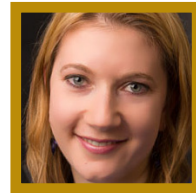# UC**DAVIS**

MATHEMATICS NEWSLETTER

Growth
& Excellence
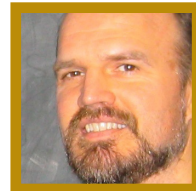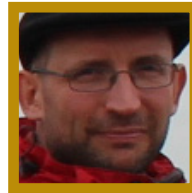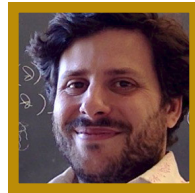
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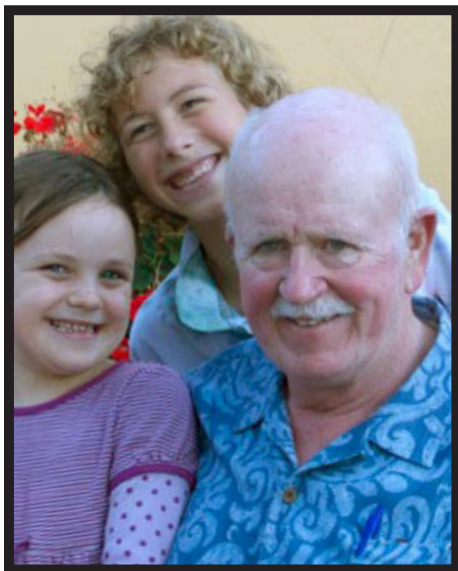
Art Krener

Arthur Krener joined the faculty of the Mathematics Department at Davis in 1971, immediately after receiving his Ph.D. from Berkeley. He spent his entire career at Davis, retiring in 2006 as a Distinguished Professor of Mathematics.

Art's mathematical interests focus on non-linear control theory, where he did foundational work. With Hermann, Krener gave the definitive treatment of controllability and ob-servability for nonlinear systems based on dif-ferential geometric tools. The importance of this paper was recognized immediately. It was cited by the IEEE Control Systems Society as one of Twenty Five Seminal Papers in Control published in the twentieth century. It forms the basis for many of the seminal advances in control theory that have followed.

Around 1960 the well-known Pontryagin Maximum Principle was developed for opti-mal control problems. These are the first order necessary conditions that a control must satis-fy to be optimal. But they are not always deter-minative, particularly for problems where the control enters affinely. The High Order Maxi-mum Principle that Krener developed gives additional necessary conditions for optimality. This work has stimulated strong interest over the years, and been generalized and extended by many authors.

With colleagues Krener gave conditions for the existence and construction of decou-pling and non-interacting control laws for nonlinear systems. This paper won the Best Paper of the Year Award of the IEEE Transac-tions on Automatic Control. He also has been a leader in the development of software tools for nonlinear control. His Nonlinear Systems Toolbox is a suite of MATLAB routines that implement a variety of the latest methods of nonlinear control.

Art's work has earned him many honors. In addition to being named a Fellow in the American Mathematical Society, he also is a Fellow of the Society for Industrial and Applied Mathematics (SIAM), the Institute of Electrical and Electronic Engineers (IEEE) and the In-ternational Federation for Automatic Control (IFAC). He has won numerous awards includ-ing a Guggenheim Fellowship, the SIAM Reid Prize, the IEEE Bode Lectureship and an IFAC Certificate of Excellent Achievements.

Krener held a variety of administrative posts while at UC Davis, including Chair of the Department of Mathematics, and member of the Committee on Academic Personnel. He began and endowed the Krener Assistant Professorships. This program brings several excellent young mathematicians to UC Davis each year. He also was founding Chair of the SIAM Activity Group on Control and Systems Theory.
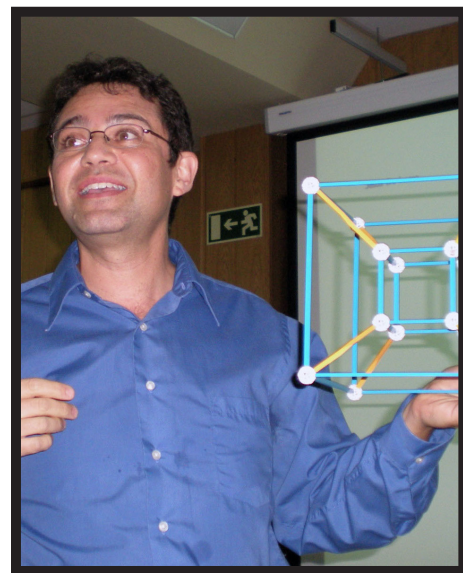
Jesus De Loera

Jesus De Loera has made many notable contributions to discrete mathematics and its applications, as well as to the education of our students at UC Davis.

He started his career working in the area of discrete and computational geometry. His Ph.D dissertation solved an outstanding prob-lem posed by Gelfand, Kapranov and Zelevin-sky concerning the structure of the space of triangulations of a product of simplices, a topic started by J. Stasheff and Milnor in the 1970's. Later, in joint work with Below and Richter-Gebert, he solved another longstand-ing problem by showing that finding a trian-gulation of a convex 3-polytope with the mini-mum number of simplices is NP-hard.

He also has made important contributions in other areas of discrete geometry, in particu-lar on computational problems involving lat-tice points, volumes, and integrals of polyhe-dra. His work in this area has been applied in many fields of mathematics, including al-gebraic geometry, representation theory and algebraic combinatorics. Together with others at UC Davis he has developed the highly suc-cessful software package LattE that provides many useful computational methods for dis-

crete geometry problems.

In recent years Jesus' research interests have extended to encompass more applied areas of mathematics, including integer and combinatorial optimization. An Integer Linear Program (ILP) problem is this: given a matrix A, vector b and linear function $f(x)$, find the maximum value of $f(x)$ over all integer vectors x that satisfy $Ax = b$ and every component of x is non-negative. In pioneering work with Hemmecke, Koeppe and Weismantel, De Loera proved the first theoretical results for the generalization of this problem in which $f(x)$ is a non-linear objective function. To put this results in context, recall the celebrated result by H.W. Lenstra: When the number of variables is fixed there is an algorithm to solve ILPs in polynomial time on the input size. De Loera et al. extended this to the case when f is non-linear. Although they showed that the problem becomes NP-hard, even in dimension two, they designed an approximation algorithm to maximize an arbitrary integral polynomial over the lattice points of a convex rational polytope with a fixed dimension.

The excellence of Jesus' De Loera's work has been recognized by all the mathematical societies. He has been a plenary speaker for the AMS, the MAA, and SIAM. In 2010 he was co-winner of the computer society award from The Institute for Operations Research and the Management Sciences.

De Loera is an outstanding mentor and teacher. While at UC Davis he has supervised eight Ph.D students, five postdocs, and over 30 undergraduate honors theses. More than 45 undergraduates have conducted research with him. He received the 2003 UC Davis Chancellor's fellow award, the 2006 UC Davis award for diversity, the 2007 Award for Excellence in Service to Graduate Students by the UC Davis Graduate Student Association, and the 2013 Chancellor's award for mentoring undergraduate research. But the success of his many students is his greatest reward, and one he receives every day.

Letter from the Chair
by Dan Romik

This has been a great year to be a mathematician. A ranking of U.S. occupations published last April by the job search website CareerCast and quoted in the Wall Street Journal, Forbes and other notable media outlets, declared 'mathematician' to be the top job in the United States in 2014. (Lumberjack was ranked as the *worst* job, in case you were wondering.) Color us unsurprised: Here in the UC Davis Mathematics Department we have always known how much fun and how rewarding math is! Of course we are delighted that the rest of the world is catching on, as this enables the Department to enjoy an exciting wave of growth.

In the past year we have hired four excellent new faculty members: Javier Arsuaga, Michael Friedlander, Mariel Vazquez and Eugene Gorsky (who will arrive later this year). Also, Niels Grønbech-Jensen has joined us by transitioning into a joint appointment with Mechanical and Aeronautical Engineering. And this year we have appointed Andrew Sornberger to be our first Research Scientist.

In the coming year our growth will continue unabated, with a recruitment for one tenure-track position at the Assistant Professor level, and no fewer than four additional faculty positions in a joint recruitment effort with the Physics Department.

The Department also has been successful in many other ways. Two of our members, Professor Jesus De Loera and Professor Emeritus Arthur Krener, were elected as Fellows of the American Mathematical Society. They join five of our faculty who were recognized with this prestigious honor in 2012. In May we hosted a large conference held to honor the research achievements of Professor Albert Schwarz. Entitled "The Mathematics of Quantum Theory," this highly successful event featured talks by Fields Medal-winner Andrei Okounkov of Columbia University and several other luminaries from mathematics and theoretical physics. In the present academic year we have scheduled talks and visits by other famous mathematical scientists, including the Fields Medalists Edward Witten and Charles Fefferman.

We have had impressive success in teaching, our other essential area of activity. Over the past year the Department graduated ten doctoral students. Our incoming class of graduate students comprises 20 students. We are proud of our continued ability to attract talented graduate students, which form an essential part of any successful research program, and wish them luck in their work.

Our undergraduate program is growing in size and prominence. This is due both to the growth in undergraduate enrollments at UC Davis, and to the increasing recognition of the value and importance of STEM (Science, Technology, Engineering and Mathematics) education. This year our undergraduate program includes 568 math majors, the most ever. And we are launching a new major, Mathematical Analytics and Operations Research, which already is attracting significant interest.

The excellence of our instructors' teaching continues to be recognized at the national level. This year, our popular lecturer Dr. Duane Kouba was awarded the 2014 Golden Section Distinguished Teacher Award by the Mathematical Association of America.

I'll conclude with a note of thanks to our outgoing chair, Joel Hass. His four years of significant accomplishments as chair have left the Department in great shape. Joel now is focusing on research activities, with a quarter-long visit to the Hebrew University in Jerusalem.

We are immensely grateful to our many contributors for their generous donations, which support and make possible many of our activities. If you are considering joining this select group, see the back of the newsletter for information on how to donate.

New Faculty
Niels Gronbach-Jensen

Niels received his M.S. in Applied Mathematical Physics and his Ph.D. in Physics in 1989 and 1991, respectively, both from the Technical University of Denmark. His thesis topics involved nonlinear phenomena, squeezing of uncertainty in quantum optics, and solitons and phase-locking in nonlinear differential equations.

After completing his doctoral work, Niels spent a year as a postdoctoral researcher in Applied Physics at Stanford University, where he was introduced to bio-molecular modeling. In 1992 he moved to the Condensed Matter and Statistical Physics group in the Theoretical Division at Los Alamos National Laboratory. He entered the division as a postdoctoral fellow, then became a Staff Member, and finally was promoted to Team Leader. While at Los Alamos, he worked in a variety of areas. These included high-performance computational implementations of molecular dynamics analyses for materials modeling, model and algorithm development for studying the role of electrostatics in bio-molecular self-assembly, and practical models for predicting radiation effects in crystalline materials. He also continued his work on nonlinear dynamics and phase-locking of oscillators.

In 1999 Grønbech-Jensen joined UC Davis as a Professor of Applied Science. At that time he also was appointed as a Faculty Scientist at Lawrence Berkeley National Laboratory. Presently that appointment is in the Applied Mathematics & Scientific Computing Department.
...continued on page 7

New Faculty
Javier Arsuaga

Javier received his B.S. degree in Mathematics from Universidad de Zaragoza, Zaragoza (Spain). In 1995 he came to the United States to work under the direction of De Witt Sumners (Florida State University) on applications of knot theory to DNA structure. His Ph.D. research focused on the use of knot theory to understand DNA packing in viruses and was funded by a fellowship of the Program in Mathematics and Molecular Biology (PMMB). He was awarded his degree in 2000, and then became a Postdoctoral Fellow in the Departments of Mathematics and Molecular and Cell Biology at Berkeley, working under R. K. Sachs and N.R. Cozzarelli, respectively. In 2003 Javier was appointed a Research Scientist at the UCSF Cancer Center, and subsequently as a tenure track Assistant Professor of Mathematics at San Francisco State University (SFSU). After nine years at San Francisco State he now joins the Departments of Molecular and Cell Biology and Mathematics at UC Davis.

Since 2005 Javier has held short term visiting positions in the Biochemistry Department at the University of Oxford and the Cancer Center at the Universidad de Salamanca.

Javier's primary research interest is in developing and applying mathematical methods to the study of the three dimensional structure of chromosomes. He uses a multidisciplinary approach because he believes that this problem, like many other current scientific problems, cannot be solved within the confines of a single discipline but must be approached from a broader, more integrative perspective.

His research currently is supported by grants from the NSF and the NIH and was featured in the NSF highlights in 2001. His research program provides opportunities for participation and training by both undergraduates and graduate students from Mathematics, Biology, Physics and Computer Science. Javier has presented his research at numerous national and international venues. Most notably he was plenary speaker at the "Math Institutes Modern Mathematics" conference in 2008 and at the annual international Conference in Computational Physics in 2012.

Javier has also organized conferences in mathematical and computational biology; he is one of the cofounders and organizers of Biology and Mathematics in the Bay Area (BaMBA). Since 2005 this group has organized an annual conference on mathematical biology that brings together biologists and quantitative researchers from industry and academia throughout the San Francisco Bay Area. These conferences have been instrumental in creating a regional community in mathematical and quantitative biology, and in helping scientists and students transition from quantitative fields into biology, where their expertise is urgently needed.
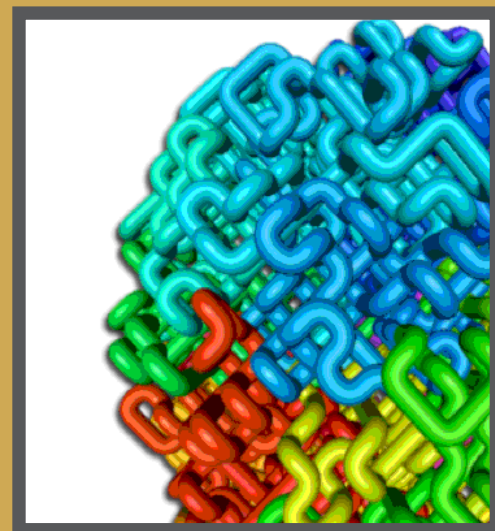
New Faculty
Mariel Vazquez

Mariel obtained her B.S. in Mathematics from the National University of Mexico (UNAM) and a Ph.D. from Florida State University, where she worked with De Witt Sumners. After receiving her doctorate, she held appointments as a Postdoctoral Fellow/Visiting Assistant Professor at UC Berkeley working with Rainer Sachs. While at Berkeley, Mariel received an Exxon Mobil Project NExT Fellowship. She moved from there to San Francisco State University, where she spent nine years. Mariel now joins the UC Davis faculty as Professor of Mathematics and of Microbiology & Molecular Genetics. She comes to Davis as a CAMPOS faculty scholar. This program aims to bring multicultural perspectives to science.

Mariel's research focuses on the applications of topological and discrete methods to the study of DNA, with an emphasis on the topological changes affected by enzymes such as topoisomerases and site-specific recombinases. In collaboration with Javier Arsuaga, Mariel also studies chromatin architecture and DNA packing in confined environments.

The excellence of Mariel's research already has been recognized by a variety of awards. She is the 2014 recipient of the Mohammed Dahleh Distinguished Lectureship at UC Santa Barbara, a 2012 recipient of the U.S. Presidential Early Career Award for Scientists and Engineers (PECASE), and a 2011 NSF CAREER Award. The PECASE honored her "for excellent interdisciplinary and international research at the interface of mathematics and biology, and for creativity and dedication to recruiting, training, and mentoring, and helping students from underrepresented groups achieve their goals."

She has served on the Advisory Board at the National Institute of Mathematical and Biological Synthesis (NIMBioS). She is associate editor of the newly-formed journal Frontiers in Molecular Biosciences, and member of the Human Resources Advisory Committee at MSRI. Mariel is committed to increasing representation of women and under-represented minorities (URM) in mathematics, she has mentored URM students and has been involved in grants focused on minority recruitment and training. Notable engagements include a plenary lecture at the 8th Australia-New Zealand Mathematics Convention (Melbourne, Australia; December 2014), the 2014 Mohammed Dahleh Distinguished Lecture (UCSB), a 2014 Distinguished PIMS lecture in Mathematical Biology (University of Saskatchewan, Canada), and invited keynote lectures at the 2013 Undergraduate Research Conference at the Interface of Biology and Mathematics (NIMBioS, University of Tennessee at Knoxville), the 2013 Sonia Kovalevsky Math Day (University of Texas at Austin), the 2012 Modern Math Workshop and the 2010 BaMBA Conference (Stanford University). Mariel has held numerous visiting positions, including appointments in the Biochemistry Department at the University of Oxford (UK), the Molecular Biology Department CID/CSIC (Barcelona), and the Institute for Mathematics and its Applications (Minneapolis).

Mariel enjoys spending free time with her husband, Javier Arsuaga, and her children. A nice relaxing day would include a walk in a beautiful park, reading or writing in a coffee shop, and visiting an art museum or going to the symphony. Mariel enjoys communicating mathematics to children, taking photographs and seeing/making art.


New Faculty
Michael Friedlander

"Doing the best with what you've got." This is how Michael Friedlander describes his principal field of research, mathematical optimization.

Optimization is essential for solving an enormous array of modern-day problems that arise in fields such as machine learning, signal processing, and medical-treatment planning.

Michael is interested in answering the mathematical and computational questions that underpin algorithms for solving such problems. The ubiquity of digital-data acquisition, and our demands for higher fidelity in processing the data, mean that these problems are now getting enormous, making the work of the optimizer ever more complex and interesting. Michael is equally happy working on both sides of the optimization coin: proving theorems and writing software to implement his ideas.

Michael received his B.A. in Physics from Cornell University in 1993, and his Ph.D. in Operations Research from Stanford University in 2002. From 2002 to 2004 he was the Wilkinson Fellow in Scientific Computing at Argonne National Laboratory. He comes to UC Davis after ten years in Canada, where he was Professor of Computer Science at the University of British Columbia in Vancouver. He also has held visiting positions at UCLA's Institute for Pure and Applied Mathematics (2010) and at Berkeley's Simons Institute for the Theory of Computing (2013).
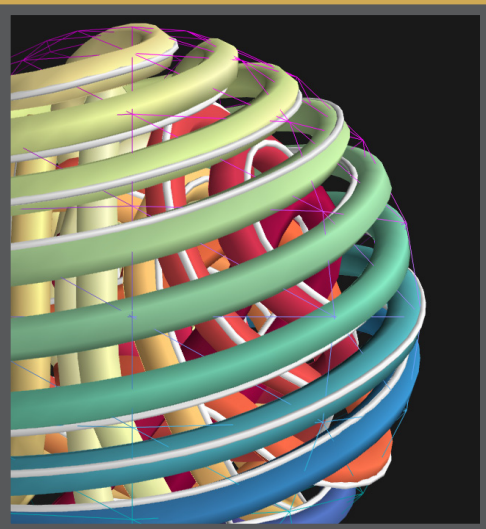
New
Krener Asst. Professor
Ying He

In 2013 Ying He received both her Ph.D. degree in Mathematics and her Master's degree in Computer Science. Both degrees were awarded by Purdue University.

Prior to coming to UC Davis she was a Postdoctoral Research Associate at Purdue University, and a visiting researcher in the Division of Mathematics and Computer Science at Argonne National Laboratory.

Ying's research interests span a wide range of areas in applied and computational mathematics. Currently she is particularly interested in developing scalable solvers for acoustic and electromagnetic scattering using high order spectral element methods. She also is working on a variety of fluid dynamics problems.

At UC Davis, Ying He's mentor will be Professor Elbridge Puckett. She also will work with other researchers from Computational Infrastructure in Geophysics (CIG) to develop state-of-the-art computational methods for modeling heterogeneities and mixing in the Earth's mantle.

Ying He's family lives in San Jose, so on weekends she enjoys spending time with them. Her favorite off-hours activities include hiking, exploring great food, and watching movies.

New
Krener Asst. Professor
Ruifang Song

Ruifang Song is originally from China. She received her Ph.D. from Harvard University in 2011 under the supervision of Professor Shing-Tung Yau. Her thesis work concerned the period integrals and Picard-Fuchs equations of Calabi-Yau hypersurfaces in homogeneous spaces. After Harvard, she moved to the University of Wisconsin-Madison, where she was a Van Vleck Visiting Assistant Professor from 2011 to 2014.

Dr. Song's primary research interests lie in algebraic geometry, and particularly in problems inspired by mathematical physics. More specifically, her work focuses on Calabi-Yau manifolds and mirror symmetry, moduli spaces, D-modules, and Hodge theory. Her mentor at UC Davis is Professor Motohico Mulase.

In her spare time she enjoys hiking, swimming, running, reading and watching movies.

New
Krener Asst. Professor
Erik Slivken

I am originally from Minnesota. But I spent the better part of the last decade first in Japan, and then Seattle, and therefore do not have that awesome Lake Wobegon accent. I am not sure if I ever did.

Before entering graduate school at the University of Washington, I worked in video games and politics. Both had their moments, but the pull of mathematics brought me back to school.

My research interests focus on Probabilistic Combinatorics in general. More specifically I work on problems involving percolation, permutations, pattern-avoidance; anything that starts with a 'p', apparently. (Partitions and Polytopes too!)

If you stop by my office to chat (math or otherwise), I may put on a pot of coffee or tea. Bring a mug!
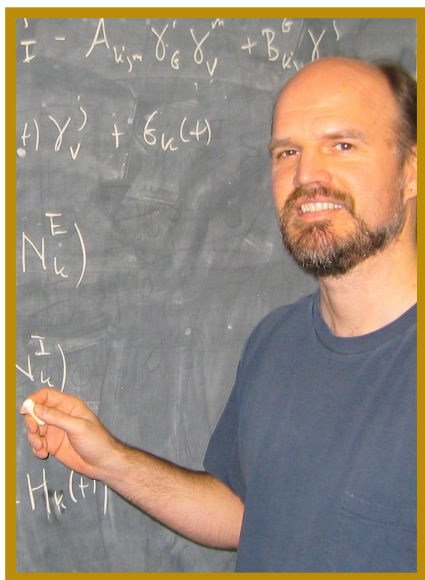
New Research Scientist
Andrew Sornborger

Andrew is the first faculty member in the Department to hold an exclusively research-based position. Trained as a theoretical physicist, and working in fields as disparate as theoretical and computational neuroscience, quantum computing, gravity, cosmology, non-linear field theory and multivariate statistics, Sornborger is perhaps best described as a journeyman theorist.

As a graduate student, Andrew studied the physics of the early universe under Robert Brandenberger at Brown University. After completing his Ph.D. he accepted a postdoctoral position in Stephen Hawking's Gravitation and Cosmology group at Cambridge, then moved to the Theoretical Astrophysics group at Fermilab. Due to an interest in cognition and a new wife with a graduate fellowship at Columbia, Andrew changed fields to theoretical neuroscience and joined Larry Sirovich's Applied Mathematics group in the Biomathematics Department at the Mount Sinai School of Medicine in New York City. At Sinai, Andrew was introduced to a new love, the analysis of neural data. Since that time he hasn't looked back (although he does glance to the side occasionally).

After accepting a tenure-track split appointment in the Mathematics Department and the College of Engineering at the University of Georgia (UGA), Andrew teamed up with Jim Lauderdale, a developmental biologist and geneticist. Their joint laboratory spent the following decade developing experimental and theoretical methods for imaging and simulating epileptic seizures in the larval zebrafish

While at UGA, Andrew also pursued other research interests, including quantum simulations on quantum computers. In one such project, Andrew proposed a quantum protocol for a quantum tunneling simulation. It now has been implemented on a quantum computer, and is the first demonstration of a fully digital quantum simulation.

Andrew came to UC Davis when his wife accepted a position as a wildlife veterinarian at the One Health Institute of the School of Veterinary Medicine. He has started off his Professional Researcher position with a bang. Days after being appointed, PI Andrew and a team of researchers at UC Davis, UCSF and UGA received a major grant from the Collaborative Research in Computational Neuroscience program, a joint NSF/NIH initiative to study the dominant theory of seizure formation and propagation in the central nervous system. In addition to being PI, Andrew is responsible for the data analysis and large-scale neuronal simulation components of this project.

In his copious spare time, Andrew takes care of his 4 year old son, Rafael, plays the violin, rock climbs and flies sailplanes (roughly in that order).

New Faculty - Gronbach-Jensen

At Davis Niels has further developed his interest in phase-locking to the behavior of macroscopic quantum systems. Specifically, he seeks to determine if the interpretation of experimental observations of ultra-cold superconducting devices requires quantum models, or if they can be equally well understood as a manifestation of nonlinear resonances due to pulsed perturbations. More recently, he has developed and analyzed new algorithms for discrete-time modeling of Langevin systems, with a focus on obtaining time-step independent thermodynamic responses from simulations.

Niels has been a Professor of Mechanical and Aeronautical Engineering since 2011, when the Department of Applied Science was closed. He now joins our faculty, with a joint appointment between Mathematics and Mechanical and Aeronautical Engineering.

Outside of work, Niels has made use of the local Davis University Airport, where he trained to become a commercial pilot of single engine aircraft.

New Faculty - Friedlander

Dr. Friedlander enjoys serving the computational optimization community. He currently is on the editorial boards of the SIAM Journal on Optimization, the SIAM Journal on Matrix Analysis and Applications, the SIAM Journal on Scientific Computing, and Mathematical Programming Computation.

This year he was elected for a 2-year term as the Program Director for the SIAM Activity Group in Optimization, where his main responsibilities will be to help organize the triennial SIAM Meeting in Optimization.

Michael, his wife Anna and their five year-old son Paul, are all enjoying life in Davis. When he isn't working on algorithms, Michael spends time on projects in his woodworking shop.

The Graduate Programs

by Sasha Soshnikov, Graduate Program Chair
and Steve Shkoller, GGAM Chair

This year the Graduate Program in Mathematics welcomes 11 new graduate students. They were selected from more than 200 applicants, one of the largest pools the Program ever has had.

The Graduate Group in Applied Mathematics (GGAM) welcomes nine new graduate students this year, seven to the Ph.D. program and two Master's students. They were selected from a candidate pool of over 100 applicants.

Several graduate students received prestigious prizes during the 2013-2014 academic year. Axel Saenz-Rodriguez won the Graduate Research Mentorship Fellowship. Amanda Young won the William K. Schwarze Scholarship. Lingyun Li was awarded the Alice Leung Scholarship in Mathematics. Edward Tavernetti won the Henry Adler Prize for excellence in teaching. Eric Brattain-Morrin was awarded the Yueh-Jing Lin Scholarship. Tom Chartrand, a second year GGAM student, won a prestigious National Defense Science and Engineering Graduate Fellowship. And Kaele Vogel, one of our entering students, has been awarded an NSF Graduate Fellowship.

The 5th Annual Davis Math Conference took place on October 16, 2014. It was organized by the Galois Group and was devoted to research projects of both Pure Math and Applied Math students. The Conference aims to present current research conducted in the Department to graduate students and faculty. This year's conference covered a diverse range of topics from topology, algebra and analysis to mathematical physics and biology.

The Department and its graduate programs hosted numerous distinguished visiting speakers during the year. Notable highlights include the following: Steven Smale (CUHK) gave a colloquium talk on new mathematical perspectives on protein folding. James Glimm (Stony Brook) presented a Distinguished Lecture on roles of mathematics in the sciences. And George Papanicolaou (Stanford) gave three lectures on mathematical economics.

This year Steve Shkoller resumed leadership of GGAM after a one year sabbatical at Oxford University. During his absence the Group was ably led by Albert Fannjiang.

The annual GGAM mini-conference took place on Jan. 25, 2014, and was a great success. This annual event brings together the faculty and students of GGAM to share research results and interests. This year's program included talks on mathematical biology, non-linear waves, dynamic optimization in economics, neurobiology, percolation theory, discrete time algorithms and atmospheric modeling.

Alumni Update

Adrienne Petersen
B.S., 2002

Adrienne Petersen continued her studies in Mathematics to get her Masters at University of Nevada, Reno in 2008. She held a lecturer position at Great Basin College in Elko, Nevada and is presently a lecturer at University of Nevada, Reno.

She married Brad Petersen in August of 2012, and their first son, Blake, was born in July 2013.

Margaret Rosasco
B.S., 1990

After graduating from UC Davis, Margaret went on to Central Michigan University, earning her Master's degree in 1995. She was hired as an Assistant Mathematician by Sierra Energy and Risk Assessment, and later became Adjunct Faculty in the Mathematics Departments at Modesto Junior College, Columbia College, and Merced College. In 2013 she received a Degree in Education, Curriculum and Instruction from the University of the Pacific. She presently holds a faculty position in Mathematics at the University of the Pacific in Stockton, California.

Katherine D. White
B.A., 1981 Math & American Studies

Katherine White got her Master's degree to gain software skills, but credits her growth and job success to the critical thinking and learning skills she acquired at UC Davis. Her American Studies program developed her ability to think outside the box, and Mathematics taught her to think theoretically.

Upon graduation she worked for Argo Systems in Sunnyvale as a software engineer. Then she moved to the then-startup company, QUALCOMM. She rose from software engineer to VP, and continued as VP when Leap Wireless was spun off. She was elected to a four year term on the local school board.

She now is retired and living in Del Mar, California, where she does volunteer work in the community.

Graduate Degree Recipients

Brummitt, Charles : Ph.D., Applied : "Models of Systemic Events: Interdependence, Contagion, and Innovation," D'Souza : Postdoctoral Researcher, Columbia University

Chong, Euna : Ph.D., Math : "Nonlinear Equations of Mixed Type and Transonic Flows," Hunter : Lecturer, University of California, Davis

Jiang, Mi : Ph.D., Applied : "Computational Studies of Competing Phases in Model Hamiltonians," Jensen : Postdoctoral Researcher, Theoretische Physik HIT, Zurich

Kwok, Ricky : Ph.D., Applied : On the Distribution of the Leading Particle in the Asep with Step Initial Condition and the Self-Adjoint Asep," Tracy

Li, Binglin : Ph.D., Math : "Towards a Theory of Abel-Jacobi Maps and Limit Linear Series for Curves of Compact Types," Osserman

Li, Lingyun : Ph.D., Applied : "Central Limit Theorem for Linear Statistic of Eigenvalues of Large Random Matrices," Soshnikov

O'Brien, Matthew : Ph.D., Applied : Joy

Reed, Matthew : Ph.D., Applied : The Central Limit Theorem for Linear Spectral Statistics of Submatrices of the Gaussian Wigner Random Matrices," Soshnikov: Adjunct Professor, Sacramento City College

Zhang, Naizhen : Ph.D., Math : "Towards the Bertram-Feinberg-Mukai Conjecture," Osserman : Lecturer, University of California, Davis

Badeau, Garrett : Applied, M.S. : Mogilner

Copos, Calina : Applied, M.S. : Guy

Fogelson, Benjamin : Applied, M.S. : Mogilner

Luttmer, Laura : Math, M.A. : Thompson

Miller, Jacob : Math, M.A. : De Loera

Ochiai, Jason : Applied, M.S. : Saito

Ray, Corina : Math, M.A.

Rensi, Efrem : Applied, M.S. : Freund

Alumni Update

Juan Gomez
B.A., 1998

Inspired by the passion for undergraduate math education exemplified by Motohico Mulase, Abigail Thompson, Arthur Krener and Evelyn Silvia in his undergraduate education, Juan Gomez has made it his goal to try and match their passion at the high school level. Currently this involves working on several committees for the California Department of Education to align to the Common Core State Standards in Math. During the past two years, Juan has been an active member of the Focus Group for the 2013 Revision of the Mathematics Framework for California Public Schools, served as an Instructional Materials Reviewer for the California Department of Education, reviewed and recommended literature for the Recommended Literature List for the CDE, helped align the existing literature list to the CCSS-M—all with the end goal to make math education more relevant to today's high school students.

Currently, Juan is working on leading Carmel High School, where he teaches Math, through the implementation process in adopting, not only curriculum, but the pedagogy required to make students better problem solvers—just like his professors at UC Davis always advocated.

On a personal note, Juan just welcomed a beautiful baby girl Lena Elizabeth in the last year, which only helps drive him to lead the change in the way mathematics is taught.
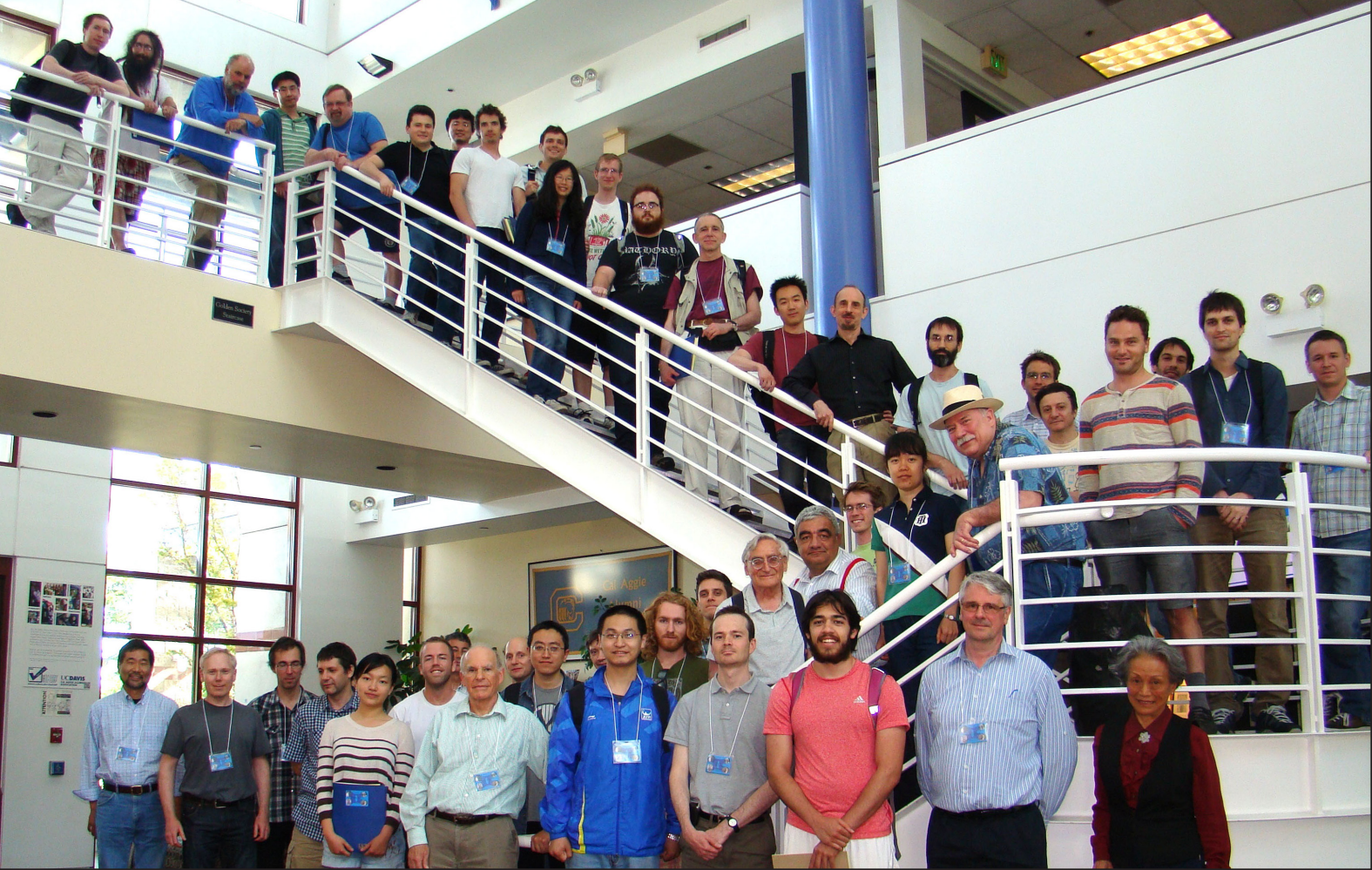
The Mathematics of Quantum Theory
A Conference in Honor of Albert Schwarz

On May 23-26, 2014, a conference was held at UC Davis to honor Professor Albert Schwarz, a Distinguished Professor in the Mathematics Department. Although some might have called it his eightieth birthday party, Dr. Schwarz preferred the title 'A Celebration of Sixty Years of Mathematics and Physics Research'. (The early years of Dr. Schwarz' career were highlighted in last year's newsletter.)

A stellar group of internationally famous researchers came to Davis to celebrate Albert's fundamental contributions to mathematics and physics, and to present their own latest research. They included three fields medalists, Vaughan Jones, Maxim Kontsevich and Andrei Okounkov, as well as John Schwarz, one of the founders of string theory. The talks focused on recent developments in topological quantum field theory and topological strings.

Members of the wider Davis community also enjoyed John Schwarz's public lecture, entitled 'String Theory: Past, Present and Future'.

All of his colleagues in the Department of Mathematics wish Albert a very happy birthday, and thank him for his tireless (and ongoing!) service to mathematics at Davis.

Our Conferences & Seminars

We have regular seminars, special colloquia and conferences throughout the year for a variety of audiences, some for the experienced mathematician and some, usually during summer, for the casually interested. Visit our website to find out who is talking and when.

http://www.math.ucdavis.edu/

Allan L. Edelson
1940 - 2014

The UC Davis Mathematics community is saddened by the passing of emeritus Professor Allan Edelson. Dr. Edelson joined the Mathematics Department in 1970, and remained with us until his retirement. In his time at Davis he played key roles in the development of the Department and of the campus.

Allan Edelson was born in Los Angeles, and moved to Northern California to attend UC Berkeley as an undergraduate. He completed his Ph.D. at SUNY Stony Brook in 1969. Professor Edelson's early work was concerned with the fixed sets of group actions on almost complex manifolds. His more recent work was in nonlinear partial differential equations, focusing in particular on elliptic equations on unbounded domains. He used both functional analytic and topological methods to analyze equations in this class.

Through his career Dr. Edelson held visiting positions at a variety of foreign Universities. These include University of Florence, Italy, the Ecole Polytechnique Federale de Lausanne in Switzerland, the University of Louvin-la-Neuve in Belgium and the University of Orleans in France.

In addition to his departmental activities, Dr. Edelson served in several important administrative capacities while at the University of California, Davis. He was our Assistant Vice Chancellor for Academic Affairs from 1988-91, and Acting Vice Provost for Faculty Relations from 1991-92.

In his spare time he was an avid outdoorsman, and made the most of the opportunities California afforded. He was a fly fisherman and mountain climber in the warmer seasons, and loved skiing with his family.

Professor Edelson leaves behind his mother Ione, his sister Donna, his children Daniel, Naomi, and Reuben, as well as four grandchildren. He is warmly remembered by his many students, and by his colleagues and friends at UC Davis.

Read More by Edelson

Papers written by Allan Edelson can be found online:
http://scholar.google.com/scholar?as_q=&as_sauthors="Allan L. Edelson"

Mathematics for the Future

The Department of Mathematics wishes to thank all alumni, parents, students, faculty, staff and friends who support the Department each year. For a list of our endowed funds, please see our web site:

http://www.math.ucdavis.edu/about/donation/

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Our Continuing Lecturers
Commitment to Undergraduate Excellence

The Mathematics Department is strongly committed to excellence in education. We strive to train our students to become excellent thinkers and problem solvers. Each of the Department's three Continuing Lecturers, profiled below, is an outstanding teacher. Together they contribute greatly to the success of our educational mission at the undergraduate level.
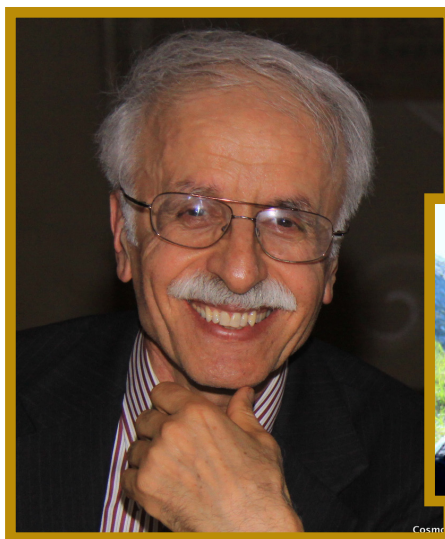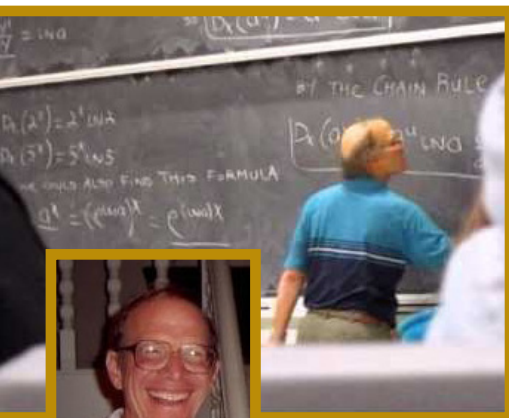
Lawrence Marx

Dr. Marx received his Ph. D. in Mathematics from the University of Minnesota in the field of commutative algebra. He was an instructor for five years at LSU, and since 1984 he has been teaching undergraduate mathematics at UC Davis.

Lawrence Marx is broadly esteemed as an excellent instructor. Every lecture is impeccably prepared, and presented with crystalline clarity. He creates an atmosphere of excitement in the classroom. His warm and friendly personality is very encouraging to the students, with whom he is very popular. He always is generous with his time, willing to help all who come to him.

In addition to his other responsibilities, Dr. Marx is an undergraduate adviser in the Mathematics Department, and teaches in the COSMOS summer program for gifted high school students.

Ali Daddel

Ali Daddel did his undergraduate work at Shiraz University in Iran, and received a Master's of Science degree from the same institution in 1980. He taught for five years at a Teacher Training College in western Iran before coming to the U.S. for his Ph.D., which he completed at UC Davis in 1990. He joined the Mathematics Department that same year, and has been with us ever since.

Dr. Daddel greatly enjoys teaching and interacting with students, and is a strong believer in active learning. He strives to keep all his students actively involved even while lecturing to large classes. To amplify important points or techniques he assigns problems in class, to be done immediately by all students. He also provides many forms of supplementary assistance, including study guides and sample test questions, answer sheets for homework problems and exams. He makes liberal use of handouts, slides and computer models, and assigns independent projects for extra credit. He requires his entering students to assess their study habits, with an eye to optimizing them. His teaching methods, which he has carefully refined over the years, have proven to be highly effective and much appreciated by the students.

Ali has contributed in many other ways to the success of the Department's instructional mission. He developed a computer lab course in linear algebra, and a course on the History of Mathematics, which now is required of all majors who select teaching as their plan.

Dr. Daddel's deep commitment to mathematics education is shown by his participation in many forms of outreach. He helped form and coached the local ARML team (ARML = American Regions Mathematics League, an organization that holds annual mathematics competitions for teams of high school students). He also has taught students at low performing high schools in Sacramento, and participated in summer training programs for their math teachers.

Ali has received wide recognition for the excellence of his teaching. He has won the Department's Outstanding Lower Division Teaching award several times. And he was awarded the 2011 the Academic Federation Award for Excellence in Teaching.

Duane Kouba

Duane graduated from Colorado State University in 1982 with a Ph.D. in functional analysis. Although he had teaching offers, both temporary and tenure-track, from several schools, he accepted a 3-year Lectureship at UC Davis because of our stellar academic reputation and because Davis, CA was a famously bicycle-friendly town.

Even though Duane loves mathematics, in his words "I find students to be infinitely curious, interesting, and enthusiastic." For this reason he chose to focus his energies on teaching rather than develop a more research-based career.

Dr. Kouba's educational philosophy has evolved over the years. Early in his career he felt that his primary role in the classroom, and his first responsibility to the students, was to teach 'rigorous mathematics.' But his views changed in the 1990's after receiving a heartwarming card from a former student. In essence the card said this:

"Hi, I am a former student of yours (9 years prior). I will graduate from the School of Osteopathy here in Los Angeles in a few weeks. I am writing to thank you for being my source of inspiration. When I was in your class I struggled with calculus and had doubts about becoming a medical doctor. However, you always told me I could do it, that if I really wanted to be a doctor I would find a way despite how I was doing in calculus...."

At first Duane didn't recall who she was. However, he refreshed his memory by looking in his records for that student's grades. She was a 21 year old single mother of a one year old baby, who was struggling to pay her bills and simultaneously to meet the academic standards at UC Davis. And she received a grade of C in his class.

Up until that point Duane had assumed that he only had a beneficial influence on the 'best' students in the class. But this, he found, was sadly mistaken. Now his goal in teaching is to keep the class' standards high, to make the instructor's expectations clear, and to teach ALL the students to be self-motivated, confident, and independent learners. He strives to teach students that THEY are responsible for their own learning and education. The instructor and the class itself are just the medium through which each student can learn.

Dr. Kouba has earned many awards in recognition of his excellence in teaching. He has been named the outstanding mathematics teacher of the year in 1992, 1999, and 2006. In 2007 the ASUCD named him the top instructor in the Division of Mathematics and Physical Sciences. This year he was given the 2014 Mathematics Association of America Golden Section Distinguished Teaching Award, and the G. Thomas Sallee Mathematics Teaching Award.

When not engaged in teaching Dr. Kouba enjoys basketball, both playing and coaching. He was assistant coach for UC Davis men's basketball from 1995-2013. He is an unofficial international basketball ambassador, playing street basketball with impoverished, but enthusiastic youth in the Philippines. In addition he regularly provide new basketballs and nets for the rims in as many neighborhoods as possible. For these reasons his many students and colleagues have given him the nickname 'Coach'.

In 1996, he created The Calculus Page (calculus.org), a website containing problems with very detailed solutions for a wide range of calculus topics. Although the website has expanded slowly, its number of users has increased exponentially. Despite the website being relatively unfinished, a current Google search under "calculus problems" will sometimes list this as the top site. The popularity of The Calculus Page led to his employment by Khan Academy in 2013.

Recently Dr. Kouba has begun teaching international mathematics classes during the summer months. In 2013 he taught mathematics courses to high school and middle school students in Thai Nguyen City, Vietnam. In 2014 he taught several calculus classes at Cebu Technological University in Cebu City, Philippines.

Life After Davis

Kathy Herman Lewis
B.S., 1984

Whenever the UC Davis Magazine crashes through the mail slot in my front door, it carries in a promise of expansion: expansion of mind, senses and world view. I am surprised by the pride and loyalty I feel, a quarter century after I earned my B.S. In fact, I have more respect for my Alma Mater now than I did in my collegiate years. In those days I was far too concerned about my GPA, my future love prospects and my career to enjoy the richness of experience offered at UCD.

My reasons for picking a school were somewhat random. Davis was far enough from home to live on campus, but close enough to allow for the occasional weekend trip home. Ultimately, I chose UC Davis because it was a well-rounded school and I had no idea what direction to take in life. On the advice of my high school counselor, I declared a major in which I had an aptitude – mathematics. The theory was that if I declared something, at least I would wind up with an adviser. Three years into my schooling I realized that my adviser was the king of the "fuzzy problem". My career plans, it turned out, fell into this category as well.

I spent my first two years wandering the course catalog, trying on classes for size. The Mathematics degree requirements were quite liberal, only 1/3 of the units were required courses and the rest could be satisfied with a plethora of different options. I found French literature and Chemistry moved me toward graduation just as easily as Differential Equa-

tions and Non Euclidian Geometry. But, try as I might, nothing came close to unseating my chosen field until the beginning of my junior year, when I took a required course with the title of "Careers in Mathematics," or something like that.

Each week we listened to a guest lecturer who described the ins and outs of his or her profession. Halfway through the quarter, I was convinced that my options as a graduate were actuarial nirvana, teaching, or brilliance. Teaching required more schooling, which I was loath to pursue, ditto on the actuarial testing cycle, and brilliance was not in my genes. My one hope came on the day that a woman from Bell Labs spoke. She was engaging, well-balanced and appealing and the career path she described exhibited those traits as well. It was a career in Computer Science.

At the end of my junior year with only three quarters of schooling left, I switched from straight mathematics to the newly formed Mathematics and Computer Science major. I attacked my final year in school with a real excitement for Computer Science and a clear picture for my immediate future beyond the walls of UC Davis. Unfortunately, I found myself holed up in the computer lab in the wee hours of the morning taking advice from the lab assistant: the kind of advice that included, "go home, sleep, eat, shower."

So determined was I to graduate in the prescribed four years, I missed out on many of the non-academic blessings of Davis. It was upon graduation when I moved to the Bay

Area and shared a house with two of my former classmates that I realized just how much I had missed during my years of college. Through their eyes I glimpsed a very different experience filled with pleasant adventures, Picnic Day parades and an appreciation of all Davis has to offer. Somehow they found time for fun amongst the requisite studying.

Although too many of my days were spent stressing about grades, I do recall some memorable moments from my college years. The weeks of sore-butt that marked the renewal of my bicycling skills at the start of each academic term and the unmistakable stripe that accompanied me on rainy days. I remember sitting in high-school quality bleachers watching a young Ken O'Brien lead our football team to victory and sharing his pride of achieving grandeur in athletics while excelling in academics.

As I look back in my rear view mirror, I feel nothing but gratitude for my time at UC Davis. The myriad classes in multiple fields have helped me engage in conversations with people in a variety of career disciplines as I have built software systems in a number of different industries. Well-rounded was the way to go.

To those of you still at Davis, I'll say this: enjoy all that Davis has to offer academically, environmentally and socially. I encourage you to savor the bounty at your feet even as you look forward to your next horizon.

The Undergraduate Program

by Tim Lewis, Undergraduate Program Chair

We began the 2014-2015 academic year by welcoming 205 new students to our undergraduate major programs. This is the largest incoming class in the history of the Mathematics Department. With this large influx, the total number of students in our four majors is now 568, which also is an all time high for the Department.

The Department awarded 61 undergraduate degrees this year – 44 in Mathematics, 13 in Applied Mathematics and 4 in Mathematical and Scientific Computation. Two of these graduates received departmental citations. In addition, Victor Fuentes, Aaron Hsu and Emily Macway graduated with highest honors. The numbers of these awards testifies to the commitment and dedication of our majors.

We place great importance on providing our students with a supportive and encouraging environment throughout their time with us. A variety of activities are designed to foster this atmosphere. Our new students were invited to attend our Undergrad Welcome Event, which took place on October 10th. We discussed with them the importance of starting early to plan their individual program of study in concert with their faculty adviser. We also stressed that we are here to help all our students succeed. We described the multiple sources of support that are available when needed.

Two important mathematics interest groups are focused on undergraduates. The Math Club meets weekly (Wednesdays 5:30-7:30pm 1147 MSB). It provides a place where people with common interests in mathematics can meet and socialize, and learn about a variety of topics in current mathematics research. All mathematics students are welcome at the Math Café. Here faculty and graduate student volunteers are available to tutor any student in any course. Professor Monica Vazirani has worked hard to make this opportunity available to students. We are happy to report that is it a strong success.

The Department of Mathematics continues to expand our course offerings to enrich the experience of our undergraduate students and to attract more students to mathematics. Last year, we established MAT 189, an advance problem-solving course, as the capstone course for all our undergraduate programs. In this course, students will study topics from a wide range of mathematics and applications, and use the knowledge acquired from other course to analyze exciting problems. We also committed to offer more special topics courses for undergraduates (MAT 180). This year's special topics courses are The Mathematics of Theoretical Physics (Prof. Andrew Waldron), Game Theory (Prof. Ben Morris), Symmetric Groups, Symmetric Functions and Computer Explorations (Prof. Anne Schilling) and Set Theory and the Continuum Hypothesis (Prof. John Hunter).

This year we launched a new undergraduate major in Mathematical Analytics and Operations Research. The new major will address business's critical need for scientifically trained analysts who can use mathematical models to interpret big data, analyze markets and forecast trends.

Once again, the Department ran a vigorous Research Experience for Undergraduates (REU) program over the summer. Students worked on a variety of projects spanning pure and applied mathematics, from discrete geometry to mathematical physics and mathematical biology. Many of the students who participated in this Summer REU will present their research in the Undergraduate Research and Exploration seminar. Any student interested in getting involved in undergraduate research is encouraged to visit the following site for more information:

http://math.ucdavis.edu/undergrad/research

Undergraduate research is a great way to jump start a mathematics career!

There are many opportunities available in the Department for enrichment of the undergraduate experience. Everyone is welcome; please join us!

Are You a Graduate?

We want to hear from you! Please send us information about yourself so that we can stay in touch and share in your experiences outside of UC Davis.

Please complete our Alumni Questionnaire: http://www.math.ucdavis.edu/news/alumni_quest or send e-mail to:

mso@math.ucdavis.edu

We will do our best to include it in the next newsletter.

Department Awards Recipients

Eric C. Ruliffson Scholarship in Mathematics

Eric Canady Ruliffson attended UC Davis from 1964-1968, loved the study of math and excelled in it. He was first and foremost a problem solver, which helped him to achieve life-long personal and professional success. While attending UC Davis, Eric worked as a summer intern in the actuarial department of Pacific Mutual Insurance in Los Angeles and was hired by them upon graduation. After serving in the Navy, Eric attended graduate school in demography at UC Berkeley. In 1973 he resumed his actuarial career at Pacific Mutual Insurance. He became a partner at the San Francisco office of Coopers & Lybrand and named a Fellow in the Society of Actuaries. He was subsequently elected to the Board of Partners for Coopers and Lybrand, the first actuary to be so honored, and later served on the Board of Partners for PricewaterhouseCoopers, the world's largest consulting firm. The Eric C. Ruliffson Scholarship in Mathematics is awarded annually to students of junior or senior standing majoring in mathematics.

Recipients – Rico Lin
  and Ekaterina Kovalenko

William K. Schwarze Scholarship in Mathematics

William Karl Schwarze was born in 1942 in San Francisco. He excelled in mathematics in high school and at UC Davis, where he received a bachelor's degree. He went on to graduate school at Berkeley and a career as a mathematics teacher in San Francisco. Perhaps due to his mathematical insights, Bill also became a successful investor in real estate. After his death in 1988, a trust he established with the SF Foundation has donated to a variety of humanitarian purposes, in particular to the Schwarze Scholarship to be presented today. This award is given to graduate students in Mathematics who have demonstrated outstanding mathematical scholarship and exceptional promise of making a strong professional contribution as a mathematics teacher and educator at the pre-college or college level.

Recipient – Amanda Young

Robert Lewis Wasser Memorial Scholarship

Robert Lewis Wasser was born in 1973 in Sacramento. He excelled in many areas—he was selected as a National Merit Scholar in 1991 and participated in the Academic Decathlon. Robert began at UC Davis in 1991. His academic achievements were numerous and impressive. He was one of the few students in our Department who had already taken as a sophomore some of our most challenging courses, such as Math 127. His instructor in that course, Professor Don Chakerian, said how much he was inspired by their discussions and that Robert's presence made the whole class much more lively and spirited. After his tragic death in an automobile accident in 1993, prior to his Junior year, his grandmother, Vera May Wasser, initiated the Robert Lewis Wasser Endowment in his memory, with contributions from family and friends. Its goal is to benefit promising mathematics students at UC Davis.

Recipient – Amanda Pan

Henry L. Alder Award

Professor Henry L. Alder received his Ph.D. from UC Berkeley in 1947. After spending a year on the faculty in the Department of Mathematics at Berkeley, he joined the Davis faculty as an Instructor of Mathematics. He advanced to the rank of Professor in 1965, and officially retired in 1992. He then served as Department Chair from 1992 to 1994. After his retirement, Professor Alder continued to teach in the Department for many years.

Professor Alder was also active in other campus programs and was always a strong advocate for quality teaching. In 1999, Professor Alder gave a gift to the UC Davis Foundation to establish an endowment. This provides support to mathematics graduate students at UC Davis through the Henry L. Alder Prize for Excellence in Teaching, an award given each year to the graduate student who is deemed to be the top teacher among all graduate students in mathematics.

Recipient – Edward Tavernetti

G. Thomas Sallee Mathematics Teaching Award

The G. Thomas Sallee Mathematics Teaching Award honors Professor Emeritus Tom Sallee's 40-year career with the Department, his dedication to being an excellent teacher, and his life goal of developing and supporting talented mathematics educators.

An endowment was established in his name that allows the Department to recognize the best teaching of lower-division mathematics courses on an annual basis.

Recipient – Duane Kouba

G. Thomas Sallee Mathematics Prize

This award is also given in recognition of Professor Emeritus Tom Sallee, and reaffirms his life goal of developing and supporting talented individuals in mathematics. This prize recognizes exceptional undergraduate students of junior or senior standing who competed in this year's Spring Mathematics Competition.

Recipient – Ruian Chen

Honorable Mention – Trevor Glynn

Evelyn M. Silvia Scholarship for Future Mathematics Teachers

The Evelyn M. Silvia Scholarship for Future Mathematics Teachers was established by generous donations from family and friends of the late Professor Evelyn Silvia. Evelyn was hired by the Department in 1973 after receiving her Ph.D. from Clark University. The focus of Evelyn's passion and unwavering commitment was to develop talented mathematics teachers at the K-12 grade level. She was extremely generous with her time, whether it was as a campus committee member or as an adviser assisting students.

This scholarship honors Professor Silvia's memory by encouraging students who aspire to be future mathematics teachers. It recognizes a junior or senior with a major in mathematics, applied mathematics or statistics who has shown an interest in teaching mathematics.

Recipient – Morgan Imel

Alice Leung Scholarship in Mathematics

Alice Siu-Fun Leung received a Master's degree in Mathematics in 1975 from UC Davis. She later worked as a global property management accountant in Hong Kong. She remembered with fondness her days at UC Davis. She enjoyed gardening and working as a volunteer helping animals.

In her will, Ms. Leung generously provided funding to award scholarships annually to graduate students in Mathematics. This award is given to students who have shown exceptional promise in all aspects of mathematics, including research, scholarship and teaching.

Recipient – Lingyun Li

Yueh-Jing Lin Scholarship in Mathematics

Yueh-Jing (Jean) Lin and Chau-Hsiung (Mike) Chuang created the Yueh-Jing Lin Fund in 2009. This endowment provides scholarship support to one or more mathematics students each year. The scholarships are available to high-achieving mathematics students, either undergraduate or graduate. Mr. and Mrs. Chuang are alumni of UC Davis who met while they were graduate students on campus. Jean received her Master's degree in mathematics in 1971, and Mike received his master's degree in agricultural education in 1969.

Recipients – Eric Brattain-Morrin and Emily Javan

Galois Group Service Award

The Galois Group is "the official voice of the graduate students in Mathematics." All graduate students in the Department of Mathematics are members of Galois; this is how graduate students in mathematics collectively communicate with Department faculty and staff. The group also coordinates and facilitates various activities, such as Monthly Game Nights and New Student Welcomes.

Every year, the Galois Group presents an award to recognize outstanding service and/or sustained commitment to the graduate group.

Recipient – Tina Denena

Departmental Citation Awards

The Department recognizes undergraduate students of exceptional ability who have taken both a very strong selection of mathematics courses and have made substantial contributions to the Department or their program. In addition, they have all received strong recommendations from the faculty.

Recipients – Victor Fuentes and Emily Macway

Citation for Outstanding Performance

These citations honor undergraduates who have taken a very strong selection of mathematics courses and distinguished themselves with exceptionally high grade point averages.

Recipients of Highest Honors – Lea Riedel, Chun Yu Hong, Richard Lo, Aaron Hsu, Gregory Lauro, Joshua Sumpter, Zayar Hlathu, Sara Thomas, Nathan White

Departmental Honors Awards

Every year, undergraduate students have the opportunity to participate in mathematical research, culminating in a senior thesis. Students typically work under the guidance of a faculty mentor to complete original research. The results are reviewed, and pending on the quality and substance, the student can receive Departmental high or highest honors.

Recipients of Highest Honors – Victor Fuentes, Aaron Hsu, and Emily Macway

Life After Davis

Deanna Needell
Ph.D., 2009

I entered the UC Davis Graduate Program in Mathematics after receiving my Batchelor's degree in Mathematics and Computer Science from the University of Nevada, Reno. I took the Analysis course taught by Prof. Roman Vershynin and absolutely loved both the subject and the way it was taught. That summer Dr. Vershynin invited me to work on a research project, an opportunity which I happily accepted. That was my very first experience doing mathematical research, and although I enjoyed it, I have to admit it wasn't my most productive summer.

At that time I learned about a relatively new field, Compressed Sensing (CS). This aims to provide ways to efficiently compress large dimensional signals without acquiring the entire signal. (For example, Compressive Signal Processing (CSP) has shown that the important information in many signals can be recovered from a far smaller sample than traditionally thought.) CS and CSP have important applications in many areas, including imaging, analog-to-information conversion, radar, large scale information synthesis, geophysical data analysis, and computational biology.

CS uses techniques from random matrix theory, functional analysis, probability, statistics, and many other areas. Suddenly, I was hooked. I loved working on an 'applied' problem using tools from pure mathematics, and I was delighted to be doing rigorous theoretical research. We developed a novel algorithm for CS and were the first to show that a linear time algorithm could give the same stability guarantees as previous approaches. This bridged a gap in the field and answered an important open question. Then I worked with Joel Tropp (a postdoc at Michigan at the time; now a professor at Cal Tech) to design a similar technique with even stronger guarantees, which has become a state of the art method for CS today.

In 2009 I received my Ph.D. from UC Davis. Then I took a two year postdoctoral position at Stanford, working with Prof. Emmanuel Candes, one of the core researchers in CS.

I have been privileged to receive a variety of honors for my research. These include the IEEE Best Young Author Paper award, and an Alfred P. Sloan Fellowship. I also have received a Simons foundation grant, and an NSF CAREER award. These will help me continue my research program in CS by funding travel, collaborations, and student research.

While at Davis I taught several classes, with Prof. Becca Thomases as my teaching mentor. One day she mentioned that I seemed to enjoy teaching. I said that I loved both research and teaching, and wished I didn't have to choose one over the other in my career. She quickly replied "Well, that means you want to work at a place like Claremont McKenna!" I wasn't familiar with the Claremont Colleges, but after her comment I began looking into them. I soon realized that Claremont McKenna could be the perfect place for me. So, after two years at Stanford I was thrilled to accept a position as Assistant Professor at Claremont McKenna College (CMC).

Although I grew up in Truckee, where there is lots of snow and cold, I quickly adapted to the beautiful weather of Southern California. My husband, Blake Hunter, also is an Assistant Professor at CMC. We are very happy here, enjoying cooking, hosting board game parties, traveling, swimming, biking, and hiking and going to the beach with our dog, Jacobi. I collect Starbucks mugs from around the world, and love anything chocolate.

I am extremely grateful to my research mentor, Prof. Vershynin, for all that he did for me. He was a fantastic adviser, teacher, and role model. I also am grateful to Becca Thomases, my teaching mentor. My time with them at UC Davis established the trajectory of my career.
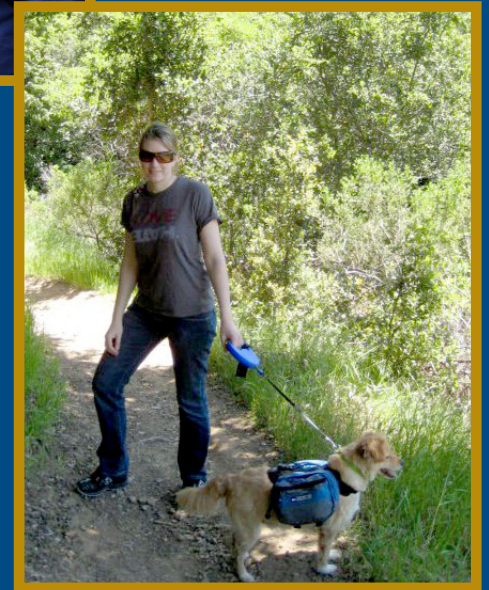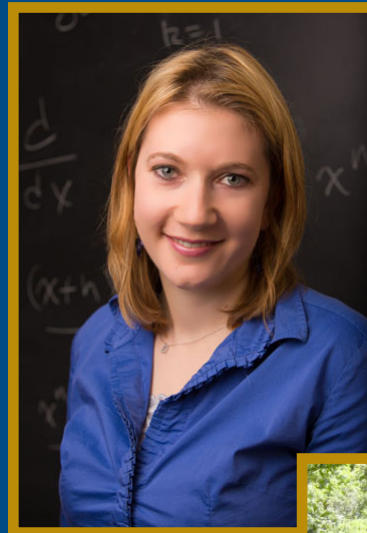
Tom Sallee's Puzzlers

1. This is a classic problem plus variants. Assume, as we do in mathematics, that the earth is a perfect sphere 40,000 km. in circumference, and a wire is wrapped tight around the equator.

a. Lengthen the wire by one meter. If the wire stands out evenly all the way around the earth, how far above the earth is it?

b. Take the wire from part (a) and pull it up as high as you can. How far above the earth can you pull it?

2. A set of positive integers sums to 100. What integers should be chosen to maximize the product? What is that maximum? How much larger would the answer be if you were allowed to use any positive numbers?

3. If you write a number in base, say, 5, when you write 213 this means $2*(5^2) + 1*(5^1) +3*(5^0) = 50+5+3 = 58$. Write out the first twenty integers in base (-4). You may only use the digits 0, 1, 2, and 3.

Note: this can be done either using no expressions with negative signs or only expressions with negative signs.

Solutions:

1. Let R = radius of earth and h = height above the earth.

a. Then $2\pi(R+h) = 2\pi R + 1$, so $h = 1/2\pi \approx 0.16$ m.

b. If the length you have added is x, then pulling the wire taught makes a right triangle of angle θ, hypoteneuse $R + h$ and adjacent side R, where h is the height above the ground that we are seeking. Examining this triangle one finds that

$R\theta + (x/2) = R \tan \theta$, and $R +h = R \sec \theta$.

Expanding the trig functions in series and retaining the smallest terms (as is valid for very small angles), the first equation gives $2R^3 = 3x$, while the second equation gives $2h = R \theta^2$. Solving for h gives

$$h = R^{1/3}(3x)^{2/3}/2^{5/3}$$

When $x = 1m$, one finds that $h = 121.43$ m.

2. If we restrict ourselves to integers, you want to use as many 3's as possible (since, for example, you are better off using $3*2$ instead of 5) and then 2's as needed. So the maximum product is $3\text{^}32*2\text{^}2$.

If you are allowed to use any set of positive numbers, you want equal numbers (denote as x) and you will have $(100/x)$ of them. The product is then $x\text{^}(100/x)$. Taking logarithms, we want to maximize $(100/x)*\ln(x)$. This maximum occurs when $\ln(x) = 1$ or $x = e$ and $100/e \sim= 36.8$. A little more work shows you want $100/x = 37$ and $x = 100/37 \sim= 2.7027$. This product is about 28% larger than the product that involves only integers.

3. 1, 2, 3, 130, 131, 132, 133, 120, 121, 122, 123, 110, 111, 112, 113, 100, 101, 102, 103, 230

OR

-13, -12, -11, -10, -23, -22, -21, -20, -33, -32, -31, -30, -1303, -1302, -1301, -1300, -1313, -1312, -1311, -1310.

Staff News

by Gladis Lopez

This has been a very productive year! We now are fully staffed, and everyone is excited to see the growth in our student enrollment and our faculty. We welcome Dan Romik as the new Department Chair, and wish him every success.

During this year, Jessica Goodall left the Department to accept another position, and Danielle Sherwood joined us as the new contacts and grants coordinator. Gladis Lopez continues her 70% appointment in the Mathematics Department.

Marianne Waage is now working 50% time on the computational staff, having reduced her time after the arrival of her baby, Connor Irving Waage. Tina Denena also had a new addition to her family, Cooper Anthony Wayne. Congratulations to Tina and Marianne, and to their families!

Sarah Driver's partner is pregnant; their baby is due to arrive February 5, 2015. We are very excited for Sarah and Cynthia and wish them well.

Please contact our administrative staff for any assistance you may need. Enjoy the academic year!

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The Department of Mathematics is on Facebook! Visit us there to get updates on current seminars, events and news. We'd be happy to include any memories or photos you have of the Department on our wall.

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