Department of Applied Mathematics
Annual Report 2014
Department of Applied Mathematics
University of Colorado at Boulder

Vision

The vision of the Department of Applied Mathematics at the University of Colorado is to be an internationally leading department in Applied Mathematics in research and education.

Mission

The Department of Applied Mathematics at the University of Colorado strives to provide excellent teaching, research, and service to the university community and to the world in the application of mathematics to other disciplines.

Objectives

The Department of Applied Mathematics has four primary objectives:

- To teach our students well;
- To seek out and develop new, interesting applications of mathematics in other disciplines;
- To provide each student with a rich educational experience;
- To create new mathematics.

We interpret this to mean:

- Provide undergraduate and graduate students with a high quality education and training in applied mathematics and prepare them for careers in government, industry, laboratories, and the academic professions;
- Offer and monitor degree programs leading to BS, MS and PhD degrees in Applied Mathematics;
- Nourish and maintain a professional environment in which excellence in teaching, learning, scholarship, and creativity are of central importance;
- 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.

Cover Art
Department of Applied Mathematics 2014 Annual Report

Overview

Applied Mathematics is central to science and engineering education. As early as 1901 Engineering Mathematics was taught by faculty in the College of Engineering. Engineering Mathematics was organized as a separate Department of Engineering Mathematics in 1901. In 1948 the name of the unit was changed to the Department of Applied Mathematics and the Department granted its first Masters Degrees in that year as well. In 1958 it graduated its first BS degrees in Applied Mathematics. Soon afterwards, in 1962, the PhD degree in Applied Mathematics was approved by the Regents. In 1966 with hiring of S. Ulam by the Mathematics Department, the Applied Mathematics Department in the College of Engineering and Mathematics Department in the College of Arts and Sciences merged. The two departments were joined from 1966 until 1989.

In 1989, following a meeting of a number of faculty and administrators in the Sciences and Engineering, a recommendation was made to establish an independent Program in Applied Mathematics (APPM). The program was organized within the College of Arts and Sciences and was given authority to grant BS, MS and PhD degrees in Applied Mathematics. After 1989 APPM began a remarkable period of development; in 1996 the Regents approved changing its title to Department of Applied Mathematics. Thus with the reemergence of this independent Program in 1989, APPM has now reached its 25 anniversary.

Instrumental faculty in the mid-1980s were Professors James Curry and Robert Easton who helped form an important committee with a vision to develop a new programmatic effort in Applied Mathematics. Early views were that the program would be housed in the Graduate School with faculty rostered in various departments; this would have been similar to how institutes were organized. In 1988 the committee recommended that Mark Ablowitz be hired as the first Director of the Program in Applied Mathematics. By the time Ablowitz arrived on campus in July 1989 to assume the position of Director, faculty committees had recommended that the Program be housed in the College of Arts and Sciences (A&S) where it is today. This supports the view that via A&S the Department can support engineering, science, and mathematics, as well as many other fields of application. In the early 1990s APPM began an affiliated faculty effort, where an affiliated faculty member from another department can direct a PhD student in conjunction with a co-advisor from APPM.

From 1989 to 2000 Ablowitz was the first Director and subsequently became Chair of the Department. From 2000-2003, Professor Harvey Segur was Chair and from 2003-2012 Professor James Curry was Chair. Ablowitz is serving as Chair 2012-present.

In 1989 the task of building the newly created program was given to Ablowitz and his colleagues. The program originally had one staff member, Janet Horn. In addition to Ablowitz and Curry, two key faculty members, Jim Meiss and Harvey Segur, were appointed beginning Fall 1989. Soon after the program was formed a number of faculty moved from the Mathematics Department to APPM; this included Professors Jerold Beberness, Robert Easton, John Maybee and John Williamson. Thus the original four faculty along with the four that moved from the Math Department plus key new faculty who were hired the early-mid 1990s: Professors Beylkin, Li, Manteuffel, McCormick and Fornberg, formed the core of the unit and collaborated on shaping its future. Over time the current structure of the undergraduate and graduate curricula were developed.

In addition to hiring tenure track faculty the Program also hired two instructor/postdoctoral researchers, who typically spend three years with the unit before moving on to permanent, typically tenure track faculty positions. In the mid-1990s one of the people hired was Dr. Anne Dougherty. Anne, a remarkable teacher and advisor, decided she preferred to remain with APPM as a senior instructor. Over time, she made improvement of APPMs undergraduate program a priority. She became our Associate Chair during Professor Curry’s term as Chair. She has been extremely influential in our teaching and service missions ever since.

During the past few years, APPM’s teaching obligations have increased significantly. This is largely due to the decision by the College of Engineering to substantially increase its overall undergraduate enrollment. APPM is in a growth phase once again. Last year the Department hired two new faculty members: Stephen Becker and Mark Hoefer, and is again gearing up to recruit a new faculty member beginning fall semester 2015. We are looking forward to the future with high expectations and excitement.

Dr. Mark J. Ablowitz
Department Chair

Dr. Anne Dougherty
Associate Chair
Undergraduate Education

The Department of Applied Mathematics in the College of Arts and Sciences offers courses and degree programs for undergraduates and graduate students. The Department of Applied Mathematics currently has 16 full-time faculty, several instructors and post-doctoral associates, and maintains an active Visitor Program with researchers from around the world. Courses range from calculus to seminars in computation, discrete mathematics, probability and statistics, nonlinear phenomena, mathematical biology, and physical applied mathematics.

The undergraduate program in AMEN prepares graduates to practice effectively in the field of mathematics, or to further their careers through advanced study. The principle focus of a major in applied math is to improve a student’s mathematical, computational, and communication skills. The focus is on modeling problems from a variety of areas including business, engineering and science.

In 2013, in order to address the challenges posed by major increases in undergraduate enrollment, as well as an ongoing space crisis on the Boulder campus, the Department of Applied Mathematics began utilizing a “help room” - a large single room space to accommodate office hours for department TAs, allowing more students to receive course assistance at once while not overcrowding the TA shared office spaces. In 2014, the department moved from a single help room in ECCR 211 to two help rooms in ECCR 244 and STAD 262A/B. Hard data on increases in office hour attendance and satisfaction are unavailable for 2013-2014, but anecdotally, the help rooms appear to be a success.

Applied Mathematics continued to offer additional sections in our lower division courses for Engineering Honors and Goldshirt Residential Academic Program (RAP) students for our Calculus courses in 2014. These sections, made possible by funds from the Engineering Honors RAP, are smaller, allowing students to get more individualized interactions with their professor, and are located in or near the Andrews Hall dormitory, home of the two programs. Popular with both students and faculty, the Sustainable By Design RAP has made inquiries about offering a similar section for their students in the Spring 2015 term.

The art of creating and testing mathematical models of real-world problems is an important part of our undergraduate training. Undergraduate students are given an opportunity to showcase their mathematical, computational and communication skills in the annual Mathematical Contest in Modeling, (MCM) an international contest sponsored by COMAP (The Consortium for Mathematics and its Applications). Students from all science, math and engineering majors are encouraged to enter. Held in February, the contest saw three teams from Applied Mathematics participating. One team was awarded a “Meritorious” ranking.
The department offers four formal interdisciplinary programs, three at the MS level.

- **A Combined MA/MS with the Molecular, Cellular, and Developmental Biology Department (MCDB).** The combined MA/MS is a three-year interdisciplinary program designed to produce students trained both in applied mathematics and in molecular biology. A student who completes this program can begin a career in the biological sciences with a very desirable combination of skills, or can continue on to a PhD either in APPM or in MCDB.

- **An MS with a Computational Science and Engineering Track.** This track is designed for a student in a participating department in science or engineering, with a strong interest in scientific computation and mathematical analysis. Under this plan, the student obtains an MS in APPM on the way to a PhD in the other department. Six other departments now participate in this program.

- **Teacher-Licensure Option.** An APPM graduate student can fulfill the outside-sequence requirement in the School of Education. By also meeting the requirements of that School, a student can obtain both an MS in applied mathematics and a license to teach mathematics in a secondary school (i.e., in middle through high school). More information about the graduate program is available at http://amath.colorado.edu/programs/grad.html

- **The University’s IQ Biology interdisciplinary program.** The IQ Biology program offers a mix of core classes, research projects and professional development experiences. These are all designed to help you work collaboratively across disciplines to solve problems. Other departments participating in IQ Biology include Chemistry & Biochemistry; Ecology and Evolutionary Biology; Molecular, Cellular and Developmental Biology; Computer Science; and Mechanical Engineering.
Enrollment Statistics

Applied Mathematics has seen a steady increase in undergraduate enrollments over the past five years, growing from a total of 2,036 undergraduates taking APPM courses in Fall 2009 to 2,723 undergraduates in Fall 2014. The largest growth has been in our lower division courses, as the College of Engineering as a whole has increased recruitment efforts and the department’s own Pre-Calculus course has now been offered in both the Fall and Spring Semesters. Lower division course enrollment increased by 4.5% between Fall 2013 and Fall 2014. While this is a lower absolute increase than the 15% between Fall 2012 and Fall 2013, it still represents nearly 2,400 students enrolled in only five courses in one semester (APPM lab enrollments are students already enrolled in other APPM courses, they do not increase the absolute count).

Unfortunately, students are also increasingly unprepared for the courses they enroll in. Of 877 students enrolled in APPM 1350 in the Fall of 2014, 280 did not successfully complete the course - 32% of students. Last Fall Semester, “only” 23% of APPM 1350 students received a grade below the minimum C- required to advance. The department increases efforts to help students outside of the classroom, with increased seating in Calculus workgroups, increased oral examinations, and the addition of dedicated help rooms.

### Lower Division Enrollments By Semester

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## Department of Applied Mathematics 2014 Annual Report

### Graduating Students

#### May
- Matthew Beale
- Dushyant Dhundara
- Dillon Fancher
- Tyler Gordon
- Mackenzie Green
- Brad Hendershott
- Stephen Krupansky
- Emma Mossinger
- Joseph Parks
- Zachary Sajevic
- Whitney Sather
- Dana Schnee
- Vladislav Soukhovei
- Rebecca Stewart
- Jeremy Upsal

#### August
- Kylie Hurd
- Shaun Starbuck

#### December
- Justin Baacke
- Tracy Babb
- Matthew Green
- Alexander Mitkus
- Katherine Peters
- Fiona Pigott
- Ilana Trumble
- Teng Wang

### Bachelor’s Degrees

#### Master’s Degrees
- Christopher Aicher (BS/MS)
- Meng Cao
- Yan Chen (BS/MS)
- Amanda Crawford
- Kerry Garcia
- Stephen Kissler (BS/MS)
- Warren Lord
- Richard Shafer
- Dan Wu

#### Doctoral Degrees
- Jose Garcia
- Amrik Sen
- Yuanting Chen
- Dustin Keck
- Sekson Sirisubtaweer

- David Appelhans
- Michael Brutz
- Christopher Leibs
- Henry Romero
Department of Applied Mathematics 2014 Annual Report
Faculty, Instructors, Research Associates, Visitors, and Staff

Core Faculty and Instructors

Mark J. Ablowitz – Department Chair; Professor; College of Arts and Sciences Professor of Distinction; PhD, Massachusetts Institute of Technology. Partial Differential Equations, Solitons, Nonlinear Waves.

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

Stephen Becker – Assistant Professor; California Institute of Technology. Optimization, Numerical Linear Algebra, Mathematical Applications, Physical Applications.

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

Sujeet Bhat – Instructor; PhD, University of Florida. Partial Differential Equations, Numerical Analysis, Graph Theory.

David Bortz – Assistant Professor; Ph.D, North Carolina State University. Biological Systems.

Jem Corcoran – Associate Professor; PhD, Colorado State University. Applied Stochastic Processes, Perfect Simulation, Statistical Physics.

Murray Cox – Instructor; PhD, Texas A&M University.

Ryan Croke – Instructor; PhD, Colorado State University. Nonlinear Phenomena.

James H. Curry – Professor; J. R. Woodhull Logicon Teaching Professor of Applied Mathematics; PhD, University of California at Berkeley. Dynamical Systems, Numerical Methods, Nonlinear Equations.

Anne Dougherty – Associate Department Chair; Chair of Undergraduate Studies; Senior Instructor; PhD, University of Wisconsin, Madison. Applied Probability, Stochastic Processes.

Vanja Dukic – Associate Professor; PhD, Brown University. Biostatistics.

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

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

Yolanda Hagar – Research Associate and Instructor; PhD, University of California Davis

Mark Hoefer – Assistant Professor; PhD, University of Colorado Boulder. Fluid dynamics of dispersive media; Dynamics of ferromagnetic media, spin torque, and localized excitations in nanomagnetism

Keith Julien – Chair of Graduate Studies; Associate Professor; PhD, Cambridge University, United Kingdom. Mathematical and Computational Fluid Dynamics, Dynamical Systems Theory.

Christian Ketelsen – Instructor; PhD, University of Colorado Boulder. Computational Mathematics

William Kleiber – Assistant Professor; PhD, University of Washington, Seattle. Multivariate Process Modeling, Stochastic Modeling of Physical Systems.

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

Manuel Lladser – Assistant Professor; PhD, Ohio State University. Probability Theory.

Yiping Ma – Research Associate and Instructor; PhD, University of California Berkeley. Nonlinear Phenomena, Physical Applied Mathematics.


Per-Gunnar Martinsson – Assistant Professor; PhD, University of Texas at Austin. Numerical Analysis, Modeling of Heterogeneous Media, Computational Biochemistry.

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

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

J. Adam Norris – Instructor; PhD, University of Colorado at Boulder. Phase Change Kinetics, Perturbation Methods, Numerical Methods.

Juan Restrepo – Assistant Professor; PhD, Northeastern University. Analysis of dynamical processes on complex networks.

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

**Post-Doctoral Research Associates**

- **Douglas Baldwin** – PhD, University of Colorado Boulder
- **Philippe Marti** – PhD, Eidgenössische Technische Hochschule Zürich
- **Sergey Voronin** – PhD, Princeton University

- **Marian Brezina** – PhD, University of Colorado at Denver.
- **Benjamin Miquel** – PhD,
- **K. C. Park** – Aerospace Engineering

- **Samuel Butler** – PhD, University of Sydney
- **Lucas Monzon** – PhD, Yale University.
- **Scott Parker** – Physics

- **Michael Calkins** - PhD, University of California Los Angeles.
- **John Ruge** – PhD, Colorado State University.
- **Annick Poquet** – National Center for Atmospheric Research (NCAR)

**Affiliated Faculty**

- **Steve C. Arendt** – Colorado Research Associates
- **Vijay K. Gupta** – Civil, Environmental, and Architectural Engineering
- **Lev Ostrovsky** – National Oceanic and Atmospheric Administration (NOAA)

- **Meredith Betterton** – Physics
- **Ute C. Herzfeld** – Institute of Arctic and Alpine Research (INSTAAR)
- **K. C. Park** – Aerospace Engineering

- **Elizabeth Bradley** – Computer Science
- **Christine M. Hrenya** – Chemical and Biological Engineering
- **Harihar Rajaram** – Civil, Environmental, and Architectural Engineering

- **Richard Byrd** – Computer Science
- **Shannon Hughes** – Electrical, Computer, and Energy Engineering
- **Steven Sain** – Institute for Mathematics Applied to Geosciences

- **Xiao-Chuan Cai** – Computer Science
- **Elizabeth Jessup** – Computer Science
- **Robert Sani** – Chemical Engineering

- **John Cary** – Physics
- **Laskshmi Kantha** – Aerospace Engineering
- **J. Michael Shull** – Astrophysical and Planetary Sciences (APS)

- **John Crimaldi** - Computser Science
- **David R. Kassoy** – Mechanical Engineering
- **Rex Skodje** – Chemistry

- **Senarath P. de Alwis** – Physics
- **Dhinaker Kompala** – Chemical and Biological Engineering
- **James Syvitski** – Institute for Arctic and Alpine Research (INSTAAR)

- **Richard DeGrand** – Physics
- **Manuel Laguna** – College of Business
- **Juri Toomre** – Astrophysical and Planetary Sciences (APS)

- **Alireza Doostan** – Aerospace Engineering
- **David Lightner** – Electrical Engineering;
- **Henry Tufo** – Computer Science

- **Garland Durham** – College of Business
- **Laskshmi Kantha** – Aerospace Engineering
- **Patrick Weidman** – Mechanical Engineering

- **Scot Elkington** – Laboratory for Atmospheric and Space Physics (LASP)
- **David Lightner** – Electrical Engineering
- **Jeffrey B. Weiss** – Astrophysical and Planetary Sciences (APS), Atmospheric and Oceanic Sciences.

- **Samuel Flaxman** - Ecology and Evolutionary Biology
- **David Lightner** – Electrical Engineering
- **Joseph Werne** – Colorado Research Associates

- **Natasha Flyer** – Institute for Mathematics Applied to Geosciences
- **Oliver McBryan** – Computer Science

- **Baylor Fox-Kemper** – Cooperative Institute for Research in Environmental Sciences (Cires)
- **Francois Meyer** – Electrical and Computer Engineering

- **Fred Glover** – College of Business
- **Nathalie Moyen** - Finance

- **Debra S. Goldberg** – Computer Science
- **Doug Nychka** – Geophysical Statistics Project, National Center for Atmospheric Research (NCAR)

- **Martin Goldman** – Physics

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John Ruge – PhD, Colorado State University.
Igor Rumanov – PhD,

Vijay K. Gupta – Civil, Environmental, and Architectural Engineering
Ute C. Herzfeld – Institute of Arctic and Alpine Research (INSTAAR)
Christine M. Hreyna – Chemical and Biological Engineering
Shannon Hughes – Electrical, Computer, and Energy Engineering
Elizabeth Jessup – Computer Science
Laskshmi Kantha – Aerospace Engineering
David R. Kassoy – Mechanical Engineering
Dhinaker Kompala – Chemical and Biological Engineering
Manuel Laguna – College of Business
Michael Lightner – Electrical Engineering;
Oliver McBryan – Computer Science
Francois Meyer – Electrical and Computer Engineering
Nathalie Moyen – Finance
Doug Nychka – Geophysical Statistics Project, National Center for Atmospheric Research (NCAR)
Department Staff

Mary Fentress – Director of Operations
Matthew Clifford/Catriona Allcock – Graduate Program Assistant.
Anna Gonzales - Accounting Technician
Ian Cunningham - Office Coordinator and Undergraduate Program Assistant
William Marquis/Jay Lecavalier - Part-Time IT Support
Meg Kwiat, Eva Lambeck – Part-Time Student Assistants

Changes in Personnel

Professor Steve McCormick retired at the end of 2013. He is currently enjoying an active retirement in the Boulder area.

Professor Stephen Becker was hired for the Fall 2014 semester. He comes to us from IBM Research in New York, and received his PhD from CalTech.

Professor Mark Hoefer also joined APPM for Fall 2014. Mark returns to Colorado after several years at North Carolina State University.

Matt Clifford left the department at the beginning of the Fall 2014 semester, and Catriona “Trina” Allcock joined as his replacement in November 2014.

Visitors in 2014

Nalini Joshi - January 20-21st  Lake Bookman - September 22 - October 9
Rod Halburd - February 17-19th  Shmeul Fishman - September 23-26th
Or Aldus - February 19-28th  Guust Nolet - December 10th
Jeff Vasil - May 19-23rd
Keaton Burns - May 19-23rd
Christopher Curtis - July 7-11th
Tuesdays - Computational Math Seminar

The Computational Mathematics seminar series was held on Tuesday mornings during the academic year at 10:00 am, in the Grandview Conference Room. Steve McCormick chaired and organized the seminars in the spring semester, and Tom Manteuffel chaired and organized in the fall.

01/21/2014  **David Appelhans**, Department of Applied Mathematics, University of Colorado Boulder
Range Decomposition with Adaptive Mesh Refinement for Peta and Exascale Computing

02/11/2014  **Christian Ketelsen**, Department of Applied Mathematics, University of Colorado Boulder
Multilevel Markov Chain Monte Carlo for Uncertainty Quantification in Subsurface Flow

02/18/2014  **Brad Martin**, Department of Applied Mathematics, University of Colorado Boulder
Seismic wave simulation through radial basis function-derived finite differences (RBF-FD): preliminary results from a new 3rd-order numerical method

02/25/2014  **John Ruge**, Department of Applied Mathematics, University of Colorado Boulder
Algebraic Multigrid

03/04/2014  **Harihar Rajaram**, Department of Civil, Environmental, and Architectural Engineering; University of Colorado Boulder
Glacier and Ice Sheet Modeling - governing equations and numerical methods

03/11/2014  **Jeff Heys**, Chemical and Biological Engineering, Montana State University
Echocardiographic Particle Image Velocimetry Data Assimilation with Least-Square Finite Element Methods

03/18/2014  **Chris Leibs**, Department of Applied Mathematics, University of Colorado Boulder
Two-Fluid Plasma

04/15/2014  **Jörg Sautter**, Department of Engineering, Aschaffenburg University of Applied Sciences
Toward CAE of Vertical Axis Wind Turbines

04/22/2014  **Ben Cowan**, Research and Development Manager, Tech-X Corporation
Application of multigrid techniques to electromagnetic systems

04/29/2015  **Jay Stotsky**, Department of Applied Mathematics, University of Colorado Boulder
Numerical Simulation of Bacterial Biofilms

09/09/2014  **Benjamin Sturdevant**, Department of Applied Mathematics, University of Colorado Boulder
An introduction to delta-f Particle in Cell Plasma Simulation
09/16/2014 Alireza Doostan, Department of Aerospace Engineering Sciences, University of Colorado Boulder
Uncertainty Quantification Using Polynomial Chaos Expansions: A Compressive Sampling Approach

09/23/2014 Alyson Fox, Department of Applied Mathematics, University of Colorado Boulder
Multilevel Solvers for the Graph Laplacian of Scale-Free Networks

09/30/2014 Delyan Kalchev, Department of Applied Mathematics, University of Colorado Boulder
Adaptive Spectral Algebraic Multigrid for Finite Element Elliptic Equations with Stochastic Coefficients

10/07/2014 Jeff Heys, Chemical and Biological Engineering, Montana State University
Improving Data with Models or Improving Models with Data

10/14/2014 Luke Olson, Department of Computer Sciences, University of Illinois at Urbana-Champaign
Using a Root-Node Based Approach to Algebraic Multigrid

10/21/2014 Ben O’Neill, Department of Applied Mathematics, University of Colorado Boulder
Parallel in time Algorithms for PDEs

10/28/2014 Billy Armstrong; Civil, Environmental, and Architectural Engineering, University of Colorado Boulder
Glacier Depth Inverse Problem

11/04/2014 Jeff Allen, Department of Applied Mathematics, University of Colorado Boulder
New FOSLS Formulation of Nonlinear Stokes Flow for Glaciers

12/02/2014 Xun Yin, Department of Chemical and Biological Engineering, University of Colorado Boulder
Single-Molecule Approach to Molecular Binding on Supported Lipid Bilayers

Tuesdays - Nonlinear Waves Seminar

The Nonlinear Waves seminar series was held on Tuesday afternoons in the Spring 2010 semester at 4:00 pm, in ECOT 226. Mark Ablowitz chaired and organized the seminar series, with assistance from graduate student Douglas Baldwin in the Spring Semester.

01/21/2014 Nalini Joshi, School of Mathematics and Statistics, University of Sydney
Geometry and Asymptotics

02/05/2014 Gino Biondini, Department of Mathematics, State University of New York (SUNY) Buffalo
The modulational instability revisited

02/18/2014 Rod Halburd, Department of Mathematics, University College London
Singularity and Integrability

03/04/2014 Anton Dzhmay, School of Mathematical Sciences, University of Northern Colorado
Discrete Schlesinger Equations and Difference Painlevé Equations

03/18/2014 Yiping Ma, Department of Applied Mathematics, University of Colorado Boulder
Traveling edge waves in optical honeycomb lattices
Thursdays - Complex Systems/Dynamics Seminar

The Complex Systems/Dynamics seminar series was held on Thursday afternoons during the academic year at 2:00 PM, in the Applied Mathematics Conference Room. Jim Meiss and Juan Restrepo co-chaired this series.

04/08/2014 Silvana De Lillo, Department of Mathematics and Computer Science, Università degli Studi di Perugia: Traveling Waves in Elastic Rods with Arbitrary Curvature and Torsion

04/29/2014 Sean Shaheen; Department of Electrical, Computer, and Energy Engineering; University of Colorado Boulder: Modeling of Organic Photovoltaics: Charge Transport, Charge Transfer Kinetics, and Exciton Dynamics

09/09/2014 Gennady El, Department of Mathematical Sciences, Loughborough University: Integrable Dynamics of Soliton Gases

09/23/2014 Igor Rumanov, Department of Applied Mathematics, University of Colorado Boulder: Quantum Painlevé II (QPII) and classical Painlevé II (PII): beta ensembles for beta = 6

09/30/2014 Lake Bookman, Department of Mathematics, North Carolina State University: Peterubations of the Landau-Lifshitz equation


10/14/2014 Olivier Pinaud, Department of Mathematics, Colorado State University: Waves in random media: asymptotics and applications

10/21/2014 Boaz Ilan; School of Natural Sciences; University of California, Merced: Spectral Mirror Imaging

11/04/2014 Aurelian Coillet, National Institute of Standards and Technology (NIST): Modelling of Kerr frequency combs: successes and challenges

Thursdays - Complex Systems/Dynamics Seminar

The Complex Systems/Dynamics seminar series was held on Thursday afternoons during the academic year at 2:00 PM, in the Applied Mathematics Conference Room. Jim Meiss and Juan Restrepo co-chaired this series.

01/23/2014 Daniel Cristofaro-Gardiner, Department of Mathematics, Harvard University: Symplectic techniques in Hamiltonian dynamics

01/30/2014 Oleg V. Vasilyev, Department of Mechanical Engineering, University of Colorado Boulder: Hierarchical Wavelet-based Modeling of Turbulent Flows

02/06/2014 Samuel Flaxman, Department of Ecology and Evolutionary Biology, University of Colorado Boulder: Genomic Architecture Drives the Rapid Origin of New Species

02/13/2014 Mark Rast, Department of Astrophysical and Planetary Sciences and Laboratory for Atmospheric and Space Physics, University of Colorado Boulder: The role of intermittency in scalar transport by turbulent flows

02/20/2014 Or Alus, Department of Physics, Technion - Israel Institute of Technology: Out of the Self Similar Point - Progress Report: Statistical description of mixed phase space systems
<table>
<thead>
<tr>
<th>Date</th>
<th>Name and Affiliation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/27/2014</td>
<td>Arkady Pikovsky, Department of Physics, University of Potsdam</td>
<td>Chaotic destruction of Anderson localization in nonlinear lattices</td>
</tr>
<tr>
<td>03/06/2014</td>
<td>John Lapeyre, The Institute of Photonic Sciences, Castelldefels, Spain</td>
<td>Single particle tracking, charge transport, and ergodicity breaking</td>
</tr>
<tr>
<td>03/13/2014</td>
<td>Tom Hraha, Department of Bioengineering, University of Colorado Anschutz Medical Campus</td>
<td>Synchronization and Phase Transitions in the Pancreatic Islet with implications for Diabetes</td>
</tr>
<tr>
<td>03/20/2014</td>
<td>Leto Peel, Department of Computer Sciences, University of Colorado Boulder</td>
<td>Detecting change points in the large-scale structure of evolving networks</td>
</tr>
<tr>
<td>04/03/2014</td>
<td>Brock Mosovsky, Ascend Analytics, LLC</td>
<td>Finite-Time Transport in Volume-Preserving Flows</td>
</tr>
<tr>
<td>04/17/2014</td>
<td>Warren Lord, Department of Applied Mathematics, University of Colorado Boulder</td>
<td>Singular value decomposition methods for understanding long term dynamics on networks</td>
</tr>
<tr>
<td>05/01/2014</td>
<td>Tiago de Paul Peixoto, Institute for Theoretical Physics, University of Bremen</td>
<td>Hierarchical Block Structures and High-Resolution Model Selection in Large Networks</td>
</tr>
<tr>
<td>06/16/2014</td>
<td>Oleg Makarenkov, Department of Mathematical Sciences, University of Texas Dallas</td>
<td>A new generic bifurcation from a fold-fold singularity of a discontinuous system</td>
</tr>
<tr>
<td>08/21/2014</td>
<td>Lev Lerman, Lobachevsky University of Nizhni Novgorod</td>
<td>An introduction to Shilnikov bifurcations</td>
</tr>
<tr>
<td>08/28/2014</td>
<td>Robert Easton, Department of Applied Mathematics, University of Colorado Boulder</td>
<td>Shaking the Dice Model - Economics and Climate Change</td>
</tr>
<tr>
<td>09/04/2014</td>
<td>Hideyuki Hotta, High Altitude Observatory, National Center for Atmospheric Research (NCAR)</td>
<td>Significant feedback from small-scale magnetic fiend and efficient energy transport in the solar convection zone</td>
</tr>
<tr>
<td>09/11/2014</td>
<td>Juan Restrepo, Department of Applied Mathematics, University of Colorado Boulder</td>
<td>Mean field theory of assortative networks of phase oscillators</td>
</tr>
<tr>
<td>09/25/2014</td>
<td>Hannah Christensen, Department of Physics, University of Oxford</td>
<td>Stochastic Parametrisation and Model Uncertainty in the Lorenz ‘96 System.</td>
</tr>
<tr>
<td>10/09/2014</td>
<td>Behrooz Touri, Department of Electrical, Computer, and Energy Engineering, University of Colorado Boulder</td>
<td>Convergence properties of random stochastic matrices</td>
</tr>
<tr>
<td>10/16/2014</td>
<td>Hiroshi Ashikaga, Division of Cardiology, Johns Hopkins University School of Medicine</td>
<td>Information Theory of the Heart</td>
</tr>
<tr>
<td>10/23/2014</td>
<td>Yue-Kin Tsang, School of Mathematics, University of Edinburgh</td>
<td>Advection-condensation of water vapor in a model of coherent stirring</td>
</tr>
</tbody>
</table>
10/30/2014 HANSPEL SCHAUB, Department of Aerospace Engineering Sciences, University of Colorado Boulder

11/13/2014 INOM MIRZAEV, Department of Applied Mathematics, University of Colorado Boulder

11/20/2014 YOGESH VIRKAR, Department of Computer Science, University of Colorado Boulder

12/04/2014 LEV A. OSTROVSKY, Earth Systems Research Laboratory, National Oceanic and Atmospheric Association (NOAA)

Fridays - Applied Mathematics Colloquium

The Applied Mathematics Colloquium series was held on select Friday afternoons during the academic year at 3:00 pm, with refreshments preceding at 2:30 pm in the Applied Mathematics Newton Lab. Jem Corcoran chaired and organized the Colloquium Series in Spring 2014, with Will Kleiber taking the reins in the Fall.

01/24/2014 LYNN SCHREYER-BENNETHUM, Department of Mathematical and Statistical Sciences, University of Colorado Denver

01/31/2014 CHRISTIAN KETELSEN, Department of Applied Mathematics, University of Colorado Boulder

02/14/2014 RAM NAIR, Institute for Mathematics Applied to Geosciences, University Corporation for Atmospheric Research (UCAR)

02/21/2014 MATTHIAS KATZFUSS, Department of Statistics, Texas A&M University

02/28/2014 PAUL CERNY; Department of Electrical, Computer, and Energy Engineering; University of Colorado Boulder

04/04/2014 SETH SULLIVANT, Department of Mathematics, North Carolina State University

04/11/2014 NATHAN KUTZ, Department of Applied Mathematics, University of Washington

04/18/2014 CLAY THOMPSON, Senior Scientist, Pfizer Pharmaceuticals

04/25/2014 SCOT ELKINGTON, Laboratory for Atmospheric and Space Physics (LASP), University of Colorado Boulder

GEO Space Debris Dynamics

Introduction to Modeling of Porous Media via Hybrid Mixture Theory and Results on Flow Potentials

Multilevel Markov Chain Monte Carlo for Uncertainty Quantification in Subsurface Flow

Discontinuous Galerkin Models for Atmospheric Numerical Modeling

Parallel inference for massive distributed spatial using low-rank models

Program Synthesis for Network Updates

Phylogenetic Algebraic Geometry

Sparsity and Equation-Free Methods for Complex Systems

Quantitative Systems Modeling in the Pharmaceutical Industry

Resonant wave-particle interactions and the dynamics of Earth's space radiation environment
08/25/2014  **Lev Lerman**, Lobachevsky University of Nizhni Novgorod  
*Mathematics in a Big Closed Russian City during the Cold War: Gorky-Nizhny Nogorod Mathematical Community*

09/12/2014  **Darren Homrighausen**, Department of Statistics, Colorado State University  
*Supernova classification using photometric measurements*

09/26/2014  **Don Estep**, Department of Statistics, Colorado State University  
*Solving stochastic inverse problems using sigma-algebras on contour maps*

10/03/2014  **Jed Brown**, Department of Computer Science, University of Colorado Boulder  
*On reducing communication and improving adaptivity in nonlinear multigrid methods*

10/10/2014  **Wenxiong Chen**, Department of Mathematics, Yeshiva University  
*Liouville Theorems for α-harmonic functions in $\mathbb{R}^n$ and in a half space*

10/24/2014  **James O. Ramsay**, Department of Psychology, McGill University  
*Multivariate and Functional Principal Components without Eigenanalysis*

11/07/2014  **Amanda S. Hering**, Department of Applied Mathematics and Statistics, Colorado School of Mines  
*Robust Multivariate Error Detection in Skewed Data with Application to Historical Radiosonde Winds*

12/05/2014  **Michael Scheurer**, National Oceanic and Atmospheric Administration (NOAA) and Cooperative Institute for Research in Environmental Sciences (CIRES)  
*Evaluating the performance of probabilistic forecasts of univariate and multivariate quantities*

## Other Applied Math Talks

*Applied Mathematics often offers special talks that do not fall within the normal seminar schedule. There are many reasons for this, but all are as important as any of our regularly scheduled seminars.*

### Statistics Seminar

02/24/2014  **Steve Scott**, Google Research  
*Bayes and Big Data: The Consensus Monte Carlo Algorithm*

03/19/2014  **Eugenia Skirta**, Department of Mathematics, East Stroudsburg University  
*Statistical Education and Consulting Center and its Role in Enhancing the Quality of Undergraduate Student Research in Sciences*

## Applied Mathematics Assistant Professor Search

11/11/2014  **Ian Grooms**, Courant Institute of Mathematical Sciences, New York University  
*Stochastic superparameterization and multiscale ensemble Kalman filters for geophysical turbulence*
11/13/2014 **Kevin Flores**, Department of Mathematics, North Carolina State University

**Mathematical modeling in personalized medicine and environmental toxicology**

11/14/2014 **Tom Trogdon**, Courant Institute of Mathematical Sciences, New York University

**Riemann-Hilbert Problems, Computation and Universality**

11/18/2014 **Michael Calkins**, Department of Applied Mathematics, University of Colorado Boulder

**Multi-scale Models for Geophysical and Astrophysical Flows**

11/20/2014 **Zachary Kilpatrick**, Department of Mathematics, University of Houston

**Stochastic dynamics of nonlinear waves in neuronal networks**

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**2014 Front Range Applied Mathematics Student Conference Keynote Speaker**

03/01/2014 **Stephan Sain**, Institute for Mathematics Applied to Geosciences, National Center for Atmospheric Research

**Solving the Earth's Equations: Mathematics and Statistics at the National Center for Atmospheric Research**

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**Boulder Dynamics Conference in Honor of Jim Meiss' 60th Birthday**

Department of Applied Mathematics 2014 Annual Report
Student Organizations

Society for Industrial and Applied Mathematics (SIAM)
The University of Colorado at Boulder undergraduate chapter of the Society for Industrial and Applied Mathematics (SIAM) was founded to promote interactions between Applied Mathematics students and faculty. Society functions include technical presentations by students, faculty, and industry speakers, field trips and student/faculty social events—all designed to introduce undergraduates to the widespread use of applied mathematics in engineering and the sciences. All interested students, from any major, are encouraged to participate in SIAM-sponsored events. Sujeet Bhat served as the faculty advisor for the Undergraduate Chapter in 2014.

The graduate student chapter of SIAM at the University of Colorado at Boulder is a low-pressure, informal setting for discussing and learning about applied mathematics. The graduate student chapter holds regular meetings every other Thursday throughout the academic year. Faculty are not allowed at these meetings and the atmosphere is very low-key. Typical meetings involve a member of the organization giving a short, informal talk about their research. Tom Manteuffel served as the Faculty Advisor for the Graduate Chapter in 2014. Tony Wong served as chapter president, and Meredith Plumley as chapter vice-president.

10th Annual Front Range Applied Mathematics Student Conference
Saturday, March 1st, 2014
Location: The University of Colorado at Denver

This conference allowed student representatives, both undergraduate and graduate, from universities across the Front Range to meet and share research in the field of applied mathematics. Participating universities in 2014 were Colorado College, the Colorado School of Mines, Colorado State University, the University of Colorado Boulder, the University of Colorado Denver, and the University of Wyoming.

Participants from the CU Boulder Department of Applied Mathematics were David Nieves, Tony E. Wong, Inom Mirzaev, Stephen Kissler, Victoria Gershuny, Ruth A. Martin, Nathan D. Monnig, Bradley Martin, Yan Chen, Rees McNally, and Warren M. Lord. Yogesh Virkar of the Department of Computer Science at CU Boulder also participated.

2014’s Keynote Speaker was Stephan Sain of the National Center for Atmospheric Research.

2014 End-of-Year Dodgeball Classic
Friday, May 2nd, 2014
Location: Carlson Gymnasium, University of Colorado Boulder

This event, held at the end of the academic term, is billed as a way for students and faculty to relax and have fun before the stresses of final exams. This was the second year the event has been held by the SIAM students.
### 2014 Graduate Chapter Meetings

<table>
<thead>
<tr>
<th>Date</th>
<th>Presenter(s)</th>
<th>Topic</th>
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<tbody>
<tr>
<td>February 20, 2014</td>
<td>Brad Martin</td>
<td>Accurate seismic wave simulation through radial-basis function-derived finite differences (RBF-FD)</td>
</tr>
<tr>
<td>March 20, 2014</td>
<td>Henry Romero</td>
<td>Cooperative Communications in the Multi-Access Setting</td>
</tr>
<tr>
<td>April 17, 2014</td>
<td>Ruth Martin</td>
<td>General Solutions to the Three-Wave Resonant Interaction Equations</td>
</tr>
<tr>
<td>October 23, 2014</td>
<td>Dale Jennings</td>
<td>MCMC Methods for Learning Structures of Bayesian Networks from Data</td>
</tr>
<tr>
<td>November 6th, 2014</td>
<td>Alyson Fox and John Nardini</td>
<td>Aly and John gave short presentations on Graphs and Math Bio, respectively.</td>
</tr>
<tr>
<td>December 9th, 2014</td>
<td>Brock Mosovksy, Senior Energy Analyst, Ascend Analytics</td>
<td>Brock and Andy are APPM alumni asked to come in and talk about their research and work in the real world.</td>
</tr>
<tr>
<td></td>
<td>Mason “Andy” Kass, Research Geophysicist, United States Geological Survey</td>
<td></td>
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</tbody>
</table>
Department of Applied Mathematics 2014 Annual Report
Faculty Research

Undergraduate Focused Grants

EXTREEMS - QED: Directions in Data Discovery (Data Cubed) in Undergraduate Education. Awarded August 1, 2014 through July 31, 2017. Anne Dougherty (Applied Math) serves as the PI, with Ken Anderson (CS), Per-Gunnar Martinsson (Applied Math), Francois Meyer (Electrical Engineering), and Doug Nychka (NCAR) as Co-PIs. The purpose of the grant is to enhance undergraduate education in data-enabled science. This is accomplished through (1) the creation of a statistics minor (approved Dec 2014) and creation of data science tracks in Applied Math and CS, (2) creation and revision of several courses which focus on large data, and (3) research projects for undergraduates which involve large data.

Individual Research Grants

Several new grants were received by APPM faculty in 2014, totaling nearly $[...] in total funds received. Department faculty were Principal Investigator, or Co-Principal Investigator, on over [...] dollars in grant funding in 2014. APPM faculty remain strong researchers and work closely with both government and private industry.

Mark J. Ablowitz

Principal Investigator on Grants Received

*National Science Foundation-Division of Mathematical Sciences (NSF-DMS), “Nonlinear wave motion”, 2009-2016*

Co-Principal Investigator on Grants Received


Gregory Beylkin

Co-Principal Investigator on Grants Received:

David M. Bortz

Principal Investigator on Grants Received

NSF-DMS, “Microbial Flocculation Dynamics”, 2012-2015

Co-Principal Investigator on Grants Received


Murray Cox

Co-Principal Investigator on Grants Received:

Presidents Teaching and Learning Collaborative (PTLC), Research on teaching and learning methods in Calculus I and II, 2014

Anne Dougherty

Principal Investigator on Grants Received:

NSF EXTREEMS-QED, “Directions in Data Discovery (Data Cubed) in Undergraduate Education”, 2014-2017

Vanja Dukic

Principal Investigator on Grants Received:

NIH, “Modeling the spread of MRSA in the Community”, 2010-2014

NSF-DEB, “Collaborative Research: Scaling up epizootic dynamics: Linking individual infection to spatial spread of a disease using Bayesian hierarchical approaches”, 2013-2016

Co-Principal Investigator on Grants Received:

NSF-GEO, “CNH: Cooking up clean air: Scaled-up quality and health impacts of clean cook stoves in Ghana”, 2012-2015


Bengt Fornberg

Principal Investigator on Grants Received:

Shell International Exploration and Production, Inc., “Radial Basis Functions (RBF) for wave propagation changing the media”, 2012-2014
Mark Hoefer

Principal Investigator on Grants Received

NSF-DMS, “Solitary Waves and Wavetrains in Dispersive Media” 2014-

Co-Principal Investigator on Grants Received


Keith Julien

Principal Investigator on Grants Received


Co-Principal Investigator on Grants Received


NSF-Expeditions in Training, Research, and Education for Mathematics and Statistics through Quantitative Explorations of Data (NSF EXTREMES-QED), “Directions in Data Discovery (Data Cubed) in Undergraduate Education”

William Kleiber

Principal Investigator on Grants Received


Congming Li

Principal Investigator on Grants Received:

NSF-DMS, “Qualitative analysis focused on some nonlinear systems” 2014-2017

Manuel B. Lladser

Co-Principal Investigator on Grants Received:

Thomas A. Manteuffel

Principal Investigator on Grants Received:

Department of Energy (DOE), “First-order system least-squares (FOSLS) for nonlinear systems arising from DOE applications”, 2010-2014


DOE, “Center for Exascale Radiation Transport”, 2013-2018

Per-Gunnar Martinsson

Principal Investigator on Grants Received: Co-Principal Investigator on Grants Received:


NSF EXTREEMS-QED, “Directions in Data Discovery (Data Cubed) in Undergraduate Education”, 2014-2017

James Meiss

Principal Investigator on Grants Received: Co-Principal Investigator on Grants Received:


Harvey Segur

Principal Investigator on Grants Received:

Publications

Research dollars alone do not measure the quality of an academic body’s faculty - the dictum of “Publish or Perish” still holds. We cite the peer reviewed materials published below.

Mark J. Ablowitz


Stephen Becker


A. Aravkin, S. Becker, V. Cevher, P. Olsen, “A variational approach to stable principal component pursuit”, Conference on Uncertainty in Artificial Intelligence


Gregory Beylkin


David M. Bortz


Murray Cox

M. Cox, “Developmental Mathematics at the College Level”, Encyclopedia of Special Education: A reference guide for the education of children, adolescents, and adults with disabilities and other exceptional individuals, vol: 2, pp. 813

Ryan Croke


Vanja Dukic


V. Dukic, G. Dwyer, D. Kennedy, “Combining principal component analysis with parameter line-searches to improve the efficacy of Metropolis-Hastings”, Environmental and Ecological Statistics, pp. 1-28
Bengt Fornberg


C-IR Davis, B. Fornberg, “A spectrally accurate numerical implementation of the Fokas transform method for Helmholtz-type PDEs” Complex Variables And Elliptic Equations, vol 59, issue 4, pp. 564-577

ND Monnig, B. Fornberg, FG Meyer “Inverting nonlinear dimensionality reduction with scale-free radial basis interpolation”, Applied Computational Harmonic Analysis vol. 37, pp. 162-170


Mark Hoefer


Keith Julien


William Kleiber


W. Kleiber, E. Porcu, “Nonstationary matrix covariances: compact support, long range dependence and quasi-arithmetic constructions”, *Stochastic Environmental Research And Risk Assessment* 23 Mar 2014


Congming Li

Z. Cheng, C. Li, “AN EXTENDED DISCRETE HARDY-LITTLEWOOD-SOBOLEV INEQUALITY”, *Discrete And Continuous Dynamical Systems*, vol. 34, issue 5, pp. 1951-1959


Manuel B. Lladser


Thomas A. Manteuffel


Per-Gunnar Martinsson


A. Gillman, P.G. Martinsson “An O(N) algorithm for constructing the solution operator to 2D elliptic boundary value problems in the absence of body loads” *Advances in Computational Mathematics*, 40(4), pp 773 - 796
James D. Meiss

JG Restrepo, JD Meiss, “Onset of synchronization in the disordered Hamiltonian mean-field model”, Physical Review E vol. 89, issue 5, Article Number ARTN 052125

RM Neupauer, JD Meiss, DC Mays, “Chaotic advection and reaction during engineered injection and extraction in heterogeneous porous media”, Water Resources Research, vol. 50, issue 2, pp. 1433-1447


Juan G. Restrepo

JG Restrepo, JD Meiss, “Onset of synchronization in the disordered Hamiltonian mean-field model”, Physical Review E vol. 89, issue 5, Article Number ARTN 052125


PS Skardal, JG Restrepo, “Coexisting chaotic and multi-periodic dynamics in a model of cardiac alternans”, Chaos 24, 043126


Invited Lectures and Meetings Attended

The department of Applied Mathematics is filled with dynamic instructors and active researchers. Presenting their results at other universities and at meetings of their peers demonstrates both of these traits. Sharing knowledge is vital to the scientific process - below we list the locations around the globe that our faculty have given and received shared knowledge.

Mark Ablowitz


Center for Nonlinear Studies, Los Alamos National Laboratory, Colloquium, March 10, 2014, “Nonlinear waves from beaches to photonic lattices”


Nonlinear Waves in Sicily, June 8-13, 2014, June 9, 2014 “Nonlinear wave in photonic lattices”


Colloquium, University of Ioannina, Greece, Oct. 23, 2014, “Nonlinear waves—Always Alluring”


David Bortz

Michigan State Science at the Edge Seminar Series, February 7, 2014, East Lansing, MI

SIAM Conference on the Life Sciences, Aug. 4, 2014, Charlotte, NC


Anne Dougherty

6th Annual symposium on STEM education, Sept 29, 2014, poster presentation

Andrews Symposium, November 4, 2014

6th Annual symposium on STEM education, Sept 29, 2014, poster presentation, “Placement and Assessment are Key!”

Vanja Dukic

Workshop on Statistics and Nonlinear Dynamics in Biology and Medicine, Banff Research Station, Banff, Alberta, Canada

Murray Cox

6th Annual symposium on STEM education, Sept 29, 2014, poster presentation

Andrews Symposium, November 4, 2014

Bengt Fornberg

NCAR Colloquium, Boulder, CO

ISCOSAHOM Conference, Salt Lake City, UT

SIAM Annual Meeting, Chicago, IL

Society of Exploration Geophysicists annual meeting, Denver, CO
Mark Hoefer


Applied Mathematics Seminar, Department of Mathematical Sciences, Loughborough University, May 2014, “Viscous Liquid Conduits, an Ideal Dispersive Hydrodynamic Medium”, Loughborough, UK

SIAM Conference on Nonlinear Waves and Coherent Structures, August 2014, “Large Amplitude Solitary Waves and Dispersive Shock Waves in Conduits of Viscous Liquids”, Cambridge, UK

Boulder Fluids Seminar, Department of Mechanical Engineering, University of Colorado Boulder, August 2014, “Large Amplitude Solitary Waves and Dispersive Shock Waves in Conduits of Viscous Liquids”, Boulder, CO


Seminar, Institute of Research in Applied Mathematics and Systems (IIMAS), National University of Mexico (UNAM), November 2014, “Experiments on Solitons, Dispersive Shock Waves, and Their Interactions”, Mexico City, Mexico


Keith Julien


Christian Ketelsen


Mechanical Engineering Fluids Seminar, Nov. 17, 2014, “Approaching the Asymptotic Regime of Rapidly Rotating Convection via Asymptotics, Simulations and Experiments”, University of California at San Diego

William Kleiber

“Equivalent Kriging”, Karlsruhe Institute for Technology, Germany.

Spatial Statistics Symposium, “The connection between smoothing splines and kriging”, Heidelberg Institute for Theoretical Studies, Germany.


Joint Statistical Meetings, “High Resolution Simulation of Nonstationary Random Fields”, Boston, MA.

Congming Li

Colloquium, January 2014, JiangSu Normal University, Xuzhou, China

Analysis/PDE seminar, February 2014, Johns Hopkins University.

Colloquium, April 2014, University of Science and Technology of China, HeFei, Anhui, China

Colloquium, April 2014, PDE center, East China Normal University, Shanghai, China

International Conference on Nonlinear Evolutionary Partial Differential Equations, June 3-8 2014, Shanghai Jiao Tong University, China

PDE Seminar, June 2014, Academy of Mathematics and Systems Sciences, Chinese Academy of Sciences, Beijing, China

10th AIMS Conference on Dynamical Systems, Differential Equations and Applications, July 7-11, 2014, Session organizer and speaker, Madrid, Spain

Second SJTU Summer School on Nonlinear Partial Differential Equations, July 13-25, 2014, Organizer and lecturer, Shanghai Jiao Tong University, China


Manuel Lladser

Smith Lab Group Presentation, May 2014, Department of Molecular and Computational Biology, University of Southern California, Los Angeles, CA

Frontier Probability Days 2014, May 2014, University of Arizona

International Workshop on Applied Probability, June 2014, Antalya, Turkey

James Meiss 60th Birthday Conference, July 2014, University of Colorado Boulder

Per-Gunnar Martinsson

Mathematics Colloquium, Feb 2014, Colorado School of Mines, Golden, CO

Applied Mathematics and Computational Science Colloquium, Feb 2014, University of Pennsylvania, Philadelphia, PA

Program in Applied and Computational Mathematics Colloquium, Feb 2014, Princeton University, Princeton, NJ

Mathematics colloquium, March 2014, Rensselaer Polytechnic Institute, Troy, NY

CBMS: Fast Direct Solvers for Elliptic PDEs, June 23-27 2014, Principal Lecturer (10 talks), Dartmouth College, Hanover, NH

SIAM Annual Meeting Minisymposium, July 2014, “Randomized methods for accelerating structured matrix computations”, Chicago, IL

International Conference on Applied Mathematics, Dec 2014, “Direct Solvers for Elliptic PDEs”, City University of Hong Kong.
Juan Restrepo

Networks Seminar, February 2014, University of Houston

Mathematics Seminar, April 2014, University of Minnesota

Applied Dynamics Seminar, October 2014, University of Maryland

Dynamics and Complex Systems Seminar, September 2014, University of Colorado Boulder

10th AIMS Conference on Dynamical Systems, Differential Equations, and Applications, July 2014, “Stabilization of Incoherence in the Disordered Hamiltonian Mean Field Model”, Madrid, Spain


Harvey Segur


Department of Mathematics Kempner Colloquium, Feb 10, 2014, “3-wave resonant interactions” University of Colorado Boulder


Department of Mathematics Colloquium, Feb 7, 2014, “The nonlinear Schrödinger equation, dissipation and ocean swell”, University of Wisconsin, Madison, WI
# Faculty Service

Service is the third pillar of faculty support for the University, alongside Teaching and Research. Activity in all three areas is required for tenure at the University of Colorado, and is expected of faculty even after achieving tenure. Service takes many forms, from membership on important governing committees, to educational outreach, to editing and reviewing scientific papers. Applied Mathematics faculty are active in all these areas and more.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position/Committee/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mark J. Ablowitz</strong></td>
<td>Chair of the Department, Chairs and Directors Advisory Council (CDAC)</td>
</tr>
<tr>
<td><strong>Stephen Becker</strong></td>
<td>APPM Undergraduate Committee, University Faculty Student Mentorship Program</td>
</tr>
<tr>
<td><strong>Gregory Beylkin</strong></td>
<td>APPM Executive Committee, Editorial Board: Applied and Computational Harmonic Analysis</td>
</tr>
<tr>
<td><strong>Sujeet Bhat</strong></td>
<td>APPM Undergraduate Committee, APPM representative: Prospective Students Day recruiting event, Faculty Advisor: Undergraduate Chapter of SIAM student group, ASPIRE Summer Freshman Math Program</td>
</tr>
<tr>
<td><strong>David M. Bortz</strong></td>
<td>APPM Professional Masters Degree Committee, Chair, APPM Assistant Professor Hiring Committee, Academic Prioritization Committee, School of Mathematical Sciences Committe</td>
</tr>
<tr>
<td><strong>Jem Corcoran</strong></td>
<td>APPM 25th Anniversary Committee, APPM Probability and Statistics Preliminary Exam Committee, University PUEC committees: Sujeet Bhat, Murray Cox, Ryan Croke, Christian Ketelsen, Anne Dougherty; Chair for all, Editorial Board: Involve</td>
</tr>
<tr>
<td><strong>Ryan Croke</strong></td>
<td>University Faculty Student Mentorship Program</td>
</tr>
<tr>
<td><strong>James H. Curry</strong></td>
<td>University Search Committee: Dean of College of Communication, Media, and Information, Session Chair/Moderator: Ford Foundation 2014 Annual Program, SIAM Membership Committee, Presidential Teaching Scholar’s Selection Committee, Program Director: NSF Division of Mathematical Sciences</td>
</tr>
<tr>
<td><strong>Anne M. Dougherty</strong></td>
<td>Associate Chair of the Department, APPM Undergraduate Committee, Chair, APPM representative: Admitted Students Day, Engineering Orientation, Engineering Undergraduate Education Council, Engineering Scholarship Committee, University PUEC committees: Sujeet Bhat, Murray Cox, Ryan Croke, Christian Ketelsen, Actuarial Studies and Quantitative Finance Committee, Organizer: Front Range Applied Mathematics Student Conference</td>
</tr>
</tbody>
</table>
Vanja Dukic
APPM Graduate Admissions Committee, Probability and Statistics Preliminary Exam Committee, School of Mathematics Committee
Arts & Sciences Council, A&S Executive Committee
Arts & Sciences Budget Committee, Chair
Boulder Campus Cyberinfrastructure Board
Editorial Board: STAT
International Society for Bayesian Analysis: Lindley Prize Committee, Program Council, Organizer 2014 World Meeting

Keith Julien
APPM Executive Committee
APPM School of Mathematics Committee, Faculty Search Committee; Chair for both
University PUEC Committee, Chair: Vanja Dukic
University PUEC Committee: Per-Gunnar Martinsson
Arts & Sciences Tenure and Promotions Committee
Editorial Board: Nonlinearity
Institute for Pure and Applied Mathematics: Long Program committee

Manuel Lladser
APPM Undergraduate Committee, Faculty Search Committee
APPM Probability and Statistics Preliminary Exam Committee, Chair
University PUEC committee: Jem Corcoran
IQ Biology Advising Committee
2015 Meeting on Analytic Algorithmics and Combinatorics, Program Committee

Bengt Fornberg
APPM Executive Committee, Faculty Evaluation Committee, Numerics Preliminary Exam Committee
University PUEC Committee, Chair: Per-Gunnar Martinsson
Boulder Faculty Assembly: Administrative Services and Technology Committee

Will Kleiber
APPM Probability and Statistics Preliminary Exam Committee, Undergraduate Committee
Associate Editor: Annals of Applied Statistics
Pan-American Advanced Studies Institutes: Organizer, Multivariate Spatial Statistics Workshop

Tom Manteuffel
APPM Numerical Analysis Preliminary Exam Committee, Promotion and Tenure Committee
SIAM Science Policy Committee
Advisory Board: Bravarian Graduate School of Computational Engineering: Fundamental and Computational Sciences Directorate, PNNL
Associate Editor: Electronic Transactions in Numerical Analysis
16th Copper Mt. Conference on Iterative Methods: Program Committee

Mark Hoefer
APPM 25th Anniversary Committee, Graduate Committee, PDE Preliminary Exam Committee
University Faculty Student Mentor Program
Guest Editor: Physica D on Dispersive Hydrodynamics
Organizer: Dispersive Hydrodynamics: The Mathematics of Dispersive Shock Waves and Applications

Congming Li
APPM PDE Preliminary Exam Committee, Post Tenure Review Committee; Chair for both
APPM Graduate Committee
University PUEC Committee: Vanja Dukic
Editorial Board: Discrete and Continuous Dynamical System A, Acta Mathematica Scientia
Organizer: 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications; 2nd STJU Summer School on Nonlinear Partial Differential Equations; Workshop on the analysis of partial differential equations III

Per-Gunnar Martinsson
APPM Graduate Committee Chair
APPM Executive Committee
A&S Graduate Education Committee
Associate Editor: SIAM Journal of Scientific Computation, Advances in Computational Mathematics
Organizing Committee: ICERM Workshop on Computational Methods, 2016 IABEM Conference
James Meiss
APPM Executive Committee, Graduate Committee
Boulder Faculty Assembly Libraries Committee
University PUEC committee: Vanja Dukic
Editor: “Mappings” in Dynamical Systems Encyclopedia, Applied Mathematics Encyclopedia at Scholarpedia
Editorial Board: SIAM Books

Adam Norris
APPM Undergraduate Committee
Advisor: Theta Tau student organization
Boulder Faculty Student Mentor Program
Boulder Faculty Assembly: At-Large A&S representative; Instructor-Track Faculty Affairs committee, co-chair; Executive Committee; Committee on Office of Discrimination and Harassment; Leadership Institute; Elections and Nominations Committee, chair

Juan Restrepo
APPM PDE Preliminary Exam Committee, Faculty Search Committee, Graduate Committee
IQ Biology: Graduate Mentoring Committee, Admissions Committee
Advisory Board: Chaos (journal)

Harvey Segur
APPM Faculty Search Committee
University Distinguished Research Lecture Committee
Department of Applied Mathematics 2014 Annual Report
Teaching Activities

Undergraduate Courses Taught by Department Personnel

Spring Semester 2014

<table>
<thead>
<tr>
<th>Course</th>
<th>Instructor(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPM 1235</td>
<td>Ann DeFranco, Sandra Williams</td>
<td>Pre-Calculus for Engineers</td>
</tr>
<tr>
<td>APPM 1340</td>
<td>Jonathan Kish</td>
<td>Calculus 1A with Algebra</td>
</tr>
<tr>
<td>APPM 1345</td>
<td>Silva Chang</td>
<td>Calculus 1B with Algebra</td>
</tr>
<tr>
<td>APPM 1350</td>
<td>Murray Cox, Ryan Croke</td>
<td>Calculus I for Engineers</td>
</tr>
<tr>
<td>APPM 1360</td>
<td>Sujeet Bhat, Silva Chang, Murray Cox, Kevin Manley</td>
<td>Calculus II for Engineers</td>
</tr>
<tr>
<td>APPM 2350</td>
<td>Christian Ketelsen, Adam Norris</td>
<td>Calculus III for Engineers</td>
</tr>
<tr>
<td>APPM 2360</td>
<td>Michael Calkins, Anne Dougherty, Keith Julien, Philippe Marti, Michael Ostroski</td>
<td>Introduction to Ordinary Differential Equations with Linear Algebra</td>
</tr>
<tr>
<td>APPM 2450</td>
<td>Graduate Students</td>
<td>Graduate Students</td>
</tr>
<tr>
<td>APPM 2460</td>
<td>Graduate Students</td>
<td>Calculus III Lab</td>
</tr>
<tr>
<td>APPM 2460</td>
<td>Graduate Students</td>
<td>Differential Equations Lab</td>
</tr>
<tr>
<td>APPM 3050</td>
<td>Adam Norris</td>
<td>Scientific Computing in Matlab</td>
</tr>
<tr>
<td>APPM 3310</td>
<td>James D. Meiss</td>
<td>Matrix Methods</td>
</tr>
<tr>
<td>APPM 3570</td>
<td>Sujeet Bhat, William Kleiber</td>
<td>Applied Probability</td>
</tr>
<tr>
<td>APPM 4360</td>
<td>Douglas Baldwin, Ryan Croke</td>
<td>Complex Variables</td>
</tr>
<tr>
<td>APPM 4390</td>
<td>Sarthok Sircar</td>
<td>Modeling in Mathematical Biology</td>
</tr>
<tr>
<td>APPM 4450</td>
<td>Anne Dougherty</td>
<td>Undergraduate Applied Analysis</td>
</tr>
<tr>
<td>APPM 4540</td>
<td>William Kleiber</td>
<td>Introduction to Time Series</td>
</tr>
<tr>
<td>APPM 4570</td>
<td>Yolanda Hagar-Slichter</td>
<td>Statistical Methods</td>
</tr>
<tr>
<td>APPM 4590</td>
<td>Vanja Dukic</td>
<td>Statistical Modeling</td>
</tr>
<tr>
<td>APPM 4660</td>
<td>Juan Restrepo</td>
<td>Intermediate Numerical Analysis 2</td>
</tr>
<tr>
<td>APPM 4720</td>
<td>Christian Ketelsen</td>
<td>Topics in Applied Mathematics - Computational Linear Algebra</td>
</tr>
<tr>
<td>APPM 4950-801</td>
<td>Adam Norris</td>
<td>Seminar in APPM: “Ant Seminar”</td>
</tr>
<tr>
<td>APPM 4950-802</td>
<td>Adam Norris</td>
<td>Seminar in APPM: “Tensor Analysis”</td>
</tr>
</tbody>
</table>
Summer 2014 - Terms A and C

APPM summer courses have been, until this year, taught only in the eight-week C Term at CU Boulder, and the lower division courses are normally taught by our graduate students. In 2014, adjunct professor and NCAR researcher Doug Nychka offered a seminar course in the A Term.

APPM 1350  Ruth Martin  Calculus I for Engineers
APPM 1360  Tony Wong  Meredith Plumley  Calculus II for Engineers
APPM 2350-300  David Nieves  Dale Jennings  Calculus III for Engineers
APPM 2360  Ed Yasutake  Michael Ostroski  Introduction to Ordinary Differential Equations with Linear Algebra
APPM 2450  Rebecca Mitchell and Rachel Tutmaher  Calculus III Lab
APPM 2460  Zach Mullen  Differential Equations Lab
APPM 3310  Sujeet Bhat  Matrix Methods
APPM 4650  Adam Norris  Intermediate Numerical Analysis I
APPM 4720/5720  Douglas Nychka  Topics in Applied Mathematics: Methods and Analysis of Large Data Sets

Fall Semester 2014

APPM 1235  Ryan Croke  Ann DeFranco
Yolanda Hagar-Slichter
Jack Olsen
Sandra Williams  Pre-Calculus for Engineers
APPM 1340  Silva Chang  Calculus 1A with Algebra
APPM 1350  Sujeet Bhat  Murray Cox  Ryan Croke  James H. Curry  Jonathan Kish  Calculus I for Engineers
APPM 1360  Silva Chang  Murray Cox  Congming Li  Calculus II for Engineers
APPM 2350  Christian Ketelsen  Adam Norris  Sergey Voronin  Calculus III for Engineers
APPM 2360  Mark Hoefer  Yiping Ma  Per-Gunnar Martinsson  Introduction to Ordinary Differential Equations with Linear Algebra
APPM 2450  Graduate Students  Calculus III Lab
APPM 2460  Graduate Students  Differential Equations Lab
APPM 3170  Sujeet Bhat  Discrete Applied Mathematics
Fall Semester 2014 (cont.)

APPM 3310  
Gregory Beylkin  
Christian Ketelsen  
Matrix Methods

APPM 3350  
Adam Norris  

APPM 3570  
Igor Rumanov  
Applied Probability

APPM 4350  
Harvey Segur  
Methods in Applied Math I (Fourier Series)

APPM 4380  
Bengt Fornberg  
Modeling in APPM

APPM 4440  
Anne Dougherty  
Undergraduate Applied Analysis

APPM 4520  
Jem Corcoran  
Introduction to Mathematical Statistics

APPM 4560  
Manuel Lladser  
Markov Processes

APPM 4650  
Tom Manteuffel  
Intermediate Numerical Analysis 1

Graduate Courses Taught by Department Personnel

Spring Semester 2014

APPM 5360  
Douglas Baldwin  
Complex Variables
  Ryan Croke

APPM 5390  
Sarthok Sircar  
Modeling in Mathematical Biology

APPM 5450  
Per-Gunnar Martinsson  
Applied Analysis 2

APPM 5460  
Juan Restrepo  
Dynamical Systems/Differential Equations/Chaos

APPM 5540  
William Kleiber  
Introduction to Time Series

APPM 5570  
Yolanda Hagar-Slichter  
Statistical Methods

APPM 5590  
Vanja Dukic  
Statistical Modeling

APPM 5610  
Gregory Beylkin  
Numerical Analysis 2

APPM 6640  
Steve McCormick  
Multigrid Methods

APPM 7400-006  
Per-Gunnar Martinsson  
Topics in Applied Mathematics - Introduction to Research

APPM 7400-005  
Gregory Beylkin  
Topics in Applied Mathematics - Multiresolution Algorithms

Fall Semester 2014

APPM 5350  
Harvey Segur  
Methods in Applied Math I (Fourier Series)

APPM 5380  
Bengt Fornberg  
Modeling in APPM

APPM 5430  
Mark J. Ablowitz  
Complex Variables

APPM 5440  
Stephen Becker  
Applied Analysis I

APPM 5470  
Congming Li  
Methods of Applied Mathematics 3: PDEs

APPM 5520  
Jem Corcoran  
Introduction to Mathematical Statistics

APPM 5560  
Manuel Lladser  
Markov Processes

APPM 5600  
Bengt Fornberg  
Numerical Analysis I

APPM 6610  
Tom Manteuffel  
Introduction to Numerical PDEs

APPM 7400-003  
Sujee Bhat  
Topics in Applied Mathematics - Teaching Excellence
### Courses Offered by the Department, Taught by Non-Departmental Personnel

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Term</th>
<th>Instructor</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPM 4120/5120</td>
<td>Spring 2014</td>
<td>Alejandro Spina, Mathematics</td>
<td>Operations Research</td>
</tr>
<tr>
<td>APPM 4520</td>
<td>Spring 2014</td>
<td>Sergei Kuznetsov, Mathematics</td>
<td>Introduction to Mathematical Statistics</td>
</tr>
<tr>
<td>APPM 4570/5570</td>
<td>Spring 2014</td>
<td>Ray Littlejohn, Engineering Mgt</td>
<td>Introduction to Applied Statistics</td>
</tr>
<tr>
<td>APPM 4580/5580</td>
<td>Spring 2014</td>
<td>Ray Littlejohn, Engineering Mgt.</td>
<td>Statistical Methods of Data</td>
</tr>
<tr>
<td>APPM 4650</td>
<td>Spring 2014</td>
<td>Alejandro Spina, Mathematics</td>
<td>Intermediate Numerical Analysis 1</td>
</tr>
<tr>
<td>APPM 4720</td>
<td>Spring 2014</td>
<td>Michael J. Stutzer, Finance</td>
<td>Math Finance 1</td>
</tr>
<tr>
<td>APPM 4520</td>
<td>Summer 2014</td>
<td>Alejandro Spina, Mathematics</td>
<td>Introduction to Mathematical Statistics</td>
</tr>
</tbody>
</table>

### Courses Offered by Other Departments, Taught by APPM Personnel

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Term</th>
<th>Instructor</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COEN 1236</td>
<td>Spring and Fall 2014</td>
<td>Graduate Students</td>
<td>Pre-Calculus Workgroup</td>
</tr>
<tr>
<td>COEN 1350</td>
<td>Spring and Fall 2014</td>
<td>Graduate Students</td>
<td>Calculus 1 Workgroup</td>
</tr>
<tr>
<td>COEN 1360</td>
<td>Spring and Fall 2014</td>
<td>Graduate Students</td>
<td>Calculus 2 Workgroup</td>
</tr>
<tr>
<td>COEN 2350</td>
<td>Spring and Fall 2014</td>
<td>Graduate Students</td>
<td>Calculus 3 Workgroup</td>
</tr>
<tr>
<td>MCEN 3012</td>
<td>Summer 2014</td>
<td>Adam Norris</td>
<td>Thermodynamics</td>
</tr>
</tbody>
</table>