CAMS

Center for Applied Mathematics and Statistics

ANNUAL REPORT

2002-2003

NJIT
New Jersey Institute of Technology

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I. FROM THE DIRECTOR

The CAMS mission requires that we both support established work and develop new areas where application of the mathematical sciences is likely to yield substantial gains for science and technology. Investment involves risk; not every initiative bears fruit. Aware of this reality, we celebrate the substantial successes of the mathematical biology group which CAMS initiated more than a decade ago.

Over the past decade, CAMS, in collaboration with the Department of Mathematical Sciences, has established NJIT as a world center in research and education in Mathematical Biology, with particular emphasis in neuroscience. Already one of the largest groups in Mathematical Biology in a mathematics department in North America, the addition of two mathematical neuroscientists in Fall 2003 will establish CAMS as a premier center in Mathematical Biology with ten active researchers, including seven in neuroscience. These research efforts are supported by three NIH grants, three NSF grants, a Whitaker Foundation grant, and a US-Israel BSF grant. Two of the neuroscientists are electrophysiologists, who maintain wet labs at Rutgers-Newark under the auspices of the Federated Department of Biology. The research undertaken by this group of Mathematical Biologists is strongly interdisciplinary with strengths in biology, mathematical modeling, mathematical analysis, and computational biology.

Even as mathematical biology has developed rapidly, CAMS has continued to support the work of researchers in more established fields. Milestones in the past year include establishment of a regular seminar devoted to fluid mechanics and the admission of the first two students into the Applied Statistics track of the Doctoral Program in the Mathematical Sciences. Current research projects in the areas of fluid mechanics, material science, wave propagation (including electromagnetics and underwater acoustics) and stochastic computing are supported by ten NSF grants, two ONR grants, and one grant each from DOE, NASA, and AFOSR. The interdisciplinary strengths of CAMS are seen in close connection of these projects with areas of current application. An excellent example is the NASA grant which supports Lou Kondic and his postdoctoral associate, Oleh Baran, to perform theoretical and computational analysis of particulate systems, at the same time it supports Robert Behringer of the Physics Department at Duke University to design and perform experiments on the same systems. The twenty-three CAMS grants in 2002-2003 (up from nineteen in the previous year) represents a high point from which we are challenged to build in the coming years. In addition to individual research proposals, CAMS is currently exploring a number of possible programs for integrating research and education efforts and thus further extend research opportunities to graduate and undergraduate students at NJIT. The Capstone Laboratory continues to make progress in bringing the CAMS vision of the Mathematical Sciences to NJIT's undergraduates. The conclusion of a SCREMS grant for upgrading the CAMS Computation Laboratory reminds us how much we rely on the support of David Ullman, Associate Provost for Information Services and Technology, David Perel, Director of Engineering Computing, and their staff to maintain state-of-the-art computing facilities needed to support CAMS research.

The accomplishments of CAMS have been built with the support, inspiration, and dedication of many individuals. CAMS is grateful to William Van Buskirk, Provost of NJIT, for creating an environment where the aspirations of CAMS are espoused and appreciated. G. Miller Jonakait, Dean of CSLA, and Donald Sebastian, Vice President for Research and Development, have encouraged CAMS through their strong support of scientific research. President Robert A. Altenkirch, who came to NJIT in Fall 2002, has already demonstrated his 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 **Jonathan Luke, Associate Director**

II. MISSION STATEMENT

The Center for Applied Mathematics and Statistics (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. The formal structure of CAMS consists of the Director, Associate Director, and various committees. However, the essential nature of the organization is that of a voluntary association of individual researchers from many disciplines joined in a collegial collaboration to enhance mathematical research at NJIT.

CAMS undertakes a wide range of activities in pursuing its mission. CAMS brings together researchers from academia, industry, and government with complementary strengths and common goals to NJIT and neighboring institutions by organizing interdisciplinary workshops. In some cases, CAMS secures the appointment of Research Professors to formalize this relationship to NJIT so that grants can be jointly pursued. CAMS provides its members with laboratory support by maintaining the CAMS/Math Computational Laboratory, the NSF Capstone Laboratory, and the Statistical Consulting Laboratory. CAMS activities also include support for the submission of research proposals, which is done through the dissemination of information, organization of group projects, collegial advice, and assistance with the application documents. Senior members of CAMS commit a significant amount of time and effort in providing guidance and mentoring to young researchers in their efforts to obtain funding. Exploring new areas of application of the mathematical sciences for the purpose of maintaining a presence in the forefront of science is a fundamental function of CAMS. Graduate student research is encouraged through the CAMS Summer Research Program and with support for students to attend conferences.

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 research and academic relationships with industry and business.

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
Connell, Cameron
Dhar, Sunil
Dios, Rose
Elmer, Christopher
Goldberg, Vladislav
Goldman, Daniel
Golowasch, Jorge
Goodman, Roy
Horntrop, David
Kappraff, Jay
Kondic, Lou
Kriegsmann, Gregory A.
Lott, Dawn
Luke, Jonathan
Matveev, Victor (2003-)
Michalopoulou, Zoi-Heleni
Milojevic, Petronije
Miura, Robert M.
Muratov, Cyrill
Nadim, Farzan
Papageorgiou, Demetrios
Perez, Manuel
Petropoulos, Peter G.
Raymond, Christopher
Siegel, Michael
Spencer, Thomas
Stickler, David
Tao, Louis (2003-)
Tavantzis, John

Visiting Members

Baran, Oleh
Chakrabarti, Aloknath
Rodrigo, Marianito
Volkov, Darko

Department of Civil and Environmental Engineering

Meegoda, Jay N.

Department of Mechanical Engineering

Aubry, Nadine
Rosato, Anthony

CAMS Research Professors

Booth, Victoria	University of Michigan
Erneux, Thomas	Université Libre de Bruxelles, Belgium
Mauri, Roberto	Università degli Studi di Pisa, Italy
Vanden-Broeck, Jean-Marc	University of East Anglia, Norwich, England

IV. COLLOQUIA AND SEMINARS

Applied Mathematics Colloquium

September 6 **Patrick Hagan**, Fixed Income Derivatives Research, Bear Stearns, Inc.
"Managing Smile Risk"

September 13 **Peter Kramer**, Department of Mathematical Sciences, Rensselaer Polytechnic Institute
"Homogenized Transport by a Spatiotemporal Mean Flow with Small-Scale Periodic Fluctuations"

September 20 **Michel Louge**, Mechanical and Aerospace Engineering, Cornell University
"On the Impact of Spheres"

October 2 **Ratnasingham Shivaji**, Department of Mathematics and Statistics, Mississippi State University
"Diffusive Logistic Equation with Constant Yield Harvesting"

October 4 **Paul H. Steen**, Chemical & Biomolecular Engineering and Center for Applied Mathematics, Cornell University (Joint Seminar with Mechanical Engineering)
"Interface instability and capillary micro-switches"

October 11 **Patrick L. Mills**, Chemical Science & Engineering Laboratory, Dupont Company
"Method-of-Lines Solution of a Multi-region Distributed Parameter Dynamic Model for a Fixed-Bed Reactor"

October 18 **Roderick Wong**, Department of Mathematics, City University of Hong Kong
"Formal versus Rigorous Asymptotics"

October 25 **Eric Vanden-Eijnden**, Courant Institute of Mathematical Sciences, NYU
"Conformational Dynamics in Complex Systems: Theory and Computational Aspects"

October 30 **Robert A. Altenkirch**, President and Professor of Mechanical Engineering, New Jersey Institute of Technology (Joint with Mechanical Engineering)
"Creeping Flame Spread in Forced and Natural Flows and Microgravity"

November 1 **Charles Peskin**, Courant Institute of Mathematical Sciences, NYU (Joint with Biomedical Engineering)
"3-D Generalization of the Hodgkin-Huxley Equations"

November 7 **Michael Ward**, Department of Mathematics, University of British Columbia
"The Stability and Dynamics of Localized Patterns for a Reaction-Diffusion System"

November 8 **Oleh Baran**, Department of Applied Mathematics, University of Western Ontario
"Bulk motion of granular matter in an agitated cylindrical bed"

November 13 **C. K. Law**, Department of Mechanical and Aerospace Engineering, Princeton University (Joint with Mechanical Engineering)
"Combustion of Multicomponent and High-Energy-Density Fuel Droplets"

November 15 **C. David Levermore**, Department of Mathematics, University of Maryland
"Fluid Dynamical Limits for the Boltzmann Equation"

November 22 **Moshe Matalon**, Department of Engineering Sciences and Applied Mathematics, Northwestern University (Joint with Mechanical Engineering)
"Flame Propagation in Narrow and Wide Channels"

December 6 **Xiangsheng Xu**, Department of Mathematics & Statistics, Mississippi State University
"Mathematical theories for electrical heating of conductors"

December 12 **Peter Winkler**, Fundamental Mathematics Research Group, Bell Laboratories
"Games People Don't Play"

January 23 **Victor Matveev**, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health
"Mechanisms of Short-Term Synaptic Facilitation"

January 24 **Steven Golowich**, Mathematical Sciences Research Center, Bell Laboratories
"Homogenization Expansion for Resonances of Microstructured Photonic Waveguides"

January 31 **Yang Xiang**, Princeton Materials Institute, Princeton University
"A Level Set Method for Dislocation Dynamics"

February 5 **Andreas Acrivos**, Levich Institute, New York, NY (Joint with Mechanical Engineering)
"Deterministic and Stochastic Properties of Sheared Suspensions. Latest Variations on a Theme by Albert Einstein"

February 7 **David Wootton**, Department of Mechanical Engineering and Mechanics, Drexel University (Joint with Mechanical Engineering)
"Mechanochemical Thrombosis Models"

February 11 **Christian Ratsch**, Department of Mathematics, UCLA
"Modeling Epitaxial Growth on Different Time and Length Scales: From Ab-Initio to Level-Sets"

February 14 **Mark Korlie**, Department of Mathematics, Montclair State University
"3-D Particle Modeling of Gas Bubbles in a Liquid"

February 21 **Eliza Michalopoulou**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Inverse problems in underwater acoustics: matched field processing and TABU optimization"

February 28 **Johannes Tausch**, Department of Mathematics, Southern Methodist University
"Asymptotically optimal BEM solvers based on Variable Order Wavelets"

March 5 **L.-S. Fan**, Department of Chemical Engineering, Ohio State University (Joint with Mechanical and Chemical Engineering)
"Real Time Three-Dimensional Tomography and the Discrete Computations for Multiphase Flow Systems"

March 7 **Michael Siegel**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Evolution of material surfaces for highly anisotropic surface energy"

March 14 **John Ball**, Oxford University & Institute for Advanced Study, Princeton
"The regularity of minimizers in elasticity"

March 28 **William Browning**, Applied Math Inc.
"Some Applications of Mathematics in Industry"

April 4 **Jared Bronski**, Department of Mathematics, University of Illinois & Institute for Advanced Study, Princeton
"Eigenvalue Asymptotics, Passive Scalar Intermittency and Small Ball Estimates for Fractional Brownian Motions"

April 9 **Ned Corron**, U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama
"Information Flow in Chaos Synchronization"

April 11 **Jianping Zhu**, Department of Mathematics, University of Akron, Ohio
"An efficient parallel algorithm for solving time dependent partial differential equations"

April 25 **Richard Bertram**, Department of Mathematics & Kasha Laboratory of Biophysics, Florida State University
"Emergent Phantom Bursting in Pancreatic Islets"

May 2 **Robert Krasny**, Department of Mathematics, University of Michigan
"An Adaptive Treecode for Particle Interactions"

June 11 **Renuka Ravindran**, Indian Institute of Technology, Bangalore
"Approximating an Infinite System of Ordinary Differential Equations"

June 19 **Richard Haberman**, Department of Mathematics, Southern Methodist University
"Slow Passage Through Homoclinic Orbits for the Unfolding of a Saddle-Center Bifurcation and the Change in the Adiabatic Invariant"

Statistics Colloquium

September 27 **Thomas Spencer**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Waiting Times, Exchangeable Random Variables, and a Fundamental Result for Exchangeable Events"

October 23 **Sam Lowe**, Management Systems Center, AT&T Labs
"Assessing AT&T Residential Customer's Future Tenure"

October 30 **Stuart Altschuler** and **Raj Nigam**, USPC Marketing Group/Research and Analytical Marketing & Management Science Group, Merrill Lynch
"Merging multiple, messy, missing, and multicollinear variables into one meaningful measure"

November 13 **John Tavantzis**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Solving Variational Inequalities (VI) Problems Using the Barrier Method with a Parking Equilibrium Example"

December 9 **Peter Nagorka**, Management Systems Center, AT&T Labs
"Statistical Inference with Inhospitable Populations for Unreasonable Information Needs"

December 18 **Zhanyun Zhao**, The Wharton School, University of Pennsylvania
"Analysis of the Dual System Estimate in the 2000 Census"

January 22 **Xinlei Wang,** Department of Management Science and Information Systems, McCombs School of Business, University of Texas at Austin
"Bayesian Variable Selection for GLM"

February 3 **Janice Daniel**, Department of Civil and Environmental Engineering and Interdisciplinary Program in Transportation, New Jersey Institute of Technology
"Impacts of the 65-mph Speed limit on Truck Safety"

February 17 **Saurin Pandya**, Cendant Corporation
"Analyzing and Comparing Various Characteristics of Emerging Stock Exchanges with Those of Matured Stock Exchanges through EGARCH Model and VAR Analysis"

March 6 **Hui Xie**, Department of Biostatistics, Columbia University
"Sensitivity Analysis of Causal Inference in Clinical Trial Subject to Crossover"

April 7 **Thomas Spencer**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Renewal Approach to Waiting Times for Exchangeable Events"

April 16 **Aridaman K. Jain**, Reliability Consultant
"Quality Index for Feedback and Reliability Improvement"

April 28 **David E. Kaufman**, Network Design and Performance Analysis, AT&T Labs
"What is "Carrier-Grade" Reliability in Voice over IP?"

June 3 **M.C. Bhattacharjee**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Probability Bounds via Stochastic Dynamic Programming with Applications to Reliability"

June 17 **Thomas Spencer**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Bootstrapping: A Nonparametric Technique For Many Things"

June 26 **Sunil Dhar**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Evaluating Randomness and Related Tests"

Fluid Mechanics Seminars

September 11 **Michael Siegel**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Singular Solutions and Ill-Posedness in the Muskat Problem"

September 30 **Stephen Tse**, Department of Mechanical and Aerospace Engineering, Rutgers University
"Flame Dynamics of Centrally-Ignited Premixed Flames"

October 21 **Charles J. Prestigiacomo**, MD, Departments of Neurological Surgery and Radiology, Neurological Institute of New Jersey, University of Medicine and Dentistry of New Jersey
"The Biophysics of Intracranial Aneurisms: Potential Lessons in Preventing Recurrence"

October 28 **Marvin Jones**, Courant Institute of Mathematical Sciences, NYU
"Flapping and falling; a study of two-dimensional hovering flight"

November 18 **Jean-Marc Vanden-Broeck**, Department of Mathematics University of East Anglia, England, and Center for Applied Mathematics and Statistics, New Jersey Institute of Technology
"Two layer flows: solitary waves and generalised fronts"

January 27 **Andre Nachbin**, Instututo Matematica Pura e Aplicada (IMAPA), Rio de Janeiro, Brasil
"Solitary wave refocusing with a terrain following Boussinesq system"

February 10 **Kate Stebe**, Department of Chemical Engineering, The Johns Hopkins University Baltimore, MD
"Creative Tension: Using Surfactants to Direct Stresses at Fluid Inertia"

April 2 **Aloknath Chakrabarti**, Department of Mathematics, Indian Institute of Science, Bangalore, India
"Weakly Singular Integral Equations in Water Wave Scattering"

April 14 **Athanassios Fokas**, Department of Applied Mathematics and Theoretical Physics, Cambridge University, England
"Integrability, Imaging of the Brain, and Boundary Value Problems"

April 16 **Cameron Connell**, Department of Mathematical Sciences, NJIT
"Boundary Instabilities in Epitaxial Growth"

Mathematical Biology Workshop

September 10 **Lora Billings**, Department of Mathematical Sciences, Montclair State University
"Noise Induced Chaos in the SEIR Model"

September 17 **Christopher Raymond**, Department of Mathematical Sciences, New Jersey Institute of Technology
"Mathematical Modeling for Immunocolloid Labeling"

September 24 **Michael Recce**, Department of Information Systems, New Jersey Institute of Technology
"Bioinformatics: What is It? Are There Interesting Math Problems?"

October 1 **Louis Tao**, Courant Institute for the Mathematical Sciences, NYU
"Simple and Complex Cells in the Primary Visual Cortex"

October 8 **Mark Goldman**, Department of Brain & Cognitive Sciences, Massachusetts Institute of Technology
"How Neurons Do Integrals"

October 15 **Jozsef Csicsvari**, Center for Molecular and Behavioral Neuroscience, Rutgers University - Newark
"Multichannel Recording Methods in the Hippocampus: Study of Local Field Potential and Multiple Unit Activities"

October 22 **Frances S. Chance**, Center for Neural Science, New York University
"Gain Modulation through Background Synaptic Input"

November 5	**Glen Atlas**, Department of Anesthesiology, University of Medicine and Dentistry of New Jersey – Newark *"An Empirical Model of Aortic Blood Flow Based Upon Esophageal Doppler Monitor Parameters"*
November 12	**David Rumschitzki**, Department of Chemical Engineering, City College of New York *"Water and Macromolecular Transport and Accumulation in Rat Cardiac Valve Leaflets"*
November 19	**William Hunter**, Department of Biomedical Engineering, New Jersey Institute of Technology *"Elastic Constitutive Laws Based on Orthogonal Modes of Stress"*
November 26	**Bruce Bukiet**, Department of Mathematical Sciences, New Jersey Institute of Technology *"Mathematical Modelling of Flow in the Lungs"*
December 3	**Anna Georgieva**, Preclinical Safety Modeling and Simulation Group, Novartis *"Mathematical Modeling of Inhibitors of the EGF/VEGF Receptor-Activated Signaling Pathways"*
December 10	**Alan M. Weinstein**, M.D., Departments of Medicine and Physiology, Cornell University Weill Medical College *"Assessing Homeostatic Properties of Epithelial Cell Models"*
January 28	**Cyrill Muratov**, Department of Mathematical Sciences, New Jersey Institute of Technology *"Traveling Waves in Autocrine Relays"*
January 28	**Amitabha Bose**, Department of Mathematical Sciences, New Jersey Institute of Technology *"Maintaining Phase between Neuronal Oscillators using Synaptic Depression"*
February 25	**Catherine E. Myers**, Department of Psychology, Rutgers University-Newark *"Understanding Human Memory Disorders:Insights from Computational Modeling"*
March 4	**Dean C. Bottino**, Physiome Sciences, Princeton, New Jersey *"Spontaneous Symmetry-Breaking by the Chemoattractant-Sensing Apparatus of Human Neutrophils: A Computational Study"*
March 25	**Ralph Siegel**, Center for Molecular and Behavioral Neuroscience, Rutgers University - Newark *"Illuminating Functional Architectures of Spatial Representation in the Inferior Parietal Lobe in Behaving Monkeys"*
April 1	**Daniel Tranchina**, Department of Biology, Courant Institute of Mathematical Sciences,and Center for Neural Sciences, NYU *"Reproducibility of the Single-Photon Response of Retinal Rods: Testing Theories by Detailed Stochastic Modeling of Underlying Biochemical Mechanisms"*

April 8	**Andrew LeBeau**, Physiome Sciences, Princeton, New Jersey *"Improving Drug Discovery and Development through Modeling and Simulation"*
April 15	**Christian Habeck**, Cognitive Neuroscience Division, Sergievsky Center, Columbia University *"Overview of Functional Neuroimaging"*
April 24	**Richard Bertram**, Department of Mathematics, Florida State University *"Glycolytic Origin of Complex Bursting in Pancreatic Islets"*
April 29	**Frank Tobin**, Scientific Computing and Mathematical Modeling Group, GlaxoSmithKline *"Challenges in Very Large Pathway Modeling"*
May 1	**Lili Zheng**, Department of Mechanical Engineering, SUNY Stony Brook (Joint with NJIT/Rutgers-Newark Applied Physics and Biomedical Engineering) "*Pulsating Fluid in Your Brain"*

V. PUBLICATIONS, PRESENTATIONS, AND REPORTS

A. PUBLICATIONS

JOURNAL PUBLICATIONS

Daljit S. Ahluwalia

Surface water waves involving a vertical barrier in the presence of an ice-cover (with A. Chakrabarti and S.R. Manam), International Journal of Engineering Science, Vol. 41, pp. 1145-1162, 2003.

Roman Andrushkiw

Analysis of Malignancy Associated DNA Changes in the Nuclei of Buccal Epithelium in the Pathology of the Thyroid and Mammary Glands (with D.A.Klyushin, Y.I.Petunin, N.V. Boroday, K.P. Galina), Annals New York Academy of Sciences , Vol. 980, pp.1-12, 2002.

Nadine Aubry

Breaking of space-time symmetries in modulated traveling waves (with R. Lima and M. Rahibe), Chaos, Vol. 13, pp. 541-551, 2003.

Feedback control of a flow past a cylinder via transverse motion (with F. Li), Physics of Fluids, Vol. 15, pp. 2163-2176, 2003.

Enhancement of microfluidic mixing using time pulsing (with I. Glasgow), Lab on a Chip, Vol. 3, 114-120, 2003.

John Bechtold

Wrinkling of Spherically Expanding Flames (with Ray Addabbo and Moshe Matalon), Proceedings of the Combustion Institute, Vol. 29, pp. 1527-1535, 2002.

Hydrodynamic theory of premixed flames: effects of stoichiometry, variable transport coefficients and arbitrary reaction orders (with Changrong Cui and Moshe Matalon), Journal of Fluid Mechanics, Vol. 487, pp. 179-210, 2003.

Denis Blackmore

On Exponentially Self-regulating Population Models (with J. Chen), Chaos, Solitons & Fractals, Vol. 14, pp. 1433-1450, 2002.

Fractionation and Segregation of Suspended Particles Using Acoustic and Flow Fields (with N. Aboobaker and J. Meegoda), ASCE Journal of Environmental Engineering, Vol. 129, pp. 427-434, 2003.

Michael Booty

Pyrolysis and oxidation of cellulose in a continuous feed and flow reactor: effects of NaCl (with B.I. Park and J.W. Bozzelli), Industrial and Engineering Chemistry Research, Vol. 41, pp. 3526-3539, 2002.

Amitabha Bose

Short-term synaptic dynamics promote phase maintenance in multi-phasic rhythms, Neurocomputing, Vols. 52-54, pp. 79-87, 2003.

Aloknath Chakrabarti

Surface water waves involving a vertical barrier in the presence of an ice-cover (with D.S. Ahluwalia and S.R. Manam), International Journal of Engineering Science, Vol. 41 pp. 1145-1162, 2003.

Solution of a logarithmic singular integral equation (with S.R. Manam), Applied Math. Letters, Vol. 16, pp. 369-373, 2003.

Scattering of surface water waves involving a vertical barrier with a gap (with S.R. Manam and S. Banerjea), Journal of Engineering Mathematics, Vol. 45, pp. 183-194, 2003.

Cameron Connell

Theory of Strain Relaxation in Heteroepitaxial Systems (with A.C. Schindler, M.F. Gyure, G.D. Simms, D.D. Vvedensky, R.E. Caflisch, and E. Luo) Physical Review B, Vol. 67, pp. 075316-1--075316-14, 2003

Christopher Elmer

A Variant of Newton's Method for the Computation of Traveling Waves of Bistable Differential-Difference Equations (with Erik Van Vleck), Journal of Dynamics and Differential Equations, Vol. 14, pp. 493-517, 2002.

Existence of Monotone Traveling Fronts for BDF Discretizations of Bistable Reaction-Diffusion Equations (with Erik Van Vleck), Journal of Dynamics of Continuous, Discrete and Impulsive Systems, Vol. 10A, pp. 389-402, 2003.

Anisotropy, Propagation Failure, and Wave Speedup in Traveling Waves of Discretizations of a Nagumo PDE (with Erik Van Vleck), Journal of Computational Physics, Vol. 185, pp. 562-582, 2003.

Thomas Erneux

Stable microwave oscillations due to external-cavity-mode beating in laser diodes subject to optical feedback (with A. Gavrielides and M. Sciamanna), Physical Review A, Vol. 66, pp. 033809-1—033809-6, 2002.

Stability and rupture of bifurcation bridges in semiconductor lasers subject to optical feedback (with B. Heageman, K. Engelborghs, D. Roose, and D. Pieroux), Physical Review E, Vol. 66, pp. 046216-1—046216-11, 2002.

On rate equations for vertical-cavity surface-emitting lasers (with G. Van der Sande, J. Danckaert, and I. Veretennicoff), Physical Review A, Vol. 67, pp. 013809-1—013809-7, 2003.

Vladislav V. Goldberg

A class of four-dimensional warped products (with F. Defever, R. Deszcz, M. Glogowska, and L. Verstraelen), Demonstratio Mathematica, Vol. 35, pp. 853-864, 2002.

Duality principle and its application for construction of varieties with degenerate Gauss maps (with M. A. Akivis), Webs and Quasigroups, Tver Gos. Univ., Tver', pp. 34-45, 2002.

Jorge Golowasch

Failure of averaging in the construction of conductance-based neuron models (with M.S. Goldman, L.F. Abbott, and E. Marder), Journal of Neurophysiology, Vol. 87, pp. 1129-1131, 2002.

Roy H. Goodman

Stopping Light on a Defect (with R. E. Slusher and M. I. Weinstein), Journal of the Optical Society of America B, Vol. 19, pp. 1635-1652, 2002.

Lou Kondic

Instabilities in the flow of thin liquid films, SIAM Review, Vol. 45, pp. 95-115, 2003.

Segregation by friction (with S.G.K. Tennakoon, B. Painter, R. Hartley, and R. P. Behringer), Europhysics Letters, Vol. 61, pp. 742-748, 2003.

Simulations of thin liquid films and drops in higher dimensions (with J. Diez), Journal of Computational Physics, Vol. 183, pp. 274-306, 2002.

Flow of thin films on patterned surfaces (with J. Diez), Colloids and Surfaces A, Vol. 214, pp. 1-11, 2002.

Instabilities in the Flow of Thin Films (with J. Diez), International Journal of Heat and Technology, Vol. 21, pp. 31-37, 2003.

Gregory A. Kriegsmann

Electromagnetic Propagation in Periodic Porous Structures, Wave Motion, Vol. 36, pp. 452-472, 2002.

Microwave Heating of Laminate Panels (with Burt Tilley), Journal of Engineering Mathematics, Vol. 44, pp. 173-198, 2002.

Scattering Matrix Analysis of a Photonic Fabry-Resonator, Wave Motion, Vol. 37, pp. 43-61, 2003.

Jay Meegoda

Immobilization Technologies, ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management (with A. S. Ezeldin, H. Y. Fang, and H. I. Inyang), Vol. 7, pp. 46-58, 2003.

Fractionation and Segregation of suspended particles using acoustic and flow fields (with N. Aboobaker and D. Blackmore), ASCE Journal of Environmental Engineering, Vol. 129, pp. 427-434, 2003.

Robert M. Miura

Clustering in Small Networks of Excitatory Neurons with Heterogeneous Coupling Strengths (with Y.-X. Li and Y.-Q. Wang), Journal of Computational Neuroscience, Vol. 14, pp. 139-159, 2003.

Spermine modulates neuronal excitability and NMDA receptors in juvenile gerbil auditory thalamus (with I. Ran and E. Puil), Hearing Research, Vol. 176, pp. 65-79, 2003.

Resonances and noise in a stochastic Hindmarsh-Rose model of thalamic neurons (with S. Reinker and E. Puil), Bulletin of Mathematical Biology, Vol. 65, pp. 641-663, 2003.

Heat-induced stretching of a glass tube under tension: Application to glass microelectrodes (with H. Huang, W.P. Ireland, and E. Puil), SIAM Journal on Applied Mathematics, Vol. 63, pp. 1499-1519, 2003.

Cyrill Muratov

Modeling and computational analysis of EGF receptor-mediated cell communication in Drosophila oogenesis (with S. Y. Shvartsman and D. A. Lauffenburger), Development, Vol. 129, pp. 2577-2589, 2002.

Theory of domain patterns in systems with long-range interactions of Coulomb type, Physical Review E, Vol. 66, pp. 066108-1 -- 066108-25, 2002.

Transitions in the model of epithelial patterning (with S. Y. Shvartsman and M. Pribyl), Developmental Dynamics, Vol. 226, pp. 155-159, 2003.

Long-range signal transmission in autocrine relays (with S. Y. Shvartsman), Biophysical Journal, Vol. 84, pp. 1883-1896, 2003.

Discrete models of autocrine cell communication in epithelial layers (with S. Y. Shvartsman), Biophysical Journal, Vol. 84, pp. 3624-3635, 2003.

D.T. Papageorgiou

Fully nonlinear gravity-capillary solitary waves in a two-fluid system of finite depth (with L.L. Barannyk), Journal of Engineering Mathematics, Vol. 42, pp. 321-339, 2002.

Chaotic flows in pulsating cylindrical tubes: A class of exact solutions of the Navier-Stokes equations (with M.G. Blyth and P. Hall), Journal of Fluid Mechanics, Vol. 481, pp. 187-213, 2002.

The effect of electric fields on the rupture of thin viscous films by van der Waals forces (with K. Savettaseranee, P.G. Petropoulos, and B.S. Tilley), Physics of Fluids, Vol. 15, pp. 641-652, 2003.

Hydrodynamics of surface tension dominated flows. Book chapter in “Interfacial Phenomena and the Marangoni Effect”, CISM Courses and Lectures, Volume 428, International Centre for Mechanical Sciences, Springer, Wien, New York, pp. 41-88, 2003.

An experimental investigation of the convective instability in a jet (with A. Chauhan, C. Maldarelli, and D.S. Rumschitzki), Chemical Engineering Science, Vol. 58, pp. 2421, 2003.

Peter G. Petropoulos

The effect of electric fields on the rupture of thin viscous films by van der Waals forces (with K. Savettaseranee, D. T. Papageorgiou, and B. S. Tilley), Physic of Fluids, Vol. 15, pp. 641-652, 2003.

An analytical study of the discrete perfectly matched layer for the time-domain Maxwell equations in cylindrical coordinates, IEEE Transaction on Antennas and Propagation, Vol. 51, pp. 785-790, 2003.

Marianito Rodrigo

Evolution of Bounding Functions for the Solution of the KPP-Fisher Equation in Bounded Domains, Studies in Applied Mathematics, Vol. 110, pp. 49-61, 2003.

Michael Siegel

Effects of small surface tension in Hele-Shaw multifinger dynamics: an analytical and numerical study (with E. Paune and J. Casademunt), Physical Review E, 66, pp. 046205-1 – 046205-13, 2002.

Jean-Marc Vanden-Broeck

Exponential asymptotics and capillary waves (with S.J. Chapman), SIAM Journal of Applied Mathematics, Vol. 62, pp. 1872-1898, 2002.

Breaking and merging of liquid sheets and filaments (with J.B. Keller and P. Milewski), Journal of Engineering Mathematics, Vol. 42, pp. 283-290, 2002.

Generalised critical flows (with F. Dias), Journal of Engineering Mathematics, Vol. 42, pp. 291-301, 2002.

Steady two-layer flows over an obstacle (with F. Dias), Philosophical Transactions of the Royal Society, Series A, Vol. 360, pp. 2137-2154, 2002.

Waves and singularities in nonlinear capillary free surface flows (with S. Tooley), Journal of Engineering Mathematics, Vol. 43, pp. 89-99, 2002.

Nonlinear two and three dimensional free surface flows due to moving disturbances (with E. Parau), European Journal of Mechanics B/Fluids, Vol. 21, pp. 643-656, 2002.

On internal fronts (with F. Dias), Journal of Fluid Mechanics, Vol. 479, pp. 145-154, 2003.

A note on withdrawal from a fluid a finite depth through a point sink (with G.C. Hocking and L.K. Forbes), ANZIAM Journal, Vol. 44, pp. 181-191, 2002.

PROCEEDINGS PUBLICATIONS

Roman Andrushkiw

Statistical Tests for Comparing Two Probabilities with Application to Cancer Risk Analysis (with D.A Klyushin, Yu.I. Petunin, and M.Yu. Savkina), Proceedings of the International Conference on Mathematics and Engineering Techniques in Medicine and Biological Sciences, pp.165-169, 2002.

Diagnosis of Breast Cancer by the Modified Nearest Neighbor Recognition Method (with D.A Klyushin., Yu.I. Petunin, V.Lysyuk, and N.V. Boroday), Proceedings of the International Conference on Mathematics and Engineering Techniques in Medicine and Biological Sciences, pp.176-180, 2002.

Analysis of Mechanoemission Curves for Water and Sodium Chloride Solutions (with V.E Orel, D.A Klyushin., and Yu.I. Petunin), Proceedings of the International Conference on Mathematics and Engineering Techniques in Medicine and Biological Sciences, pp.170-175, 2002.

John Bechtold

Extinction of Near-stoichiometric Premixed Flames in a Strained Flow Field, (with Eliana Antoniou and Moshe Matalon), Proceedings of the Third Joint Meeting of the U.S. sections of The Combustion Institute, Chicago, IL, pp. 1-6, 2003.

Denis Blackmore

Interaction of shocks and weak vorticity fields (with L. Ting), Proceedings of Fifth World Congress on Computational Mathematics, Web Publ., Vienna, Austria, July, 2002. Online at http://wccm.tuwien.ac.at./proceedings/ for download of CD of proceedings (ISBN 3-9501554-0-6).

Hamiltonian analysis of vortex filaments, Proceedings of Fourth International Conference on Nonlinear Mechanics, Shanghai, China, Vol. 1, pp. 221-225, Aug., 2002.

Analysis of slender vortex filaments (with L. Ting), Proceedings of Fourth International Conference on Nonlinear Mechanics, Shanghai, China, Vol. 1, pp. 105-115, Aug. 2002.

Quantum coherent transform of Lax integrable Hamiltonian systems: quantum computing (with U. Taneri and A. Prykarpatsky), Proceedings of SCI 2002, Orlando, FL, Vol. 2, pp. 346-354, 2002.

On a class of factorized operator dynamical systems and their integrability (with R. Basiura, A. Prykarpatsky, and O. Soroka), Proceedings of SCI 2002, Orlando, FL, Vol. 3, pp. 234-240, 2002.

Daniel Goldman

Modeling the effect of biophysical parameters on mass transport in capillary networks, Second Joint IEEE Engineering in Medicine and Biology Society/Biomedical Engineering Society Conference, Houston, TX, pp. 1515-1516, 2002.

An experiment-based model of oxygen transport in capillary networks under normal and septic conditions (with R. Bateman and C. Ellis), Second Joint IEEE Engineering in Medicine and Biology Society/Biomedical Engineering Society Conference, Houston, TX, pp. 1517-1518, 2002.

Simulations of capillary network oxygen transport during transient ischemia in the presence and absence of tissue myoglobin, Advances in Experimental Medicine and Biology, Vol. 510, pp. 355-359, 2003.

Lou Kondic

Dynamics of Sheared Granular Materials (with B. Utter and R. P. Behringer), Proceedings of the Sixth Microgravity Fluids Physics and Transport Phenomena Conference, pp. 453-475, 2002.

Jay Meegoda

Detection of Segregation in Asphalt Pavement Materials using the ARAN Profile System (with G. M. Rowe, A. A. Jumikis, M. J. Sharrock, N. Bandara, and H. Hettiarachchi), Pavement Evaluation 2002 Conference, Roanoke, Virginia.

Laboratory Information Management System (with C. Tang, M. McDonald and T. Boucher), Proceedings of Transportation Research Board 2003 annual meeting, Washington DC, January 2003 (CD ROM).

Detection of Segregation using laser (with G. M. Rowe, A. A. Jumikis, N. Bandara, C. H. Hettiarachchi, and N. Gephart), Proceedings of Transportation Research Board 2003 annual meeting, Washington DC, January 2003 (CD ROM).

Demetrios T. Papageorgiou

Chaotic flows in pulsating cylindrical tubes: A class of exact Navier-Stokes solutions (with M. Blyth and P. Hall), Proceedings of the International Conference on Mathematical Analysis and Its Applications, National Technical University, Athens, Greece, pp. 287-297, 2003.

B. PRESENTATIONS

Roman Andrushkiw

May 2003: Fourth International Conference on Dynamical Systems and Applications, Atlanta, GA
Equations of Interface Dynamics for Quasi-Stationary Stefan Problems

June 2003: International Conference on Mathematical Engineering Techniques in Medicine and Biological Sciences, Las Vegas, NV
Stratification of General Populations and Its Application in the Analysis of Resistant Tumor Cells

June 2003: International Conference on Mathematical Engineering Techniques in Medicine and Biological Sciences, Las Vegas, NV
Construction of the Bulk of General Population in the Case of Exchangeable Sample Values

Nadine Aubry

July 2002: 2002 ASME Joint US-European Fluids Engineering Division Summer Meeting, Montreal, Quebec, Canada
Optimal Control of Vortex Shedding by Electro-Magnetic Field

September 2002: Industrial Advisory Board Meeting for the New Jersey Center for Micro-Flow Control, NJIT, Newark, NJ
Introduction and Brief Overview of the Center

October 2002: Mechanical Engineering Gathering Alumni Event, NJIT, Newark, NJ
Vision to promote excellence in education and research

November 2002: 2002 ASME International Mechanical Engineering Congress, New Orleans, Louisiana
Direct Simulation of Electrorheological Suspensions Subjected to Spatially Nonuniform Electric Field

December 2002: Peer Review for the New Jersey Center for Micro-Flow Control, NJIT, Newark, NJ
New Jersey Center for Micro-Flow Control

March 2003: The Department of Mechanical Engineering Presentation to Alstom Power, Windsor, CT
Vision to promote excellence in education and research

May 2003: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT (Plenary Speaker)
Electro-Manipulation of Particles in Fluidic Devices

June 2003: Ecole Polytechnique de l'Universite' de Nantes, Nantes, France
Some progress in micro-fluidic devices

Oleh Baran

July 2002: Granular & Granular-Fluid Flow, Gordon Research Conference, Plymouth, NH
Bulk motion of granular matter in an agitated cylindrical bed

November 2002: Colloquium at the Department of Mathematical Sciences, NJIT, Newark, NJ
Numerical simulations of granular matter in an agitated cylindrical bed

John Bechtold

September 2002: 25th Anniversary Conference: Department of Engineering Science and Applied Mathematics, Northwestern University, Evanston, IL
Wrinkling of Spherically Expanding Flames

March 2003: Proceedings of the Third Joint Meeting of the U.S. Sections of The Combustion Institute, Chicago, IL
Extinction of Near-Stoichiometric Premixed Flames in a Strained Flow Field

Manish Bhattacharjee

December 2002: Annual General Meeting, Calcutta Statistical Association, Calcutta, India
Alternative Perspectives in Modeling the Sex Ratio

December 2002: Colloquium, Theoretical Statistics and Mathematics Unit
Indian Statistical Institute, Calcutta, India
The Fine Structure of the Time to Extinction in Branching Processes

Denis Blackmore

July 2002: Fifth World Congress on Comp. Mech., Vienna, Austria
Interaction of Shocks and Weak Vorticity Fields

Aug. 2002: Fourth International Conference on Nonlinear Mechanics, Shanghai, China
Hamiltonian Analysis of Vortex Filaments

May 2003: NSF CARGO Grantees Conference, Santa Rosa, CA
Accuracy and Stability of Swept Volume Representations

May 2003: SIAM Snowbird Conference on Dynamical Systems, Snowbird, UT
Periodic Motion of Coaxial Vortex Ring Configurations

June 2003: Second MIT Conference on Fluid and Solid Mechanics, MIT, Boston, MA
Vorticity Field - Shock Interaction

Michael Booty

June 2003: First Joint Meeting of CAIMS and SIAM and 2003 SIAM Annual Meeting, Montreal QC, Canada
Microwave Heating of a Fiber in a Cavity

Amitabha Bose

May 2003: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
Phase maintenance in neuronal networks

April 2003: Center for Neural Sciences, New York University, New York, NY
Phase maintenance and depressing synapses

March 2003: Mathematical Biosciences Institute, Ohio State University
Synchronization in globally inhibitory networks

January 2003: Mathematical Biology Seminar, New Jersey Institute of Technology
Maintaining phase between neuronal oscillators using synaptic depression

October 2002: Mathematical Biosciences Institute, Ohio State University
Maintaining phase between neuronal oscillators using synaptic depression

October 2002: Mostly Biomathematics Lunchtime Seminar, New York University,
Maintaining phase between neuronal oscillators using synaptic depression

Bruce Bukiet

July 2002: SIAM 50th Anniversary and Annual Meeting, Philadelphia, PA
Mathematical Modeling of Baseball

July 2002: SIAM 50th Anniversary and Annual Meeting, Philadelphia, PA
Modeling Stresses and Strains in the Human Heart (with H. Chaudhry, A. B. Ritter, and R. Arora)

April 2003: American Physical Society, April Meeting, Philadelphia, PA
An Event to Encourage High School Students to Pursue College Degrees in Physics and Math

March 2003: 52nd Annual Meeting of the Pennsylvania Council of Teachers of Mathematics, Lake Harmony, PA
Mathematical Magic Tricks and Why they Work

October 2002: AMTNJ 2002 Annual Two-Day Meeting, Somerset, NJ
Inspiring your Students to Want to Learn Math

Aloknath Chakrabarti

January 2003: J.B. Keller Workshop on Applied Mathematics at the University of Stanford, Palo Alto, CA
Weakly singular Integral Equations in Water Wave Scattering
(with D.S. Ahluwalia and S.R. Manam)

January 2003: J.B. Keller Workshop on Applied Mathematics at the University of Stanford: Palo Alto, CA
Diffraction by a lossy half-plane (with D.S. Ahluwalia)

March 2003: Seminar at New Jersey Institute of Technology,
Weakly singular Integral Equations in Water Wave Scattering

Cameron Connell

March 2003: American Physical Society March Meeting, Austin, TX
An Atomistic Model of the Elastic Field of a Surface Step

Sunil K. Dhar

April 2003: The Seventeenth New England Statistics Symposium,
Department of Statistics, University of Connecticut
On the Characterization of a Bivariate Geometric Distribution

Rose Dios

November 2002: Midwest Conference on Combinatorics, Southern Illinois University at Carbondale
(1) *Cryptography and Computing*
(2) *Further Investigations of Balanced Arrays of Strength 6* (with D.Chopra)

Christopher Elmer

November 2002: Kansas Center for Advanced Scientific Computing, Department of Chemistry, University of Kansas
Bistable Differential-Difference Reaction Diffusion Equations: Dynamics and Applications

February 2003: SIAM Conference on Computational Science and Engineering (CSE03)
Hyatt Regency Islandia Hotel and Marina, San Diego, CA
Solving Differential-Difference Equations and Their Application to Crystalline Growth

May 2003: SIAM Conference on Applications of Dynamical Systems (DS03), Snowbird Ski and Summer Resort, Snowbird, UT
Coupled FitzHugh-Nagumo Equations

Thomas Erneux

September 2002: Northwestern University, Chicago, IL
Delay differential equations modelling lasers subject to optical feedback

April 2003: Workshop on "Multiscale Systems and Applications", Berlin
Strongly pulsating oscillations for lasers subject to optical feedback

May 2003: SIAM conference on "Applications of Dynamical Systems", Snowbird, UT
Bifurcation bridges in lasers subject to optical feedback

June 2003: IAP Doctoral School, Les RiÃ¨zes et les Sarts
Laser dynamics: the point of view of the theoretical physicist

Vladislav V. Goldberg

July 2002: First Joint Meeting of the American Mathematical Society and Italian Mathematical Union, Pisa, Italy
Webs and Partial Differential Equations

September 2002: Colloquium of the Department of Mathematical Sciences, Binghamton University (SUNY at Binghamton), Binghamton, NY
Algebraic Aspects of Web Geometry

September 2002: Colloquium of the Department of Mathematical Sciences, Binghamton University (SUNY at Binghamton), Binghamton, NY
Web Geometry: Past, Present, and Future

October 2002: Colloquium of Dipartimento di Modeli Matematici per le Scienze Applicate, University of Rome, Rome, Italy
Algebraic Aspects of Web Geometry

October 2002: Seminario Matematico di Messina, University of Messina, Messina, Italy
Linearizability Conditions for Four-Webs in the Plane

October 2002: Seminario di Topologia Algebraica e Differenziale, University of Rome, Rome, Italy
Geometry Varieties with Degenerate Gauss Maps

October 2002: Colloquium of Dipartimento di Scienzi Matematiche, University of Trieste, Trieste, Italy
New Developments in Differential Geometry of Varieties with Degenerate Gauss Maps

November 2002: Conference ``Lobachevskii Seminar", Kazan', Russia
(1) *New Developments in the Theory of Varieties with Degenerate Gauss Maps* (with M. A. Akivis)
(2) *Applications of the Duality Principle for Construction of Varieties with Degenerate Gauss Maps* (with M. A. Akivis)

March 2003: Geometrie des tissus et equations differentielles, Luminy, France
Linearizability Criterion for a d-Web in the Plane with Applications

May 2003: Nagoya University, Nagoya, Japan
Linearizability Criterion for a d-Web in the Plane with Applications

May 2003: The Workshop ``Webs and Projective Differential Geometry'', Shimane University, Matsue, Japan
Differential Geometry of Varieties with Degenerate Gauss Maps

May 2003: The Geometry Colloquium of Department of Mathematics, Hokkaido University, Sapporo, Japan
Linearizability Criterion for a d-Web in the Plane with Applications

June 2003: International Conference ``Kolmogorov and Contemporary Mathematics'', Russian Academy of Sciences and Moscow State University, Moscow, Russia
Linearizability Criterion for a d-Web in the Plane (with M. A. Akivis and V. V. Lychagin)

Daniel Goldman

August 2002: International Society on Oxygen Transport to Tissue, Manchester, UK
Simulations of the effect of oxy-myoglobin binding kinetics on capillary network oxygen transport under time-varying flow conditions

October 2002: Biomedical Engineering Society/IEEE Engineering in Medicine and Biology Society, Houston, TX
(1) *Modeling the effect of biophysical parameters on mass transport in capillary networks*
(2) *An experiment-based model of oxygen transport in capillary networks under normal and septic conditions*

March 2003: Northeast Bioengineering Conference, Newark, NJ
Computational modeling of drug delivery by microvascular networks

April 2003: Experimental Biology/Microcirculatory Society, San Diego, CA
Calculations of septic capillary and tissue oxygen distributions for varying type and degree of microvascular injury

April 2003: Biomedical Engineering Department, New Jersey Institute of Technology
Results on oxygen delivery and utilization during sepsis obtained using a computational model

Jorge Golowasch

October 2002: The 6th New Jersey Symposium on Biomaterials Science, New Jersey Center for Biomaterials. NJIT, Rutgers University and UMDNJ
(1) *Plasticity and stability in the adult nervous system*
(2) *Growth and survival of grafted and primary adult neurons cultures*

November 2002: Soc Neurosci Abs., 67.21, Orlando, FL
Characterization of pyloric rhythm recovery following decentralization in the crab, Cancer borealis

November 2002: Soc Neurosci Abs., 312.7, Orlando, FL
Determination of voltage-gated ion current distributions from single point current- and voltage-clamp measurements

November 2002: Soc Neurosci Abs., 312.6, Orlando, FL
Space clamp errors revisited: leak subtraction errors due to the non-linearity of the leak current

November 2002: Annual Biomedical Research Conference for Minority Students (ABRCMS), New Orleans, LA
Growth and Survival of Grafted and Primary Adult Neuron Culture

March 2003: 29th Annual East Coast Nerve Net Meeting, Woods Hole, MA
(1) *Effects of neuromodulators on crab neuron survival*
(2) *Effect of Paxilline on ionic currents in crab STG neurons*

April 2003: NYU Center for Neural Science, Computational Neuroscience Forum, NYC
Homeostasis of neuronal network activity

April 2003: Rutgers University Provost Day, Newark, NJ
Dynamic stability: Cellular processes to stabilize flexible neuronal networks

Roy H. Goodman

July 2002: SIAM Annual Meeting, Minisymposium on Recent Advances in Mathematical Modeling for Optical Fiber Communications, Philadelphia, PA
Trapping Light with Fiber Defects

October 2002: Mathematics Colloquium, Department of Mathematics, Southern Methodist University, Dallas, TX
Trapping Light: Numerical Experiments and ODE Models

May 2003: SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
Resonance and Capture of Sine Gordon Solitons

David Horntrop

February 2003: SIAM Computational Science and Engineering, San Diego, CA
Spectral Schemes for Stochastic Partial Differential Equations

Lou Kondic

July 2002: The SIAM General Meeting, Philadelphia, PA
Coalescence of liquid drops

August 2002: Department of Physics, University National del Centro, Buenos Aires, Argentina
Instabilities, pattern formation, and Topological Changes in Flow of Thin Liquid Films

August 2002: Institute of Physics, University National del Centro, Tandil, Argentina
Instabilities, pattern formation, and Topological Changes in Flow of Thin Liquid Films

August 2002: The Sixth Microgravity Fluids Physics and Transport Phenomena Conference, Cleveland, OH
Dynamics of Sheared Granular Materials

November 2002: American Physical Society-Division of Fluid Dynamics Annual Meeting, Dallas, TX
(1) *Computer Simulations of Force Propagation in Sheared Granular Materials*
(2) *Contact line instability and thickness profiles of spreading films*
(3) *Flow of Sheared Granular Materials*

March 2003: University of Delaware, Department of Mathematics, Newark, DE
Contact line instabilities of thin liquid films

May 2003: 89th Statistical Mechanics Conference, Rutgers University, New Brunswick, NJ
Extended temperature for dense granular materials

May 2003: Levich Institute of CUNY, New York, NY
Contact line instabilities of thin liquid films

Gregory A. Kriegsmann

July 2002: NSF-CBMS Regional Conference in Mathematical Sciences, Colorado School of Mines, Golden, CO
A S-Matrix Based Hybrid Method

September 2002: Third World Congress on Microwave and R.F. Processing, Sydney, Australia
Mathematical Heating of Silicon Wafers in Cylindrical TM Cavities: A Mathematical Model

November 2002: Department of Theoretical and Applied Mathematics, University of Illinois at Urbana Champaign, Urbana, IL
Microwave Heating of Materials: A Mathematical Overview

February 2003: Department of Mathematics, Bringham Young University, Provo, UT
Scattering Matrix Analysis of a Phonic Fabry-Resonator

May 2003: Department of Mathematics, University of Delaware, Newark, DE
Scattering Matrix Analysis of a Phonic Fabry-Resonator

June 2003: 5th Dublin Differential Equations Conference, Dublin, Ireland
Pattern formation in Microwave Heated Ceramics

Dawn Lott

January 2003: AMS Session on Statistics and Numerics, Joint Mathematics Meeting, Baltimore, Maryland
On the use of infinite elements for the determination of optimal closure patterns based on stress analysis

February 2003: MAA Session on Computational Mathematics in Linear Algebra and Differential Equations, Joint Mathematics Meeting, Baltimore, MD
Effective and efficient numerical techniques for the calculation of the quantity of calcium species during calcium sparks in heart muscle

February 2003: Distinguished Minority Lecture Series, Northwestern University, Evanston, IL
Effective and efficient numerical techniques for the calculation of the quantity of calcium species during calcium sparks in heart muscle

February 2003: Colloquim series of the United States Naval Academy, Annapolis, MD
Effective and efficient numerical techniques for the calculation of the quantity of calcium species during calcium sparks in heart muscle

Jonathan Luke

July 2002: SIAM 50th Anniversary Annual Meeting, PA
(1) *Stratification of a Sedimenting Suspension*
(2) *A Method for Simulating Heating in a Microwave Cavity*

Zoi-Heleni Michalopoulou

July 2002: The First International Conference on Inverse Problems: Modeling and Simulation, Fethiye, Turkey
Tabu for source location and geoacoustic inversion (with Urmi Ghosh-Dastidar)

December 2002: 144th Meeting of the Acoustical Society of America, Cancun, Mexico
Tabu optimization for matched-field inversion (with Urmi Ghosh-Dastidar)

March 2003: Department of Mathematics, William Paterson University, Wayne, NJ
Women's History Month Talk: *Tracking whales and finding submarines in the ocean*

March 2003: Women in technology leadership awards, NJIT, NJ
Applied Mathematics in Action

April 2003: 145th Meeting of the Acoustical Society of America, Nashville, TN
Gibbs sampling for multipath arrival time estimation in an uncertain environment
(with Michele Picarelli)

Jay Meegoda

May 2003: PANY/NJ, NJ
Detection of Segregation in Asphalt Pavement Materials using the ARAN Profile System

March 2003: Rutgers Paving Conference, Edison, NJ
Detection of Segregation in Asphalt Pavement Materials using the ARAN Profile System

October 2002: NJSAT Dinner meeting, Jamestown, NJ
Detection of Segregation in Asphalt Pavement Materials using the ARAN Profile System

November 2002: Asphalt User/Producer Group meeting, Newport Beach, RI
Detection of Segregation in Asphalt Pavement Materials using the ARAN Profile System

Robert M. Miura

August 2002: International Congress of Mathematicians, Beijing, China
Spatial Buffering: Mathematical Model and Computer Simulation (presented by H. Huang)

August 2002: Department of Mathematics, City University of Hong Kong, Kowloon, Hong Kong
(1) *Solitons and the Inverse Scattering Method: An Historical View*
(2) *Some Nonlinear Differential Equation Problems from Biomedical Applications*

November 2002: Society for Neuroscience 32nd Annual Meeting, Orlando, FL
Determination of Nonuniform Distributions of Ion Channels in Multiple Compartment Models
(with A. Bose, J. Golowasch, F. Nadim, and M.R. Rodrigo)

January 2003: JBK80, Workshop on Applied Mathematics - Future Directions, Stanford University, Palo Alto, CA
Dispersal of Ions in the Brain-Cell Microenvironment
(with Y.-Q. Wang)

June 2003: Department of Mathematical Sciences, NJIT
Solitons and the Inverse Scattering Method: An Historical View

Cyrill Muratov

July 2002: SIAM 50th Annual Meeting, Philadelphia, PA
(1) *Modeling and computational analysis of spatially distributed feedback loops in Drosophila oogenesis*
(2) *A quantitative approximation scheme for the traveling wave solutions in the Hodgkin-Huxley model*

November 2002: Workshop ``Invasion Phenomena in Biology and Ecology'', Institute Henri Poincare, Paris, France
Waves and patterns by autocrine cells in epithelial layers

November 2002: Conference on ``Dynamics of Patterns in Reaction-Diffusion Systems and Related Topics'', Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan
Free boundary problem and its applications to reaction-diffusion systems of activator-inhibitor type

March 2003: Conference on ``Mathematical understanding of complex patterns in the life sciences, Lorentz Center, Leiden, The Netherlands
An asymptotic study of the inductive pattern formation mechanism in Drosophila egg development

Farzan Nadim

July 2002: 3rd Forum of European Neuroscience, Paris, France
Short-Term Synaptic Depression Promotes Phase Maintenance In Oscillatory Networks

July 2002: Computational Neuroscience Meeting, Chicago, IL
Short-Term Synaptic Dynamics Promote Phase Maintenance In Multi-Phasic Rhythms

October 2002: Mathematical Association of America, New Jersey Section, Fairleigh Dickinson University, Madison, NJ
Coordination of multiple rhythmic activities in the nervous system

October 2002: Mathematical Biosciences Research Institute, Ohio State University, Columbus, OH
Synaptic depression mediates bistability in neuronal networks with recurrent inhibitory connectivity

November 2002: Society for Neuroscience Annual Meeting, Orlando, FL
(1) *Target Specific Synaptic Dynamics From A Single Neuron*
(2) *Effects of Proctolin on the LP to PD synapse in the crab Cancer borealis*
(3) *Distinct Synaptic Dynamics By The Pacemaker Neurons Of A Rhythmic Neuronal Network*
(4) *Space Clamp Errors Revisited: Leak Subtraction Errors Due To The Non-linearity Of The Leak Current*
(5) *Determination Of Voltage-Gated Ion Current Distributions From Single-Point Current- And Voltage-Clamp Measurements*

December 2002: NSF-IGERT Neuromechanics Program, Case Western Reserve University, Cleveland, OH
Synaptic Dynamics Give Rise to Bistability in Recurrent Neuronal Oscillators

December 2002: Department of Biology Colloquium, Case Western Reserve University, Cleveland, OH
Synaptic Dynamics in Rhythmic Motor Systems

January 2003: Zlotowski Center for Neuroscience, Ben-Gurion University, Beer-Sheva, Israel
Synaptic Dynamics in Rhythmic Motor Systems

February 2003: Department of Mathematics Colloquium, Gustavus Adolphus College, MN
Synaptic dynamics and bistability in neuronal oscillators

February 2003: Department of Physiology and Biophysics, Mount Sinai School of Medicine, New York, NY
Synaptic Dynamics in Rhythmic Motor Systems

April 2003: East Coast Nerve Net Meeting, Woods Hole, MA
(1) *The strength and timing of feedback are dynamically changed for rhythm stabilization*
(2) *Uber-Claws: Automatic Phase Analysis of the STG Pyloric Rhythm*

Demetrios T. Papageorgiou

July 2002: SIAM 50th Anniversary Annual Meeting, July 8-12, 2002, Philadelphia, PA
Weakly nonlinear stability of two-phase core-annular flows in the presence of surfactants (with Said Kas-Danouche (speaker) and Michael Siegel).

July 2002: Department of Mathematics, Imperial College of Science, Technology and Medicine Fluid Dynamics Seminar, London, United Kingdom
Bubble motion in surfactant solutions

September 2002: Department of Chemical Engineering, University of Florida, Gainesville, FL
Dynamics and breakup of liquid jets

November 2002: 55th Annual Meeting, American Physical Society, Division of Fluid Dynamics, Dallas, TX
Numerical simulations of the drag coefficient as a function of bulk concentration of rising bubbles in the stagnant cap regime (with R. Palaparthi and C. Maldarelli.)

November 2002: 55th Annual Meeting, American Physical Society, Division of Fluid Dynamics, Dallas, TX
(1) *Large amplitude capillary waves in electrified fluid sheets* (with J.-M. Vanden-Broeck)
(2) *Three-dimensional fully nonlinear interfacial long waves in a bounded two-fluid system* (with L. Barannyk (speaker))
(3) *The effect of electric fields on the rupture of thin viscous films by van der Waals forces* (with K. Savettaseranee, P.G. Petropoulos, and B.S. Tilley)

March 2003: Applied Mathematics Colloquium. School of Mathematics, University of East Anglia, Norwich, England
Bubble motion in surfactant solutions

Peter G. Petropoulos

August 2002: NASA Langley Research Center (ICASE), Hampton, VA
On the long-time behavior of unsplit perfectly matched layers

August 2002: Projets Estime Ondes Otto, INRIA-Rocquencourt, France
Some recent results on unsplit PML for electromagnetics

January 2003: AFOSR Annual Electromagnetics Workshop, San Antonio, TX
On the long-time behavior of unsplit perfectly matched layers

April 2003: "Analytical and Computational Methods in Electromagnetics," Spring Eastern Sectional Meeting of the American Mathematical Society, Courant Institute of Mathematical Sciences, NY
On the long-time behavior of unsplit perfectly matched layers

June 2003: Department of Mathematics, University of Crete, Heraklion, Greece
Absorbing Layer Boundary Conditions for the Numerical Solution of the Time-Dependent Maxwell Equations in Open Domains

Christopher S. Raymond

September 2002: Mathematical Biology Seminar, NJIT
Mathematical Modeling for Immunocolloid Labeling

Anthony D. Rosato

December 2002: Materials Research Society, Boston, MA
Dynamical Behavior of an Intruder in a Granular Couette Flow

August 2002: London Mathematical Society Workshop on Particle Size Segregation, Lancaster, UK
Dynamical Behavior of an Intruder in Boundary Driven Granular Flows

May 2003: NASA-Glen Research Center Workshop on Fine Particles, Cleveland, OH
Direct Numerical Simulation of Fine Particle Flows

Michael Siegel

July 2002: SIAM Annual Meeting, Philadelphia, PA
Evolution of Material Surfaces for Highly Aniostropic Surface Energy

August 2002: NIRT Annual Meeting: Formation and Self Assembly of Quantum Dots, Northwestern University, Evanston, IL
Evolution of Material Surfaces for Highly Aniostropic Surface Energy

September 2002: Fluid Dynamics Seminar, NJIT
Singular Solutions and Ill-posedness for the Muskat Problem

November 2002: APS Division of Fluid Dynamics Annual Meeting, Dallas, TX
Singular Solutions and Ill-posedness for the Muskat Problem

November 2002 Seminar, Department of Physics, University of Barcelona, Barcelona, Spain
Evolution of Material Voids for Highly Aniostropic Surface Energy

January 2003
Applied Mathematics Seminar, UCLA, Los Angeles, CA
Evolution of Material Surfaces for Highly Aniostropic Surface Energy

February 2003: Mathematics Colloquium, NJIT
Evolution of Material Surfaces for Highly Aniostropic Surface Energy

Thomas Spencer

November 2002: INFORMS Annual Conference, San Jose, CA
Renewal Approach to Waiting Times for Exchangeable Events

Jean-Marc Vanden-Broeck

September 2002: University of East Anglia, UK
Generalised fronts and related free surface flows

November 2002: NJIT Fluid Dynamics Seminar
Two layer flows: solitary waves and generalised fronts

November 2002: APS Division of Fluid Dynamics, Dallas, TX
(1) *Large amplitude capillary waves in electrified fluid sheets*
(2) *Internal fronts and two-layer flows*

January 2003: JBK80, Stanford, Palo Alto, CA
Nonlinear waves and fronts at the interface between two fluids

January 2003: Tuck's Symposium, Adelaide, Australia
Nonlinear free surface flows

April 2003: British Applied Mathematics Collquium, Southampton, UK
(1) *Stewartson's memorial lecture: Nonlinear waves and generalised fronts propagating at the interface between two fluids*
(2) *Electrostatic models of protein aggregation*
(3) *The effect of an uneven bottom on the free surface flow under a sluice gate*

May 2003: Workshop on interfacial waves, Loughborough, UK
Nonlinear interfacial waves

C. TECHNICAL REPORTS

REPORT 0203-1: Vladislav V. Goldberg
4-webs in the plane and their linearizability

REPORT 0203-2: Vladislav V. Goldberg
Maximum rank webs are not necessarily almost Grassmannizable.

REPORT 0203-3: Christopher E. Elmer and Erik S. Van Vleck
Anisotropy, propagation failure, and wave speedup in traveling waves of discretizations of a Nagumo PDE

REPORT 0203-4: Dmitri A. Klyushin, Yuri I. Petunin, Roman I. Andrushkiw, Natalya V. Boroday, and Karelia P. Ganina
Cancer diagnostic method based on pattern recognition of DNA changes in buccal epithelium in the pathology of the thyroid and mammary glands

REPORT 0203-5: D. A. Lott and H. R. Chaudhry
On the use of infinite elements for the determination of optimal closure patterns based on stress analysis

REPORT 0203-6: K. Savettaseranee, D. T. Papageorgiou, P. G. Petropoulos, and B. S. Tilley
The effect of electric fields on the rupture of thin viscous films by van der Waals forces.

REPORT 0203-7: E. Becache, P. G. Petropoulos, and S. D. Gedney
On the long-time behavior of unsplit perfectly matched layers

REPORT 0203-8: L. Kondic
Instabilities in gravity driven flow of thin fluid films

REPORT 0203-9: L. Kondic and J. A. Diez
Computing three dimensional thin film flows including contact lines.

REPORT 0203-10: Sunil K. Dhar and Srinivasan Balaji
On the characterization of a bivariate geometric distribution

REPORT 0203-11: Steve Kunec and Amitabha Bose
High-frequency, depressing inhibition facilitates synchronization in globally inhibitory networks

REPORT 0203-12: C. B. Muratov and S. Y. Shvartsman
An analytical study of the inductive pattern formation mechanism in Drosophila egg development

REPORT 0203-13: David Stickler
A shallow water ocean acoustics inverse problem

REPORT 0203-14: Yair Manor, Amitabha Bose, Victoria Booth, and Farzan Nadim
The contribution of synaptic depression to phase maintenance in a model rhythmic network

REPORT 0203-15: Akira Mamiya, Yair Manor, and Farzan Nadim
Short-term dynamics of a mixed chemical and electrical synapse in a rhythmic network

REPORT 0203-16: Michal Pribyl, Cyrill Muratov, and Stanislav Shvartsman
Discrete models of autocrine cell communication in epithelial layers

REPORT 0203-17: Cameron Connell and Russel E. Caflisch
Atomistic theory of elasticity for thin epitaxial films

REPORT 0203-18: A. C. Schindler, M. F. Gyure, G. D. Simms, D. D. Vvedensky, R. E. Caflisch, C. Connell, and Erding Luo
Theory of strain relaxation in epitaxial growth

REPORT 0203-19: Cameron R. Connell, Russel E. Caflisch, Erding Luo, and Geoff Simms
A discrete elastic model for epitaxial systems and the force field at a step

REPORT 0203-20: Sunil K. Dhar and Varun Oberoi
How random is "random"?

REPORT 0203-21: Jason A. Luther, Alice A. Robie, John Yarotsky, Christopher Reina, Eve Marder, and Jorge Golowasch
Episodic bouts of activity accompany recovery of rhythmic output by a neuromodulator and activity deprived adult neural network

REPORT 0203-22: Adrien E. Desjardins , Yue-Xian Li, Stefan Reinker, Robert M. Miura, and Richard S. Neuman
The influences of I_h on temporal summation in hippocampal CA1 pyramidal neurons: a modeling study

REPORT 0203-23: Stefan Reinker, Ernest Puil, and Robert M. Miura
Membrane resonance and stochastic resonance modulate firing patterns of thalamocortical neurons

REPORT 0203-24: Marianito Rodrigo, Christopher Elmer, and Robert M. Miura
A construction technique for heteroclinic solutions to continuous and differential-difference damped wave equations

REPORT 0203-25: Yue-Xian Li, Yuqing Wang, and Robert M. Miura
Clustering in small networks of excitatory neurons with heterogeneous coupling strengths

REPORT 0203-26: Huaxiong Huang, Robert M. Miura, William P. Ireland, and Ernest Puil
Heat-induced stretching of a glass tube under tension: applications to glass microelectrodes

REPORT 0203-27: Israeli Ran, Robert M. Miura, and Ernest Puil
Spermine modulates neuronal excitability and NMDA receptors in juvenile gerbil auditory thalamus

REPORT 0203-28: David Bernstein, Kyriacos C. Mouskos, and John Tavantzis
Implementation of the barrier method to the variational inequality (VI) parking spatial price equilibrium problem

REPORT 0203-29: Aloknath Chakrabarti, Daljit S. Ahluwalia, and S.R. Manam
A note on surface water waves for finite depth in the presence of an ice-cover

REPORT 0203-30: Aloknath Chakrabarti, Daljit S. Ahluwalia, and S.R. Manam
Role of weakly singular integral equations in surface water wave scattering

VI. EXTERNAL ACTIVITIES AND AWARDS

Daljit S. Ahluwalia

Board of Overseers Award for Public and Institute Service, received on October 9, 2002.

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

Roman Andrushkiw

Associate Editor, Proceedings of International Conference on Math. & Eng. Techniques in Medicine and Biological Sciences (METMBS'02).

Member, Program Committee METMBS'02.

Nadine Aubry

Member of the selection paper committee, 2004 International Congress for Theoretical and Applied Mechanics, Warsaw, Poland.

National Science Foundation (NSF) panel for Graduate Fellowship Program (GRP) (Mechanical and Aeronautical Engineering Panel), Member, Arlington, VA, February, 2002.

Member-at-large (one of seven), US National Committee on Theoretical and Applied Mechanics (USNC/TAM), November 1, 2001 -Present (appointment by the Chair of the National Research Council).

Denis Blackmore

Editorial Board, ACS Journal of Chemical Information and Computer Sciences.

Served on NSF Panel.

Reviewed monograph in quantum optics for World Scientific Publ.

Amitabha Bose

Organized a minisymposium at SIAM Conference on Applications of Dynamical Systems (DS03), entitled: Techniques of Neural Computing: Exploiting Changes in Synaptic Input, Snowbird Ski and Summer Resort, Snowbird, UT.

Bruce Bukiet

Significant media attention for Mathematical Modeling of Baseball and for Gambling Related Mathematics:

"Going to bat for logic" by Paul Mulshine, in Sunday Star-Ledger, Dec.8, 2002, Perspective section p. 3.

Article in National Post, "Don't put money on betting model" by Joe O'Connor, August 2, 2002, (http://www.nationalpost.com/search/site/story.asp?id=CB243D99-8453-4FB2-AAB2-57E0CE99151B).

Live 4 minute TV interview on CNN Headlines about the mathematical modeling of baseball, July 24, 2002.

Christopher E. Elmer

Organized a minisymposium at SIAM Conference on Applications of Dynamical Systems (DS03), dynamical systems entitled: Models for Nerve Axons: Modeling, Analysis, and Computation, Snowbird Ski and Summer Resort, Snowbird, UT.

Invited participant in the New Directions Short Course on Cellular Physiology, June 16-27, 2003 at the Institute for Mathematics and its Applications, Minnesota.

Vladislav V. Goldberg

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

Editorial Board Member, Rendiconti del Seminario Matematico di Messina (elected in March 2002).

Vladislav V. Goldberg and Maks A. Akivis (Jerusalem Institute of Technology, Israel) were nominated for Lobachevskii Medal by NJIT and Jerusalem Institute of Technology.

Vladislav V. Goldberg was awarded twice by German Mathematical Society and Mathematical Research Institute Oberwolfach to participate in the program Research in Pairs: with Maks A. Akivis (Jerusalem Institute of Technology, Israel) and Valentin V. Lychagin, University of Tromsoe, Norway.

Gregory A. Kriegsmann

1992- Editorial Board, Journal of Engineering Mathematics.

1994- Editorial Board, SIAM Journal on Applied Mathematics.

1996- Editorial Board, I.M.A. Journal of Applied Mathematics.

1997- Editorial Board, Analysis and Applications.

2000- Editorial Board, Wave Motion.

2002- Vice President of Publications, SIAM Journal on Applied Mathematics.

Dawn Alisha Lott

Vice-Chair of Speakers, Mathematical Association of America (MAA).

Graduate Selection Committee, Enhancing Diversity through Graduate Education (EDGE).

Jay Meegoda

Editorial Board member ASTM Geotechnical Testing Journal

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

ASCE North Jersey Section, Chairperson of Geotechnical Group- organized a successful dinner seminar/ Converse Lecture (April 2002).

Member of Millburn Environmental Commission, Township of Millburn, NJ.

Zoi-Heleni Michalopoulou

Senior Member IEEE, June 2002.

Fellow of the Acoustical Society of America, December 2002.

Cyrill Muratov

Co-organizer, Minisymposium entitled "Mechanisms and modeling of cell-cell communication", SIAM 50th Annual Meeting, Philadelphia, PA, July 2002.

Robert M. Miura

Scientific Nominating Committee, Fields Institute for the Mathematical Sciences, Toronto, Canada (since 2003).

Scientific Advisory Panel, Fields Institute for the Mathematical Sciences, Toronto, Canada (since 2002).

Co-Editor-in-Chief, Analysis and Applications (World Scientific, publisher) (since 2000).

Editorial Board, Integrative Neuroscience (World Scientific, publisher) (since 1999).

Editorial Board, Canadian Applied Mathematics Quarterly (since 1991).

Organizer, Third Pacific Rim Conference on Mathematics, Vancouver, B.C., Canada, 2004 (since 2001).

Theme Leader, BioMedical Theme, Mathematics of Information Technology and Complex Systems (MITACS), Networks of Centres of Excellence, Canada (1998-2002).

Research Management Committee, MITACS (1998-2002).

Synge Committee, Canadian Mathematical Society, (1999-2002).

Farzan Nadim

Cycle Director, Stomatogastric Nervous System Cycle, Neural Systems and Behavior Course, Marine Biological Laboratory, Woods Hole, MA.

Demetrios T. Papageorgiou

Associate Editor of the SIAM Journal on Applied Mathematics.

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

Harlan J. Perlis Award for Research, New Jersey Institute of Technology.

Peter G. Petropoulos

Visiting Scientist, ICASE, NASA Langley Research Center, Hampton, VA (July-August 2002).

Anthony D. Rosato

Editorial Board Member: International Journal of Nonlinear Science and Numerical Simulation.

Associate Editor: Mechanics Research Communications.

Michael Siegel

Member, Doctoral Defense Committee for E. Paune, University of Barcelona, Barcelona, Spain.

Thomas Spencer

Appointed to the INFORMS Strategic Planning Committee for 2003.

Reappointed for a second year by the INFORMS board to be the Chair of the 2004 Edelman Prize Committee.

Active member of the INFORMS Practice Conference Advisory Council; Received several recognition certificates from INFORMS for this effort.

Member Board of Advisors for the INFORMS journal Interfaces.

Jean-Marc Vanden-Broeck

Stewartson's memorial lecture, Southampton, April 2003.

Editorial Board member, The Quarterly Journal of Mechanics and Applied Mathematics.

Editorial Board Member, The ANZIAM Journal.

Guest Editor, Journal of Engineering Mathematics, Special issue on Free Boundary Problems.

Institute Awards Ceremony on October 9, 2002:

Board of Overseers Award for Public and Institute Service

Daljit S. Ahluwalia, Ph.D., (left) chair of the department of mathematical sciences at the New Jersey Institute of Technology (NJIT), Newark, recently received the Board of Overseers Award for Public & Institute Services at NJIT's University Awards ceremony. Daljit S. Ahluwalia of **Pearl River, NY** pictured with Robert Altenkirch, NJIT President (center) and William C. Van Buskirk, NJIT Provost (right) received this in honor of his contribution in building a nationally recognized mathematics department at NJIT.

Harlen J. Perlis Award for Research

Demetrius Papageorgiou, Ph.D., (left) Professor of Mathematical Sciences at the New Jersey Insitute of Technology (NJIT), Newark, recently received the Harlem J. Perlis Award for Research at NJIT's University Awards ceremony. Demetrius Papageorgiou of **Brooklyn, NY** pictured with Robert Altenkirch, NJIT President (center) and William C. Van Buskirk, NJIT Provost (right) was selected for work that advances the state of the art in his field and furthers scientific investigation.

CSLA Awards Ceremony on May 9, 2003:

On May 9, 2003, CSLA held its 20th Anniversary Banquet and Awards Ceremony. Several awardees were affiliated with CAMS.

Gregory A. Kriegsmann was honored for his contribution to Graduate Education. In the photo below, Dr. Kriegsmann (right) receives the award from Haimin Wang.

Robin Tannenbaum (BS in Mathematics, NJIT, and now with IBM) received the Outstanding NJIT Alumni Award for an Undergraduate Student (in photo below, Robin is shown with Daljit S. Ahluwalia).

John Pelesko received his Ph.D. in Mathematical Sciences at NJIT, and is now with the faculty at the University of Delaware. He received the Outstanding Alumni Award for a Graduate Student. John (left) is shown in the photo below with Daljit S. Ahluwalia.

Padma Gulati was honored with the Outstanding CSLA Staff Award for her invaluable contributions to the Department of Mathematical Sciences and CSLA (in the photo below, Padma is shown with William Skawinski).

Miao Li (lower left photo) receiving her award from Nancy Coppola (right), and Lyudmyla Barannyk (lower right photo) receiving her award from Eliza Michalopoulou (right), were recognized as outstanding undergraduate and graduate students, respectively. Miao and Lyudmyla are students in the Department of Mathematical Sciences.

Dean Mill Jonakait (in photo below) congratulating our awardees

VII. FUNDED RESEARCH

A. EXTERNALLY FUNDED RESEARCH

CONTINUING FUNDED PROJECTS

1. *Asymptotic and Singular Perturbation Methods for Bifurcation Problems with Applications*

   National Science Foundation: August 1, 1999 - February 28, 2003
   Thomas Erneux

2. *An Experiment-Based Computational Study of Blood Flow and Transport During Sepsis*

   The Whitaker Foundation: September 1, 2001 - August 30, 2004
   Daniel Goldman

3. *Activity-Dependent Regulation of Ionic Currents*

   National Institute of Mental Health: December 2001 - November 2006
   Jorge Golowasch

4. *Gravity and Granular Materials*

   NASA: March 1, 2000 - October 30, 2003
   Lou Kondic
   Robert Behringer

5. *Instabilities in the Flow of Thin Liquid Films*

   National Science Foundation: February 1, 2002 - January 31, 2005.
   Lou Kondic

6. *Microwave Processing of Ceramic Materials*

   National Science Foundation-Mathematical Sciences Division: August 2000 - January 2004
   Gregory A. Kriegsmann

7. *Applied Mathematical Problems in Microwave Processing*

   Department of Energy: Office of Scientific Computing: August 2001 - July 2003
   Gregory A. Kriegsmann

8. *Computational Electromagnetic Methods in Microwave Material Processing*

   National Science Foundation: August 1, 1998 - July 31, 2003
   Jonathan Luke

9. *Efficient Shallow Water Matched Field Inversion*

   ONR: January 1, 2002 - September 30, 2004
   Zoi-Heleni Michalopoulou

10. *Graduate Traineeship Award: Detection and Localization in the Ocean in the Presence of Coherence Loss Mechanisms*

ONR: October 1, 2000 - September 30, 2003
Zoi-Heleni Michalopoulou
Urmi Ghosh-Dastidar

11. *Regulation of Neuronal Oscillations by Synaptic Dynamics*

National Institute of Mental Health: December 1, 2000 - November 30, 2005
Farzan Nadim

12. *Hydrodynamics of Bubble Motion and Oscillatory Flows*

National Science Foundation: June 1, 2000 - August 31, 2003
Demetrios Papageorgiou

13. *Numerical Modeling of Electromagnetic Wave Propagation and Scattering: High-Order Schemes, Impedance Boundary Conditions and Cole-Cole Dielectrics*

Air Force Office of Scientific Research: January 1, 2002 - January 1, 2005
Peter G. Petropoulos

14. *Analysis and Numerical Computations of Moving Boundaries in Fluid Dynamics and Materials Science*

National Science Foundation: July 23, 2001 - July 31, 2004
Michael Siegel

PROJECTS FUNDED DURING PRESENT ACADEMIC YEAR

1. *Differential Difference Equations*

National Science Foundation: July 15, 2002 - June 30, 2004
Christopher Elmer

2. *Homeostatic Regulation of Ion Currents and Neuronal Net*

NIH: July 1, 2002 - November 30, 2002
Jorge Golowasch

3. *Pulse Propagation and Capture in Bragg Grating Optical Fibers*

National Science Foundation: July 1, 2002 - June 30, 2005
Roy Goodman

4. *Mesoscopic Modeling and Simulation Monte Carlo Methods*

University of Massachusetts/ National Science Foundation:
September 1, 2002 - August 31, 2005
David J. Horntrop

5. *Collaborative Research: Modeling and Computational Analysis of Cell Communication in Drosophila Ogenesis*

National Science Foundation: August 14, 2002 - July 31, 2005
Cyrill Muratov

6. *Mechanisms of Dose and State Dependence of Neuromodulation*

U.S.-Israel Sci Foundation: September 1, 2002 - August 31, 2003
Farzan Nadim

7. *RCN: The Pyloric Model Group*

Ohio State University/National Science Foundation: May 15, 2002 - April 30, 2003
Farzan Nadim

8. *Transport and Heterogeneity in Surface-Volume Reactions*

University of Wisconsin/NIH: September 1, 2002 - August 31, 2007
Christopher Raymond

9. *Numerical Investigations of Three and Two Dimensional Free Boundary Problems*

National Science Foundation: August 1, 2002 - July 31, 2005
Jean-Marc Vanden-Broeck

B. PROPOSED RESEARCH

PROJECTS PROPOSED DURING PRESENT ACADEMIC YEAR

1. *Scientific Computing Research Environments for the Mathematical Sciences*

National Science Foundation: July 1, 2003 - June 30, 2005
Daljit S. Ahluwalia (PI)
Michael Siegel (Co-PI)
David Horntrop
Peter Petropoulos
Cameron Connell
Christopher Raymond
Zoi-Heleni Michalopoulou

2. *Computer-Aided Cytospectrophotometric Method of Cancer Diagnosis*

United States Civilian Research & Development Foundation (CRDF):
September 2003 - December 2004
R. Andrushkiw
Yu.I. Petunin
S. Haque
J. Norris
D. Klyushin
N. Boroday

3. *Nonlinear Flame Dynamics: Effect of Mixture Composition*

National Science Foundation: July 1, 2003 - June 30, 2006
John Bechtold

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

National Science Foundation: Aug. 1, 2003 - July 31, 2005
Denis Blackmore
Ming Leu
William Regli
Wei Sun

5. *Biocomplexity in Salt Marshes*

National Science Foundation: Sept. 1, 2003 - Aug. 31, 2007
Michael Levandowsky
Denis Blackmore
Gabory Benoit
Max Haggblom

6. *Segregation of Particles by Fluid Flow and Acoustic Fields*

National Science Foundation: July 1, 2003 - June 30, 2005
Jay Meegoda
Denis Blackmore

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

National Science Foundation: July 1, 2003 - June 30, 2006
Amitabha Bose
Victoria Booth

8. *Study of Optimal Travel Speed Limits for Shared Traffic*

NJ - DOT: Nov. 2002 - Oct. 2003
Hal Deutschmann
Bruce Bukiet

9. *Asymptotic and Singular Perturbation Methods for Bifurcation Problems with Applications*

National Science Foundation:
Thomas Erneux

10. *Linearizability Conditions for Webs and Their Applications in Thermodynamics and Economics*

National Science Foundation: July 1, 2003 - June 30, 2005
Vladislav Goldberg

11. *Inverse and Control Problems for Studying Physiological Transport*

National Science Foundation: September 1, 2003 - August 30, 2006
Daniel Goldman

12. *Mesoscopic Modeling and Simulation for Surface Processes*

National Science Foundation: July 1, 2003 - June 30, 2006
David J. Horntrop

13. *Some Open Problems in the Flow of Thin Liquid Films with Contact Lines*

National Science Foundation: July 1, 2003 - June 30, 2006.
Lou Kondic

14. *Establishment of Linked Ph.D. Programs*

Council for International exchange of scholars
Javier Diez
Lou Kondic

15. *Three-Dimensional Infinite Elements Applied to Optimal Closure Patterns in Hyperelastic Skin*

National Science Foundation: July 1, 2003 - June 30, 2006
Dawn A. Lott

16. *Analysis of Continuous and Discrete Models for Nonlinear Waves in Dissipative Media*

National Science Foundation: June 2003 - May 2006
Robert M. Miura
Marianito Rodrigo

17. *Modelling and Analysis of Spreading Cortical Depression*

National Science Foundation: July 2003 - June 2006
Robert M. Miura

18. *Gravity-Free Phase Segregation of Liquid Mixtures*

NASA Fluid Physics Program: October 2003 - September 2007
Demetrios T. Papageorgiou
Roberto Mauri

C. EXTERNALLY FUNDED PROJECTS -- NOT THROUGH CAMS

1. *New Jersey Center for Micro-Flow Control*

NJ Commission on Science and Technology: December 1, 2000 - November 30, 2005
N. Aubry
E. Geskin
Y. Kevrekidis
B. Khusid
P. Singh
S. Sundaresan
S. Mitra
D. Hahn

2. Ultra-Filtration of In-Service Fluids

US Navy: May 2001 - April 2003
N. Aubry
B. Khusid

3. *Laboratory for Electro-Hydrodynamics*

W. M. Keck Foundation: January 2000 - January 2005
N. Aubry
B. Khusid
A. Acrivos

4. *Application of Modern Differential Geometric Methods in Economics Problems*

U.S. Civilian Research and Development Foundation (CRDF):
September 1, 2003 - August 31, 2005
Vladislav Goldberg
Samvel Harutyunyan, Armenian State Pedagogical University, Yerevan, Armenia

5. *The Pyloric Model Group: Functional Analysis of a Complex, Distributed Biological Neural Network*

National Science Foundation: May 1, 2001 - April 30, 2006
Scott Hooper
Ron Harris-Warrick
Jorge Golowasch
Eve Marder
Farzan Nadim
Michael P. Nusbaum

6. *New Jersey Consortium for Biological Physics*

New Jersey Commission on Science and Technology, R&D Excellence Program: November 2002 - October 2007
William Bialek
Curtis Callan
Boris Shraiman
Jorge Golowasch

7. *Investigation of Subsurface Contamination and Effectiveness of Remediation Technologies Using Geotechnical Centrifuge Techniques*

Research Grant Council of Hong Kong: January 2000 - June 2003
I. M. C. Lo
J. N. Meegoda

8. *Research, Development, Demonstration and Validation of Intelligent Systems for Conveyance and Storage Infrastructure*

U.S. Army Environmental Center: May 2001 - December 2002
T. Juliano
J. Meegoda

9. Correlation of Surface Texture, Segregation, and Measurement of Air Voids

New Jersey Department of Transportation: January 2001- August 2002
Jay Meegoda
G. Rowe

10. Corrugated Steel Culvert Pipe Deterioration

New Jersey Department of Transportation: January 2003 - December 2004
J. Meegoda
T. Juliano

11. Modeling of Cerebral Aneurysms: Integration of Computer Simulations, Biophysical Properties, and Clinical Behavior

Doris Duke Foundation: July 1, 2003
Charles Prestigiacomo
Michael Siegel
Demetrious Papageorgiou
Hans Chaudhry
John Federici
Thomas Findley

VIII. COMMITTEE REPORTS AND ANNUAL LABORATORY REPORT

A. READING ROOM by Marianito Rodrigo and Christopher Raymond

During this academic year, the CAMS Reading Room continued to function as a place where faculty members and graduate students could interact in an informal setting. To this end, afternoon teas were organized by C. Raymond and M. Rodrigo with the help of the graduate students. Tea time was scheduled three times a week (Tuesdays, Thursdays, and Fridays) and occasionally during special seminars on Mondays and Wednesdays. We are pleased to report that they were well attended, both by CAMS members and by graduate students.

This year we also had the honor of having Prof. Dudley Herschbach, the 1986 Nobel Laureate in Chemistry, as one of our distinguished guests during tea time. He was visiting NJIT on May 9 on the occasion of the 20th anniversary of the College of Science and Liberal Arts.

Dr. Robert M. Miura and Dr. Dudley Herschbach

B. COMMITTEE REPORTS

SEMINAR COMMITTEE REPORT by Daniel Goldman

In 2002-2003, the Colloquium Committee Members were Daniel Goldman and Thomas Spencer. The 2002-2003 Department of Mathematical Sciences and CAMS Colloquium Series was a successful and popular event. This year our seminar schedule was further expanded to include a Fluid Mechanics series (Demetrios Papageorgiou and Nadine Aubry), as well as an Applied Mathematics series (Goldman), a Statistics series (Spencer), and a Mathematical Biology series (Robert Miura). The lectures, delivered by well-known mathematicians and engineers from academia and industry, covered a variety of fields including materials science, fluid mechanics, neuroscience, stock derivatives, and numerical analysis.

A number of the colloquia were jointly sponsored with other departments: seven with Mechanical Engineering, two with Biomedical Engineering, two with Chemical Engineering, and one with the Joint NJIT-Rutgers Applied Physics Program.

PUBLICATIONS COMMITTEE REPORT by Lou Kondic

The Publications Committee is involved with production and distribution of CAMS Technical Report Series, and with production of CAMS Annual Report.

Starting this year, our Technical Reports joined the electronic age. The full text of all reports is available at CAMS webpage in PDF format. Therefore, the reports are publicly available to everybody (both inside and outside of NJIT) interested to learn about the research performed by the members of the Center. A total of 27 reports have been produced this year, and we expect that the number will grow as the CAMS members get accustomed to the new format and submission requirements. In special cases, and with the approval of the CAMS Director, hard copies of the reports can still be produced (subject to the availability of funds).

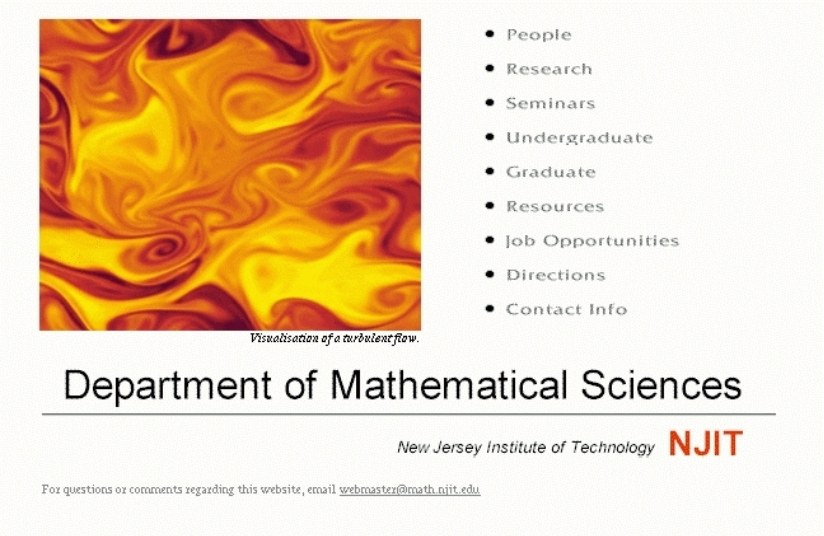
The CAMS Annual Report is available both electronically, and in paper version. This document presents a detailed overview of the activities in CAMS, and this year also includes a short overview of numerous prestigious awards to CAMS members. The committee thanks Susan Sutton, Departmental Administrative Assistant, for her capable support that made production of this document possible.

WEB COMMITTEE REPORT by Peter Petropoulos and Cyrill Muratov

The web committee, composed of Cyrill Muratov and Peter Petropoulos, is responsible for the maintenance of the DMS and CAMS web pages, as well as for new content that DMS/CAMS decide to make available to the public.

The main activity in the maintenance of the web site is the continuous updating of information on the department's web pages. Typically, various technical problems with the files submitted to the committee by others, must be fixed in order for them to appear properly on the web. Also, updated versions of syllabi and course-related materials are being posted on a day-to-day basis.

In the beginning of the 2002-2003 Academic Year, the Committee undertook a major redesign of the Department's main web page, as well as of the internal structure of the entire site. The new front page (below) offers an appealing modern look that reflects the spirit of research and teaching dedication of the faculty, staff, and graduate students at DMS/CAMS. The new internal structure of the web site also has motivated the staff to effect changes to the site's content.



During the month of April, with the help of Robert Miura, all the web pages related to the Undergraduate program were updated. They now reflect up to date information on the degrees offered by the Department. A substantial part of the undergraduate pages have been redesigned. Currently, the Committee is engaged in the revision of the web content related to the Graduate Program in collaboration with the Director of Graduate Studies, D. T. Papageorgiou.

Other day-to-day duties of the committee include: a) updating the graduate pages by posting the current degree brochures, past qualifying exams, as well as course information, b) keeping a

record of past DMS/CAMS-sponsored seminars by archiving the past seminar pages and making them available in the corresponding sections of the web pages, c) posting the new CAMS technical reports as they become available on the publications web pages, and d) helping faculty resolve their web-related problems.

C. ANNUAL LABORATORY REPORT

STATISTICAL CONSULTING LABORATORY by Sunil K. Dhar

The Mathematical Sciences statistics faculty serves the NJIT community and outside individuals and organizations as statistical consultants. Here are examples of a few of them.

Date: Wednesday, April 30, 2003
Client: Professor Farzan Nadim, Dr. Jorge Golowasch, and Ph.D. student Latha Nambiar
Description: Showed how to determine the common sample size based on the power of the two-sample test, population variances, and true population mean difference.
Consultant: Sunil K. Dhar

Date: Thursday, February 20, 2003
Client: Dr. Dawn Hall Apgar, Director of the Developmental Disabilities at the Center for Architecture and Building Science Research, and Dr. Paul Lerman
Description: Read material developed by Dr. Paul Lerman on Consumer Competencies and discussed the validity of the statistical design and variable selection for their multivariate model. Also, explored other plausible statistical procedures.
Consultant: Sunil K. Dhar and Thomas Spencer

Date: Wednesday, January 22, 2003
Client: Ph.D. student Jaikrishna Patnaik, working for Professor I. Jy Chien, Transportation Department, New Jersey Institute of Technology
Description: Helped the student carry forward his regression analysis in SAS
Consultant: Ivan Zorych

Date: September 25, 2002
Client: Ph.D. student Thipnakarin Bonfueng, Advisor Lisa Axe, Civil and Environmental Engineering Department
Description: To solve statistics related Ph.D. level problems.
Consultant: Sunil K. Dhar

Date September 11, 2002
Client: Ph.D. student Congzhe Zhang, Advisor Professor Meng Chu Zhou, Electrical and Computer Engineering Department
Description: Consulted him on his research problem on the "cellular industry" and gave him references to help solve it using ideas from "packing problems".
Consultant: Sunil K. Dhar

Date: August 1, 2002
Client: Ph.D. student, Mechanical Engineering, Amit Banerjee
Description: Gave estimators that are better competitors of the maximum likelihood estimators in problems where robustness of the estimator is an important consideration.
Consultant: Sunil K. Dhar

IX. CURRENT AND COLLABORATIVE RESEARCH

A. RESEARCH DESCRIPTIONS

Daljit S. Ahluwalia

The research of Daljit S. Ahluwalia is in the field of applied mathematics, mainly in the areas of asymptotics and wave propagation. Using analytic and asymptotic methods, he has addressed a wide range of phenomena including scattering, diffraction, reflection, guided waves, dispersion and shock waves. Applications of this work include ocean acoustics, water waves, electromagnetics and elastic waves.

Roman Andrushkiw

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

Nadine Aubry

Nadine Aubry's research involves the development of novel, enabling technologies leading to new classes of products through radical flow performance gains via miniaturized actuation. Such gains will result in manipulation of micro- and nano-size objects in suspensions, mixing enhancement, suppression/enhancement of turbulence, suppression of flow-generated noise and vibrations, and thermal management. She is working on the development of computational fluid dynamics software for complex flows, miniaturized flows and flows subjected to actuators, the development of flow control software, the development of miniaturized sensors and actuators with required characteristics, the development of integrated MFC devices and the development of validation techniques for the latter. She is the Director of the New Jersey Center for Micro-Flow Control and is in close collaboration with the following labs: W. M. Keck Laboratory, Electro-hydrodynamics, and Computational Fluid Dynamics.

John Bechtold

The research of John K. Bechtold has focused on the modeling and analysis of physical problems, primarily in the area of theoretical combustion. His studies cover a wide range of topics in both premixed and non-premixed combustion, including stability, ignition, extinction, and complex flame/flow interactions. His current projects include the development of new generalized models of near-stoichiometric flames, stability of expanding and converging flames, and radiation-driven flows in microgravity.

Manish C. Bhattacharjee

The primary focus of the research by Manish C. Bhattacharjee is on applied probability with particular emphasis on reliability theory and corresponding statistical issues arising in stochastic modeling of system performance and degradation. His studies in statistical reliability theory covers the topics of nonparametric classes of survival distributions, their closure properties under formation of systems with similarly aging components, related characterization problems, repairable systems and non-traditional applications of reliability theoretic methods and ideas to other areas such as (i) queueing - in operations research, (ii) branching processes in applied probability, and (iii) modeling economic inequality. His current projects include investigation of

conditions for shape-duality between hazard rate and mean residual life functions, and closure properties of randomly stopped sums with geometric stopping times that arise in many applications, such as in queueing, ruin probability problems in actuarial science, and shock models of failure.

Denis Blackmore

Dynamical systems (nonlinear dynamics) theory is a rich amalgam of techniques from algebra, analysis, chaos theory, differential equations, differential geometry, differential topology, fractals, geometry, singularity theory, and topology, and has important applications in every branch of science and engineering. Denis Blackmore's research is primarily in the theory and applications of dynamical systems and closely related fields. He has studied a plethora of applications in such areas as acoustics, automated assembly, biological populations, computer aided geometric design, fluid mechanics, granular flows, plant growth (phyllotaxis), relativistic and quantum physics, and rough surface analysis. His theoretical work includes fundamental results on solution properties and integrability of differential equations, and analysis of hypersurface singularities. Among his current projects are acoustically generated particle flows, biocomplexity of marshes, competing species dynamics, dynamical models in economics, integrability of infinite-dimensional dynamical systems (PDEs), particle dynamics, phyllotaxis, virtual reality systems, vortex dynamics, and weak shock waves.

Victoria Booth

The research of Victoria Booth is in the area of computational neuroscience focusing on mathematical and biophysical modeling of the electrical firing behavior of neurons and neuronal networks. Her studies in single cell modeling involve the development of models from experimental data, mathematical analysis of cell properties and mechanisms that generate experimentally observed firing patterns, and investigation of pharmacological modulation of cell behaviors. An additional area of her research is in the implementation of optimization schemes for parameter determination in neuronal models. Her network modeling studies involve the development of small scale networks to mathematically analyze the role of cell properties and the synaptic connections among cells in generating observed network behavior. Her current projects include the development of network models of region CA3 in the hippocampus to study the firing patterns of place cells, and modeling the pyloric network in the crab stomatogastric ganglion to investigate properties of its observed rhythmic firing patterns.

Michael Booty

Michael Booty's principal research interests are in mathematical modeling and asymptotic analysis, and most of the applications he has considered are in the area of fluid mechanics and combustion. His main studies in combustion have focused on the time-dependent and multidimensional dynamics of propagating reaction waves in gas mixtures, solid phase mixtures, and porous media analyzed by a combination of multiple scale, stability, and bifurcation techniques. His other studies have included prototype reaction-diffusion models, the dynamics of fast reaction waves, and time-dependent effects in droplet burning. He also has collaborated on experimental studies for conditions that minimize pollutant formation in the thermal oxidation of common materials. His current research interests include time-dependent effects in droplet burning, and collaborative studies on bubble dynamics and slow, localized thermal waves in material processing.

Amitabha Bose

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

Bruce Bukiet

Bruce Bukiet's research concerns mathematical modeling of physical phenomena. He has studied the dynamics of detonation waves, including curved detonations and detonation models of discrete mixtures. He studies biological systems with regard to stresses in the heart. His current focus in biology concerns flow in the lungs with the goal of improving medical treatments. Professor Bukiet also is interested in understanding and optimizing aspects of baseball from a mathematical modeling perspective.

Cameron Connell

Cameron Connell's current interests are in applications of mathematics to materials science. The focus of his work is on the interface between atomistic and continuum methods for modelling materials. This is driven by its fundamental role in the current drive for multiscale modelling of materials. He is particularly interested in applications to the modelling of epitaxial growth of semiconductors and metals.

Sunil K. Dhar

The research focus of Sunil Dhar has been on model building and inference. His ongoing research involves proving existence, computing and developing robust and efficient minimum distance estimators such as L2-distance type, under the following models: linear, AR [k], the additive effects outliers, and the two-sample location model. He also developed functional least squares estimators under the additive effects outliers model. An optimization technique for the general class of sums of absolute multivariate linear functionals has been developed by him. He extended the negative multinomial distribution; this new model has many applications. His ongoing research in multivariate lifetime reliability models involve deriving new multivariate geometric and the generalized discrete analog of Freund's models, with demonstrated applications. Other discrete models developed by him are in the area of models of order k. He has acquired statistical consulting experience.

Rose Dios

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

Christopher E. Elmer

The research of Christopher E. Elmer has focused on developing analytical and numerical solution methods for functional differential equations of mixed type and their application to phase transitions in solids. His studies of spatially discrete reaction-diffusion equations include functional analysis and iterative numerical techniques to demonstrate the solution properties of propagation failure, lattice anisotropy, and step-like interfaces. His studies of solution techniques for general differential-difference equations has led to his development of a relaxation variant of Newton's method and the creation of a collocation code. His current projects include developing a public domain collocation code for solving differential-difference equations, analyzing error due to applying differencing methods to reaction-diffusion equations, analyzing multiple interface solutions to spatially discrete reaction-diffusion equations, analyzing the solutions of the spatially discrete sine-Gordon equation, developing an orthogonal spline collocation tool for studying diffusion induced grain boundary motion in thin films, and modeling crystalline material growth with energy equations which contain a spatially discrete gradient.

Vladislav V. Goldberg

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

Daniel Goldman

The research of Daniel Goldman has focused on the analysis and simulation of nonlinear partial differential equations, the development of numerical methods for PDEs, and the modeling of complex physiological processes. His work on the Ginzburg-Landau equation has involved the characterization of chaotic behavior in one and two spatial dimensions using tools from both turbulence and dynamical systems. His work in numerical analysis has covered operator splitting schemes for dissipative systems and efficient methods for solving reaction-convection-diffusion problems in complex geometries. His work in theoretical and computational biology has studied affinity maturation in the immune system and the relationship between capillary network structure and tissue oxygen delivery. His current projects include improvement of numerical methods for studying time-dependent microvascular transport, investigation of the factors that determine the hemodynamic properties of capillary networks, and modeling of various pathophysiological processes that occur in the microcirculation.

Jorge Golowasch

The research of Jorge Golowasch addresses the general question of how the nervous system manages to remain plastic (capable of changing the properties of its components), while at the same time remaining stable. He studies this question by investigating the properties of voltage-dependent ionic currents after long-term perturbations. He uses both electrophysiological and computational tools to study mechanisms of neuronal plasticity and homeostasis of the ionic currents that determine the excitability and electric activity of neurons and simple neural networks in the crustacean (crab, lobster) stomatogastric nervous system. He also uses computer models to understand how neuronal ionic currents interact to produce activity and how they flow through the intricate branches of a neuronal tree. Additionally, he studies other forms of plasticity and growth regulation in cultured dissociated neurons and long term cultures of entire parts of the nervous system.

Roy Goodman

Roy Goodman's research focuses, broadly, on nonlinear wave phenomena. The tools he uses consist mainly of asymptotic methods, dynamical systems analysis, and numerical simulation. Physical applications he has studied include storm propagation in the atmosphere at middle latitudes and the interaction of light pulses in telecommunications optical fibers. Recently, he has been investigating the interaction of nonlinear waves with localized changes to the media through which they propagate. This includes the enticing possibility of "light trapping" at specified locations in optical fibers, as well as more abstract studies of classical nonlinear wave equations.

David J. Horntrop

The research of David J. Horntrop has focused on the development and numerical simulation of stochastic models of physical phenomena for problems ranging from materials science to fluid dynamics. His studies of turbulent diffusion were based on random field models for the advection of passive scalars and involved asymptotics, stochastic analysis, and the creation of novel wavelet-based Monte Carlo numerical schemes for the simulation of random fields. His current

studies of materials involve the development and use of mesoscopic models to describe surface processes in order to gain insight on the importance of small scale phenomena on the creation of large scale patterns. He is presently developing and validating new spectral methods for the numerical solution of stochastic partial differential equations for these studies.

Lou Kondic

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

Gregory A. Kriegsmann

The research of Gregory A. Kriegsmann has focused on the modeling, analysis, and numerical simulations of physical problems arising in industrial and technological settings. His studies in microwave heating of materials describe the nonlinear interaction between electromagnetic waves and materials, and the effect of cavity geometry. His research on acoustic and electromagnetic scattering theory includes applications to radar, structural acoustics, and acoustics in flows. His studies in circuit theory cover the design and analysis of oscillators and power supplies. His current work is focused on microwave assisted chemical vapor infiltration, thermal patterns in microwave heating experiments, and microwave assisted ceramic sintering.

Dawn A. Lott

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

Jonathan H. C. Luke

The research of Jonathan H. C. Luke has focused on the modeling and analysis of physical problems primarily in the areas of low-Reynolds-number fluid dynamics and wave propagation in complex media. His studies in sedimentation theory cover the topics of velocity fluctuations, renormalization, the method of reflections, cluster dynamics, and variational and numerical methods. His studies of electromagnetic waves in highly dispersive media mainly concern energy deposition and numerical methods. His current projects include analysis of the stability of numerical implementations of no-slip boundary conditions for the Navier-Stokes equations in streamfunction-vorticity form, simulation and analysis of energy deposition from electromagnetic

waves in dispersive materials, and effective boundary conditions for heating and scattering problems in a microwave cavities.

Victor Matveev

The research of Victor Matveev is in the area of computational neuroscience, and is focused primarily on biophysical modeling and numerical simulations of synaptic function and its mechanisms. In his work, Victor Matveev employs analytical methods as well as a variety of computational techniques, from stochastic modeling to numerical solution of partial and ordinary differential equations. Victor Matveev performs most of his work in collaboration with experimental neurophysiologists, and develops models to explain and fit the experimental data. His current projects include the study of the mechanisms of short-term synaptic facilitation and other calcium-dependent processes involved in neurotransmitter secretion, and the modeling of presynaptic calcium diffusion and buffering. To facilitate his research, Victor Matveev also has been working on the development of a software application designed for solving the reaction-diffusion equation arising in the study of intracellular calcium dynamics ("Calcium Calculator").

Jay Meegoda

Jay Meegoda's research can be best described as mechanics of geo-environmental engineering where he utilizes scientific concepts and engineering technologies in real world applications. Under the heading of mechanics of geo-environmental engineering, his research can be further subdivided into five main trust areas: engineering properties of contaminated soils; centrifugal modeling of contaminant transport; micro-mechanics of civil engineering materials; reuse of contaminated soils; and ultrasound research. Micro-mechanic models were used to explain the mechanical behavior of civil engineering materials. He received the best practice paper award in 2001 from the Environmental Multimedia Council of the Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE) for a publication resulting from the above research. Currently, his research is focused on use of a laser to detect segregation in asphalt pavements and development of smart pipes for drinking and waste water distributions.

Zoi-Heleni Michalopoulou

The research of Zoi-Heleni Michalopoulou focuses on inverse problems in underwater acoustics. Currently, new global optimization approaches based on the tabu methodology are being developed for matched-field source localization and geoacoustic inversion. Also, arrival time and amplitude estimation in uncertain environments is pursued via a novel Gibbs sampling scheme.

Petronije Milojevic

The research of P.S. Milojevic is focused on studying semilinear and (strongly) nonlinear operator equations using a combination of topological, approximation, and variational methods and applications to ordinary and partial differential equations. He has developed various fixed point results for condensing and A-proper maps. His studies of semilinear operator equations with monotone and (pseudo) A-proper maps involves nonresonance and resonance problems with Fredholm and hyperbolic like perturbations of singlevalued and multivalued nonlinear maps, and Hammerstein equations. He has widely applied these abstact theories to BVP's for (contingent) ordinary and elliptic PDE's, to periodic and BVP's for semilinear hyperbolic and parabolic equations and to nonlinear integral equations. His study of nonlinear and strongly nonlinear operator equations is concerned with the existence and the number of solutions of such equations involving condensing, monotone and various types of approximation maps. His current research deals with Hammerstein equations and weakly inward A-proper and pseudo A-proper maps and applications to differential and integral equations.

Robert M. Miura

The research of Robert M. Miura covers several areas in mathematical physiology, especially in neuroscience. The techniques used are mathematical modelling, mathematical analysis, approximation methods, and numerical simulations. His research on excitable biological cells, including neurons, cardiac cells, and pancreatic beta-cells, is aimed at understanding electrical effects on cell function and signalling. These studies involve detailed investigations of membrane electrical properties, subthreshold resonance, stochastic resonance, signal propagation on dendrites, and mechanisms leading to bursting electrical activity. His studies on spreading cortical depression, and more generally intercellular communication via ion flows, includes analysis and simulations of partial differential equation models. Diffusion of ions in the brain is studied using the lattice Boltzmann method.

Cyrill B. Muratov

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

Farzan Nadim

Farzan Nadim studies rhythmic motor activity generated in the central nervous system by combining experiments and computational techniques. Nadim has a joint appointment with the Federated Department of Biological Sciences and runs a laboratory that conducts experiments on isolated nervous systems of crustacea. These experiments involve elecrophysiological recordings from multiple nerves and neurons, pharmacological manipulations of the system, and immunohistology. The neuronal circuits studied all produce oscillatory output of various frequencies. The lab also models these systems both at the detailed biophysical level and using analytic mathematical techniques. His current focus is on contribution of synaptic dynamics to network output and the interaction between multiple oscillatory systems.

Demetrios T. Papageorgiou

The research of Demetrios T. Papageorgiou focuses on the modeling, analysis, and computation of physical and technological problems that involve fluid dynamics and aerodynamics. His studies in surface tension driven flows cover the stability, dynamics, and breakup of single and compound liquid jets, both in the presence and absence of surface active agents, which affect interfacial tension. Analysis of finite-time-singularities has been used to motivate experiments for rheological measurements. His studies in bubble dynamics are a theoretical and experimental collaborative research effort to control the drag on rising bubbles using surfactants. Current projects include jet and bubble dynamics, nonlinear stability of core-annular flows when surfactants are present, nonlinear stability of electrified liquid films, and study of viscous flows in pulsating channels or tubes by construction of Navier-Stokes solutions both numerically and analytically with particular emphasis on chaotic regimes and their influence on applications.

Manuel Perez

The research of Manuel Perez is in the areas of heat transfer, drying of porous media, expert systems, medical diagnosis by computer, and mechanical properties of fibrous webs. He is now

working on survival studies of prostate cancer patients, and on evaluating the efficacy of surgical procedures and radiation treatment for various stages of the disease.

Peter G. Petropoulos

The research of Peter G. Petropoulos has focused on the numerical modeling and asymptotic analysis of physical problems in the areas of transient electromagnetic wave propagation in complex media. His studies of pulsed electromagnetic waves in dispersive media mainly concern the asymptotic and numerical methods for studying the response of relaxing (Debye) and fractionally-relaxing (Cole-Cole) dielectrics, as well as the development fourth-order accurate finite difference methods for the time-domain Maxwell equations with discontinuous coefficients. His current projects include analysis of the error in problems where impedance boundary conditions are employed, development of numerical techniques to simulate pulse propagation in Cole-Cole dielectrics, analysis of perfectly matched absorbing boundary conditions in relation to exact absorbing boundary conditions, and the development of fourth-order accurate schemes in the presence of curved boundaries.

Christopher Raymond

The research of Christopher S. Raymond has focused on mathematical modeling and the development of asymptotic, perturbative, and numerical techniques for studying reaction-diffusion systems in which the reactions are confined to the vicinity of either propagating interfaces (applications to combustion, material synthesis, and frontal polymerization) or to portions of the boundary of the domain of interest (biological applications). He is currently concentrating on developing and analyzing mathematical models for immunocolloid labeling, a novel technique for imaging molecular scale features on cell surfaces using electron microscopy.

Marianito Rodrigo

The research of Marianito Rodrigo is on the analysis of nonlinear partial differential equations, in particular, reaction-diffusion systems and nonlinear wave equations. He is also interested in developing methods for finding explicit solutions of these systems. He has also worked on the analysis of some reaction-diffusion systems arising in neurophysiology and population ecology. His current projects include studies on spatially-discrete reaction-diffusion systems and coagulation-diffusion equations of cluster growth.

Michael Siegel

The research of Michael Siegel is focused on the analysis and numerical computation of moving boundary problems that arise in fluid mechanics, materials science, and physiology. His research in fluid dynamics covers singularity formation on interfaces for inviscid and low Reynolds number (Stokes) flow, the dynamics of drops and bubbles (including the influence of surfactant), and effect of small regularization--such as surface tension--on mathematically ill-posed interfacial flow problems. His studies in materials science primarily involve crystal growth and diffusion controlled moving boundary problems. In physiology, he has studied optimal suturing patterns for skin wounds and formulated models for determining the stress and strain distribution in the heart wall that occur due to changes in heart geometry. His current projects include analytical studies of the evolution of slender axisymmetric bubbles with surfactant, pinch off (topological singularities) in slender bubbles, and the singular effects of surface tension in the dynamics of two-finger competition in Hele-Shaw flow.

Thomas Spencer

The research of Thomas Spencer III has focused on the applications of statistics, and operations research to large scale business problems, especially those that arise out of operational issues in call centers. For his work on simulating call centers, he received the Franz Edelman Award in 1993 from the Institute of Operations Research and the Management Sciences. He also has done work on the distributions of waiting times associated with sequences of exchangeable

random variables. In addition he has an active interest in statistics and probability in sports, and the analysis of sports data.

David Stickler

The research of David Stickler has centered on the application of asymptotic and numerical methods to study some basic problems in wave propagation and diffusion. The wave propagation problems have application in electromagnetics, acoustics, and elasticity. They include some problems in inverse scattering. The diffusion problems include work in thermal conduction and thermo-elastic diffusion. In this work, both uniform and non-uniform asymptotic methods have been developed. His current research focuses on the equilibrium configuration of elastic membranes with the emphasis on cylindrically symmetric annular rings.

Louis Tao

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

John Tavantzis

The research of John Tavantzis is in the field of operations research applied to problems of parking allocations. Given several parking lots with certain capacities, how does one assign parking so as to minimize total cost to individuals who need to park during certain time intervals. Discrete and probabilistic models are considered.

B. SELECTED RESEARCH RESULTS

Oleh Baran

John Bechtold

Amitabha Bose

Bruce Bukiet

Cameron Connell

Christopher Elmer

Daniel Goldman

Jorge Golowasch and Farzan Nadim

David Horntrop

Lou Kondic

Gregory A. Kriegsmann

Zoi-Heleni Michalopoulou

Robert M. Miura

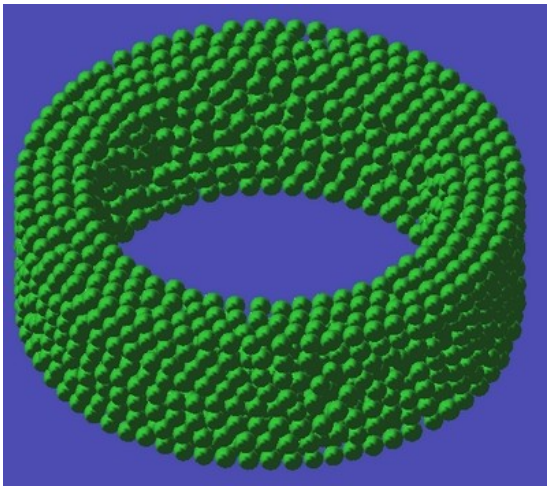
Cyrill Muratov

Oleh Baran

Title: 3D Simulations of Granular Materials in Couette Cell
(with Lou Kondic, NJIT, and Robert P. Behringer, Duke University)

Granular flows attract intensive interest because the phenomenon, while still poorly understood from a fundamental perspective, is often encountered in practical problems and is of industrial relevance.

In my current research, I am studying numerically a system of hard inelastic spheres placed between two concentric cylinders. The top wall of the container (couette cell) is rotated around the vertical axes of the cell, inducing a shear in the granular layer. The bottom wall can be vibrated vertically, thus increasing the collision rate between particles and helping to set a constant shearing rate throughout the sample. The figure below shows a single time frame of our granular layer in the set-up described above. In my numerical simulations, I use an event driven algorithm.



The results of my simulations are being compared to existing experiments performed at Duke University. The research will answer important questions related to planned space station experiments.

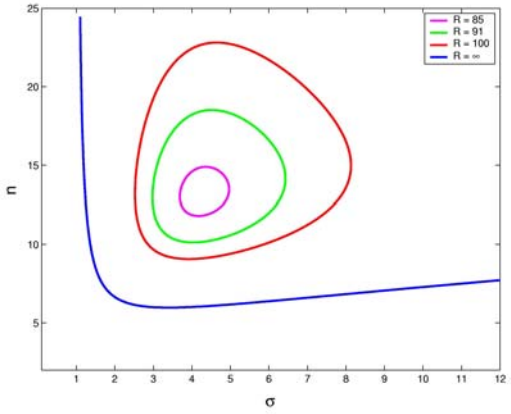
Supported by NASA.

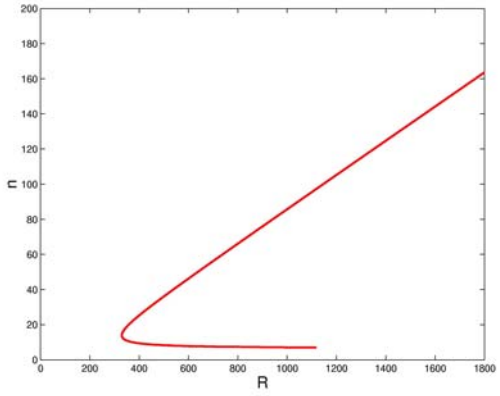
John Bechtold

Title: Wrinkling of Large-Scale Premixed Flames

The storage of large amounts of combustible gases presents potentially hazardous situations, and creates a need to understand the behavior of explosion flames. Experiments on spherical explosion flames have determined that several regimes of burning take place. One first observes a smooth laminar flame surface, then the formation of cells, flame wrinkling, and ultimately a self-turbulizing flame.

We have employed a mathematical model of large-scale flames to examine the stability characteristics of spherically expanding flames. The analysis yields predictions for a number of flame properties, including the critical flame size at the instability onset, cell size beyond the threshold, and an estimate of the flame speed of the developing turbulent flame. The figure on the left shows the neutral stability curves for several values of flame size. Here n is the wavenumber, and sigma the thermal expansion of the gas. At small radii, the flame is stabilized by the effects of curvature and diffusion. At larger radii, a region of instability is seen to develop due to the thermal expansion of the gas. This region expands indefinitely as the flame continues to propagate outward. The figure on the right show a typical neutral stability curve in the n vs. R plane, with fixed sigma. The curve traces out a peninsula of instability, with the nose determining the onset of instability. As the flame continues to propagate beyond the stability threshold, there exists a finite, but growing, range of unstable wavelengths. This cascade of ever-decreasing unstable wavelengths gives rise to a fractal-like wrinkling of the flame surface. We have employed the predicted limiting wavelengths as inner and outer cut-off scales in a fractal analysis of the flame surface and derived an analytical expression for the turbulent flame speed.



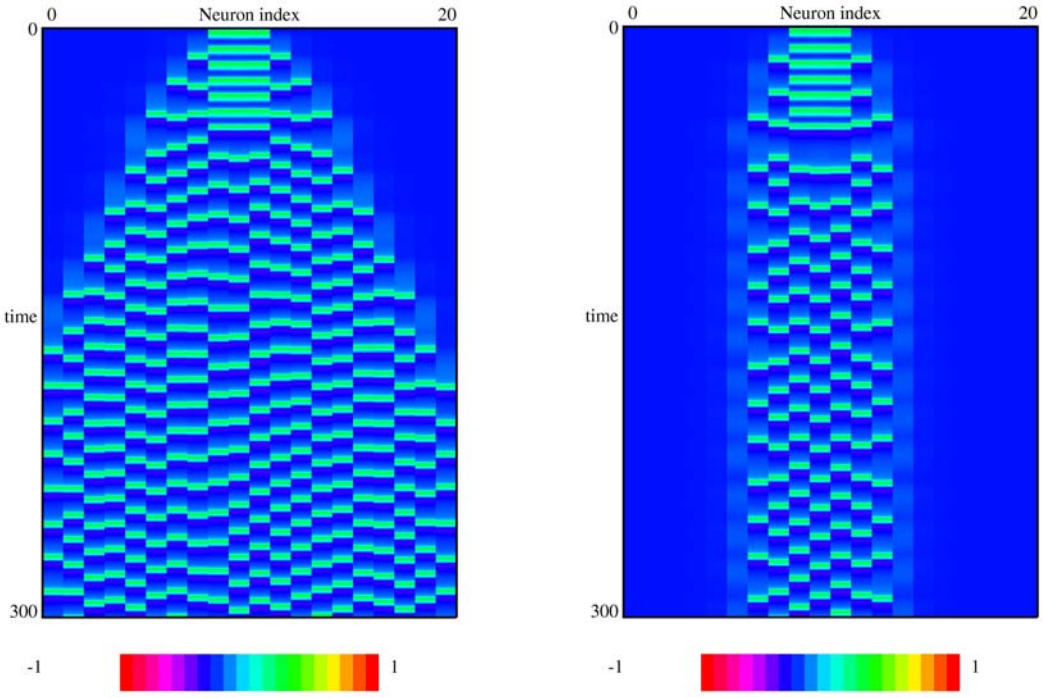


Amitabha Bose

Title: Bumps in Chains of Oscillators Coupled Only by Excitation
(work with Jonathan Rubin, University of Pittsburgh)

In the figures below, two different activity patterns from a 1-dimensional array of neural oscillators coupled only be excitatory synapses are shown. In one, a wave of excitation spreads through the entire network causing all cells to eventually oscillate (time on vertical axis, neurons 1-20 on horizontal axis). Alternatively, in the other for a slightly smaller value of coupling strength, the excitation does not spread to the entire network and a stable bump solution is obtained in which only 7 neurons oscillate. Both simulations have the same initial conditions. Neurons 9, 10 and 11 were initially given a 50 msec jolt of excitation to initiate activity. Stable bumps are thought to be important in modeling working memory in which a bump would correspond to a recalled memory.

The existence of stable bumps in excitatory networks has recently been reported, but the mechanism by which the spread of excitation is stopped remained a mystery. Jonathan Rubin and I show that the spread of excitation can be curtailed due to slow passage near a saddle-node bifurcation. The results show that the timing of synaptic inputs, and not just the strength of inputs, to a particular neuron determine whether or not it will fire. Thus while two adjacent neurons may receive excitatory inputs of equal strength, only one of the two may fire, thereby stopping the spread of the excitatory wave.



Supported by the National Science Foundation.

Bruce Bukiet

Title: Mathematical Modeling of Baseball

How do you determine the best batting order for a baseball team? How much difference does it make?
Lots of statistics are collected in baseball. These statistics have been used mostly to rank individual players: Who has the most home runs, the highest batting average, the highest slugging average, and on and on. It's more difficult to use the stats to understand how an entire baseball lineup should perform. But with some clever thought and simple mathematical tools, one can answer interesting baseball questions.

Modeling a Lineup
Brute force attempts to compute the expected number of runs for a lineup are too inefficient. Even a simple method -considering only walks, singles, double, triples, home runs, and outs could entail considering the number of runs scored by more than 1031 possible sequences. And this would give the results for only one potential lineup! There are more than 360,000 possible batting orders for 9 players.

A great improvement in efficiency comes from noting that there are only 25 situations that can occur in a half inning in baseball. There are zero, one or two outs. There are 8 baserunner situations: no runners, a man on first base, men on first and second ...or bases loaded. Finally, there are three outs when the inning is over.

By realizing that a batter's plate appearance turns one of these situations into another, the growth of work reduces from exponential to linear. Considering 40 batters takes just twice as much work as 20 batters. Of course, there is much bookkeeping to be kept in order to keep track of the runs scored. This approach involves setting up the problem as a Markov chain, using probability and matrix operations.

In a nutshell, this analysis yields the probability of a team being in any situation for inning or baserunners or outs or number-of-runs after a given number of batters have been up. The result is a lineup's expected number of runs and its run distribution: how often it could expect to score no runs, one run, etc.

Making a Great Lineup
We consider the best lineup to be the one that scores the most runs on average. It is assumed that the run distribution obtained by the lineup that scores the most runs on average could be expected to win the greatest possible number of games for this set of players. By considering the 362,880 possible orders for the 9 players, as above, we can order the lineups from best to worst.

We studied the 1989 National League to ascertain principles common to optimal lineups and reduce the number of lineups needed for testing. We ranked players by Scoring Index -the number of runs a team would score on average if it had 9 copies of the given player. Interestingly, we found that the slugger -the player with the highest Scoring Index -should bat second or

Bukiet (continued)

Full Enumeration Results for Atlanta Braves 1989

Players	Scoring Index	Best Order	Worst Order
Smith	0.887	Perry	Pitcher
McDowell	0.649	Smith	Theadway
Blauser	0.484	McDowell	Perry
Theadway	0.430	Blauser	Davis
Perry	0.416	Theadway	Thomas
Murphy	0.411	Murphy	Blauser
Thomas	0.241	Thomas	McDowell
Davis	0.198	Pitcher	Murphy
Pitcher	0.078	Davis	Smith
Expected Runs Per Game		3.557	3.260
Win-Loss		86.5-75.5	75.5-86.5

third on 3/4 of the teams and bat fourth on only 1/4 of the teams considered. We also found that the pitcher should almost never bat last. (These two findings are, of course, not in keeping with the way most managers construct their lineups.) The rules to consider in arranging a lineup are:

- Place the best batter (by scoring index) second, third, or fourth.
- Place the second best batter in the first five positions.
- Place the third and fourth best batters in the first six slots.
- Place the fifth best batter first, second, fifth, sixth or seventh.
- The sixth best batter should bat in any position except eighth or ninth.
- Place the seventh best batter either first or sixth through ninth.
- The eighth and ninth best batters should bat in the last three positions.
- Either the second or third best batter must be placed immediately before or immediately
- after the best batter.
- The worst batter must be placed four through six positions after the best batter.
- The second worst batter must be placed four through seven positions after the best batter.

This leads to having to consider less than 1000 batting orders and yields a lineup that on average scores within 1/3 of a run of optimal for a 162 game season.

How Important Is the Batting Order?

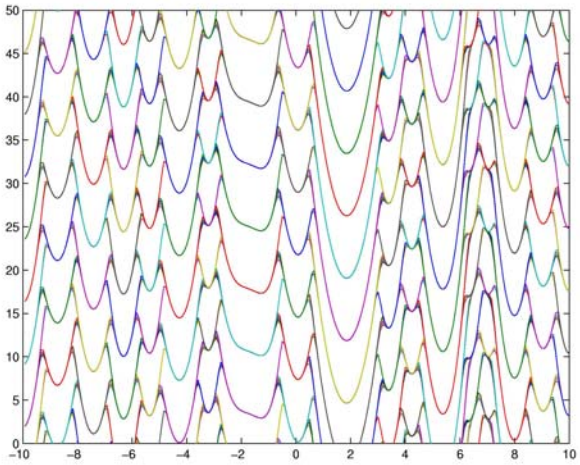
To compare lineups, it is not enough to know the average number of runs a team should score. A team that scores 5 runs on average cannot expect to win 100 games. We use the run distribution for the two lineups and, taking extra inning games into account, find the probability of a team winning a game. The best lineup against the worst -where the pitcher leads off -should usually win about 85 games and lose 77, a four game difference. The most extreme case found was 5-1/2 games. An example of best and worst lineups for the 1989 Braves is presented in the table. The method also can be used to solve other problems, for example, to determine the influence of a trade on wins and to rank Most Valuable Player candidates.

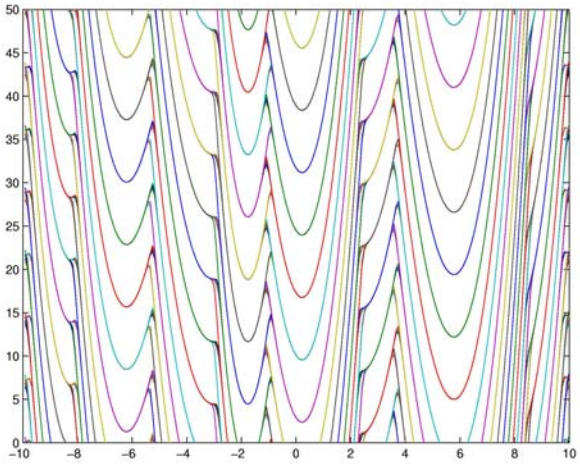
Cameron Connell

Title: Coarsening of Step Bunches in Step Flow Growth

Step flow growth is one mode of epitaxial growth of crystals. In step flow, the crystal grows by the forward marching of a train of steps of monoatomic height. As they march forward, the steps themselves can have complicated interactions, which can be kinetic or elastic in nature, or involve some external phenomenon such as an applied electric field. Step bunching, where several step coalesce to form one large macrostep, is a common outcome of these effects. The pictures below show the evolution of a step train, and step bunches that have been induced by the presence of impurities on the surface. Impurities slow the step train down, which interacts in complicated ways with the constant flux of adatoms from above.

The figures below are snapshots over the crystal surface at two different times and show that over time a coarsening process is taking place as the cellular regions between step bunches increase in width. This complicated pattern evolution can be understood as the net effect of travelling wave solutions of the step flow model. There is a coarsening exponent associated with this evolution, a, where $L(t) = Ct^a$ and L(t) is the average width of the cellular structures observed on the surface. a can be calculated from the distribution of wavespeeds. In the figures shown, a is about 0.75.





Christopher Elmer

Title: Discrete FitzHugh-Nagumo Equations

Vertabrate nerve fibers are encased by a lipid layer called myelin, which has small gaps at periodic intervals (called nodes of Ranvier) (Figure 1). To model the propagation of action potentials along such a nerve fiber, one uses an (infinite) system of time dependent ODEs, where single pairs of ODEs represent the voltage change across a node of Ranvier. Using a traveling wave ansatz, this infinite system can be transformed into a single pair of differential-difference equations (DDEs), which possess traveling front and traveling pulse solutions, a DDE that contains both advances and delays. Traditionally action potential propagation along such nerve fibers has been approximated by a pair of PDEs that transform into a pair of ODEs using a traveling wave ansatz. An important phenomenon that both the nerve fibers and the DDEs exhibit, but the ODEs do not exhibit, is failure of the action potential to propagate in the presence of a driving force. Figure A is a plot of the action (the energy functional) associated with our nerve propagation model. Note the barriers to motion. Figure B is a phase plot of the globally stable and unstable manifolds. Note the transversal intersections of the manifolds which imply the existence of homoclinic and heteroclinic tangles that preclude the possibility of a "smooth" flow (no traveling waves are possible).

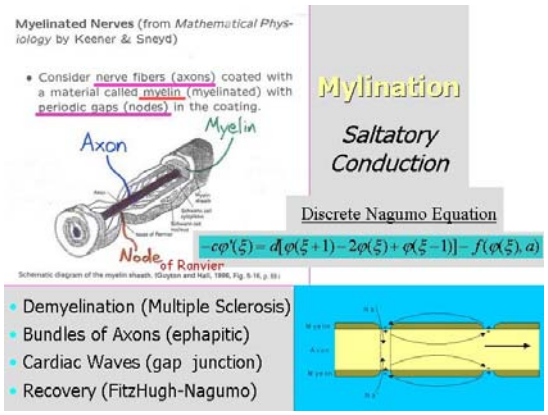


Fig. 1

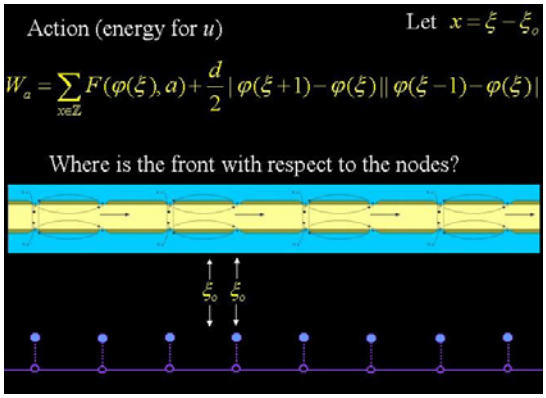


Fig. A

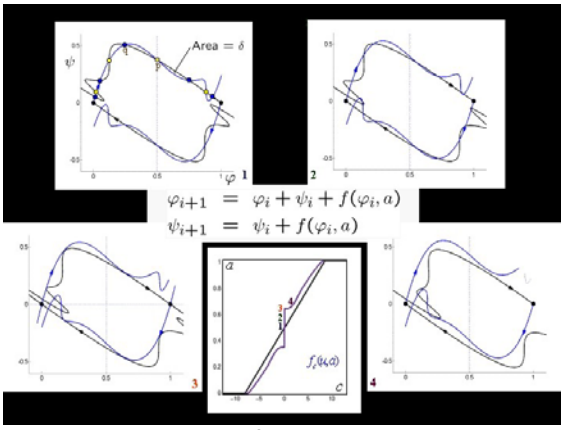


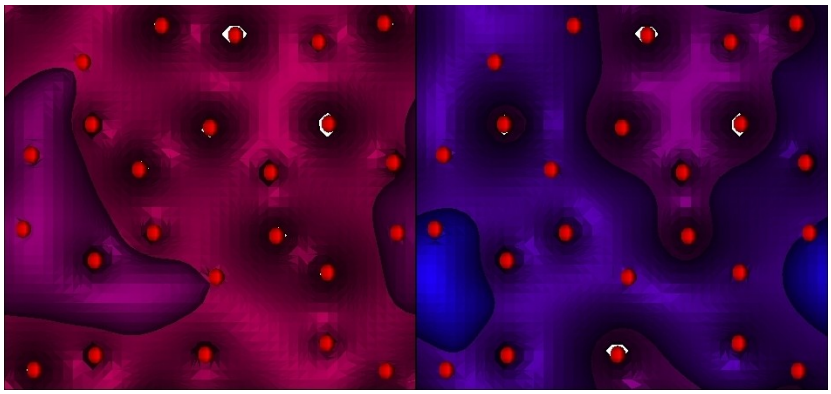
Fig. B

Supported by the National Science Foundation.

Daniel Goldman

Title: Oxygen Delivery and Utilization During Sepsis

We are performing numerical simulations of oxygen transport in capillary networks under various control and sepsis conditions in order to determine how observed changes in blood flow affect tissue oxygen delivery and utilization. We are currently investigating how the degree of microvascular injury caused by sepsis impacts the spatial heterogeneity of oxygen transport and the occurrence of localized tissue hypoxia. Shown from the venular end are calculated oxygen distributions in the tissue surrounding three-dimensional arrays of capillaries. Oxygen concentrations are shown as isosurfaces, where red and blue represent high and low oxygen, respectively, and red dots represent the capillaries. On the left, a moderate disturbance of capillary blood flow due to sepsis produces relatively uniform tissue oxygen distributions and no low oxygen regions, while on the right a severe maldistribution of blood flow results in a large amount of tissue oxygen heterogeneity and two distinct regions of low oxygen concentration (blue). These results are currently being used to interpret available experimental data in order to better understand how sepsis leads to decreased tissue oxygen extraction capability.



Supported by the Whitaker Foundation.

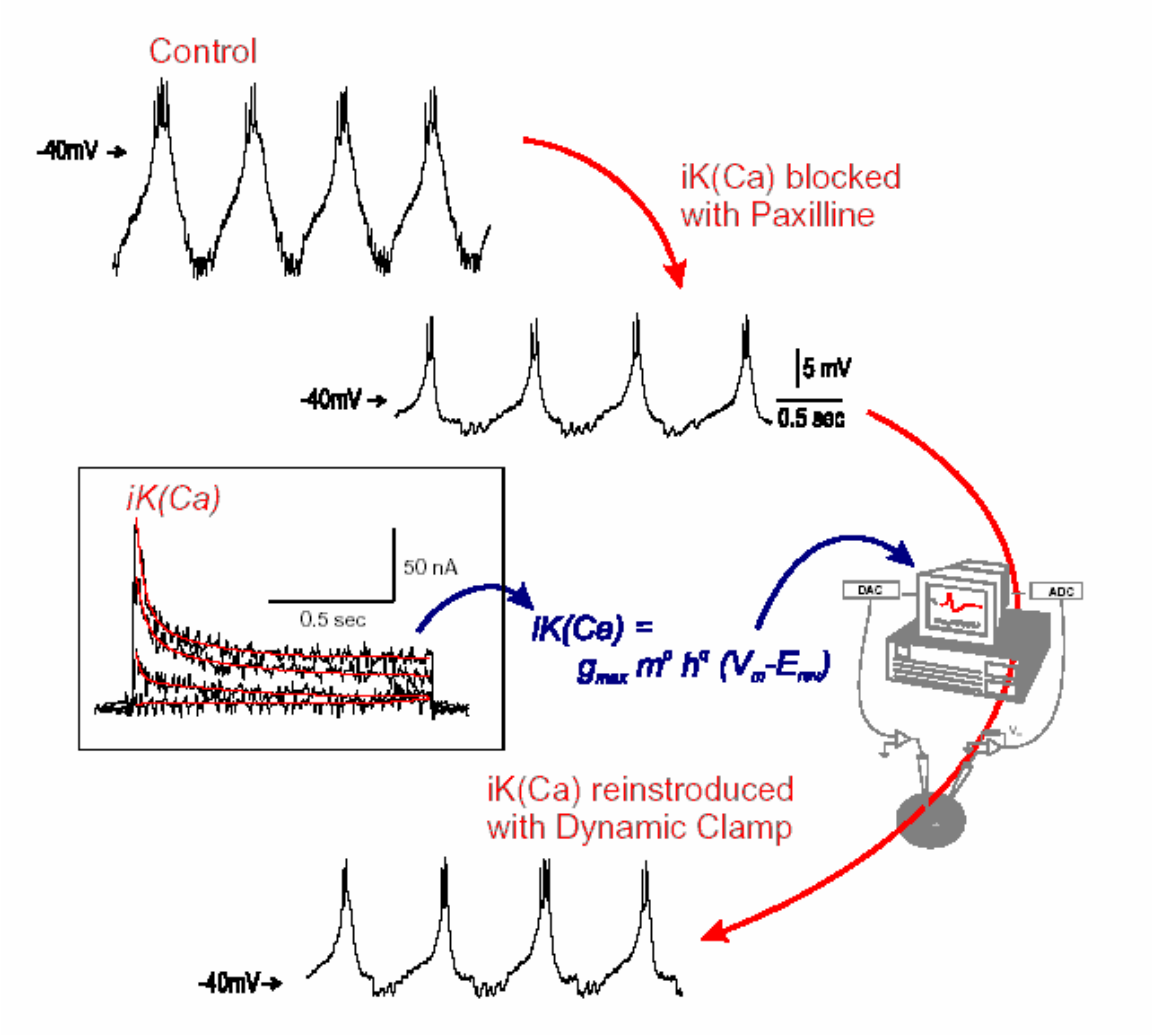
Jorge Golowasch and Farzan Nadim

Title: Role of Calcium–Activated Potassium Current in Pattern Generation in the Crab Stomatogastric Ganglion.

Ca-dependent K currents, iK(Ca), are an important element in the electrical machinery of a neuron, controlling intrinsic and network properties. Electrophysiological as well as modeling experiments have shown that iK(Ca) may determine either bursting, plateau, or action potential properties. In the neurons of the Stomatogastric Ganglion (STG) of crustaceans, it is the largest outward current, but its contribution to neuronal or network activity is not known with certainty (Golowasch et al, 1992; Kiehn & Harris-Warrick, 1992). We are characterizing a specific pharmacological inhibitor of this ionic current in STG neurons of the crab, *Cancer borealis*, in order to use it as a tool to study the role of iK(Ca) in the generation of rhythmic activity by these neurons. The indole-diterpene Paxilline, obtained from *Penicillium paxilli*, blocks 80% of the total K+ currents measured from a holding voltage, Vh=-40mV, with a Ki=1.17uM. The 20% remaining can be attributed to the delayed rectifier K+ current, iKd. Paxilline blocks iK(Ca) completely at 20uM, at which concentration it does not appear to affect significantly other K+ currents (iA or iKd), nor inward currents such as ih or iCa. We conclude that Paxilline can be used as a potent and specific blocker of iK(Ca) in crab STG neurons.

In order to test the contribution of iK(Ca) to STG neuron activity, we measured the effects of specifically eliminating iK(Ca) with Paxilline on the STG pyloric rhythm. We find that iK(Ca) has little influence on the pyloric rhythm cycle frequency and on the phase relationships among component neurons (see Figure). As a control, we used the dynamic clamp technique to reintroduce the Paxilline-blocked iK(Ca) in PD neurons. The dynamic clamp technique is a hybrid computational-electrophysiological technique that consists of software designed to read the real voltage of a neuron and use it to compute on-line the current that it generated at those voltages by differential equations describing real ionic conductances (specified by Hodgkin-Huxley-type equations). Here again, we observe very little effect on the pyloric rhythm (see Figure). We infer that, in spite of its great amplitude, iK(Ca) has little if any effect on rhythmic pattern generation. We are further exploring the possibility that iK(Ca) affects instead the properties of individual action potentials or of synaptic transmission by local effects around the synapses.

Golowasch and Nadim (continued)



In this figure, the first panel (top left) corresponds to the membrane voltage oscillations of a real pacemaker neuron in the STG. The next panel below shows the effect of pharmacologically eliminating the Ca-dependent K+ current, iK(Ca), with 20uM Paxilline. The third panel of voltage recordings (bottom) shows the activity of the same neuron after injection via a microelectrode of an iK(Ca) described by Hodgkin-Huxley equations fitted to real iK(Ca) currents measured in this cell (inset). This equation, summarized in blue, is calculated by appropriate software (see computer) and fed back into the cell by a Digital-to-Analog interface.

Golowasch, J., F. Buchholtz, I.R. Epstein & E. Marder (1992). The contribution of individual ionic currents to the activity of a model stomatogastric ganglion neuron. *J. Neurophysiol.*, 67(2): 341-349.

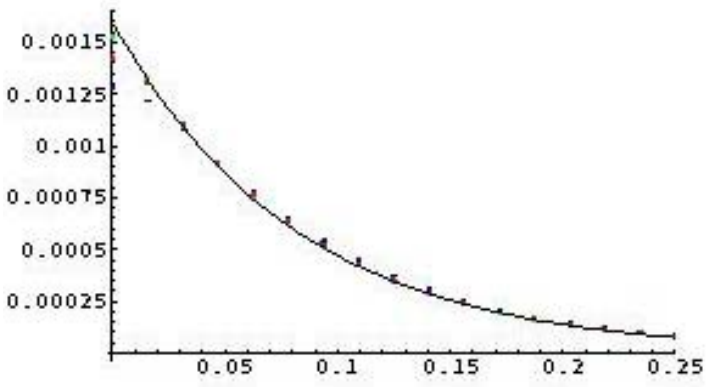
Kiehn, O. & Harris-Warrick, R (1992). 5-HT modulation of hyperpolarization-activated inward current and iK(Ca) in a crustacean motor neuron. J. Physiol., 68(2): 496-508.

Supported by NIMH 64711 (JG) and 60605 (FN).

David J. Horntrop

Title: Understanding the Effect of the Form of Noise in Stochastic Models

One important issue that often arises in developing stochastic partial differential equations as models of physical phenomena such as surface processes is the proper form of the noise. In most models, the noise is assumed to be completely decorrelated spatially and temporally, i.e. a white noise process in space and time. However, in a computational simulation such an idealized noise can only be approximated. Thus, it is important to understand the sensitivity of the solution of the equation to the form of the noise. Given the limiting relationship between colored noise and white noise, it is natural to study the effect of using colored noise in place of white noise in the equation. As a test problem, we consider an equation with multiplicative noise in which the equilibrium covariance can be calculated analytically when the forcing is white noise. In the plot, this covariance is represented by the solid line while the dots are simulation results using colored noise. In the limit as the colored noise approaches white noise, the results from the simulations approach the correct limiting behavior with the greatest difference in behavior occurring at the smallest correlation lengths.



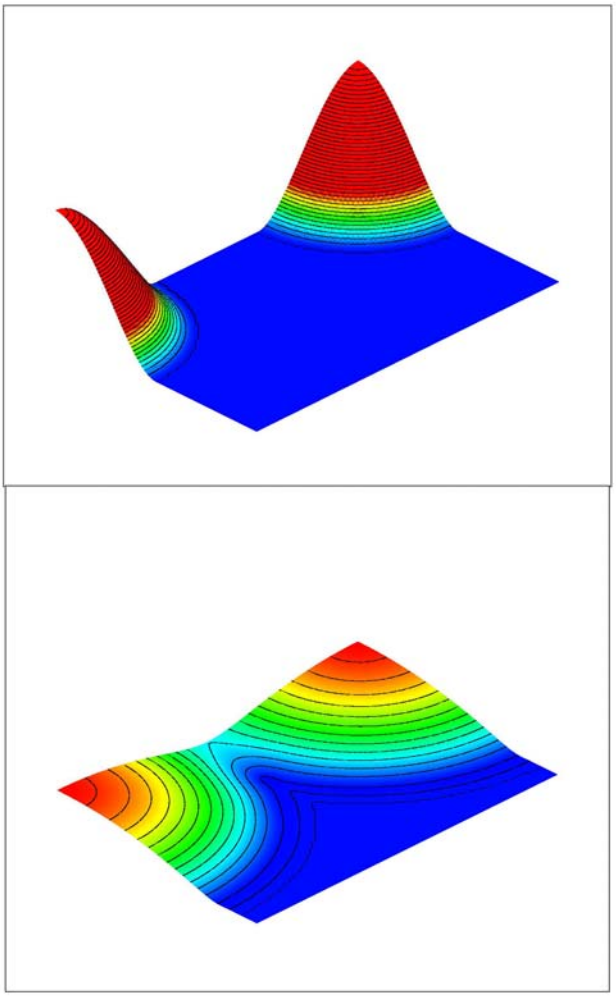
Supported by the National Science Foundation.

Lou Kondic

Title: Coalescence of Liquid Drops

The merging of liquid drops spreading on a solid substrate is an interesting process with a number of applications. Mathematically, it involves a topological change in fluid configuration. All the problems involving topological changes (another example is formation of a dry spot on prewetted surface) are worth exploring since they are very common and not very well understood.

The figure shows computational results for the mergence of two drops spreading on a solid surface under gravity. The results are computed using a finite difference based method - details can be found in our recent publication: J. Computational Physics, Vol. 183, pp. 274-306 (2002) (with J. Diez). The simulations allow us to analyze the merging process, and also the influence of the parameters that are relevant in technological applications, such as the details of fluid/solid interaction.



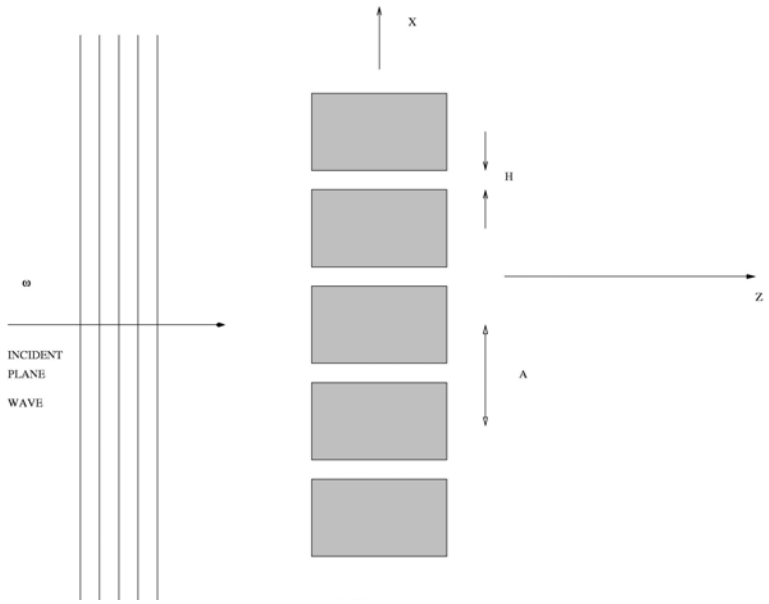
Supported by the National Science Foundation.

Gregory A. Kriegsmann

Title: Complete Transmission Through a Two-Dimensional Diffraction Grating

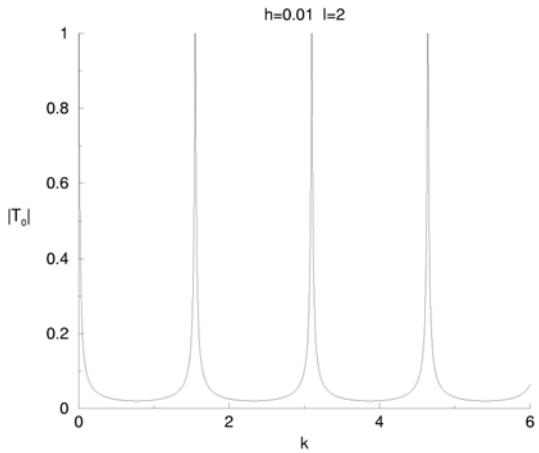
We have recently modeled and analyzed the propagation of a normally incident plane electromagnetic wave through the two-dimensional metallic grating shown in Figure 1. The period of the structure *A* and its length *L* are on the order of the incident wave length λ, but the height of the channel *H* separating the blocks is very small. Exploiting the small parameter *H/A,* we derive an approximate transmission coefficient for this grating.

FIGURE 1



Since the channel through which the wave can propagate is very narrow, it is intuitive that most of the wave will be reflected and the transmission coefficient will be *O(H/A).* However, at certain frequencies there is complete transmission. This “transparency” is caused by the waves reflecting back and forth in the channel creating a resonance. The transmission coefficient showing this phenomenon is shown in Figure 2 where *L/A=2* and *H/A=0.01*.

FIGURE 2



It is clear from this figure that the grating has very localized pass-bands where it is transparent, and very broad stop-bands where it is opaque. These features may make the structure useful in photonic applications such as a highly selective filter.

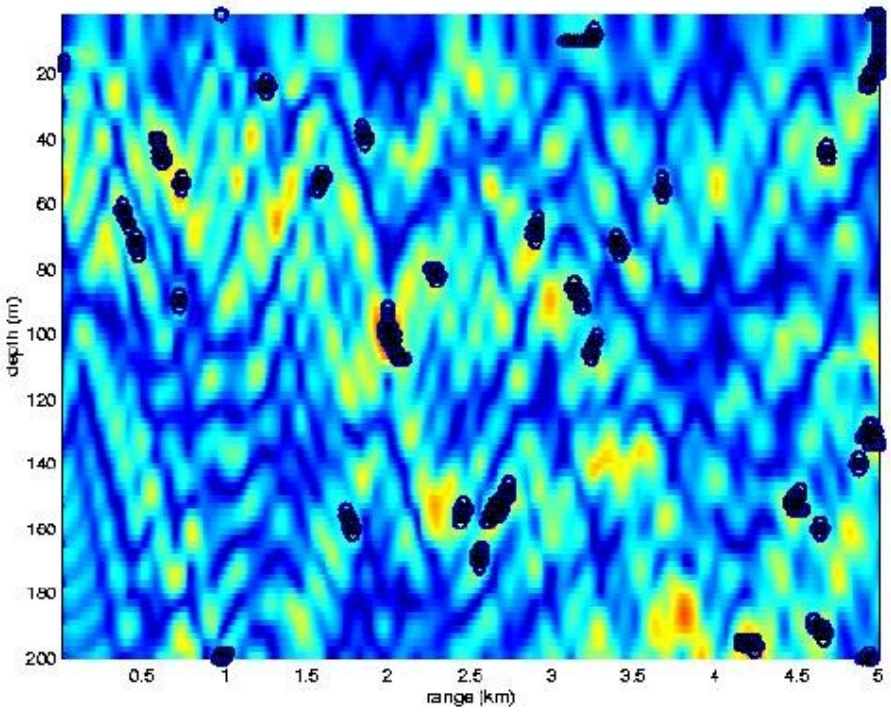
Supported by the National Science Foundation.

Zoi-Heleni Michalopoulou

Title: TABU Optimization for Matched Field Inversion

A new global optimization method for inversion in underwater acoustics was developed based on the TABU approach of using memory to navigate the search space. The new technique has the ability to get "un-trapped" from local maxima, which makes it attractive for use in maximization of matched-field correlation.

In this work, the scope is to estimate parameters that have an impact on sound propagation and the generation of acoustic data. Matched field processing is used, correlating "real" to replica fields and TABU is implemented to accelerate the parameter search. Figure 1 shows the ambiguity surface generated by matched field processing of an exhaustive search for unknown source range and depth; the circles represent the parameter values visited by TABU. TABU searches the space intelligently, avoiding low correlation (blue regions) and favoring high correlation combinations (red and yellow). It identifies the correct parameter values (2 km for range and 100 m for depth) efficiently after only a few iterations.



Supported by the Office of Naval Research.

Robert M. Miura

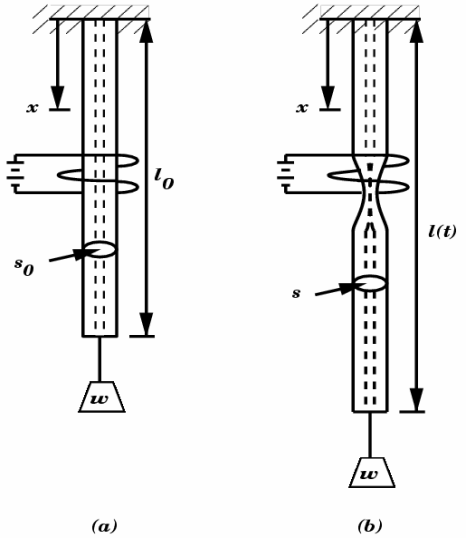
Title: Heat-Induced Stretching of Glass Microelectrodes
(with H. Huang, W.P. Ireland, and E. Puil)

Glass objects, such as laboratory glassware, fiber optics, and hand-blown artistic glassware, are produced routinely. In some applications, when heat is applied to soften the glass during the formation of these glass objects, the procedures involve mechanical devices that then make the formation process amenable to the use of mathematical models.

Glass microelectrodes have played an essential role in cell electrophysiology and are used to inject electric current and dyes into cells and measure membrane potentials by inserting them through cellular membranes or to form a patch clamp of the membrane. Laboratories make these microelectrodes on a daily basis using commercially available glass tubes and electrode pullers with coil heaters for softening the glass tubes during the stretching procedure. The local heat application softens the glass tube and the stretching causes the tube to neck down to a small diameter (see Figure). The temperatures determine whether the tube breaks or stretches out.

Two experimentally relevant parameters for glass microelectrodes are tip length and tip diameter. Tip length determines the physical strength of the electrode and how easily it will penetrate tissue and cells, and tip diameter determines whether the electrode is suitable for intracellular recording (approximately 0.1 micron) or for patch recording (approximately 1 micron outside diameter and 0.5 micron inside).

The relationship between the variables (heater geometry, length of first pull (for a patch electrode), rate of the second pull, etc.) and electrode properties is usually obtained by trial-and-error. Since the influence of these variables on electrode shape is not well determined, we develop a basic mathematical model for the glass microelectrode formation process. Then, different types of pullers can be simulated, the effects of parameters can be explored, and new electrode pullers can be designed.



Cyrill Muratov

Title: Discrete Models of Autocrine Cell Communication in Epithelial Layers
(work with M. Pribyl and S. Shvartsman)

Pattern formation in epithelial layers relies heavily on cell communication by secreted ligands. While the experimentally observed signaling patterns can be visualized at the level of single cells, a biophysical framework for their interpretation is currently lacking. To this end, we develop a family of discrete models of cell communication in epithelial layers. The models are based on the introduction of cell-cell coupling coefficients that characterize the spatial range of intercellular signaling by diffusing ligands. We derive the coupling coefficients as functions of geometric, cellular, and molecular parameters of the ligand transport problem. An example of a computed ligand field over a layer of square or hexagonal cells is shown in Fig.1.

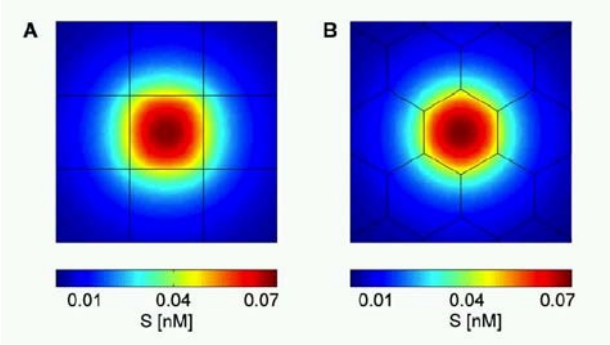


Fig. 1

Using the obtained coupling coefficients, we analyze a nonlinear model of positive feedback between ligand release and binding. In particular, we study criteria for the existence of the patterns consisting of clusters of a few signaling cells, as well as the onset of signal propagation. The existence diagrams as functions of the ligand release rate per cell Q_s and the forward binding constant k_on are shown in Fig. 2 (cells with crosses are ignited upon reaching the threshold).

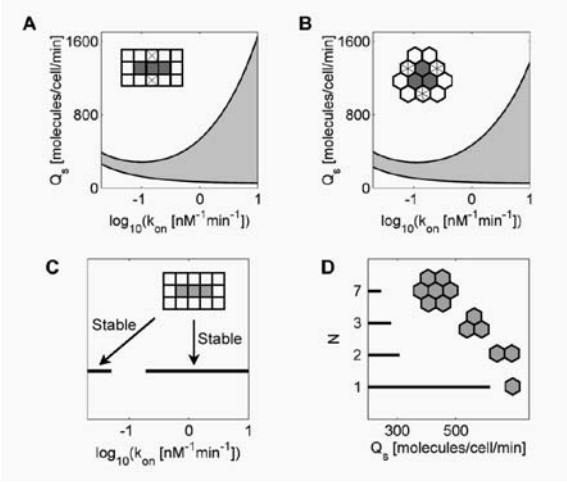


Fig. 2

We use our model to interpret recent experimental studies of EGFR/Rhomboid/Spitz module in Drosophila development.

Supported by the National Science Foundation.

C. COLLABORATIVE RESEARCH

John Bechtold

Premixed flame models, M. Matalon (Northwestern University)

Denis Blackmore

Biocomplexity in salt marshes, M. Levandowsky (Pace), G. Benoit (Yale), and M. Haggblom (Rutgers)

Vortex field-shock wave interactions, L. Ting (Courant)

Vortex filament dynamics, O. Knio (Johns Hopkins)

Vortex dynamics on a sphere, C. Lim (RPI) and J. Tavantzis (NJIT)

Dynamical models for phyllotaxis, J. Kappraff (NJIT)

Galton's board dynamics, A. Rosato (NJIT)

Deformational viscoelastic flows, P. Singh (NJIT)

Dynamics of suspended particles in acoustic and fluid flow fields, J. Meegoda (NJIT) and N. Aboobaker (NJDOT)

Periodic orbits and bifurcations in dynamical systems, J. Champanerkar (NJIT) and C. Wang (Rutgers)

Dynamics of discrete population models, J. Chen (Univ. of Delaware)

Computational topology, M. Leu (Univ. Missouri-Rolla), Y. Mileyko (NJIT), W. Regli and W. Sun (Drexel)

Infintite dimensional integrable dynamical systems, A. Prykarpatsky (Krakow Univ.), V. Samoilenko (Kiev Univ.), and U. Taneri (Eastern Med. Univ.)

Amitabha Bose

Phase determination in neuronal networks, Yair Manor (Ben-Gurion University of the Negev, Bersheeva, Israel), Farzan Nadim (NJIT), and Victoria Booth (University of Michigan)

Models for frog ventilatory rhythmogenisis, Tim Lewis (New York University) and Kosta Vasilokas and Richard Wilson (University of Calgary, Canada)

Bumps in chains of oscillators coupled only by excitation, Jonathan Rubin (Pittsburgh University)

Synchronization in globally inhibitory networks, Steve Kunec (Boston University)

Bruce Bukiet

Flow in the lungs, H. R. Chaudhry (NJIT) and S. Kirshblum (Kessler Institute)

Modeling balance, H. R. Chaudhry (NJIT), J. Ji (NJIT), and T. Findley (VA Medical Center)

Christopher Elmer

Anisotropy, propagation failure, and wave speedup in traveling waves of discretizations of a Nagumo PDE, E.S. Van Vleck (University of Kansas)

A construction technique for heteroclinic solutions to continuous and differential-difference damped wave equations, M. Rodrigo and R.M. Miura (NJIT)

Computation of mixed type functional differential boundary value problems, K.A. Abell (University of Sussex, England), A.R. Humphries (McGill University, Canada), and E.S. Van Vleck (University of Kansas)

Analytical and numerical solutions for spatially-discrete FitzHugh-Nagumo equations, C. Lee (University of Kansas), P. Raff (Carnegie Mellon), and E.S. Van Vleck (University of Kansas)

Reaction diffusion solutions on a lattice with variable diffusion, C. Raymond (NJIT)

Vladislav V. Goldberg

Varieties with degenerate Gauss maps, M. A. Akivis (Jerusalem Institute of Technology)

Linearization problems for four-webs, M. A. Akivis (Jerusalem Institute of Technology) and V. V. Lychagin (University of Tromso, Norway)

Linearization problems for three-webs, V. V. Lychagin (University of Tromso, Norway)

Almost Grassmann structures, H. Sato (Nagoya University, Japan)

Almost Grassmann structures and special metrics, R. Deszcz, M. Glogowska (Academia of Agriculture, Wroclaw, Poland) and F. Defever, L. Verstraelen (Catholic University of Leuven, Belgium)

Webs and PDEs, A. Prastaro (University of Rome, Italy)

Daniel Goldman

Modeling transport in the rat EDL microcirculation during sepsis, C. Ellis and R. Bateman (University of Western Ontario, Canada)

Modeling oxygen transport in the rat EDL microcirculation under normal conditions, C. Ellis, R. Bateman (University of Western Ontario, Canada) and A. Popel (Johns Hopkins University)

Modeling oxygen transport by capillaries and capillary networks in the presence of hemoglobin-based blood substitutes, A. Popel, A. Vadapalli, and N. Tsoukias (Johns Hopkins University)

Jorge Golowasch

The pyloric model group: functional analysis of a complex, distributed biological neural network, Ron Harris-Warrick (Cornell University, NY), Scott Hooper (Ohio University), Eve Marder (Brandeis University), Farzan Nadim (NJIT), and Michael Nusbaum (University of Pennsylvania)

Analysis of space-clamp errors in geometrically complex neurons, Farzan Nadim (NJIT)

Roy Goodman

Bragg gratings in optical fiber communications, Michael Weinstein (Bell Laboratories)

Dynamical systems modeling of wave-defect interactions, Philip Holmes (Princeton University), Michael Weinstein (Bell Laboratories), and Richard Haberman (Southern Methodist University)

David J. Horntrop

Mesoscopic modeling for pattern formation in materials, M. Katsoulakis (University of Massachusetts) and D. Vlachos (University of Delaware)

Lou Kondic

Flow of thin liquid films, J. Diez (University del Centro, Pinto, Argentina)

Discrete modeling of granular materials, R. Behringer (Duke University)

Stability of two fluid flows, B. Tilley (Olin College of Engineering)

Dawn Alisha Lott

Three-dimensional infinite elements applied to optimal closure patterns in hyperelastic skin, H.R. Chaudhry (NJIT)

Stabilty of calcium release events during calcium sparks in heart muscle, J.R. Berlin (UMDNJ)

Modeling of cerebral aneurysms; integration of computer simulations, biophysical properties and clinical behavior, M. Siegel and H.R. Chaudhry (NJIT) and C. Prestigiacomo (UMDNJ)

Zoi-Heleni Michalopoulou

Pulse dispersion in the ocean, Leon Cohen (Hunter College, City University of New York)

Source localization in the Haro Strait, Charles Gaumond (Naval Research Laboratory)

Robert M. Miura

Perturbation analysis of traveling waves of spreading cortical depression, H. Ikeda (Toyama University, Japan)

Lattice Boltzmann method applied to ion diffusion in the brain, Y.Q. Wang (Pacific Institute for the Mathematical Sciences, Canada), H. Huang (York University, Canada), and B. Steinberg (McGill University, Canada)

Synchronous phase-clustering states in networks excitatory neurons with nonuniform coupling, Y.Q. Wang (Pacific Institute for the Mathematical Sciences, Canada) and Y.X. Li (University of British Columbia, Canada)

Temporal summation of EPSPs in pyramidal neurons, A. Desjardins (Harvard University/MIT), Y.X. Li (University of British Columbia, Canada), S. Reinker (University of British Columbia, Canada), and R. Neuman (Memorial University, Canada)

Glass microelectrode formation, H. Huang (York University, Canada), W.P. Ireland (University of Prince Edward Island, Canada), and E. Puil (University of British Columbia, Canada)

Stochastic resonance, S. Reinker and E. Puil (University of British Columbia, Canada)

Auditory thalamic neurons and tinnitus, A. Chavez-Ross, I. Ran, and E. Puil (University of British Columbia, Canada)

Determination of membrane electrical properties, V. Booth (University of Michigan), A. Bose, J. Golowasch, F. Nadim, and M. Rodrigo (NJIT)

Brownian motion on distorted ratchets, Y.-X. Li (University of British Columbia, Canada) and Y. Chen (NIDDK, National Institutes of Health)

Cyrill Muratov

Modeling and computational analysis of cell communication in Drosophila oogenesis, S. Y. Shvartsman (Princeton University)

Breakup of universality in the generalized spinodal nucleation theory, Eric Van den-Eijnden (Courant Institute of Mathematical Sciences and Institute for Advanced Study)

Pulse initiation in noisy excitable systems, Weinan E (Princeton University), Eric Van den-Eijnden (CIMS), and Weiqing Ren (CIMS)

Linear vs. nonlinear selection for the propagation speed of the solutions of scalar reaction-diffusion equations invading an unstable equilibrium, M. Lucia (Rutgers University) and M. Novaga (University of Pisa, Italy)

Farzan Nadim

Regulation of neuronal oscillations by synaptic dynamics, Y. Manor (Ben-Gurion University, Beer-Sheva, Israel), A. Bose (NJIT), and V. Booth (University of Michigan)

Configuration of circuit dynamics by modulatory fibers, M. P. Nusbaum (University of Pennsylvania Medical School) and Y. Manor (Ben-Gurion University, Israel)

Determination of voltage-gated ion current distributions from single-point currents and voltage-clamp measurements, J. Golowasch, A. Bose, M. Rodriguez, and R. Miura (NJIT)

Demetrios T. Papageorgiou

Theory and experiment on the motion of a bubble with an adsorbed surfactant monolayer, Charles Maldarelli (City College of New York) and Ravichandra Palaparthi (Orica Inc., Colorado)

Chaotic flows in pulsating cylindrical tubes, Philip Hall and Mark Blyth (Imperial College, England)

Large amplitude capillary waves in electrified fluid sheets, Jean-Marc Vanden-Broeck (University of East Anglia, England)

Dynamics and breakup of surfactant coated compound threads, Omar Matar and Richard Craster (Imperial College, England)

Manuel Perez

Survival studies of prostate cancer patients, evaluating the efficacy of surgical procedures and radiation treatment for various stages of the disease, Dr. Mario Reis (University of Porto, Portugal)

Peter G. Petropoulos

Energy estimates and stability issues pertaining to the unsplit perfectly matched layer for hyperbolic systems fo partial differential equations, Eliane Becache (Projet Ondes, INRIA-Rocquencourt, France)

Christopher S. Raymond

Mathematical modeling for immunocolloid labeling, Paul Milewski and Ralph Albrecht (University of Wisconsin-Madison), and David Edwards (University of Delaware)

Asymptotic analysis for weakly modulated traveling wave solutions of discrete reaction diffusion equations, Christopher Elmer (NJIT)

Anthony D. Rosato

Dynamics of a Galton's board, D. Blackmore (NJIT)

Michael Siegel

Break-up of an inviscid drop in viscous surrounding: experiment, simulation and theory, Pankaj Joshi and Osman Basaran (Purdue), Itai Cohen (Harvard University), Wendy Zhang and Sid Nagel (University of Chicago), and Peter Howell (Oxford University)

Singularity formation and ill-posedness in the Muskat problem, Russ Caflisch (UCLA) and Sam Howison (Oxford University)

Exact solutions for the evolution of a bubble in Stokes flow: a Cauchy transform approach, Darren Crowdy (Imperial College, London)

Evolution of material voids for highly anisotropic surface energy, Mike Miksis and Peter Voorhees (Northwestern University)

Thomas Spencer

Waiting times for exchangeable random variables, S. Balaji (George Washington University)

John Tavantzis

Barrier methods in variational inequality problems, David Bernstein (James Madison University) and Kyriakos Mouskous (The City College of New York)

Jean-Marc Vanden-Broeck

Nonlinear interfacial waves, Frederic Dias (Ecole Normale Superieure)

Exponential Asymptotics, Jon Chapman (Oxford University)

Waves in the presence of electric fields, Demetrius Papageorgiou (NJIT)

Modelling of the deformation of a sail, Michael Booty (NJIT)

Self-similar solutions for the breakup of fluid sheets, John Billingham (Birmingham University)

Impact of obstacles on a free surface, Jim Oliver and John Ockendon (Nottingham University and Oxford)

Gravity capillary free surface flows, Mark Cooker (University of East Anglia, England)

X. STUDENT ACTIVITIES

A. UNDERGRADUATE ACTIVITIES

Robert M. Miura, Director of Undergraduate Studies

Pi Mu Epsilon:

The New Jersey Kappa Chapter of Pi Mu Epsilon inducted 8 students and one professor into Pi Mu Epsilon on April 28, 2003: Tomasz Bober, Elaine Bochniewicz, Ed Folgar, Josh Isralowitz, Matt Karasiewicz, Seth Levy, Laura Medwick, Thomas Schreck, and Professor Rose Dios.

Students were honored after a pizza lunch. After the ceremony, students elected officers for the club: Seth Levy (president), Tomasz Bober (vice-president), Matthew Karasiewicz (treasurer), and Laura Medwick (secretary).

Math Club:

The undergraduate Math Club held several meetings this year. The students arranged a talk by people from Career Development Services about careers in mathematics. The officers of the Math Club are: President: Jon Porus; Vice President: Robert Miller; Vice President: Matt Karasiewicz; Treasurer: Henry Rodriguez; and Secretary: Silvino Sanchez.

Research and Presentations:

NJ I-Tower Undergraduate Research Experience: Varun Oberoi (Advisor: Sunil Dhar), How Random is "Random?"; Jonathan Porus (Advisor: Robert M. Miura), A Study of Spreading Cortical Depression Using Shapiro's Computational Model. Each student prepared a poster and gave a short talk on their research on May 9, 2003.

Summer 2003 Research Students: Josh Isralowitz (Advisor: Denis Blackmore), Countable Subsets of Metric Spaces and Surface Intersections, supported by Sponsored Chair in Applied Mathematics and National Science Foundation (pending); Santosh Kushwah (Advisor: Dan Goldman), Modeling Blood Flow in Capillaries Under Normal and Septic Conditions, supported by

the Whitaker Foundation; Seth Levy (Advisor: David Horntrop), Efficient Calculation of Convolution for Mesoscopic Simulation, supported by the National Science Foundation (pending). Linda Nguyen (Biology, Rutgers-Newark)(Advisor: Jorge Golowasch), In Vivo Recordings of Central Pattern Generators, and Regulation by Feeding and by Previous Activity, supported by NIH.

Awards and Scholarships:

Students in the Department of Mathematical Sciences received several awards and merit-based scholarships for AY 2002-2003. They were:

Actuarial Sciences Award: Jennifer Dorn, Junior, (CS and Math Sci)

Daljit S. and Devinder K. Ahluwalia Scholarship for Applied Mathematics: Geoffrey Cox, Senior (CS and Math Sci); Miao Li, Senior (CS and Math Sci); Ankit Shah, Junior (Math Sci)

Santokh S. and Labh K. Ahluwalia Award: Jonathan Porus, Junior (Math Sci and CS)

College of Science and Liberal Arts, Outstanding Undergraduate Student Award: Miao Li, Senior (CS and Math Sci)

Simon Cohen Awards: Ed Folgar, Junior (Math Sci); Laura Medwick, Sophomore (Math Sci)

Mathematical Sciences Awards: Joshua Isralowitz, Sophomore (Math Sci); Seth Levy, Junior (Math Sci)

NJIT Alumni Association Award: Miao Li, Senior (CS and Math Sci)

Gary Thomas Award: Robert Miller, Junior (Math Sci and CS)

Alumni:

Sunil Patel (Appl Stats (03)) is in the MS program in Information Sciences at NJIT; Rosalie Soriano (Stats and Act Sci (03)) is working at Price-Waterhouse-Cooper; and Ami Modi (Appl Stats (03)) is working at SBLI USA Mutual Life Insurance Company, Inc. Other graduates are: Elaine Bochniewicz (Math Sci (03)), Michael Caruso (Appl Math (03)), and Maureen Ricarte (Math Sci (03)).

Stephen Nauyoks (02) and Tsezar Seman (02) are both in the MS program in Applied Math at NJIT; and Priyal Gogri (02) is in the MS program in Applied Statistics at NJIT.

Roman Onik (02), Petter Otterstedt (02), and Sarabjit Singh (02) are in the MS program in Computer Science at NJIT; and Pritam Dodeja (01) is in the MS program in Information Systems at NJIT.

The following graduates of the MS program in Applied Math are currently pursuing doctoral studies:

Steven Arturo (00), Chemical Engineering, NJIT; Jeremy Carlo (01), Columbia University; Brandy Rapatski (98), U. Maryland; Hoa Tran (98), Mathematical Sciences, NJIT; Shirley Yap (99), U. Pennsylvania.

Capstone Laboratory Projects:

Annual Capstone Presentations by Lou Kondic and Daniel Goldman

Each Spring, senior Mathematical Sciences majors take the Methods of Applied Mathematics II, or capstone, course in which small teams of students conduct applied research projects under the guidance of faculty members. These projects, carried out in a special laboratory created under a National Science Foundation grant, involve performing physical experiments and analyzing the results using mathematical and computational techniques learned as part of the undergraduate curriculum. In 2003, two groups of students completed and presented capstone projects. The photos were taken after the final presentation. The following pages describe in more detail their research projects.

CAPSTONE PROJECT: Hele-Shaw Flow Past Obstacles

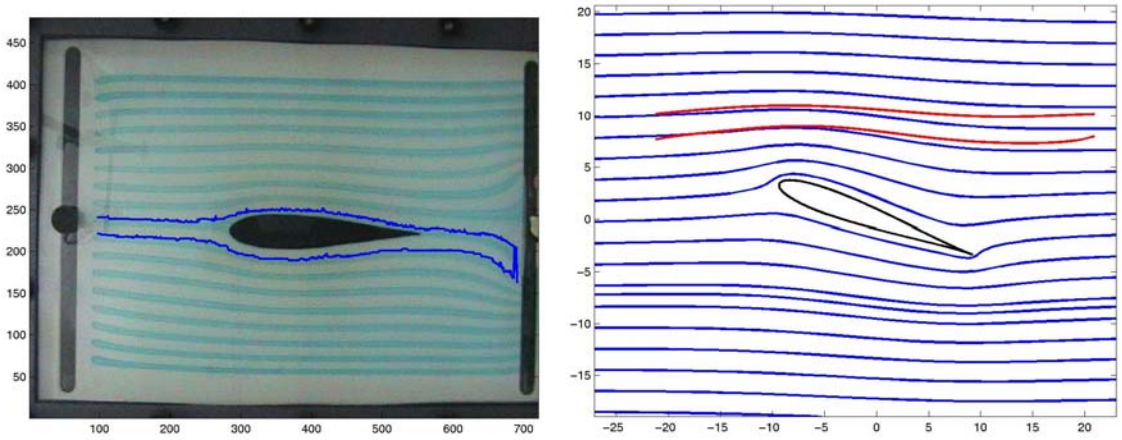
Advisor: Professor Daniel Goldman

Students: Nelson Almeida, Dana Bertrand, Michael Caruso, Valeria Ceballos, Geoffrey Cox, Mona Das, Emilia Gagiu, and Charles Henches

Graduate Student Assistant: Hoa Tran

This project used the Hele-Shaw setup to study flow around a cylinder and flow around an airfoil at various angles of attack. The flow was visualized using ink sources evenly distributed along the entrance to the flow domain, and the students then extracted the streamlines using an automated computer routine that they wrote (left figure below). By using relatively low-order polynomial interpolation, the students were able to obtain smooth streamline curves for each of the experimental situations studied.

After performing a mathematical analysis to show that the experimental flows could be approximated by two-dimensional ideal flows, the students used potential flow theory and the Joukowski transformation to solve for the flows around a cylinder and an airfoil. These theoretical results were then compared to experiment by plotting streamlines (right figure below).



CAPSTONE PROJECT: Contact Line Instability in the Flow of Thin Liquid Films

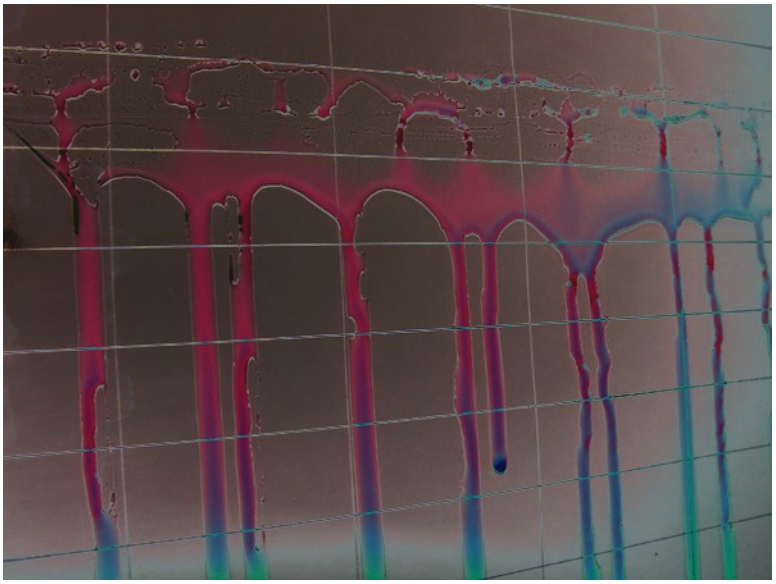
Advisor: Professor Lou Kondic

Students: Michael Abdelnoor, Charles Jamerlan, Ravi Kant, Miao Li, Tom Shreck, Dwayne Searwar, and Yu Han Su

Graduate Student Assistant: Tsezar Seman

The experimental part of this project has been performed using a previously built platform (see CAMS Annual Report 2000/01) consisting of a frame covered by a sheet of glass. The fluid is then released to flow under gravity down a plane. Very quickly the fluid front (contact line) becomes unstable and develops patterns. The figure shows the resulting pattern for the flow of partially wetting fluid (glycerol) down an “inverted” plane characterized by an inclination angle of 120 degrees relative to the horizontal. The students used a small amount of food coloring and, in addition, image processing to achieve a high contrast thus permitting good visualization.

The theoretical part involved a number of different directions. Students, or student groups, were assigned complementary projects with the idea of having them concentrate on a single given aspect or technique, but also exposed them to the complete problem via interaction with their colleagues, weekly informal seminars, etc. The student projects have included linear stability analysis, numerical simulations of highly nonlinear PDE's using explicit and implicit methods, and analysis of the self-similar solutions. The students' results were presented in a Special Applied Math Seminar on May 8, 2003.



B. GRADUATE STUDENT RESEARCH PROGRAMS

Demetrios T. Papageorgiou, Director of the Graduate Program

Ph.D.s Awarded:

Xiaoyun Sun, January 2003.
Thesis: Closed-loop Control of Vortex Shedding from a Cylinder with Lorentz Force
Advisor: Dr. Nadine Aubry
Current Position: CAE Engineer, BASF Corp., Morristown, New Jersey

Lyudmyla Barannyk, May 2003.
Thesis: Fully Nonlinear Interfacial Waves in a Bounded Two-Fluid System
Advisor: Dr. Demetrius Papageorgiou
Current Position: Postdoctoral Fellow, University of Michigan at Ann Arbor

Urmi Ghosh-Dastidar, May 2003.
Thesis: Optimization for Source Localization and Geoacoustic Inversion in Underwater Acoustics
Advisor: Dr. Zoi-Heleni Michalopoulou
Current Position: Assistant Professor, New York City College of Technology, Brooklyn, New York

Publications, Presentations, and Conference Participation:

Christina Ambrosio attended the SIAM Conference on Applications of Dynamical Systems in Snowbird, Utah which was held May 27-31, 2003. She gave a poster presentation titled, “Distinct Synaptic Pathways Control the Frequency of a Rhythmic Network” (coauthors Profs. Farzan Nadim, Amitabha Bose, and Yair Manor).

Lyudmyla Barannyk (with Demetrios T. Papageorgiou) published the paper: *Fully nonlinear gravity-capillary solitary waves in a two-fluid system of finite depth*, Journal of Engineering Mathematics 42: 321-339, 2002. She also presented "Three-Dimensional Fully Nonlinear Interfacial Long Waves in a Bounded Two-Fluid System" (together with D. Papageorgiou), at the 55th Annual Meeting of the Division of Fluid Dynamics in Dallas, Texas held from November 24 to November 26, 2002.

The American Women in Mathematics (AWM) offered a total of 20 travel awards for women graduate students and postdocs to attend the AWM Workshop for Women Graduate Students and Recent Ph.D.s from June 16-17, 2003, in Montreal, Canada, held in conjunction with the First Annual Meeting of CAIMS and SIAM, the 24th Annual Meeting of CAIMS/SCMAI and the Annual meeting of SIAM.

NJIT won three out of the 20 AWM awards for travel and two days food and lodging expenses. The NJIT students selected were:

Lyudmyla Barannyk gave a talk in a minisymposium on Biology and Fluid Dynamics: “Fully Nonlinear Interfacial Waves in a Channel" (with Demetrios T. Papageorgiou). She earned her Ph.D. in May 2003, and has accepted a prestigious postdoctoral position in the Department of Mathematics at the University of Michigan, Ann Arbor, effective September 2003.
Jyoti Champanerkar presented a poster, “Global Hopf & Pitchfork Bifurcations” and represented the NJIT Chapter of SIAM at the SIAM Conference.
Tetyana Segin (M.S. in Applied Mathematics, May 2001, NJIT) presented a poster, “Nonlinear Long-Wave Stability of Two-Fluid Flow Interface in an Inclined Channel”.

Urmi Ghosh-Dastidar presented “Tabu for source localization and geoacoustic inversion” (coauthored with Z. H. Michalopoulou), at the First International Conference, Inverse Problems: Modeling and Simulation, in Fethiye, Turkey, in July 2002.

Arnaud Goullet presented “Mixing Enhancement by Dual Speed Rotating Stirrer” at the 14th U.S. National Congress of Theoretical and Applied Mechanics on June 27, 2002, in Blacksburg, Virginia. He also presented “Mixing Enhancement by Dual Speed Rotating Stirrer” at the American Physical Society, Division of Fluid Dynamics 55th Annual Meeting, on November 25, 2002.

Fu Li published (with Nadine Aubry) the paper, *Feedback control of a flow past a cylinder via transverse motion*, Physics of Fluids, Vol. 15, pp. 2163-2176, 2003.

Valery Lukyanov attended the Joint Summer Research Conference “Waves in Periodic and Random Media”, at Mount Holyoke College, South Hadley, Massachusetts, from June 22-28, 2002.

Yuri Mileyko and **Lin Zhou** attended the 6th PIMS-IMA Graduate Industrial Mathematics Modelling Camp (GIMMC) at the Banff International Research Station (BIRS) in Alberta, Canada from May 16 to May 24. They also attended the 7th PIMS-IMA Industrial Problem Solving Workshop (IPSW) at the University of Calgary, Alberta, Canada from May 25 to May 29. Both events were sponsored by the Pacific Institute of the Mathematical Sciences (PIMS) and the Institute for Mathematics and its Applications (IMA).

Kelly Savettaseranee published (with D.T. Papageorgiou, P.G. Petropoulos, and B.S. Tilley) the paper, *The effect of electric fields on the rupture of thin viscous films by van der Waals forces,* Physics of Fluids, Vol. 15, pp. 641-652, 2003.

Tetyana Segin presented her work, “Nonlocal Effects in Two-layer Flow”, at the 55th Annual Meeting of the Division of Fluid Dynamics in Dallas, Texas held from November 24 to November 26, 2002.

Hoa Tran gave a presentation titled, "Transport of Electromagnetic Energy in Models for Dispersive Media" at the SIAM 50th Anniversary and 2002 Annual Meeting in Philadelphia, PA in July 2002.

Report of the Ph.D. Qualifying Exam Committee by Peter G. Petropoulos

In August 2002, qualifying exams were given in Analysis, Applied Mathematics, Linear Algebra/Numerical Methods and Topics in Statistics. In order to continue in the Ph.D. program, students must achieve an A grade in their qualifying exams. Four students taking the Analysis exam and one student taking the Topics in Statistics exam achieved an A grade.

In January 2003, qualifying exams were given in Applied Mathematics and Linear Algebra/Numerical Methods. Three students taking the Applied Mathematics exam and one student taking the Linear Algebra/Numerical Methods exam achieved an A grade.

Summer Activities:

Graduate Student Summer Program, May 19 - August 8, 2003

Activities:

Advanced Linear Algebra and Numerical Methods
Instructors: Denis Blackmore and David Horntrop
Meets: 10 AM-12 Noon, Tuesdays and Thursdays
Teaching Format: Formal lectures, student projects and presentations, and problem sessions.

Advanced Real and Complex Analysis
Instructor: Marianito Rodrigo
Meets: 1 PM - 3 PM, Mondays and Wednesdays
Teaching Format: Formal lectures, student projects and presentations, and problem sessions.

Summer Student Seminar Series
Organized by Marianito Rodrigo, with the assistance of Jyoti Champanerkar
Fridays, 10 -11 AM, Room 611

May 23: Arnaud Goullet "Chaotic Advection"

May 30 Jyoti Champanerkar "Global Hopf & Pitchfork Bifurcations"

June 6 Lyudmyla Barannyk "Fully Non-linear Interfacial Waves in a Bounded Two Fluid System"

June 13 Satrajit Roychaudhury & Soumi Lahiri "Sample Based Approaches for Calculating Marginal Densities"

June 20 Valery Lukyanov "Scattering Matrix Analysis of Periodic Structures"

June 27 Yuriy Mileyko "Differential Equations Approach to Manifold Intersections"

July 11 Ivan Zorych "Regression In Practice (with SAS examples)"

July 14 Dmitri Tseluiko & Filippo Posta "Distribution of Prime Numbers and The Riemann Hypothesis"

July 18 Christina Ambrosio "Distinct Synaptic Pathways Control the Frequency of a Rythmic Network"

July 21 Priyal Gogri "Project Steam Plant"
Zeliha Senturk "Spheres in Weyl Spaces"

July 25 Tetyana Segin-"Nonlinear Interfacial Stability of Compressible/Incompressible Fluids Flow"

August 1 - Muhammed Hameed – "Influence of Surfactant on the Break-up of a Fluid Jet"
Lin Zhou – "Perturbation Analysis on Dispersive Properties of Microstrip"

August 4 Francis Kariuki – "Applications of Ordinary Differential Equations"
Krishnandu Ghosh –"Introduction to Wave Propagation"

August 8 Michelle Picarelli "Gibbs Sampling on Time Delay and Amplitude Estimates in an Uncertain Environment"

Summer Faculty Seminar Series
Organized by Denis Blackmore
Wednesdays from 10 - 11 AM in Room 611

May 21: Prof. D. Goldman, NJIT
"Mathematical and Computational Modeling of Transport Processes in the Microcirculation"

May 28: Prof. M. Booty, NJIT
"Microwave Heating of an Object in a Waveguide"

June 4: Prof. R. Miura, NJIT
"Solitons and Inverse Scattering: An Historical View"

June 11: Prof. Renuka Ravindran, IIT Bangalore
"Approximating an Infinite System of Ordinary Differential Equations"

June 18: Prof. D. Stickler, NJIT
"A Shallow Water Ocean Acoustics Problem"

June 19 (Bonus Talk, 2-3 PM, Room 611): Prof. Richard Haberman, SMU
"Slow Passage Through Homoclinic Orbits for the Unfolding Saddle-Center Bifurcation and the Change in the Adiabatic Invariant"

June 25: Prof. D. Blackmore, NJIT
"Computational Topology: An exciting blend of mathematics and computer science"

July 2: Prof. R. Goodman, NJIT
"Interaction of Sine-Gordon Solitons with Defects"

July 9: Prof. D. Horntrop, NJIT
"Numerical Methods for Stochastic Partial Differential Equations"

July 16: Prof. P. Petropoulos, NJIT
"Absorbing Boundary Conditions for Numerical Solution of the Time-Dependent Maxwell Equations in Open Domains"

July 23: Prof. C. Connell, NJIT
"Micromechanics of Defects in Thin Films"

July 30: Prof. B. Bukiet
"Mathematical Modeling of Air Flow in the Lungs"

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