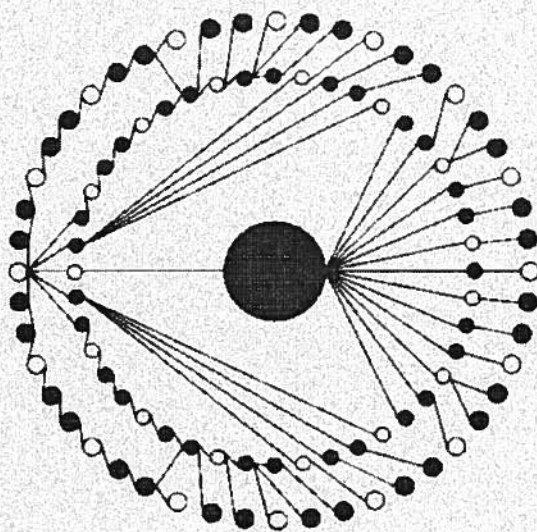


Department of Applied Mathematics



Annual Report 1999-2000

University of Colorado at Boulder
Boulder, Colorado 80309-0526

Mark J. Ablowitz, Chair
June 30, 2000

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OVERVIEW

From the Chair

The Department of Applied Mathematics continues its outstanding efforts in undergraduate, graduate and postdoctoral education as well as research and scholarly work. The \$2.3 million NSF grant supporting Vertical Integration in Research and Education (VIGRE) via APPM tetrahedral groups has been solidified with the appointment of two new postdoctoral instructors: Drs. Natasha Flyer and Panayotis Panayotaros. By summer's end, VIGRE PI James Meiss expects to have appointed eight VIGRE graduate assistants. In addition VIGRE will be supporting at least eight undergraduates.

We are delighted to note that the graduate committee has recruited an impressive new class of approximately 20 graduate students including a new Chancellors Graduate Fellow, Scott MacLachlan.

Similarly, the CCHE excellence grant, mentioned at this time last year in the APPM annual report, has allowed the Department to further many of its goals. It helps extend the vertical integration efforts of the unit in the direction of technology throughout the curriculum, allows the purchase of seriously needed computing equipment and has let the unit begin an outreach effort for high school teachers ("The Summer Institute") in probability and statistics, calculus and related software applications.

The teaching activities of the unit continue at an extremely high level. In 1999-2000 APPM taught 3529 students which translates to approximately 13,000 student credit hours. APPM faculty continue their research and service activities at an impressive level. The faculty wrote 26 papers and book chapters, gave 44 invited lectures at conferences and universities worldwide and serve on 12 editorial boards in 15 capacities. Important to the unit are its affiliated faculty, of which there are 39 affiliates who can direct MS and PhD theses with a co-advisor from APPM. We are pleased to note the following:

- Professor Tom Manteuffel has been elected President of the Society of Industrial and Applied Mathematics. Congratulations Tom!
- Dr. Jem Corcoran has been hired as an Assistant Professor beginning fall semester 2000. Jem is an expert in applied probability/stochastic processes. We are looking forward to Jem's arrival!
- Professor James Curry has developed a significant collaboration with Sun Microsystems to begin a teaching/training effort in Java programming and the Solaris operating system. An additional goal is to allow CU students to obtain Sun certification as part of its curricula. Thank you, Jim!
- Professor Harvey Segur will assume the role of Chair and Dr. Anne Dougherty will assume that of Associate Chair of the Department on July 1.

Finally, it has been my pleasure to work as Director/Chair of the Program/Department of Applied Mathematics during the past eleven years. I thank Associate Chair James Curry for an outstanding job during this period. I wish the new Chair/Associate Chair of the Department great success.

From the Associate Chair

The Associate Chair continues to provide coordination and operational support for scheduling, assigning, and implementing the Departments teaching mission. Additionally, the Associate Chair is concerned with current and future development plans and goals. Below we mention one project we have been engaged in during the 1999-2000 academic year.

The Associate Chair has been working with Sun Microsystems to establish a relationship leading to both internships and teaching opportunities for Applied Mathematics students, postdoctoral associates, instructors and faculty. We have had some successes and believe the Department now has a solid foundation to build on. More specifically, Sun has agreed to pilot an educational effort that allows several applied math department members to become Sun certified instructors. To date, four graduate students have successfully achieved certification as "Sun certified academic instructors". This means that those students have passed the JAVA language certification examination and can certify other university colleagues in this area. It also means that there are now several new educational opportunities that are available to students enrolled in the academic effort.

In addition to the above, the Department of Applied Mathematics submitted two course proposals that added JAVA materials to the curriculum, JAVA 1 and JAVA 2. The Department offered the JAVA 2 course, APPM 2775, during the pre-summer Maymester term as well as during both the A and B summer sessions starting June 2000. The Department also plans to offer the JAVA 1 and JAVA 2 courses as part of its regular offerings starting with the fall 2000 academic year.

The Associate Chair wrote and submitted an Engineering Excellence Fund (EEF) proposal and the Department was awarded \$25,000 for course development. The EEF award will be used to begin the development of hands on interactive JAVA based projects that will be suitable for Calculus II students. EEF funding will also be used to begin the development of a lower division Linear Algebra course suitable for students in the College. This project is aligned with the JAVA educational development activities that were described above.

All of the efforts mentioned above were carried out with the help of faculty, graduate students and especially staff. It has truly been a year of excellence.

1. ROLE AND MISSION

The objectives of the Department of Applied Mathematics at the University of Colorado at Boulder are summarized below:

- a) Provide undergraduate and graduate students with high quality education and training in applied mathematics and prepare them for careers in industry, laboratories and the academic professions.
- b) Offer and monitor degree programs leading to a BS, MS and PhD degrees in Applied Mathematics.
- c) Nourish and maintain a professional environment in which excellence in teaching, learning, scholarship and creativity are of central importance.
- d) Assure teaching and research expertise in a number of key areas of applied mathematics including the methodology of applied mathematics, computational mathematics and algorithms, industrial applications, applied probability and statistics.

2. DEPARTMENTAL ACTIVITIES

A. Undergraduate Education

In 1999-00, the Department of Applied Mathematics had a core of thirteen tenure track faculty members plus two instructors responsible for the teaching and advising of all undergraduate and graduate students taking applied mathematics courses. The Department has a large teaching commitment since most undergraduate engineering majors are required to take four courses in applied mathematics. The Department taught a total of 3,529 undergraduate and graduate students in 22 undergraduate courses and 23 graduate courses. We had 60 undergraduate majors with 11 receiving their baccalaureate degrees. We are proud that 22 made the Dean's List for academic achievement with grade point averages of 3.5 or better. There are also 20 students pursuing a minor in Applied Mathematics in the College of Arts and Sciences. The VIGRE Grant that the department received from the National Science Foundation has begun to change the character of our undergraduate major. Five of our undergraduates have participated in "tetrahedra" consisting of undergrads, grads, postdocs and faculty working together on many parts of a common research theme. In the coming academic year, it is expected that eight of our undergraduates will be part of the VIGRE program. The art of creating and testing mathematical models of important real world problems will be increasingly emphasized as part of the undergraduate training. Participation in research seminars and group discussions will broaden the undergraduate experience, making our majors even more competitive when they enter the job market.

A combined Bachelor's-Master's program was created and approved during 1999-2000. The program permits a well-focussed student to acquire both a Bachelor's degree and a Master's degree in five years in the Applied Math Department. The first student to use this path plans to finish in 2001.

At the May graduation ceremony Elaine Spiller received the Henrie-James award for outstanding scholarship and service by a student continuing to graduate school. Willie Heuett was honored as the outstanding senior with a 3.73 grade-point average, and Anna Segurson was honored for outstanding service. The undergraduate student chapter of SIAM (the Society for Industrial and Applied Mathematics) continued its active tradition. Events this past year included nine student presentations, a resume-writing workshop, invited speakers and several mentor lunches. Jillian Redfern served as Chapter President. She was assisted by Willie Heuett, Mark Snyder, Anna Segurson and Elaine Spiller. The officers for the 2000-01 academic year will be Mary Kindel and Saverio Spagnolie (co-Presidents), Jeremy Horgan-Kobelski (Secretary) and Jocelyn Renner (Treasurer). Anne Dougherty was the faculty advisor for 1999-2000 and will continue in that capacity next year.

The Department entered two 3-person teams in the 2000 Mathematical Contest in Modeling. This international contest, sponsored by COMAP (The Consortium for Mathematics and its Applications), ran from 12:01 am February 4, 2000 until 5:00 p.m. February 7, 2000 and drew 495 entries from around the world. The CU-Boulder team of Bill Woessner, Rich Younger and Martin Linck was designated as one of the Outstanding Papers for Problem A. This is the highest designation possible. In addition, their paper was selected as the INFORMS winner (Institute for Operations Research and the Management Sciences). The paper submitted by Jim Barron, Cristy Shannon and John Herman was designated as Honorable Mention for Problem C. Only 26% of the papers received this designation. Bengt Fornberg and Anne Dougherty served as faculty advisors for both teams.

Six of our graduating seniors will be continuing their education in various graduate programs. They are Jonathan Peeters at MIT in Mathematics and Elaine Spiller at Northwestern University in Applied Mathematics; Willie Heuett at the University of Washington in Applied Mathematics and Statistics; Anna Segurson at the University of Arizona in Computer Science; Anthony Moscoso at the American Economic Association Summer Institute at the University of Texas and will continue on to a graduate program in Economics; and William Woessner at the University of Maryland in Computer Science.

B. Graduate Education

During 1999-2000, the Department had about 50 graduate students. This number has held fairly steady for the last three years. Of these, about 18 were supported as teaching assistants. One more held a prestigious Chancellor's Fellowship. This is the department's first full year of support from NSF's VIGRE (Vertical Integration in Research and Education) program, and 4 of our students held VIGRE Fellowships. This number is expected to grow to about 12 within the next few years. Many of our students hold research assistantships. This is due both to the success of our faculty in obtaining research support, and to our Affiliated Faculty Program. The Department has 39 Affiliated Faculty members, each of whom can direct a graduate student towards a PhD in Applied Mathematics. In 1999-2000, 8 students were supported as research assistants within the department, 6 more held research assistantships in other departments on campus, and an additional 8 held full time research positions off campus (either in a government lab or in a private company).

Applied and Computational Harmonic Analysis (Beylkin)
Cambridge University Press Texts in Applied Mathematics (Ablowitz)
Communications on Applied Nonlinear Analysis (Bebernes, Easton)
Electronic Transactions in Numerical Analysis (Manteuffel)
Journal of Engineering Mathematics (Ablowitz)
Journal of Numerical Linear Algebra and Applications (Manteuffel)
Physica D (Meiss)
Proceedings of the American Mathematical Society (Ablowitz)
Rocky Mountain Journal of Mathematics (Bebernes)
SIAM Journal of Numerical Analysis (Manteuffel, Beylkin, McCormick)
SIAM Journal on Scientific Computation (McCormick)
Studies in Applied Mathematics (Ablowitz)

In addition, Tom Manteuffel was elected President of the Society of Industrial and Applied Mathematics (SIAM) this past year.

G. Conferences

Copper Mountain

We organize the Copper Mountain Conference in April of each year, alternating between Iterative Methods in even years and Multigrid Methods in odd years. This year the conference was on Iterative Methods and was held on April 3-7. There were 190 participants and 120 lectures. A special feature of this conference is the support of students, which usually amounts to free lodging and registration, and travel assistance in some cases, for over 30 graduate students. The Student Paper Competition and substantial participation by the students in the lecture program and audience has been one of hallmarks of this series, and it has helped to make these conferences central contributors to the field of multigrid and iterative methods.

H. Remarks

We are pleased to note that Assistant Professor Keith Julien received a positive comprehensive review. The Department carried out a successful search for an assistant professor for ay 2000-20001. We are delighted to have Dr. Jem Corcoran join the faculty. Jem's field of expertise is stochastic processes and statistics.

The Department wishes to sincerely thank its to all of its staff—Bruce Fast, Stu Naegele, Michelle Travis, Rebecca Thomas and Margy Lanham—for their remarkable efforts in keeping the unit running effectively. We must bid farewell to Rebecca Thomas who is returning to Texas for graduate study. We wish her success in her studies and future career. We are also saying a sad goodbye to Michelle Travis who is returning to the less hurried existence outside the University. Our best wishes go with her.

3. FACULTY, RESEARCH ASSOCIATES AND STAFF

A. Core Faculty and Long Term Visitors

Mark J. Ablowitz, Chair, Professor; PhD, Massachusetts Institute of Technology. Partial Differential Equations, Solitons, Nonlinear Waves.

Deborah Alterman, Postdoctoral Research Associate; PhD, Northwestern University. Nonlinear Waves.

Jerrold Bebernes, Professor; PhD, University of Nebraska. Differential Equations, Reaction Diffusion Systems, Combustion Theory, Analysis.

Gregory Beylkin, Professor; PhD, New York University. Computational Methods, Wavelets, Geophysical Inverse Scattering.

Amy Biesterfeld, Instructor; PhD, University of California at Los Angeles. Applied Probability, Stochastic Processes.

Anjan Biswas, Instructor, Postdoctoral Research Associate; PhD, University of New Mexico. Nonlinear Waves, Nonlinear Optics, Solitons.

Marian Brezina, Postdoctoral Research Associate; PhD, University of Colorado at Denver. Algebraic Multilevel Methods.

Stephen Bricher, Visiting Professor (Linfield College, McMinnville, OR); PhD, University of Colorado at Boulder; Partial Differential Equations.

Robert Cramer, Postdoctoral Research Associate; PhD, University of Colorado at Boulder. Numerical Analysis, Wavelets, Potential Theory

James H. Curry, Professor; PhD, University of California at Berkeley. Dynamical Systems, Numerical Methods, Nonlinear Equations.

David Dean, Postdoctoral Research Associate; PhD, University of Colorado at Denver. Computational Math, Multigrid Analysis.

Anne Dougherty, Senior Instructor; PhD; University of Wisconsin, Madison. Applied Probability, Stochastic Processes.

Tobin Driscoll, Postdoctoral Research Associate; PhD, Cornell University. Numerical Analysis, Numerical Methods for PDEs and Conformal Mapping.

Robert Easton, Professor; PhD, University of Wisconsin. Dynamical Systems, Hamiltonian Mechanics.

Bengt Fornberg, Professor; PhD, Uppsala University, Uppsala, Sweden. Numerical Analysis, Computations of Wave Phenomena.

David Gines, Postdoctoral Research Associate; PhD, University of Colorado at Boulder. Wavelets and Multilevel Methods, Biomedical Engineering.

Rod Halburd, Instructor; PhD, University of New South Wales. Integrable Systems, Darboux-Halphen System.

Keith Julien, Assistant Professor; PhD, Cambridge University. Mathematical and Computational Fluid Dynamics, Dynamical Systems Theory.

Congming Li, Assistant Professor; PhD, New York University. Elliptic Partial Differential Equations.

Tom Manteuffel, Professor; PhD, University of Illinois, Urbana. Computational Math; Numerical Linear Algebra, Iterative Mathematics, Numerical Solution of PDE's.

Steve McCormick, Professor; PhD, University of Southern California. Computational Math, Numerical Partial Differential Equations, Multigrid Methods, Parallel Computation, Computational Fluids, Tomography, Electromagnetics.

James D. Meiss, Professor; PhD, University of California at Berkeley. Dynamical Systems, Hamiltonian Mechanics, Plasma Physics.

Martin Mohlenkamp, Postdoctoral Research Associate; PhD, Yale University. Computational Harmonic Analysis, Non-linear PDEs and Cryptography.

Lucas Monzón, Postdoctoral Research Associate; PhD, Yale University. Harmonic Analysis, Wavelets.

J. Adam Norris, Part-time Instructor; PhD, University of Colorado, Boulder. Phase Change Kinetics, Perturbation Methods, Numerical Methods.

Gareth Roberts, Postdoctoral Research Associate; PhD, Boston University. Dynamical Systems.

Harvey Segur, Professor; PhD, University of California at Berkeley. Nonlinear Waves, Fluid Dynamics, Asymptotic Methods.

John Shortle, Instructor; PhD, University of California at Berkeley. Queueing Theory, Probabilistic Design of Engineering Systems, Visualization of Probability.

John Williamson, Professor; PhD, University of Minnesota. Statistical Methods in Genetics, Applied Probability, Mathematical Statistics.

B. Affiliated Faculty

Steve C. Arendt (Colorado Research Associates), Theoretical Fluid Dynamics

Mark Balas (Aerospace Engineering, Electrical Engineering), Control of large-scale and distributed parameter systems, system identification and adaptive control, Nonlinear PDE's, Numerical Methods for model reduction, controller synthesis and stability analysis.

Norm Bleistein (Mathematics, Colorado School of Mines), Direct & Inverse Scattering, Asymptotic Methods, Wave Phenomena

William Blumen (Program in Atmospheric and Oceanographic Sciences--PAOS), Geophysical Fluid Dynamics in Atmospheric Science

Elizabeth Bradley (Computer Science), Scientific Computation, Artificial Intelligence, Nonlinear Dynamics

Richard Byrd (Computer Science), Numerical Computation, Optimization Algorithms

John Cary (Physics), Nonlinear Dynamics, Plasma Physics, Accelerator and Space Physics

Senarath deAlwis (Physics), Theoretical Physics, String Theory, Quantum Gravity

Thomas DeGrand (Physics), Numerical Methods for Quantum Field Theory

Fred Glover (Graduate School of Business), Large-scale Systems, Applied Artificial Intelligence, Optimization Models

Martin Goldman (Physics), Plasma Physics, Nonlinear Waves, Turbulence

Vijay Gupta (Geological Sciences; Cooperative Institute for Research and Environmental Sciences), Hydrology, Stochastic Processes, Fluid Dynamics

Ute Christina Herzfeld (INSTAAR, Geomathematics), Geostatistical Analysis of Remote Sensing Data, Applications in Glaciology, Marine Geophysics and Global Change Research

Tissa Illangasekare (Civil Engineering), Mathematical Modeling of Flow and Transport in Porous and Fractured Media, Computational Methods, Numerical Modeling

Elizabeth Jessup (Computer Science), Numerical Computation, Parallel Computation

David Kassoy (Mechanical Engineering), Fluid Dynamics, Combustion Theory, Thermal Science

James Kelly (College of Business), Heuristic Search, Optimization, Artificial Intelligence

Manual Laguna (College of Business), Exact and Heuristic Methods for Combinatorial Optimization Problems, Network Flow Programming, Applied Artificial Intelligence

Michael Lightner (Electrical Engineering), VLSI, Discrete Mathematics, Graph Theory

Shankar Mahalingam (Mechanical Engineering) Turbulent Combustion, Direct Simulations

Andrew Moore (Atmospheric and Oceanic Sciences), Ocean-Atmosphere Modeling

Oliver McBryan (Computer Science), Parallel Computation, Graphics and Visualization, Computational Fluid Dynamics

Lev Ostrovsky (CIRES/NOAA Environmental Technology Laboratory), Nonlinear Waves, Fluid Dynamics, Oceanography, Acoustics

K.C. Park (Aerospace Engineering) Parallel computation, Structural vibrations

Harihar Rajaram (Civil, Environmental and Architectural Engineering), Fluid Flow, Transport Phenomena and Reactive Processes in Geologic/Geochemical Phenomena

John Rundle (Geological Sciences; Cooperative Institute for Research in Environmental Sciences), Statistical Mechanics Applied to Earth Sciences, Complex Systems, Simulations of Nonlinear Systems, Earthquakes, Transport Processes in the Geological Sciences

Robert Sani (Chemical Engineering), Computational Fluid Dynamics, Free and Moving Boundary Problems, Stability of Systems

Robert Schnabel (Computer Science), Numerical Methods for Optimization, Nonlinear Equations, Parallel Scientific Computation

Richard Seebass (Aerospace Engineering), Aerodynamics, Gas Dynamics, Supersonic and Hypersonic Flows

J. Michael Shull (Astrophysical and Planetary Sciences), Theoretical Astrophysics

Rex Skodje (Chemistry and Biochemistry; Joint Institute for Laboratory Astrophysics), Nonlinear Dynamics, Quantum Chaos, Molecular Dynamics

Gary Stormo (Molecular, Cellular and Developmental Biology--MCDB), Molecular Structures and Patterns, Computer Sequence Analysis, Splicing Algorithms

Renjeng Su (Electrical Engineering), Nonlinear Dynamics Modeling, Control, Robotics

Juri Toomre (Astrophysical and Planetary Sciences; Joint Institute for Laboratory Astrophysics), Astrophysics, Mathematical Modeling, Numerical Simulation

Patrick Weidman (Mechanical Engineering), Hydrodynamic stability, solitary waves and their interaction, counter-rotating vortex rings, Stokes flow on dendrite models, similarity flows in natural convection, fluid sloshing in freely suspended containers

Jeffrey B. Weiss (Astrophysical and Planetary Sciences; Atmospheric and Oceanic Sciences), Geophysical Fluid Mechanics, Turbulence, and Climate predictability

Thomas Warner (Atmospheric and Oceanic Sciences) Numerical modeling of mesoscale atmospheric phenomena; Marine meteorology

Joseph Werne (Colorado Research Associates), Fluid dynamics

Ellen Zweibel (Astrophysical and Planetary Sciences), Plasma Physics, Astrophysics

C. Short Term Visitors, 1999-2000

Chaoqun Liu, Louisiana Technological University, August 18-August 19, 1999

Javier Villarroel, Universidad de Salamanca, Spain, August-September 1999

Piere Lochak, University of Paris, September 27- September 30

Jan Hesthaven, Brown University, September 30- October 2, 1999

Silvana de Lillo, Universita de Perugia, Italy, October 1999

Ted Vessey, St. Olaf College, Minnesota, November 18-19, 1999

Ben Herbst, University of Stellenbosch, South Africa, November 18- November 28, 1999

Karin Goosen, University of Stellenbosch, South Africa, November 18- 28, 1999

Sang Dong Kim, Korea, January 23-February 22, 2000

Chang-Ock Lee, Inha University, Korea, January 23-February 22, 2000

Alan Elcrat, Wichita State University, February 10- February 13, 2000

Johannes Korsawe, University of Essen, Germany, March 27-March 31

Ulrich Ruede, University of Erlangen, Germany, April 1-April 11, 2000

Gerhard Starke, University of Essen, Germany, April 8-April 12, 2000

Vassilis Rothos, University of Warwick, England, May 4-May 18, 2000

D. Staff

Bruce Fast	Systems Administrator
Stu Naegele	Professional Research Assistant
Margy Lanham	Professional Research Assistant
Michelle Travis	Student Services Coordinator
Rebecca Thomas	Faculty Services Coordinator

4. COLLOQUIA, SEMINARS, SYMPOSIA, 1999-2000

A. Applied Mathematics Colloquium Schedule, 1999-2000

Our Applied Mathematics Colloquium series continued this year. The colloquia were held Friday afternoons during the academic year at 3:00 p.m., with coffee and tea preceding at 2:30 p.m. in the APPM conference room, ECOT 226.

Alberto Bressan, International School for Advanced Studies, SISSA, Trieste, Italy, August 27, 1999, "Hyperbolic Systems of Conservation Laws".

Alexandre Chorin, University of California at Berkley, September 3, 1999, "Scaling Laws in Turbulence".

Graeme Fairweather, Colorado School of Mines, September 10, 1999. "Almost Block Diagonal Linear Systems: Applications and Solution Techniques".

Mark Balas, University of Colorado at Boulder, September 17, 1999, "Adaptive Control of Persistent Disturbances: A Semi-tutorial".

Jan Hesthaven, Brown University, Providence, Rhode Island, October 1, 1999, "Cartesian Grid Methods for Maxwell in Complex Geometries".

Chris Bizon, Colorado Research Associates, October 8, 1999, "Associates Patterns in Shaken Sand: Follow the Bouncing Balls".

Jeremy Haefner and Gene Abrams, University of Colorado, Colorado Springs, October 15, 1999, "SHOWME- Spearheading Online Work in Mathematics Education".

Willy Hereman Colorado School of Mines, October 22, 1999, "Symbolic Computation of Conserved Densities, Generalized Symmetries, and Recursion Operators for Nonlinear Evolution and Lattice Equations".

William A. Massey, Bell Laboratories, Lucent Technologies, Murray Hill, New Jersey, October 29, 1999, "Strong Approximations for Markovian Service Networks".

Walter Craig, Brown University, Providence, Rhode Island, November 12, 1999, "Traveling Water Waves".

Ben Herbst, University of Stellenbosch, South Africa, November 19, 1999, "Applications of the SVD".

Joseph Werne, Colorado Research Associates, December 3, 1999 "Optimal Perturbations and the Transition to Turbulence in Wind Shear".

David Fritts, Colorado Research Associates, January 21, 2000, "Turbulence Dynamics and Mixing Accompanying Kelvin- Helmholtz Instability".

Hari Rajaram, University of Colorado at Boulder, January 28, 2000, "Solute Dispersion in a Rock Fracture with a Random Aperture Field".

Don Wang, University of California at Los Angeles, February 4, 2000, "Analysis of a Class of Strange Attractors".

Alan Elcrat, Wichita State University, February 11, 2000, "Some Steady Vortex Flows Past a Cylinder and a Sphere".

- Terry Clark, National Center for Atmospheric Research, February 18, 2000, "Infrared Image Analysis and Numerical Modeling of Wildfires".
- Peter Bates, Brigham Young University, February 25, 2000, "Nonlocal and Discrete Models for Phase Transition: Propagation and Pinning of Interfaces".
- Ken Klingenstein, University of Colorado at Boulder, March 3, 2000, "Internet2 and the Mathematics of Trust".
- Rouslan Krechetnikov, Central Aerohydrodynamic Institute, Moscow, March 10, 2000, "Hidden Invariances in Problems of 2D and 3D Wall-adjacent Jets for Newtonian and non-Newtonian fluids".
- Xu Yan Chen, Georgia Institute of Technology, March 17, 2000, "A Dynamical Systems Study of Self-similar Scaling in Linear and Nonlinear Elliptic Equations".
- Bryce McLeod, University of Pittsburgh, March 24, 2000, "The Wedge Entry Problem".
- Gareth Roberts, University of Colorado at Boulder, April 7, 2000 "Stability of Elliptic Periodic Orbits in the N-Body Problem".
- Alejandro Aceves, University of New Mexico at Albuquerque, April 14, 2000, "Dynamics of Optical Pulses Propagating in Nonlinear Waveguide Arrays".
- G. W. Stewart, University of Maryland at College Park, April 21, 2000, "Krylov Sequences and Eigensystems".
- Ricky Berger, US West Advance Technologies, Boulder, CO, April 28, 2000, "Strategies for Success for Applied Mathematicians in Industry".

B. Seminars in Applied Mathematics, 1999-2000

The Department maintained the Applied Mathematics Seminar, a weekly seminar series on Thursday afternoons at 4:00 p.m. Each Thursday, we used the Physics seminar room G-031 and had coffee and tea on the 11th floor of Duane Physics. We are grateful to the Physics department for allowing us to use their facilities. A list of visiting speakers and the titles of their talks follows:

- Akira Hasegawa, Kochi University of Technology, August 26, 1999, "Dispersion Managed Solutions". Yoshi Ichikawa, Nogoya, Japan, "Symmetry Analysis of Bifurcations in the Standard Map".
- Peter Clarkson, University of Kent at Canterbury, September 2, 1999, "The Relationship Between the Discrete and Continuous Painleve Equations".
- Javier Villarroel, University of Salamanca, Spain, September 9, 1999. "Interacting Soliton Solutions of KP and DS equations".
- Rod Halburd, University of Colorado at Boulder, September 23, 1999, "Meromorphic Solutions of Differential Equations 1: Nevanlinna Theory".
- Pierre Lochak, Universite Pierre et Marie Curie, France, September 30, 1999, "An Infinitesimal Trace Formula for the Laplace Operator on Closed Riemann surfaces".
- Silvana De Lillo, University of Perugia, Italy, October 7, 1999, "On a Burgers-Stefan Problem".
- Norman Lebovitz, University of Chicago, Illinois, October 14, 1999, "Nonlinear Dynamical Systems for the Elliptic Instability".

- Lev Ostrovsky, CIRES/NOAA Environmental Technology Laboratory, Boulder, October 21, 1999, "Mechanisms of Acoustic Nonlinearity in Rocks".
- Evgenii A. Kuznetsov, Landau Institute for Theoretical Physics, Moscow, November 4, 1999, "Hard Soliton Excitation Regime: Stability Investigation".
- Rod Halburd, University of Colorado at Boulder, November 18, 1999, "Meromorphic Solutions of Difference Equations: Series Expansions".
- Yoshi Kimura, Graduate School of Mathematics, Nagoya University, Japan, December 2, 1999, "Vortex Motion on Surfaces With Constant Curvature".
- Yasuhiro Fujii, University of Tokyo, Japan, December 16, 1999 "Operator-valued Riemann-Hilbert Problem for Correlation Functions of the XXZ Spin Chain".
- Tetsu Deguchi, Ochanomizu University in Japan, December 22, 1999, "Some Numerical Results on Random Linking With Applications to Polymers".
- B. C. Low, NCAR High Altitude Observatory, January 27, 2000, "Magnetic Topology and Hydromagnetic Equilibrium".
- Gino Biondini, Northwestern University, February 3, 2000, "Soliton Communications and Wavelength-division Multiplexing".
- Bengt Fornberg, University of Colorado at Boulder, February 10, 2000, "A fast Spectral Algorithm for Nonlinear Wave Equations".
- Michael Spector, University of Colorado at Boulder, Center of Integrated Plasma Studies, February 17, 2000, "On the Pressure Distribution for Random Gaussian Velocities".
- Gregory Beylkin, University of Colorado at Boulder, February 24, 2000, "Generalized Gaussian Quadratures and a Theorem of Caratheodory".
- Yasushi Komori, University of Tokyo, March 2, 2000, "Yang-Baxter Equation and Elliptic Ruijsenaars Model". Akinori Nishino, University of Tokyo, "Rodrigues Formulas for the Nonsymmetric Macdonald Polynomials". Hideaki Ujino, University of Tokyo, "Conserved Operators and their Simultaneous Eigenfunctions for the Quantum Calogero Model".
- Rouslan Krechetnikov, Central Aerohydrodynamic Institute, Moscow, March 9, 2000, "Current Mathematical Problems of Nonlinear Stability-receptivity Theory".
- Brian Marks, Northwestern University, March 16, 2000, "Dispersion Managed Optical Communication Systems with Optimized Amplifier Placement".
- Bryce McLeod, University of Pittsburgh, March 23, 2000, "Similarity Solutions of the Kuramoto-Sivashinsky Equation".
- Deborah Alterman, University of Colorado at Boulder, April 6, 2000, "Diffractive Short Pulse Asymptotics for Nonlinear Wave Equations".
- Alejandro Aceves, University of New Mexico at Albuquerque, April 13, 2000, "Pulse Formation and Dynamics in nonlinear Fiber Grating Structures".
- Anjan Biswas, University of Colorado at Boulder, April 20, 2000, "Dynamics of Solitons in Optical Fibers".
- Rudy Horne, University of Colorado at Boulder, May 4, 2000, "Four-wave Mixing in Strong Dispersion-Managed WDM Soliton Systems".

Vassilis Rothos, University of Warwick, England, May 11, 2000, "Persistent Homoclinic Orbits in Near-Integrable PDEs and PDEs".

Igor Klaikhandler, Northwestern University, May 18, 2000, "Broad-banded Modulations of the Stokes Waves".

C. University of Colorado, Denver - University of Colorado, Boulder Joint Seminars in Computational Mathematics, 1999-2000

The Joint CU Denver-CU Boulder Computational Math Seminar continued the expanded form of last year, with the regular lecture on Tuesdays at 12:00 preceded by three hours of open discussion, with the location alternating between Denver and Boulder. There were typically 20 or more faculty, students, and visitors from the two campuses attending the open discussions and regular lectures. A partial list of speakers and the titles of their talks follows:

Panayot S. Vassilevski, Center for Applied Scientific Computing, Lawrence Livermore National Laboratory, August 31, 1999, "An algebraic (or matrix) framework for multilevel methods as preconditioners".

Donald Estep, School of Mathematics, Georgia Tech, October 5, 1999, "Estimating the Error of Numerical Solutions of Systems of Reaction-Diffusion Equations".

Lynn S. Bennethum, Math Department, CU Denver, October 19, 1999, "A derivation of boundary conditions at an interface".

Joerg Sautter, Department of Applied Mathematics, University of Colorado at Boulder, November 2, 1999, "Analysis of Time Integrators for Numerical Simulations in Fluid Dynamics Balls".

Steve McCormick, Department of Applied Mathematics, University of Colorado at Boulder, December 7, 1999, "Least-Squares Methods for Partial Differential Equations".

Lea Jenkins, Math Department, Texas A and M, February 1, "Aggregate-based multilevel Schwarz preconditioning for Richards' equation".

John A. Belward, Mathematical and Computer Sciences, Colorado School of Mines, March 7, 2000, "Surface Fitting and the Structure of Rainfall Data".

Brad Wallin and Colin J. Aro, Lawrence Livermore National Laboratory, April 11, 2000, "Iterative solver performance on algebraically reduced implicit mechanical linear systems".

You-lan Zhu, Department of Mathematics, University of North Carolina at Charlotte, April 25, "Some mathematical problems in finance."

D. Dynamical Systems Seminars

The weekly Dynamical Systems seminar is a research working group led by James Meiss and Robert Easton. Following is a partial list of the speakers and the titles of their talks:

Carson Chow, University of Pittsburgh, January 20, 2000, "Synchronization in Neuronal Networks".

James Meiss, Department of Applied Mathematics, University of Colorado at Boulder, January 27, 2000, "Iterated Function Systems: The Program".

Don Wang, University of California at Los Angeles, February 3, 2000, "Heteroclinic Connections and Diffusing Time for the Monotone Twist Maps".

Glen Stewart, Laboratory for Atmospheric and Space Physics, February 10, 2000, "A 4D Symplectic Map for the Interaction of Two Planets".

David Sterling, National Institute of Science and Technology, February 17, 2000, "Chaotic Synchronization".

Lou Pecora, Naval Research Laboratory, February 24, 2000, "A Master Stability Function for Synchronization in Coupled Arrays of Oscillators".

James Howard, Department of Physics, University of Colorado at Boulder, March 2, 2000, "Chaotic Dynamics of Ion Traps".

Panos Panayotaros, IIMAS-UNAM, University of Mexico, March 9, 2000, "Surface Waves in Nonlinear Elasticity".

Greg Duane, National Center for Atmospheric Research, March 16, 2000, "Synchronized Chaos in Geophysical Fluid Dynamics".

Bob Easton, Department of Applied Mathematics, University of Colorado at Boulder, March 23, 2000, "An Introduction to Arnold Diffusion".

Gareth Roberts, Department of Applied Mathematics, University of Colorado at Boulder, April 6, 2000, "Elliptical Central Configurations: Stability Results".

Vanessa Robins, Department of Applied Mathematics, University of Colorado at Boulder, April 13, 2000, "Computational Homology".

Kristian Sandberg, Department of Applied Mathematics, University of Colorado at Boulder, April 20, 2000, "A Connection Between Representations of Wavelets and Dynamical Systems".

Tom Peacock, April 27, 2000, "MEMS Control of a Planar Jet".

Steve Arendt, Colorado Research Associates, May 4, 2000, "Numerical Modelling of Late-Wake Turbulence".

E. Probability and Statistics Seminars

Slava Akmaev, Department of Applied Mathematics, University of Colorado at Boulder, September 24, 1999 and October 8, 1999, "A Phylogenetically Enhanced Comparative Method for Protein Tertiary Structure Prediction".

Amy Biesterfeld, Department of Applied Mathematics, University of Colorado at Boulder, October 15, 1999, "Applying Sequential Analysis to Foraging Theory".

John Shortle, US West, Boulder, Colorado, October 22, 1999, "Blocking Models for Telecommunications Networks (tutorial)".

- John Shortle, US West, Boulder, Colorado, November 5, 1999, "Call Blocking Algorithms for Telecommunications Networks".
- Dennis Dietz, US West, Boulder, Colorado, November 12, 1999, "Replicative Use of an External Analytical Model in Simulation Variance Reduction".
- Burt Simon, University of Colorado at Denver, November 19, 1999, "A Quick Tutorial on Simulation Variance Reduction".
- Jeff Luftig, School of Business, University of Colorado at Boulder, December 3, 1999, "Data Mining in Industrial Research".
- Hui Wang, Columbia University, December 10, 1999, "A Barrier Option of American Type".
- Jem Corcoran, University of Georgia, December 13, 1999, "Perfect Simulation with Applications to Statistical Mechanics".
- John Shortle, US West, Boulder, Colorado, December 15, 1999, "Dynamic Call Blocking Algorithms for Telecommunications Networks".
- Craig Williamson, US West, Boulder, Colorado, February 7, 2000, "An Analysis of Underground Electrical Cable Failures".
- John Shortle, US West, Boulder, Colorado, February 14, 2000, "A New Method of Drawing Probability Densities".
- Tim Brown, ITP and Electrical and Computer Engineering, University of Colorado at Boulder, February 21, 2000, "Direct Classification using Indirect Data".
- Laurie Heyer, Department of Mathematics, University of Southern California, April 3, 2000, "Exploring Genome-wide Expression Data".
- Yi-Ju Chao, Motorola, April 11, 2000, "Weak Convergence of a Sequence of Semimartingales to a Diffusion with Discontinuous Drift and Variance Functions".
- Bennett Fox, SIM-OPT Consulting, April 17, 2000, "Filtering the Feynman-Kac Formula".
- Mark Snyder, Department of Applied Mathematics, University of Colorado at Boulder, April 24, 2000, "Benford's Law and Dynamical Systems".
- Richard McNamara, Department of Applied Mathematics, University of Colorado at Boulder, April 24, 2000, "An Unusual Estimator for the Mean of an Exponential Distribution".
- Markus Esmermann, Department of Mathematics, University of Colorado at Denver, May 1, 2000, "Speeding up Simulations of Stochastic Linear Programs with Quasi-Control Variables".

F. SIAM Undergraduate Seminars

The following Seminars were sponsored by the SIAM Undergraduate chapter:

Professor Ted Vessey, St. Olaf College, "Records are Made to be Broken," November 18, 1999.

Peter Fox and Elaine Spiller, Department of Applied Mathematics, February 7, 2000.

Anna Segurson, Department of Applied Mathematics, February 23, 2000.

Jeremy Horgan-Kobelski and William Woessner, Department of Applied Mathematics, March 1, 2000.

Saverio Spagnolie and Jonathan Peeters, Department of Applied Mathematics, March 14, 2000.

Jillian Redfern and Mark Snyder, Department of Applied Mathematics, March 22, 2000.

5. COMMITTEES

A. Undergraduate Committee – John Williamson, Chair

The members of the Undergraduate Committee were Jim Curry (ex officio), Anne Dougherty, Keith Julien, and John Williamson (Chair). In addition, Anne Dougherty was Faculty Advisor to SIAM, an undergraduate Applied Math organization.

The Department of Applied Mathematics had 60 undergraduate majors this year. During the academic year 22 of our majors were on the Dean's list with a grade point average of 3.5 or better during either the fall or spring semester. Elaine Spiller won the 2000 Henrie-James Award as the outstanding applied mathematics major who is going on to graduate school. Willie Heuett received the Outstanding Senior Award for highest grade point average. Anna Segurson received the Outstanding Senior Award for service. Eleven students graduated this year with bachelor of science degrees in applied mathematics. Four of these students graduated with a cumulative grade point average of 3.5 or better.

The minor in Applied Mathematics, available to students in the College of Arts and Sciences or in Engineering, is growing. There are now 20 students who are pursuing a minor in Applied Mathematics or who have graduated with the minor during the past year.

B. Graduate Committee – Harvey Segur, Chair

The graduate committee for 2000-2001 consisted of Gregory Beylkin, Steve McCormick, Jim Meiss, and Harvey Segur (Chair).

The main business of the committee is to advise the current graduate students, process graduate applications, decide on admission to the graduate program and administer the preliminary exams. These exams are given twice each year, in four areas: Applied Analysis, Computational Analysis, Partial Differential Equations and Probability/Statistics.

The program had about 50 graduate students during 1999-2000, 14 of whom began their graduate work in the fall of 1999, with 10 full-time and 4 part-time students. During the year, 3 students received PhDs and 12 received MS degrees.

The number of funded teaching assistantships remained at about 17-19 for several years. Primarily because of student-labs that were added to our sophomore-level courses, this number has now grown to 23-27. Even so, most of our full-time graduate students are supported on research contracts.

The NSF VIGRE grant began in the fall of 1999. We awarded four VIGRE Fellowships to our current students, and we used this grant to recruit an excellent group of beginning students for the fall, 2000. Some of these students will be awarded VIGRE fellowships as they begin their research programs in their second year.

In 1999-2000, the percentage of graduate students who are U.S. citizens remained between 70-80%. The current percentage of female students (34%) fell within our usual range (20-40%). The current percentage of minority students (6%) also remained within our usual range (6-15%). Considering the students planning to begin graduate study in 2000-2001, the number of minority students will increase, the number of female students will decrease, and the number of U.S. citizens will remain about the same.

A combined Bachelor's-Master's program was created and approved during 1999-2000. The program permits a well-focussed student to acquire both a Bachelor's degree and a Master's degree in five years in the Applied Math Department. The first student to use this path plans to finish in 2001.

6. FACULTY SERVICE TO THE UNIVERSITY, DEPARTMENT AND SOCIETIES, CALENDAR YEAR 1999

Mark Ablowitz: Department Chair; Member of College of Arts & Sciences Council of Chairs; Member of College of Arts and Sciences Strategic Planning Committee.

Jerrold Bebernes: Member of Department of Applied Mathematics Executive Committee, Co-Chair, Colloquium Committee

Gregory Beylkin: Consulted for Fast Mathematical Algorithms and Hardware Corp., Consulted for Pacific Northwest National Laboratory, Member of Undergraduate Committee.

Amy Biesterfeld: Consulted with Vista Gaming Corporation, Golden, CO; Co-Organizer for Probability and Statistics Colloquium, Department of Applied Mathematics.

James Curry: Department Associate Chair; Sigma Chi Distinguished Lecturer; Served on Chancellor's task force on grad education; Served on several NSF review panels; Appointed JR Woodhull/Logicon Teaching Professor of Applied Mathematics in College of Engineering.

Anne Dougherty: March 1998 -present. Member Probability and Statistics Preliminary Committee; Faculty Advisor for the SIAM, (Society for Industrial and Applied Mathematics) Undergraduate Chapter; Department of Applied Mathematics Undergraduate Committee member; Search Committee member for Department of Applied Mathematics instructor position; Boulder Campus Actuarial Certificate Committee Member; Faculty participant in several Engineering College programs: Engineering Open House activities, Fall 1999; Engineering Orientation Program, August 19-20, 1999; Organized presentations at the Women in Engineering Career Days programs, February 27, 1999 and October 5, 1999; High School Honors Institute, August 1-4; Committee on Engineering Scholarships, College of Engineering and Applied Science; Outreach to Delta County School District; Outreach to Buena Vista School District.

Robert Easton: Chair, Department Undergraduate Committee; Chair, Department Diversity Committee; Department Transfer Credit Evaluator; Helped organize the Applied Math Dynamical Systems Seminar in collaboration with Jim Meiss, and gave several lectures at the seminar; Department Representative at the Council of Chairs meetings; Department Representative, Arts and Sciences Council Chair; Department Representative, Chair, Planning Committee of the Arts and Sciences Council; Member of the Arts and Sciences Council Executive Committee; Member College Educational Policy and Planning Committee, College of Engineering; Member Undergraduate Academic Affairs Committee, College of Engineering; Member of Center for Chaos and Complexity; Member of ad-hoc committee to develop program plan for proposed new science library.

Bengt Fornberg: Chairman of the Applied Mathematics Graduate Committee; Chairman of the Colloquium Committee; Consultant to Division of Applied Mathematics, Brown University, on DARPA/AFOSR project on time-domain computational electromagnetics; Member of CRCW - Council on Research and Creative work, Boulder, CO; Primary non-PI writer of successful proposal to CCHE jointly with Mathematics at CU-Denver; "E-mentor" in Mathematics for an elementary school class in Longmont; St. Vrain Public School System.

Keith Julien: NSF Reviewer for one grant proposal to Division of Ocean Sciences Program, October 1999; Member of the Applied Mathematics Undergraduate Committee, 1998; Member of the Engineering and Excellence Fund Committee, 1998.

Congming Li: Member of Department Graduate Committee.

Tom Manteuffel: Society of Industrial and Applied Mathematics: Vice-President, Chair of Science Policy Committee, Member Master Program Committee, Chair of Major Awards Committee; Consultant, Lawrence Livermore National Laboratory; Science Advisory Committee, SquareOne Technologies; Department of Applied Mathematics: Graduate Committee, Computing Committee, Compensation Committee, Computational Math Prelim Committee; Co-Chair: Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO., March 30-April 3, 1999.

Steve McCormick: Consultant, Lawrence Livermore National Laboratory; Co-Chair Copper Mountain Conference on Multigrid Methods, Copper Mountain, March 30-April 3, 1998; Department Computational Math Prelim Committee, Department Computing Committee, Department Graduate Committee.

James Meiss: Created and maintained the "Frequently asked questions" document for the sci.nonlinear usenet newsgroup. See <http://amath/appm/faculty/jdm/faq.html>;
Chair, ad hoc computer committee: Oversee computer staff, laboratory procedures and software & hardware maintenance for our research lab (15 Sun, 7 SGI), staff computers (11 Macintosh), and undergraduate lab (3 SGI); Graduate Committee: Graduate applications and vetting; Preliminary Examination Committee, Jan 99 and Aug 99; Write and grade the PDE preliminary exam for MS and PhD students; Textbook Selection subcommittee for APPM 2360; Applied Mathematics Alumni Newsletter: created, and edited the first issue, sent to over 600 alumni. See it at <http://amath/appm/alumni/newsletter_1.pdf>; Faculty Teaching Excellence Program: Computer Technology Liaison; Boulder Campus: Goldwater Scholarship - recruit and select applicants for this National Scholarship; Member of International Education Scholarship Committee, presentations at bi-annual meetings; Graduate School Subcommittee on Technology in the Humanities Center for Integrated Plasma Studies; Fellow, Colorado Center for Chaos and Complexity; Organizer, Southwest Dynamical Systems Meeting to be held at UCLA in November 2000.

Harvey Segur: Chairman of Department Graduate Committee

John Williamson: Chairman, Undergraduate Committee, Member of College of Engineering Scholarship Committee, Member of Engineering Academic Council

7. TEACHING ACTIVITIES

A. Courses Taught by Department Faculty, Academic Year 1999-2000

(i) Undergraduate Courses

APPM 1350	<i>Biswas, Dougherty, McCormick, Norris, Segur</i> , Calculus 1 for Engineers
APPM 1360	<i>Biswas, Bricher, Norris, Segur</i> , Calculus 2 for Engineers.
APPM 2350	<i>Driscoll, Halburd, Li, Roberts</i> , Calculus 3 for Engineers
APPM 2360	<i>Alterman, Bebernes, Easton, Fornberg, Shortle</i> Linear Algebra and Differential Equations
APPM 2380	<i>Meiss</i> , Introduction to Ordinary Differential Equations
APPM 2450	<i>Sandberg</i> , Calculus 3 Lab
APPM 2460	<i>Mullowney, Tearle</i> , Differential Equations Lab
APPM 3010	<i>Julien</i> , An Introduction to Nonlinear Systems: Chaos
APPM 3050	<i>Driscoll, Norris</i> , Symbolic/Numerical Computations
APPM 3310	<i>Curry, Roberts</i> Matrix Methods and Applications
APPM 3570	<i>Dougherty</i> , Applied Probability
APPM 4350	<i>Alterman</i> , Methods in Applied Mathematics: Boundary Value Problems
APPM 4360	<i>Ablowitz</i> , Methods in Applied Mathematics: Complex Variables
APPM 4380	<i>Fornberg</i> , Modeling in Applied Mathematics
APPM 4520	<i>Williamson</i> , Introduction to Mathematical Statistics
APPM 4560	<i>Dougherty</i> , Markov Processes
APPM 4570	<i>Biesterfeld</i> , Statistical Methods
APPM 4580	<i>Dougherty</i> , Statistical Methods Data
APPM 4650	<i>Easton, Taylor</i> , Introduction to Numerical Analysis
APPM 4660	<i>Fornberg</i> , Intermediate Numerical Analysis 2
APPM 4720	<i>Curry</i> , Wavelets
APPM 4955	<i>Curry</i> , Seminar--Applied Mathematics

(ii) Graduate Courses

APPM 5120	<i>Goodrich</i> , Operations Research
APPM 5350	<i>Alterman</i> , Methods in Applied Mathematics: Boundary Value Problems
APPM 5360	<i>Ablowitz</i> , Methods in Applied Mathematics: Complex Variables
APPM 5440	<i>Williamson</i> , Applied Analysis 1

APPM 5450	<i>Williamson</i> , Applied Analysis 2
APPM 5460	<i>Meiss</i> , Dynamical Systems
APPM 5470	<i>Segur</i> , Methods in Applied Mathematics 3: Partial Differential Equations
APPM 5480	<i>Weidman</i> , Methods 4
APPM 5520	<i>Williamson</i> , Introduction to Mathematical Statistics
APPM 5560	<i>Dougherty</i> , Introduction to Probability Problems
APPM 5570	<i>Biesterfeld</i> , Statistical Methods
APPM 5580	<i>Dougherty</i> , Statistical Methods Data
APPM 5600	<i>Julien</i> , Numerical Analysis 1
APPM 5610	<i>Julien</i> , Numerical Analysis 2
APPM 5720	<i>Curry</i> , Wavelets
APPM 6620	<i>Beylkin</i> , Numerical Computations in Applied Mathematics
APPM 6630	<i>Beylkin</i> , Numerical Computation 2
APPM 7300	<i>Ablowitz</i> , Nonlinear Waves
APPM 7400	<i>Curry, Driscoll, Mohlenkamp, Monzon</i> , Seminar—Teaching and Learning
APPM 8000	<i>Fornberg</i> , Colloquium
APPM 8100	<i>Ablowitz</i> , Seminar--Nonlinear Equations
APPM 8100	<i>Meiss</i> , Seminar--Dynamical Systems
APPM 8200	<i>Manteuffel, McCormick</i> , Seminar--Computational Mathematics

B. Summer Courses, 2000

APPM 1350	<i>R. Ghrist</i> , Calculus I
APPM 1360	<i>M. Ghrist</i> , Calculus II
APPM 2350	<i>Biswas, McColl</i> , Calculus III
APPM 2360	<i>Tearle</i> , Intro. Linear Algebra and Differential Equations
APPM 2450	<i>Burrell</i> , Calculus III Lab
APPM 2460	<i>Vadlamani</i> , Differential Equations Lab
APPM 2775	<i>Austin, E. Wright</i> , JAVA II
APPM 4650	<i>Gines</i> , Intro to Numerical Analysis I
APPM 5040	<i>Dougherty</i> , Extend Your Limits
APPM 5070	<i>Biesterfeld</i> , Beyond the Norm

8. RESEARCH ACTIVITIES FOR CALENDAR YEAR 1999

A. Research Publications for Calendar Year 1999

Mark Ablowitz

- "A Comparison Between Lumped and Distributed Filter Models in Wavelength-division Multiplexed Soliton Systems", M.J. Ablowitz, G. Biondini, S. Chakravarty and Rudy L. Horne, *Optics Communications*, **172**, 211-227 (1999).
- "New Solutions of the Nonstationary Schrodinger and Kadomtsev-Petviashvili Equations", M.J. Ablowitz and J. Villarroel, in *Symmetries and Integrability of Difference Equations*, Eds. P.A. Clarkson and F.W. Nijhoff, London Mathematical Society Lecture Note Series 255, Cambridge University Press, Cambridge, UK, 1999, 151-164.
- "On Discretization of the Vector Nonlinear Schrodinger Equation", M.J. Ablowitz, Y. Ohta, and A.D. Trubatch, *Phys. Letters A*, **253**, 287-304, (1999).
- "On the Discrete Spectrum of the Nonstationary Schrodinger Equation and Multipole Lumps of the Kadomtsev-Petvishvili Equation", M.J. Ablowitz and J. Villarroel, *Commun. Math. Phys.*, **207**, 1-42, (1999).
- "On Painlevé and Darboux-Halphen-Type Equations," *The Painlevé Property*, 573-589, Springer (1999).
- "Solitons and Symmetries", M.J. Ablowitz, P.A. Clarkson, *J. Wnrg. Math.* **36**, Nos. 1-2, 1-9 (1999)
- "The Generalized Chazy Equation from the Self-duality Equations", M.J. Ablowitz, S. Chakravarty, and R. Halburd, *Stud. Appl. Math.*, **103**, 75-88, (1999).

Jerrold Bebernes

- "Single-point Blowup for Nonlocal Parabolic Problems", (with C. Li and P. Talaga), *Physica D*, **134**, 48-60, (1999).

Gregory Beylkin

- "Compactly Supported Wavelets Based on Almost Interpolating and Nearly Linear Phase Filters (Coiflets)", (with L. Monzon and W. Hereman), *Applied and Computational Harmonic Analysis*, **7**, 184-210, (1999).
- "Fast Spectral Projection Algorithms for density-Matrix Computations", (with N. Coult and M. Mohlenkamp), *J. Comp. Phys.*, **152**, 32-54, (1999).

Anne Dougherty

- "Combined visual/haptic rendering modes for scientific visualization", (with F. Infed, S.W. Brown, C.D. Lee, D.A. Lawrence, and L.Y. Pao. *Proc. 8th Annual Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems* (1999)

Bob Easton

- "Stability of Levitrons", with Holger Dullin, *Physica D*, **126**, 1-17, (1999).

Bengt Fornberg

- "Spatial Finite Difference Approximations for Wave-type Equations", with M. Ghrist, *SIAM J. Num. Anal.* **37**, 105-130 (1999).
- "A Fast Spectral Algorithm for Nonlinear Wave Equations with Linear Dispersion", with Tobin Driscoll, *Journal of Computational Physics*, **55**, 456-467, (1999).
- "Block-pseudoscriptal Methods for Maxwell's Equations: II. Two-dimensional Discontinuous-coefficient Case", *Siam J. Sci. Comp.*, 1146-1167, (1999).
- "Steady Vortex Flows obtained from a nonlinear eigenvalue problem," *Flows and related numerical methods (Toulouse, 1998)*, *Soc. Math. Appl. Indust*, 130-136 (1999).

Keith Julien

"Fully Nonlinear Three-dimensional Convection in a Rapidly Rotating Layer", with E. Knobloch, *Physics of Fluids*, **11**, no. 6, 1469-1483, (1999).

"Strongly Nonlinear Magnetoconvection in Three Dimensions", with E. Knobloch and S. Tobias, *Physica D*, **128**, 105-129, (1999).

"Plumes in Rotating Convection, Part 1", with S. Legg, J. McWilliams and J. Werne, *Journal of Fluid Mechanics*, **388**, (1999).

Congming Li

"Harmonic Maps on Complete Manifolds", *Discrete and Continuous Dynamical Systems*, **4**, 799-805, (1999).

"Single-point Blowup for Nonlocal Parabolic Problems", *Physica D*, **134**, 48-60, (1999).

Tom Manteuffel

"Analysis of Velocity-flux Least-squares Principles for the Navier-Stokes Equations: Part II" I. Bochev, Z. Cai, T.A. Manteuffel, S. McCormick, *SIAM J. Numer. Anal.*, **36**, 1125-1144, (1999).

Steve McCormick

"Analysis of Velocity-flux Least-squares Principles for the Navier-Stokes Equations: Part II" I. Bochev, Z. Cai, T.A. Manteuffel, S. McCormick, *SIAM J. Numer. Anal.*, **36**, 1125-1144, (1999).

James Meiss

"Quadratic Volume Preserving Maps: an Extension of a Result of Moser", K.E. Lenz, H.E. Lomeli and J.D. Meiss, *Regular and Chaotic Motion*, **3**, 122-130, (1999).

"Homoclinic Bifurcations for the Henon Map", D Sterling, H.R. Dullin and J.D. Meiss, *Physica D*, **134**, 153-184, (1999).

"On the Breakup of Invariant Tori with Three Frequencies", J.D. Meiss, in *Hamiltonian Systems with Three or More Degrees of Freedom*, Ed. C. Simo, Kluwer, Sagaro, Spain, 494-498, (1999).

B. Invited Lectures and Meetings Attended for Calendar Year 1999

Mark Ablowitz

Invited Lecture, Department of Mathematics, Technion-Israel Institute of Science, Haifa, Israel, "Dispersion Managed Soliton Communications", March 29, 1999.

Invited Lecture, Department of Applied Mathematics, Weizmann Institute of Science, Rehovot, Israel, "Soliton Communications", March 30, 1999.

Invited Lecture, Department of Mathematics, Florida State University, Tallahassee, Florida, "Soliton Communications", April 16, 1999.

Invited Lecture, Conference on Nonlinearity, Integrability and All That-20 Years After NEEDS '79, Gallipoli, Italy, "On Difference Analogs of Painleve Equations", July 4, 1999.

Invited Lecture, Conference on Solitons, Collapses, and Turbulence, Landau Institute, Moscow, Russia, "Modulated Periodic Waves in Deep Water", August 6, 1999.

Invited Lecture, Nonlinear Optics Workshop, Tucson, Arizona, "Long Time Dynamics of Modulational Instability", September 17, 1999.

Invited Lecture, Novikov Seminar, Department of Mathematics, University of Maryland, College Park, Maryland, "Modulated Periodic Waves in Deep Water", October 23, 1999.

Invited Lecture, Conference on Integrating Integrability into Mathematics and Science, Tucson, Arizona, "Long Time Dynamics of Modulational Instability", October 29, 1999.

Invited Lecture, Nagoya University, Nagoya, Japan, "Modulated Periodic Waves in Deep Water", November 7, 1999.

Invited Lecture, Symposium on Massive WDM and TDM Soliton Transmission Systems, Kyoto, Japan, "On the Evolution and Interaction of Dispersion Managed Solitons", November 9, 1999.

Gregory Beylkin

ARPA Program Review, "On Design of IIR and FIR Filters", January 22, 1999.

Invited Lecture, "Seismic Imaging from the Oil Industry Point of View", DMUS Workshop, Arlington, Virginia, March 9, 1999.

DARPA Program Review, "Accurate Multiresolution Modeling of Earth's Gravitational Field", July 1, 1999.

DARPA Program Review, "Subsampling in the Design of Factored FIR and IIR Filters", July 1, 1999.

PNL Program Review, "On Multiresolution PDE Solvers", September 22, 1999.

Invited Lecture, "On New Classes of discretization Schemes for Nonlinear PDEs", SES Meeting, Austin, Texas, October 27, 1999.

Invited Lecture, "On Adaptive Solution of Advection-Diffusion Equations in Multiwave Bases", University of New Mexico, October 28, 1999.

Invited Lecture, "On Direct Solvers, Multigrid and Numerical Homogenization", Wavelet and Multiresolution Workshop, Hong Kong, December 1, 1999.

Amy Biesterfeld

Invited Lecture, Department of Mathematical Sciences, Air Force Academy, September 14, 1999.

Invited Lecture, Department of Mathematics, University of Colorado at Denver, September 21, 1999.

Invited Lecture, Department of Applied Mathematics, University of Colorado at Boulder, October 15, 1999.

Anne Dougherty

Presented Paper, Colorado Council of Teachers of Mathematics Annual Meeting, Denver, Colorado, "Bridging the Mathematical Gap Between High School and the University: A Report on an Ongoing Project to Determine Calculus Readiness", October 16, 1999.

Bob Easton

Invited Lecture, University of Colorado at Boulder, Department of Applied Mathematics, "Gromov Capacity", November 4, 1998.

Invited Lecture, International Conference on Celestial Mechanics, Northwestern University, "Symplectic Capacity", December 15-19, 1999

Bengt Fornberg

Presentations given at CU Boulder, Uppsala University (Sweden), University of Strathclyde (Scotland), and National University of Singapore.

Keith Julien

Invited Lecture, "A New Class of Equations for Rotationally Constrained Flows", Seminar Series, Program in Atmospheric and Oceanographic Sciences, University of Colorado at Boulder, April 1999.

Invited Lecture, "Reduced equations for Rotationally Constrained Flows", First International Symposium on Turbulence and shear Flow Phenomena, Santa Barbara, CA, September 1999.

Invited Lecture, "Numerical Problems in Geophysical and Astrophysical Fluid Flows", VIGRE Fast Algorithms Seminar Series, Applied Mathematics, University of Colorado at Boulder, October 1999.

Invited Lecture, "Beta and Magnetoconvection: Weakly and Strongly Nonlinear Dynamics", VIGRE Nonlinear Dynamics Seminar Series, Applied Mathematics, University of Colorado at Boulder, November 1999.

Congming Li

Invited Lecture, Academia Sinica, Beijing, P.R.China, August 1999.

Invited Lecture, Shanxi Normal University, Linfeng, P.R.China, August 1999.

Invited Lecture, National Center of Theoretical Science, Taiwan, October 1999.

Invited Lecture, National University of Taiwan, Taipei, November 1999.

Invited Lecture, Hong Kong University of Science and Technology, Hong Kong, November 1999.

Tom Manteuffel

Speaker, SIAM Annual Meeting, Atlanta, GA, May 14, 1999.

Invited Lecture, DOE Workshop on Algorithms for Massively Parallel Computers, Washington, DC, June 14, 1999.

Invited Lecture, Workshop on Algebraic Multilevel Methods, Livermore, CA, June 25, 1999.

Speaker, Department Colloquium, Department of Mathematics, University of Queensland, Brisbane, Australia, November 12, 1999.

Speaker, Department Colloquium, Department of Mathematics, University of Queensland, Brisbane, Australia, November 19, 1999.

Speaker, Department Colloquium, Department of Mathematics, University of Southern Queensland, Toowoomba, Australia, December 17, 1999.

Steve McCormick

Speaker, Copper Mountain, CO, Copper Mountain Conference on Multigrid Methods, April 1999.

Speaker, Los Alamos, NM, Los Alamos National Laboratory Colorado Days, May 1999.

Speaker, Boulder, CO, University of Colorado Joint Computational Math Seminar, Nov. 1999.

James Meiss

Invited Lecture, "Heteroclinic Bifurcations and Principle Intersections in Volume Preserve Mappings", SIAM Dynamical Systems Conference, Snowbird, Utah, May, 1999.

John Williamson

Visited Imperial Cancer Research Fund offices at Leeds University, UK, Spring 1999

Attended Mathematical Genetics meeting in Loughborough, UK, Spring 1999

Visited European Institute of Oncology in Milan, Italy, Spring 1999

C. Research Grants Active in 1999

	Amount for 1999
Mark Ablowitz	
NSF, Mathematics Division, 1997-2000	\$37,000
AFOSR, Mathematics, 1997-99	\$70,100
NSF, Engineering Communications, 1998-2001	\$71,900
CCHE, 1999-2002; Co-PI's, B. Fornberg, J. Curry	\$62,000
Gregory Beylkin	
DARPA/AFOSR, 1998-2000	\$275,100
DARPA/Univ. of Va., 1996-99	\$130,300
DARPA/USC, 1998-2001	\$90,400
DARPA/Raytheon, 1998-2001	\$73,800
James Curry	
NSF/SCREMS	\$35,000
Anne Dougherty	
Co-PI, NSF IRI; PI, D. Lawrence	\$8,100
Bengt Fornberg	
NSF, Mathematics Division, 1997-2000	\$27,000
Keith Julien	
NASA, 1997-2000	\$82,300
NSF/CORA, 1998-2000	\$11,900
NASA/CORA, 1999-2002	\$12,000
Congming Li	
NSF, Mathematics Division, 1996-99	\$9,500
NSF, Mathematics Division, 1999-2002	\$17,600
Tom Manteuffel	
DOE, Applied Mathematics, 1996-99	\$50,000
DOE/Lawrence Livermore, 1998-2001; Co-PI's, S. McCormick, C. Farhat, K.C. Park	\$632,000
Co-PI, NIH, 1998-2000; PI, V. Barocas	\$52,800
Steve McCormick	
DOE, Applied Mathematics, 1996-99	\$50,000
NSF, Math Div., 1997-2000; Co-PI's T. Manteuffel, T. Russell	\$160,000
Co-PI, NIH, 1998-2000; PI, V. Barocas	\$52,800
James Meiss	
NSF, Graduate Traineeship, 1993-99	\$55,500
NSF, Mathematics Division, 1996-99	\$16,900
NSF, Mathematics Division, 1999-2002	\$17,600
NSF/VIGRE, 1999-2004; Co-PI's, M. Ablowitz, J. Curry, B. Fornberg	\$276,400
Harvey Segur	
NSF, Mathematics Division, 1998-2001	\$39,900
John Williamson	
NIMH, 1995-99	\$55,100

D. Miscellaneous for Calendar Year 1999

Mark Ablowitz

Coordinating Editor: *Proceedings of the American Mathematical Society*

Editorial boards: *Journal of Engineering Mathematics; Studies in Applied Mathematics*,
Cambridge University Press Texts in Applied Mathematics

Reviewer: NSF Grants; Australian, and Hong Kong; *Physics Letters A; Physical Review Letters; Journal of Engineering Math; Cambridge University Press*

Jerrold Bebernes

Editor: *Rocky Mountain Journal of Mathematics; Communications on Applied Nonlinear Analysis*

Gregory Beylkin

Editorial boards: *SIAM Journal on Numerical Analysis; Editorial and Advisory Board, Applied and Computational Harmonic Analysis.*

Amy Biesterfeld

Refereed articles for: *Journal of Computational Statistics and Data Analysis; Journal of Statistics Education*

James Curry

Refereed articles for *Journal of the Atmospheric Sciences*; Served on several NSF review panels

Robert Easton

Editorial Board: *Communications on Applied Nonlinear Analysis*

Reviewed papers for several mathematical journals.

Bengt Fornberg

Refereed about a dozen articles for various journals; refereed two books (Cambridge University Press and Springer).

Keith Julien

Refereed papers for the *Journal of Fluid Dynamics and Physics of Fluids*; Reviewed NSF proposal to Division of Ocean Sciences Program

Congming Li

Reviewed papers for many professional journals

Tom Manteuffel

Editor-in-Chief, *SIAM Journal of Numerical Analysis*; Editorial Board, *Journal of Numerical Linear Algebra and Applications*; Associate Editor, *Electronic Transactions in Numerical Analysis*; Reviewed many papers; Reviewed many proposals for NSF and DOE

Steve McCormick

Associate Editor-in-Chief: *SIAM Journal on Numerical Analysis*

Associate Editor: *SIAM Journal on Scientific Computation*

Reviewed papers for: *AIMS Reviews, Zentralblatt*; reviewed many proposals for NSF and DOE

James Meiss

Reviewer for Textbook proposals for McGraw-Hill publishing company

Reviewer for Textbook proposals for Addison-Wesley publishing company

Harvey Segur

Reviewer: *European Journal of Mechanics, Journal of Fluid Mechanics, Physics Letters A, Physical Review Letters, Fizika B*, Reviewer for NSF, Reviewer for Research Grants Council, Hong Kong, Book reviewer for Math.Reviews, Book reviewer for Springer-Verlag

9. PREPRINTS OF THE DEPARTMENT: 1999-2000

The following is a list of preprints developed by Department faculty and visitors during this academic year. If you would like a copy of any preprint, please request a copy in writing from Faculty Coordinator, Department of Applied Mathematics, Campus Box 526, University of Colorado, Boulder, CO 80309-0526.

413. *A Comparison Between Lumped and Distributed Filter Models in Wavelength-Division Multiplexed Soliton Systems*, by M.J. Ablowitz, G. Biondini, S. Chakravarty, and R. Horne, August 1999.
414. *Wavelets with Symmetry Properties I*, L. Monzon, May 1998.
415. *A Linear System and Explicit Solutions for Approximate Linear Phase Filters*, L. Monzon, November, 1999.
416. *On the Evolution and Interaction of Dispersion-Managed Solitons*, by M. J. Ablowitz, G. Biondini, and E. S. Olson, November, 1999.
417. *On the Scattering of Multipole Lumps for the Kadomtsev-Petviashvili Equation*, by M. J. Ablowitz and J. Villarroel, December, 1999.
418. *On a Burgers-Stefan Problem*, by M. J. Ablowitz and S. DeLillo, April, 1999.
419. *Solutions of a Burgers-Stefan Problem*, M.J. Ablowitz and S. DeLillo, November, 1999.
420. *Navanlinna Theory and Difference Equations*, M. J. Ablowitz and R. Halburd, December 1999.
421. *Incomplete Collisions of Wavelength-Division Multiplexed Dispersion-Managed Solutions*, M. J. Ablowitz, G. Biondini, and E. S. Olson, March 2000.
422. *Long Time Dynamics of the Modulational Instability of Deep Water Waves*, M. J. Ablowitz, J. Hammack, D. Henderson, and C. M. Schober, March 2000.
423. *Four-wave Mixing in Strong Dispersion-Managed WDM Soliton Systems*, M. J. Ablowitz, R. Horne, E. Spiller, G. Biondini, and S. Chakravarty, April 2000.
424. *Diffraction Short Pulse Asymptotics for Nonlinear Wave Equations*, D. Alterman and J. Rauch, November 1999.
425. *The Linear Diffractive Pulse Equation*, D. Alterman and J. Rauch, December 1999.
426. *Nonlinear Geometric Optics for Short Pulses*, D. Alterman and J. Rauch, February 2000.
427. *Staggered Time Integrates for Wave Equations*, M. Ghrist, T. A. Driscoll, and B. Fornberg, January 2000.
428. *Note on Nonsymmetric Finite Differences for Maxwell's Equations*, T. A. Driscoll and B. Fornberg, March 2000.
429. *A Pade-based Algorithm for Overcoming Gibbs' Phenomenon*, T. A. Driscoll and B. Fornberg, April 2000.
430. *Some Steady Axisymmetric Vortex Flows Past a Sphere*, A. Elcrat, B. Fornberg, and K. Miller, April 2000.

431. *Homoclinic Orbits and Transport in a Perturbed Integrable Suris Map*, H. E. Lomeli and J. D. Meiss, September 1999.
432. *Heteroclinic Primary Intersections and Codimension One Melnikov Method for Volume Preserving Maps*, H. E. Lomeli and J. D. Meiss, October 1999.
433. *Computing Connectedness: Disconnectedness and Discreteness*, V. Robins, J. D. Meiss, and L. Bradley, October 1999.
434. *Self-rotation Number using the Turning Angle*, H. R. Dullin, D. Sterling, and J. D. Meiss, July 1999.
435. *The Cubic and Quartic Polynomial Diffeomorphisms of the Plane*, H. R. Dullin and J. D. Meiss, November 1999.
436. *Towards Computing Homology from Finite Approximations*, V. Robins, May 2000.
437. *Chaos in Relaxed Newton's Method: the Quadratic Case*, L. Billings, J. H. Curry, and V. Robins, June 1999
438. *Extreme value theory and mixed distributions—Applications*, A.M. Dougherty, R.B. Corotis and L.M. Schwartz, May 1999.
439. *Combined visual/haptic rendering modes for scientific visualization*, F. Infed, S.W. Brown, C.D. Lee, D.A. Lawrence, A.M. Dougherty, L.Y. Pao Nov. 1999.
440. *Rate-hardness: A new performance metric for haptic interfaces*, D.A. Lawrence, L.Y. Pao, A.M. Dougherty, M. Salada, Y. Pavlou, Dec 1999.
441. *Total versus single point blow-up for a nonlocal gaseous ignition model*, S. Bricher, Dec. 1999.