a Galton-Watson Process"

Poster, Joint Statistical meeting (JSM), August 2006, "Nonparametric Estimators of the Age of a Galton-Watson Process"

Sibabrata Banerjee

Poster, Frontiers in Applied and Computational Mathematics, NJIT, May 2007, "Problems Related to Efficacy Measurement and Analysis"

Poster, Provost's Research Day, NJIT, April 2007, “Problems Related to Efficacy Measurement and Analysis”

Poster, Joint Statistical Meeting (JSM), August 2006, “Problems Related to Efficacy Measurement and Analysis”

Joon Ha:

Conference Talk and Poster:

May 2007: Poster, Frontiers in Applied and Computational Mathematics, NJIT, “Sustainment of Activity in Neuronal Networks Coupled by Gap Junctions”.

May 2007: Contributed talk, SIAM conference (DS07), Snowbird, Utah, “Sustainment of Activity in Neuronal Networks Coupled by Gap Junctions”.

Travel Award: GSA General Travel Award, Spring 2007.

Rashi Jain:

Achievement: Received ONR scholarship January 2007 – December 2009.

Activities: Attended PIMS Industrial Problem Solving Workshop from June 7 – June 15, 2007, project titled "Optimization of Multi-Drug Composition for the most Efficacious Action".

Yogesh Joshi:

Presented poster titled "Discrete Pioneer-Climax Dynamics: Preliminary Report" at the Frontiers in Applied and Computational Mathematics conference, NJIT, May 14-16, 2007.

Participated in Graduate Student Mathematical Modeling Camp-07 (GSMMC’07) held at Rensselaer Polytechnic Institute, June 5-8, 2007, Title of Project: Brownian Chain Evolution: A Propulsion Mechanism? Supervision of: Don Drew

Participated in Mathematical Problems in Industry’07 (MPI’07) held at University of Delaware, June 11-15, 2007. Title of Project: Modeling Diffusion in a Lens Capsule via Fluorescence Recovery After Photobleaching.

Kamyar Malakuti:

Recipient of Gk12 Fellowship, NJIT's C2PRISM Program. NJIT, Starting June 2007.

Poster presentation at the Frontiers in Applied and Computational Mathematics conference, titled "Calculation of Complex Singular Solution to the 2D Boussinesq Equations". NJIT, May 2007.

Myongkeun Oh:

Conference Talk and Poster:

May 2007: Poster, Frontiers in Applied and Computational Mathematics, NJIT, “Asynchronous activity in a non-weakly coupled two-cell inhibitory network with finite synaptic decay time”.

May 2007: Poster, SIAM conference (DS07), Snowbird, Utah, "Asynchronous activity in a non-weakly coupled two-cell inhibitory network with finite synaptic decay time".

Travel Award: GSA General Travel Award, Spring 2007.

Yu Zhang:

Conferences and presentations:

07/2007 Presentation to the 16th Annual Meeting for Computational Neuroscience (CNS), Toronto, CANADA

05/2007 Presentation to the 4th Annual Conference of Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology, Newark, NJ

04/2007 Presentation to the 18th Annual Sigma Xi Student Research Symposium, Saint Joseph's University, Philadelphia, PA

03/2007 Presentation to the 33nd Annual East Coast Nerve Net, Woods Hole, MA

11/2006 Presentation to the 2nd Graduate Student Research Day, NJIT, NJ

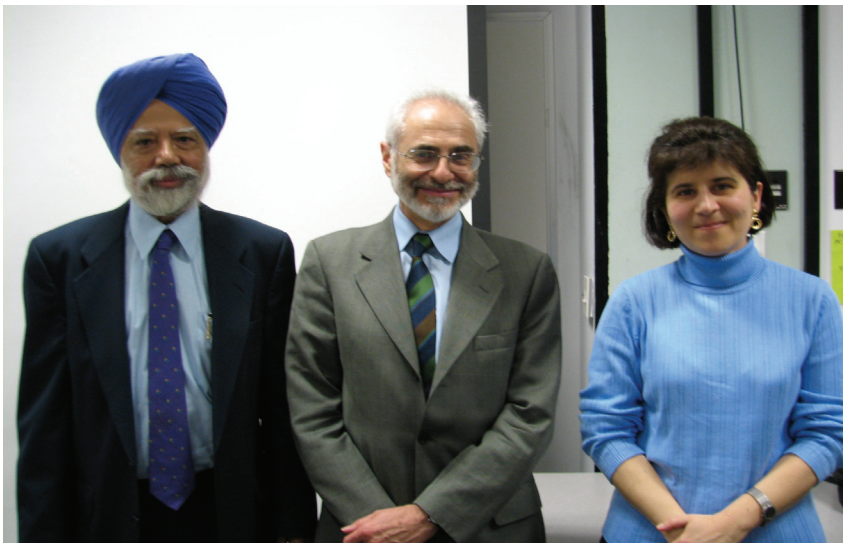
Honors: 04/2007 Membership of Sigma Chapter at NJIT of Alpha Epsilon Lambda, the National Honor Society for Graduate and Professional Students

Publications:

The Effect of the A-current on the Activity Phase of Follower Neurons in an Inhibitory Network, Yu Zhang, Amithaba Bose, Farzan Nadim, BMC Neuroscience 2007. Note: this paper has been accepted, and it will be published in or after July 2007.

NJIT's SIAM Student Chapter and GSA Mathematical Sciences Group

The main purpose of NJIT's SIAM Student Chapter is to foster the awareness and interest of students, and graduate students in particular, in research in Mathematical Sciences. The GSA and SIAM Student Chapter co-sponsored a seminar by Dr. Andrea Prosperetti (Johns Hopkins University) on April 27, 2007. Dr. Prosperetti presented his research on the Stability of Rising Bubbles.



Prof. Andrea Prosperetti (center), Prof. Ahluwalia, Chair of DMS (left) and Prof. Michalopoulou, Director of Undergraduate Programs (right)

Soccer Match

For the fourth consecutive year, faculty and students met for a friendly soccer game (sponsored by GSA) on the Reading Day before final exams during the Spring Semester. For the second consecutive year, the undergraduate team beat the graduate students/faculty team. A barbecue on the campus green followed the game.

Faculty-Student Soccer Game on May 10, 2007

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 2006

July 6 **Yiming Cheng** (Joint work with Dr. Robert M. Miura and Bin Tian)
Using SVM to Predict Polyadenylation Sites

July 11 **Dr. Michael Booty** (Joint work with Dr. Gregory A. Kriegsmann)
Microwave Heat-Processing of a Thin Cylinder in a Cavity

July 13 **Dr. Javier Diez**, Instituto de Fisica Arroyo Seco, Universidad Nacional, Argentina
Pearling Process of a Fluid Strip on a Partially Wetting Surface

July 18 **Dr. Yuan Young**
Novel Filament Dynamics in Complex Fluid

July 20 **Dr. Michael Siegel**
The Effect of Surfactant on the Deformation and Breakup of a Bubble in a Viscous Surrounding

July 25 **Yu Zhang**
Mathematical Models for Single and Multi-neuronal Systems

July 27 **Filippo Posta**
Controlling Nitrogen Cross-Over in a Recirculating PEMFC

August 1 **Dr. Jonathan H. Luke**
Sedimentation: Just Falling Down?

August 3 **Anisha Banerjee**
Mathematical Modeling of Spreading Depression

Fall 2006

October 23 **Qiming Wang**
Stability of Pure Capillary Waves

November 1 **Ye Yang**
Cochlea Modeling Using Mixed Finite Element Formulations for Acoustoelastic Systems

November 8 **Hui Wu**
Pattern Formation in Reaction-Diffusion Systems

November 15 **Bo Ren**
A Numerical Solver for the Stokes Equation in a Specific Case

December 4 **Kuan Xu**
Numerical Study on Fully Nonlinear Internal Wave in a Two-Layer System

Spring 2007

February 5 **Dr. Yuan N. Young**
Diffusive Transport of Elastic Fibers in Cellular Flows

February 19 **Dr. X. Sheldon Wang**
Direct/Iterative Strategies Using Mixed Finite Element Formulations and ALE Descriptions for Viscous Fluids Interacting with Flexible Structures

March 5 **Dr. Shidong Jiang**
Fast Numerical Algorithms and Their Applications

March 19 **Dr. Richard O. Moore**
Modelling Thermal Effects in Nonlinear Crystals

March 26 **Dr. Peter Gordon**
Combustion in Porous Media: Recent Results and Open Problems

April 2 **Dr. David J. Horntrop**
Stochastic Modeling and Simulation for Materials

April 9 **Dr. Horacio G. Rotstein**
Rhythmic Oscillations in the Hippocampal Formation

April 16 **Dr. Lou Kondic**
Signal Propagation through Particulate Systems

April 23 **Dr. Roy H. Goodman**
Fractal Structures in Wave Collisions

May and June 2007

May 24 **Nebojsa Murisic**
Evaporative Liquid Films

May 31 **Leo Espin**
Solute Transport in Pulsating Channels

June 4 **Dr. Demetrios Papageorgiou**
Dynamics of Thin Films

June 7 **Xinli Wang**
Influence of Surfactant On Air Entrapment In Liquid-Film Coating

June 11 **Dr. Amit Bose**
Neuronal Dynamics and Phase Constancy

June 18 **Dr. Yuan Young**
Dynamics of Bio-Filaments in Stokesian Fuids

June 21 **Qiming Wang**
Breakup of An Infinite Electrified Jet

June 25 **Dr. Victor Matveev**
Introduction to Neuronal Excitability and Bursting

June 28 **Myongkeun Oh**
Asynchronous Activity In A Non-Weakly Coupled Two-Cell Inhibitory Network With Finite Synaptic Decay Time

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

Center for Applied Mathematics and Statistics
Department of Mathematical Sciences
606 Cullimore Hall
University Heights, Newark, NJ 07102
(973) 596-5782 fax (973) 596-5591
http://math.njit.edu/research/