Department of Mathematics

Cornell University

Annual Report 2000–01

Image of Lorenz attractor provided by Warwick Tucker, H. C. Wang Assistant Professor, Department of Mathematics, Cornell University.

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Annual Report 2000–01

Year in Review:
Mathematics Instruction
and Research

Cornell University
first among private institutions
in undergraduates who later earn Ph.D.s.

Ithaca, New York, the home of Cornell University, is located in the heart of the Finger Lakes Region. It offers the cultural activities of a large university and the diversions of a rural environment.

Mathematics study at Cornell is a unique experience. The university has managed to foster excellence in research without forsaking the ideals of a liberal education. In many ways, the cohesiveness and rigor of the Mathematics Department is a reflection of the Cornell tradition.

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The Year in Review 2000–01

This past academic year we conducted a number of faculty searches and were pleased to hire some excellent candidates. I am delighted to announce that our search for a senior faculty member resulted in the appointment of a leading probabilist, Gregory Lawler. Greg has been at Duke University since 1979, and we are delighted that he has decided to join us at Cornell. He is an expert on the theory of random walks. His work was recently the subject of a popular article. (See Department Publicity, p. 13, item 3).

We welcome four new H. C. Wang assistant professors in July 2001: Kai-Uwe Bux (University of Frankfurt); Martin Dindoš (University of North Carolina at Chapel Hill); Irina Mitrea (Institute for Advanced Study in Princeton); and Milen Yakimov (University of California at Berkeley). In addition, we will have two new VIGRE Assistant Professors for the 2001–02 academic year: Matthew Fickus (University of Maryland, College Park) and Anita Mareno (Cornell University). Jason Schweinsberg and Alexander Vladimirsky, both from the University of California at Berkeley, will come to Cornell supported by National Science Foundation postdocs. (See also New Faculty, pp. 14–15.)

The visiting faculty program participants for 2000–01 were: Carolyn DeSilva from Gettysburg College; William Manzer from Western Wyoming Community College; Robert Piché (spring 2001) from Tampere University of Technology (Finland); Nancy Tisch from Cornell University; and Joseph Zaks (fall 2000) from the University of Haifa (Israel).

Our faculty received a number of prestigious honors this year. Harry Kesten won the Leroy Steele Prize for lifetime achievement this year. This prize was won earlier by Eugene Dynkin. Warwick Tucker was presented the Wallenberg Prize of the Swedish Mathematical Society. Yuri Berest received a Sloan Foundation Research Fellowship. José Ramírez was given the Magnus Memorial Prize by the Courant Institute. Leonard Gross was honored with a special session on Analysis on Infinite Dimensional Spaces at the Joint Mathematics Meetings at New Orleans, Louisiana, in January 2001.

Members of our graduate student community were awarded a variety of honors and awards this year. Kathryn Nyman won the John M. and Emily B. Clark Distinguished Teaching Award given by the College of Arts and Sciences. Nelia Charalambous, Noam Greenberg, and Huibin Zhou received Hutchinson Fellowships for spring 2001. Huibin Zhou received the Liu Memorial Award from the Graduate School. The Robert J. Battig Graduate Prize was given to Alan Demlow, and the York Award was presented to Yi Lin.

Each year we award the Kieval prize to an outstanding undergraduate senior. This year it was given to Jesse McCarthy Alt, who graduated magna cum laude in mathematics with distinction in all subjects. Jesse will begin graduate school in fall 2001 at Boston University where he will study mathematics and statistics. (See also Awards and Honors, p 9.)

Once again, the department benefited from the hard work of Stephen Chase as director of undergraduate studies (DUS). Steve served the department in the role of associate chair and DUS since July 1995. His extensive concern for and knowledge of the undergraduate program has been a valuable asset to the department. The department continues to draw upon his wisdom in these matters as he trains his successor, Birgit Speh, who takes office as director of undergraduate studies on July 1, 2001.

I would also like to thank Dan Barbasch, who served as director of graduate studies (DGS) since May 1997. His graduate student recruiting efforts on behalf of the department were critical to our success in this first year of our VIGRE grant. Dan took a well-deserved sabbatical in spring 2001. Louis Billera was acting DGS in his absence, and Lou has agreed to continue as director of graduate studies for the coming academic year. We will continue to exploit Dan's knowledge of the graduate program by having Dan chair a committee to review and revise the introductory courses for graduate students.

Maria Terrell completed her first year as teaching assistant coordinator. Maria has been active on many fronts. These include her efforts to extend training and teaching development throughout the year and her efforts to improve graduate student satisfaction with the teaching assistant experience.

The mathematics major committee was very active this year. The committee was chaired by Peter Kahn and included Reyer Sjamaar and Ravi Ramakrishna. In addition to a thorough review of the structure and procedures of the major, they hosted several elaborate receptions for prospective majors in the department lounge.

Our undergraduate mathematics club was active and instrumental in the success of this year's Kieval Lecture, presented by Colin Adams. (See Undergraduate Program, pp. 5–6.)

Richard Durrett continued in his role of VIGRE coordinator. Robert Strichartz was quite active in promoting our VIGRE-related outreach program and the first year of the Math Explorers Club, a Saturday morning program for high school students. (See VIGRE, below.)

Robert Connelly gave the second annual public lecture for Mathematics Awareness Month. This presentation is part of our ongoing effort to increase public appreciation for the importance of mathematics and coincides with the nationwide Mathematics Awareness Month. His lecture was entitled "How to unfold a carpenter's rule in the plane," and it was presented on April 28, 2001 in Malott Hall. Connelly was also invited to give the annual Harry M. Gehman Lecture at the April 2001 meeting of the Seaway Section of the Mathematical Association of America at Binghamton University. There is a popular account of his work in the Seaway Current newsletter. (See Department Publicity, p. 13, item 6.)

Karen Vogtmann, as chair of the web oversight committee, worked with staff member Michelle Klinger to redesign our departmental web pages. The goal was to update the web pages to make them useful and informative. (We think that they look a lot better too.) Faculty pages were added to provide research information. The new site is better organized and easier to navigate within. Our hope is to make the department more accessible to interested researchers, prospective faculty, graduate students and undergraduate majors. (Take a look at www.math.cornell.edu!)

Sadly, Professor Emeritus Paul Olum passed away on January 19, 2001 in Sharon, Massachusetts. He was 82. Paul first came to Cornell in 1949 as an assistant professor. From 1963 to 1966 he served as chair of the department. Although he left the university in 1974 to become the dean of the arts college at the University of Texas, his many contributions to mathematics at Cornell earned him emeritus status and our lasting admiration.

VIGRE

The 2000–01 academic year was the first year of the Mathematics Department's five-year VIGRE grant. The acronym VIGRE is pronounced "vigor" and stands for Vertically InteGrated Research and Education. Its goals are to prepare undergraduate students, graduate students and postdoctoral fellows for the broad range of opportunities available to individuals with training in the mathematical sciences and to promote interaction of scholars across boundaries of academic age and department standing.

VIGRE Postdocs: The fall semester saw the arrival of four new VIGRE postdocs. Their names (with Ph.D. institution) are James Conant (University of California at San Diego), Russell Miller (University of Chicago), Lawren Smithline (University of California at Berkeley) and Edward Swartz (University of Maryland). The new postdocs have a teaching load of one course per semester to allow them time to continue to develop their research skills. They also have a faculty mentor to help them cope with the mysterious process of being a professional mathematician (e.g., applying for grants, learning how to teach, dividing time between teaching and research).

The recruiting process for postdocs who will begin in fall 2001 took place in February. Our target was two postdocs, and we were successful in hiring Matthew Fickus from the University of Maryland and Anita Mareno from Cornell University.

VIGRE Graduate Fellows: Also new on the scene were our first four VIGRE graduate fellows. Their names (with undergraduate institutions) are: David Benbennick (University of Alaska, Fairbanks), Kristin Camenga (St. Olaf College), Jeffrey Mermin (Duke University) and Everilis Santana-Vega (University of Puerto Rico Humaco). (Kristin Camenga had been a high school teacher for some time.) These students were free from teaching responsibilities their entire first year to make it easier to get through the demanding first-year courses. They will also have one semester free in each of the second and third years to allow them to broaden their education and explore possible thesis areas. The incoming class for fall 2001 has three more VIGRE fellows: Jason Bode (Calvin College), Edoardo Carta (University of Puerto Rico) and William Gryc (Amherst College).

Graduate Student VIGRE Semesters: Continuing graduate students can benefit from the VIGRE grant through VIGRE semesters. In the fall, Rajmohan Rajagopalan used his free time to take two courses in computer science, part of fulfilling the requirements for a minor in that area. Kathryn Nyman worked with David Bock (visiting us from Ithaca High School) in Math 171 to prepare for teaching it herself in the spring. Kathryn won a Clark Teaching Award in the spring. (See Awards and Honors, pp. 9–10.) Suzanne Hruska assisted Beverly

West in Math 103, a course on *Iteration and Patterns* for liberal arts undergraduates. Sharad Goel (a student from the Center for Applied Mathematics) helped to run the Math Explorer's Club, a Saturday activity for local high school students, which is described in more detail below.

In the spring, three more students were supported by VIGRE: Maria Sloughter, under the guidance of Allen Back, developed computer lab activities for the Math Explorer's Club. Lee Gibson explored applications of mathematics to biology with Rick Durrett. Leah Gold escaped the dreary Ithaca winter and spent a month at the University of Nice, where Mike Stillman was spending his sabbatical. Leah learned about the applications of computer algebra to biology there and at Cornell through discussions with Ron Elber and Jon Kleinberg from the Computer Science Department. Both Lee and Leah received travel awards from the VIGRE grant to attend the AMS meeting in New Orleans in January and to participate in its short course on mathematical biology.

Summer Support for Graduate Students: Six graduate students received grants this summer to explore potential thesis areas or to work on their research: Spencer Hamblen, Christopher Hardin, Suzanne Hruska, Maria Sloughter, Aaron Solo and Sarah Spence. This type of activity was not a part our original VIGRE plans. Of course, at that time we did not anticipate that the Cornell Graduate School, which had supported 10–12 graduate students each year, would suddenly cut its support due to its mounting budget deficit. The flexibility to respond to such unexpected events is one of the nice features of our VIGRE grant.

Summer Support for Undergraduates: At the undergraduate level, the new VIGRE grant helped support the Cornell Research Experiences for Undergraduates program in the summers of 2000 and 2001. The new money allowed the program to be expanded to include two or three more Cornell undergraduates and provided additional financial support for the faculty members who devote eight weeks of their summer to supervising the undergraduate projects.

In addition to support for the REU program, three undergraduates each summer receive small grants to work directly with Cornell faculty. In the summer of 2000, Anselm Levskaya worked with John Hubbard, Jesse Alt with Sergei Artemov and Chan-Ho Suh with Ravi Ramakrishna. In summer 2001, Debbie Grier worked with Lou Billera, Brian Renne with Anil Nerode and Alex Smith with Robert Strichartz. Most recipients used the summer to get a start on their senior theses.

Undergraduates also benefited through travel awards to allow them to go to conferences. Yoon Ha Lee was supported this year to attend the Third Nebraska Conference for Undergraduate Women in Mathematics at the University of Lincoln, Nebraska.

Math Explorer's Club: The benefits of our VIGRE grant are felt by local high school students through the Math Explorer's Club, which is organized by Robert Strichartz and was run this year by four graduate students: Lee Gibson, Sharad Goel, Maria Sloughter and Tiberiu Tomita (Applied Math). It has four six-week sessions during the school year, Saturday mornings 10:30 AM–1:00 PM. In the first one-hour period students are presented with a mathematical idea, problem or exploration as part of a six-week module. This is followed by a half-hour break at which refreshments are served. The final hour is devoted to problem-solving or computer lab activities.

The fall modules were *Secret Codes and Cryptography* (Ravi Ramakrishna), *Fractals* (Robert Strichartz), *Math and Art* (Robert Connelly and Maria Terrell) and *Symmetry and Complex Numbers* (Yulij Ilyashenko). The spring modules were *Graph Theory* (Stephanie van Willigenberg), *Probability* (Vlada Limic) and *The Square Puzzle* (Russell Miller). As part of Connelly's module, students used brass rods and steel springs to build polyhedral structures. Each student got a small structure to take home as a souvenir, and several large ones now decorate our lounge. The VIGRE grant gave us the flexibility to grant Connelly's request for supplies and to support an Expanding Your Horizons workshop for middle-school girls run by graduate students Leah Gold, Debra Goldberg (Applied Math), Melanie Pivarski, Maria Sloughter and Finger Lakes paperfolder Angela Baldo. The amounts of money involved were small but served to create a lot of excitement about math.

VIGRE Interdisciplinary Colloquium: The final activity of the VIGRE grant was the VIGRE Interdisciplinary Colloquium. This monthly event aims to expose graduate students, postdocs and faculty, both inside and outside the Mathematics Department, to the many uses of mathematics in applications. Lectures on a broad spectrum of topics were given by Eva Tardos (Computer Science), Steve Ellner (Ecology and Evolutionary Biology), Steve Tanksley (Plant Breeding and Plant Biology), Steve Strogatz (Theoretical and Applied Mechanics), Jon Kleinberg (Computer Science), Philip Protter

(Operations Research and Industrial Engineering) and David Mermin (Physics).

In addition to these seven talks, there was a three-week mini-symposium on *Mathematical Sciences and the Law*, organized by Lou Billera and Marty Wells, a statistician in ILR and the Law School. Walter Mebane (Government) presented *Evidence for excessive Buchanan vote share in Palm Beach County, Florida*. Paul Edelman from Vanderbilt University discussed *Cooperative games, voting power and the Supreme Court*. The third and final talk was a joint effort by Theodore Eisenberg (Law School) and Marty Wells. Their topic was *Forecasting life and death: a statistical analysis of juries and their death penalty decisions*. For a comprehensive list of talks, see Department Colloquia, p. 41.

Graduate Program

The Cornell Mathematics Department is rated among the top in the country by the American Mathematical Society. The *U.S. News and World Report* placed Cornell ninth in the nation in its 1999 national ranking of graduate mathematics programs.

The graduate program included 67 graduate students during the 2000–01 academic year. Ph.D. degrees were awarded to seven students, while five earned special master's degrees. The total number of students in the academic year 2001–02 will be 73. The entering class will consist of thirteen new Ph.D. students, as well as two one-year nondegree students from France, who will be supported under an exchange agreement with the Cornell Abroad EDUCO Center in Paris.

Entering students Pavel Gyrya and Edoardo Carta received one-year fellowships from the Graduate School; these fellowships will cover full tuition and stipend. Jason Bode and William Gryc received VIGRE fellowships, awarded under our NSF VIGRE grant. This grant will support students for four semesters during their first three years of graduate study. John Thacker has been awarded a two-year National Defense Science and Engineering Graduate Fellowship. After his first year, Carta will also be a VIGRE fellow for three years. The remaining eight entering students — Bryant Adams, Farkhad Eshmatov, Henri Johnson, Vadims Moldavskis, Achilleas Sinefakopoulos, José Trujillo, Jonathan Turnes and Treven Wall — will be supported as teaching assistants.

Graduate students play an essential role in all aspects of the department: teaching, research, mentoring of undergraduates and community outreach programs. They were particularly active this year in the recruitment of new students, helping to make the process a success.

Class representatives were David Brown (sixth year), Swapneel Mahajan (fifth year), Sarah Spence (fourth year), Noam Greenberg (third year), Christopher Francisco (second year) and Todd Kemp (first year). The Graduate and Professional Student Representative was Steven Sinnott.

The following awards were given to students for outstanding achievement in coursework, research and teaching:

- Kathryn Nyman won the John M. and Emily B. Clark Distinguished Teaching Award given by the College of Arts and Sciences.
- Huibin Zhou received the Liu Memorial Award from the Graduate School.
- The Hutchinson Fellowship was awarded to Nelia Charalambous, Noam Greenberg and Huibin Zhou.
- The Battig Award was given to Alan Demlow.
- The York Award was presented to Yi Lin.

(See Awards and Honors, pp. 9–10.)

The Olivetti Club is devoted to expository talks on current research areas and is organized entirely by graduate students. This year the organizers were Lee Gibson and Jean Cortissoz in the fall and Joseph Miller and Nelia Charalambous in the spring. Most of the speakers were graduate students. (See Department Colloquia, p. 38, for a list of talks.) In summer 2000, David Brown, Christopher Hruska, Swapneel Mahajan and David Revelle gave four-lecture Olivetti-style mini-courses for other graduate students.

The graduate students were also active this year in giving off-campus research presentations at meetings and specialized conferences. A sampling of these follows:

- David Brown — AMS/MAA Joint Meetings in New Orleans, L'Odysse Dynamique at CIRM;
- Ryan Budney — AMS Meeting at Columbia University and the Topology Seminar at Columbia University;
- Alan Demlow — Mixed Finite Element Methods and Applications at Mathematisches Forschungsinstitut, Oberwolfach, Germany;
- Noam Greenberg — 13th Greater Boston Logic Conference at MIT;
- Leah Gold — Route 81 Conference, Ithaca, poster presentation at the AMS/MAA Joint Meetings;

- Christopher Hruska — AMS Special Session on Geometric and Computational Group Theory in Las Vegas, Geometry/Topology Seminar at the University of Chicago, Topology Seminar at the University of Michigan, AMS Special Session on Geometric Group Theory at the AMS/MAA Joint Meetings in New Orleans, Albany Group Theory Conference, Geometry/Topology Seminar at SUNY Binghamton;
- Suzanne Hruska — L'Odysse Dynamique at CIRM, Midwest Dynamical Systems Seminar at Northwestern University, Semi-Annual Workshop in Dynamical Systems at Pennsylvania State University, Midwest Several Complex Variables Meeting at Purdue University;
- Todd Kemp — Week-long seminar on Clifford Algebras, Clifford Modules and Orthogonal Vector Fields on Spheres at the University of Calgary;
- Lek-Heng Lim — AMS Western Sectional Meeting in San Francisco, DPMMS Graduate Student's Seminar at Cambridge University;
- Joseph Miller — 2001 Greater Boston Logic Meeting at MIT;
- Kathryn Nyman — Poster session at the AMS/MAA Joint Meetings in New Orleans;
- Fernando Schwartz — Participant in the MSRI summer graduate program on Global Theory of Minimal Surfaces, Berkeley, California, Summer 2001.

The graduate students were also active in giving expository talks in a variety of settings, as well as in other activities, both on and off campus. These include the following:

- David Brown, Kathryn Nyman and Sarah Spence coordinated Preparing Future Faculty meetings at local colleges; talks were given at Wells College by Alan Demlow and Gordon Ritter, and at Hobart College by Christopher Francisco, Alan Demlow, Christopher Hruska, Nelia Charalambous and Samuel Hsiao. Chris Francisco also gave a talk at Ithaca College.
- David Brown, Kristin Camenga and Kathryn Nyman participated in the Graduate Outreach Minicourses given at local elementary and high schools. For example, Kathryn gave a course on graph theory for fourth graders at Belle Sherman Elementary in Ithaca.
- Maria Sloughter and Melanie Pivarski put together several math games for the girls who participated in this year's Expanding Your Horizons program, organized by university students for local school girls and highlighting science and mathematics.
- Lee Gibson and Maria Sloughter assisted with the VIGRE-supported Math Explorers Club for local high school students.
- David Brown and Lee Gibson attended the spring meeting of the MAA at SUNY Binghamton.
- Kathryn Nyman participated in a job search panel at Binghamton University in January 2001. David Brown, Nathaniel Miller and Kathryn Nyman also participated in a job search panel at Cornell in April 2001 that was organized by the Teaching Assistant Coordinator, Maria Terrell.

Finally, we note that of the seven students who have received Ph.D.s in 2000–01, five have obtained academic jobs, one is working at a bioinformatics company and the last will seek an industrial position after moving to Ann Arbor.

Undergraduate Program

The Cornell undergraduate program in mathematics in the academic year 2000–01 included 107 majors (plus 14 conditional acceptances). Bachelors degrees were awarded to 39 students, including one in August 2000. These numbers continue a trend of modest increase that began a few years ago and seems to be accelerating. One student was graduated magna cum laude this year, and six were graduated cum laude. Ryan Williams, a May graduate, will attend graduate school at Cornell's Computer Science Department with an NSF Graduate Research Fellowship. Justin Kinney, a junior double-majoring with physics, won a Goldwater Scholarship. (See Awards and Honors, p. 9.)

In addition to those undergraduates receiving VIGRE support for summer research (p. 3), Dan Ramras received an award from the Arts College to work with Ken Brown.

Three of our majors produced senior theses. These were:

- Jesse Alt, *Research on a reflective lamda calculus*;
- Narattaya Khamsemanan, *Two-distance preserving functions*;
- Ryan Williams, *Access complexity*.

The Mathematics Library has begun a collection of selected senior theses, to which the above-named will be added.

We conducted four undergraduate receptions this year, two in the fall and two in the spring. The first fall reception was organized by Ravi Ramakrishna and consisted of advertisements for our spring courses. Strictly speaking, this was aimed at all students, though mostly majors participated.

The second fall reception was a more elaborate affair aimed at majors and prospective majors, drawing perhaps twenty students and a nearly equal number of faculty. Various faculty and staff made presentations: the chair welcomed the students; Robert Strichartz described opportunities for undergraduate research; a representative from Cornell Abroad together with Maria Terrell promoted the virtues of the Mathematics in Moscow program; Ravi Ramakrishna spoke of his undergraduate experience in a similar program in Budapest; and Lisa Harris from the Career Center gave a presentation about job opportunities.

The first spring reception was a slightly more elaborate version of our first fall reception. We advertised courses, this time without oral presentations but instead with visual aids — a collection of attractive posters constructed by staff, each presenting information about a new or altered course. A particularly nice feature of some of these posters was the (color) photo of the faculty member who would be giving the course. A number of these faculty were at the reception, hence readily identified and approached by the students. Somewhere between fifteen and twenty students attended this reception, together with about a dozen faculty.

Finally, a smaller and less formal affair occurred a few weeks later. It featured a presentation by Professor Joe Rosenblatt, chair of the Mathematics Department at the University of Illinois. He discussed employment and education issues. This was aimed at least as much at graduate students as at undergraduates. A handful of each attended.

The Harry S. Kieval Lecture this year was given by Colin Adams, the Francis C. Oakley Third Century Professor in Mathematics and Statistics from Williams College. The lecture, *Real estate in hyperbolic space: investment opportunities in the next millenium*, was held in Malott Hall (cf., *Math Matters*, Winter 2000). This was a highly entertaining talk that developed a surprising amount of serious geometry.

In April, the chair of the Mathematics Department at the University of Illinois, Professor Joseph Rosenblatt, gave an informal presentation to some undergraduates, graduate students and faculty on employment and educational issues in mathematics.

Ongoing activities include the Math Table and the Math Club. The Math Table meets on Fridays for dinner at Risley Hall, providing an informal, mathematically-literate social setting for faculty, graduate students and undergraduates. The Math Club continued to meet weekly this year, with meetings consisting of lectures, both by students and faculty, and puzzle and problem sessions. Several members attended the Hudson River Undergraduate Conference held at Skidmore College on April 28, 2001. The students listed below gave talks at the conference:

- Dan Ramras, *Cliques in random graphs*;
- Jordan Barry, *Information theory and cannibalism*;
- Ramiro Rodriguez, *Probability reasoning*;
- Chan-Ho Suh, *Being wild: a series of counterintuitive embeddings into Euclidean 3-space*.

Research and Professional Activities

Department-sponsored research expenditures for the 2000–01 fiscal year totaled $1,656,663. This included 42 grants and contracts from federal, state and private agencies awarded to 35 faculty. Faculty submitted 18 new grant proposals, 10 of which have been funded to date, and requested the continuation of 23 awards.

Editorships included:

- Dan Barbasch, editor of *Proceedings of the AMS*;
- Yuri Berest, editor of the *Journal of Nonlinear Mathematical Physics*;
- Louis Billera, member of the editorial boards of the *Journal of Algebraic Combinatorics* and *Discrete and Computational Geometry*;
- Robert Connelly, editor of *Contributions to Algebra and Geometry*;
- R. Keith Dennis, consulting editor for *Mathematical Reviews*;
- Richard Durrett, associate editor of *Notices of the AMS* and the *Journal of Theoretical Probability*;
- Clifford Earle, managing editor of *Proceedings of the AMS*;
- José F. Escobar, member of the editorial boards of the *Electronic Journal of Differential Equations* and *Revista Colombiana de Matemàticas*, international editor of *Innovación y Ciencia*;
- Leonard Gross, member of the editorial boards of the *Journal of Functional Analysis*, *Reviews*

of Mathematical Physics, *Potential Analysis*, the *Soochow Journal of Mathematics* and *Revista Colombiana de Matemàticas*;

- John Guckenheimer, editor of the *Journal of Experimental Mathematics*, the *SIAM Journal of Applied Dynamical Systems* and the *International Journal of Bifurcation and Chaos*, managing editor of *DSWeb*;
- Timothy Healey, member of the editorial boards of *Journal of Elasticity* and the *SIAM Journal on Mathematical Analysis*;
- Yulij Ilyashenko, editor-in-chief of the *Moscow Mathematical Journal*, member of the editorial boards of *Functional Analysis and its Applications*, *Dynamical and Control Systems*, *Ergodic Theory and Dynamical Systems*, *Proceedings of the Moscow Mathematical Society* and *Mathematical Enlightenment*;
- Harry Kesten, member of the editorial boards of the *Indiana University Journal of Mathematics* and the *New York Journal of Mathematics*;
- Anil Nerode, editor of *Computer Modelling and Simulation*, *Mathematics and Computer Modelling*, *Constraints*, *Grammars* and *Documenta Mathematica*;
- Michael Nussbaum, associate editor of *Annals of Statistics*, *Annales de l'Institut Henri Poincaré* and the *European Series of Industrial and Applied Mathematics* (Probability and Statistics);
- Lawrence Payne, member of the editorial boards of *Mathematical Methods in the Applied Sciences* and the *Glasgow Mathematical Journal*;
- Richard Rand, member of the editorial board of *Journal of Vibration and Control*;
- James Renegar, associate editor of the *SIAM Journal on Optimization*;
- Laurent Saloff-Coste, editor of *Mathematische Zeitschrift*, associate editor of *Stochastic Processes and their Applications*, the *European Series of Industrial and Applied Mathematics* (Probability and Statistics) and *Annales de la Faculté des Sciences de Toulouse*;
- Richard Shore, managing editor of *Bulletin of Symbolic Logic*;
- Birgit Speh, editor of the *New York Journal of Mathematics* and the *Journal of Representation Theory*;
- Michael Stillman, algebraic geometry editor for *Proceedings of the AMS*;
- Robert Strichartz, executive editor of the *Journal of Fourier Analysis and Applications*;
- Lars Wahlbin, managing editor of *Mathematics of Computation*;
- James West, member of the editorial board of *Fundamenta Mathematicae*.

Support Staff

Restructuring of Staff Positions: The dedication and skill of our staff is one of the major things that makes this department a pleasant place to be and keeps it running smoothly. As the demands on our department change, we sometimes find ourselves with more responsibilities than our existing staff can handle comfortably. At such times it is the chair's responsibility to request additional resources from the dean, and on rare occasions the dean responds favorably to such requests. Such a rare event has just taken place. The deans have agreed to increase our staff by one. Department manager Colette Walls put together a plan that redesigns many staff positions and allows us to use this new position in the best possible way.

In her new position as teaching program coordinator, Catherine Stevens continues to coordinate course requests and assignments, faculty office assignments, conflict of interest forms and summer session tasks, as she did in her former position as chair's assistant. She takes over the annual newsletter publication from the undergraduate coordinator/receptionist position (as held by Nora Balfour). In addition, keys/security and textbook orders, formerly completed by Michelle Klinger's position, will now be coordinated by Cathy. She will also begin to conduct the annual space inventory and coordinate special projects for the manager.

The responsibility for managing faculty designated accounts will be moved from our research accountant, Gayle Davis, to our new undergraduate coordinator, Brenda Jones. Gayle will continue to provide fiscal oversight and reporting for grants and contracts, and she has redesigned the financial projection report for principal investigators to make this information clearer and easier to understand. Brenda will begin filing and completing monthly operating statements for Gayle, as well as conducting the annual capital equipment inventory. By distributing some of Gayle's routine accounting tasks to others, she will have more time available to oversee the department's proposal submissions process and manage research funds. This will greatly benefit faculty researchers, who rely on Gayle to keep their accounts current and out of overdraft.

Michelle Klinger was assigned the special project of working with Karen Vogtmann, the faculty chair of the department website committee, to redesign the department's website during the fall 2000 semester. The results of their creative endeavors can be viewed at www.math.cornell.edu. With the completion of the new web site, new tasks are required to continually update and revise information on the web. In addition, there's a growing need for course web page support, especially in the large "czared" courses. By restructuring staff workloads, we moved a number of teaching program and other duties to Cathy and the new receptionist, thus making time for Mikki to take on additional duties to meet the growing demand for web support. I am hopeful this new effort will benefit the department with an increased and more effective internet presence, as well as free up the Czars and TAs in large classes from the clerical duties of maintaining web pages.

Departures: Nora Balfour left the undergraduate coordinator/receptionist position in February 2001 to take a position as the chair's assistant in the Computer Science Department. Although Nora had only been with us for two years, her unique personality made a deep impression on the department. Consequently, we were very sorry to see her go. However, I am happy to say that she has gone on to better things. Her new position is a promotion in classification level at the university. As sad as it is to lose a good staff member, it's a pleasure to watch them move up the career ladder.

New Hires: Brenda Jones replaced Nora Balfour at the front desk as the receptionist, undergraduate coordinator and faculty recruitment coordinator. She will oversee the summer REU application process and also help Gayle and Colette with aspects of departmental accounting. In addition, she will be learning technical typing this fall so that she can provide back-up support for Arletta Havlik. She worked in a similar position in the Ithaca College Department of Sociology for two years. Prior to that, she was a secretary in the Dean of Humanities and Sciences Office at Ithaca College for a year.

Linda Clasby is the new assistant to the chair. For 18 years, she was the executive staff assistant in the Office of Sponsored Programs, working directly for Jack Lowe. She then became Jack Lowe's assistant when he moved to the Office of the Vice Provost for Research. For the past two years, she was the administrator for the Ward Center for Nuclear Sciences at Cornell. The new duties for the chair's assistant position will be to provide direct clerical and administrative support to the chair, as well as process academic appointments, help visitors with visa issues and disseminate the minutes of the faculty meetings during the academic year. In the new year, Linda will be collecting information for the chair regarding faculty leaves, sabbaticals, committee assignments, academic promotion and tenure reviews.

Task Meetings: During 2000–01, the staff held task meetings wherein key administrative tasks were documented, reviewed, analyzed and in some cases changed. In addition to reevaluating procedures, our goal is to create a task manual that will help with staff cross-training and supervision. The administrative manager (Colette Walls) attends each meeting. In most cases the chair (John Smillie) and/or the non-academic human resource representative (Gayle Davis) also attends. The relevant employee prepares in advance for the meeting by writing up procedures for accomplishing the task in chronological order, by academic year. The employee also lists key contacts and attaches samples of materials used in completing the task. The employee then explains the procedures in detail, using the accompanying documentation to clarify the process for the other participants.

After the task has been explained and reviewed chronologically, the participants discuss the process to determine if there could be a more efficient way to complete the task. We operate from the perspective that tasks change over time, and a periodic full evaluation of the process will help the employee get additional help or propose new systems or procedures for completing the task.

The task meeting process is labor intensive and time consuming; however, the end results appear to be worth the effort. When finished, we will have a well-documented departmental task manual. We will also have closely examined and analyzed our key tasks, in some instances updating and changing the procedures. The department will benefit from a more professional and efficient workplace with routine bureaucracy replaced by thoughtful and well-considered standard operating procedures.

Faculty Changes

On leave for 2000–01:

Dan Barbasch, sabbatical leave, spring 2001
R. Keith Dennis, sabbatical leave, fall 2000
David Henderson, sabbatical leave, fall 2000
John Hubbard, leave, academic year
Richard Platek, sabbatical leave, fall 2000
Oscar Rothaus, sabbatical leave, fall 2000
Avery Solomon, leave, academic year

Birgit Speh, sabbatical leave, spring 2001
Michael Stillman, sabbatical leave, spring 2001

On leave for 2001–02:
Stephen Chase, sabbatical leave, spring 2002
Peter Kahn, sabbatical leave, fall 2001
Harry Kesten, leave, academic year
Gregory Lawler, leave, fall 2001
Michael Morley, sabbatical leave, spring 2002
Irena Peeva, leave, academic year
Richard Shore, sabbatical leave, spring 2002
Reyer Sjamaar, sabbatical leave, spring 2002
Robert Strichartz, sabbatical leave, spring 2002

Other department personnel changes are noted in the Department Directory, pp. 18–19.

Gifts

As always, we appreciate the kindness and generosity of alumni and other friends of mathematics. During the 2000–01 academic year, designated donor gifts increased the principal of various department endowments. In addition, the department received some unrestricted gift donations, which are used to supplement departmental activities for the mathematics community at Cornell. In many cases, contributions were received in response to the department newsletter, *Math Matters*. By distributing this newsletter, we hope to keep our many friends current on department activities. If you would like to be added to the newsletter mailing list, please contact Catherine Stevens at cls15@cornell.edu.

Awards and Honors

Battig Graduate Prize: Recipients of the Robert John Battig Graduate Prize are graduate students in mathematics at Cornell who have passed their A exam (typically in their second year of study). Any such graduate student is eligible regardless of social and financial background. A department committee composed of the chair, the director of graduate studies and three members of the graduate admissions committee select a recipient each year based on excellence and promise in mathematics. This year's recipients were Alan Demlow and David Revelle.

Clark Distinguished Teaching Award: Recipients of the John M. and Emily B. Clark Distinguished Teaching Award have demonstrated their devotion to teaching, student counseling and development of new courses and new methods of student instruction. Among the very best teaching assistants in the college, Kathryn Nyman was presented with the Clark Award at a College of Arts and Sciences convocation honoring distinguished faculty and students.

Freshman Math Prize: The department sponsored the third annual Freshman Math Prize Exam this year. This is a challenging prize exam with cash awards open to all freshmen at Cornell. The winner this year was Asher Walkover of Woodmere, NY. Second prize went to Omar Nayeem of Chesterfield, MO. Other winners were Zhengyun Zhang of Hamden, CT, Shawn Chen of Ithaca, NY and Brian Lukoff of Lafayette, PA.

Goldwater Scholarship: Justin Kinney, a junior majoring in mathematics and physics, was one of three Cornell recipients of a Barry M. Goldwater Scholarship in science and mathematics. The Goldwater Scholarship, honoring Senator Barry M. Goldwater, was designed to encourage outstanding students to pursue careers in the fields of mathematics, the natural sciences and engineering. It is a premier undergraduate award of its type in these fields. The one- and two-year scholarships cover college expenses up to $7,500 per year, including tuition, fees, books and room and board. This is the sixth year in a row that Cornell has had three or more Goldwater winners and the second year in a row that one of the Cornell recipients was a mathematics major.

Hutchinson Fellowship: The Hutchinson Fellowship is awarded to mathematics graduate students who have been outstanding in their work as teaching assistants or as students in the graduate program. The award provides one semester of relief from teaching to allow the students to work on their thesis problems. Accordingly, it is given to students who have completed three years of study and are not in their final year. This year's recipients were Nelia Charalambous, Noam Greenberg and Huibin Zhou.

Ithaca High School Senior Prize: Each year for the past several years the Cornell Mathematics Department has awarded a prize to a senior at Ithaca High School who has demonstrated substantial interest and significant native ability in mathematics. This prize is funded substantially by contributions solicited from various faculty. Typically, the high school selects a short-list of students, whom one or two of our faculty interview. This year's prize was awarded to Yu Gu. According to her calculus teacher, Severin Drix, Yu excelled at everything they had for her, including computer science, fractals and chaos. She authored the "Seven Gates of Nerdhood" and is reported to be a great tiddlywinks player. Yu will be attending Cornell Engineering in the fall.

Kieval Prize: The Harry S. Kieval Prize in Mathematics, established in 1994 by Harry S. Kieval '36, provides an annual award to an outstanding graduating senior mathematics major. The student is selected by the Mathematics Department's honors committee on the basis of academic performance, the quality and variety of math courses taken, and faculty recommendations. The 2000–01 Kieval Prize was awarded to Jesse Alt, who graduated magna cum laude in mathematics.

The traditional lambda-terms constitute a calculus of general functional dependencies, thus providing a mathematical prototype of numerous functional programming languages (e.g., LISP, ML, SCHEME) and automated provers (Nuprl, Coq, Metaprl, etc.). A recent solution of Goedel's provability problem led to a new more powerful system of reflective lambda-terms. However, a major problem remained open: the existence and uniqueness of normal forms for reflective lambda-terms. Jesse Alt solved this problem by a smart modification of existing methods. Reflective lambda-calculus changes our conception of the appropriate syntax and semantics for functional programming languages, automated deduction, formal verification and reasoning about knowledge.

Liu Memorial Award: Awarded annually by the Graduate School, the Liu Memorial Award is named in honor of Ta-Chung Liu, econometrician and chair of the Economics Department in the late 1960s. Recipients are chosen based on demonstrated academic ability and performance, with some consideration given to character and financial need. Each field may nominate one student each year, and we are pleased that our nominee, Huibin Zhou, was chosen to receive a Liu Award. In fact, Huibin may be the first mathematics graduate student to receive a Liu Award.

Magnus Memorial Prize: On April 19, José Ramírez, H. C. Wang assistant professor, was presented with the Wilhelm T. Magnus Memorial Prize by his Ph.D. institution, New York University. The Magnus Prize is awarded each year for significant contributions to the mathematical sciences.

Sloan Research Fellowship: Yuri Berest was one of two Cornell faculty to receive a Sloan Foundation Research Fellowship this year. Sloan fellows are engaged in research at the frontiers of physics, chemistry, computer science, mathematics, neuroscience and economics. The fellowships allow scientists to continue their research with $40,000 each over two years. Fellows are free to pursue whatever research is of most interest to them. Prof. Berest's research focuses on the intersection of several mathematical disciplines, including mathematical physics, algebraic geometry and noncommutative algebra.

Steele Prize: Presented by the American Mathematical Society, the Leroy P. Steele Prize for Lifetime Achievement is one of the highest distinctions in mathematics. Harry Kesten, Goldwin Smith Professor in Mathematics, was presented the 2001 Steele Prize at the Joint Mathematics Meetings in New Orleans in January. In addition to doing distinguished research on theoretical problems, Prof. Kesten has also contributed to the understanding of many practical questions dealing with matters such as population growth and river networks. His work has also been influential in statistical mechanics. The prize citation states that Professor Kesten is being honored for "his many and deep contributions to probability theory and its applications."

Wallenberg Prize: Warwick Tucker, H. C. Wang assistant professor, was awarded the Swedish Mathematical Society's Wallenberg Prize this June at a ceremony during the SMS's annual meeting in Lund. Bodil Branner (Denmark) gave a talk about his work in auto-validating methods in dynamical systems and its implications. (See An Old Problem Solved, p. 20.)

York Award: The Eleanor Norton York Award was established by friends of Eleanor York, who died of cancer in 1993. Each year one student in the Mathematics Department and one student in the Astronomy Department, in which Eleanor was employed, are selected to receive this award. The recipients are chosen from those in the middle of their graduate education on the basis of their achievements to date and to encourage them to have even more success in the future. The Eleanor York Award for 2000–01 was awarded to Shamibrata Chatterjee in the Astronomy Department and will be presented to a Mathematics Department graduate student at the Fall Reception in September 2001. The previous winner in Mathematics was Yi Lin.

Instructional Activities

The faculty taught 121 courses in 209 lectures and 170 recitations during the 2000–01 academic year, generating 22,922 credit hours. They taught 5,872 students aided by 92 teaching assistants and associates. The enrollment figures are reflected on pp. 16–17. The Dept. of Theoretical and Applied Mechanics shares the teaching of engineering calculus and is accredited with 50% of the credit hours for Math 190 and 191 in the fall and

Math 293 and 294 in the fall and spring; the remaining 18,986 credit hours are accredited to Mathematics.

Curriculum Changes

Three new courses were introduced into the department's curriculum during the 2000–01 academic year.

Math 402, the *Smorgasbord Seminar*, is a lecture series given by members of the department on current research topics in mathematics. It is intended to provide advanced undergraduates with a taste of many different areas of the discipline. The seminar was offered during the fall 2000 semester under the supervision of Professor Robert Strichartz, who developed it originally as part of the REU program (p. 24). For a list of talks, see Department Colloquia, p. 34.

Math 424, *Wavelets and Fourier Series*, was developed and taught for the first time by Robert Strichartz in spring 2001. Both topics mentioned in the title of this course provide methods to represent and approximate general functions in terms of simple "building blocks." The course presents, at the advanced undergraduate level and with a minimum of sophisticated prerequisites, an introduction to these topics and some of their applications.

Math 774, *Asymptotic Statistics*, is an advanced graduate course that provides an introduction to asymptotic statistical decision theory, empirical stochastic processes and related topics in mathematical statistics. It was designed by Professor Michael Nussbaum and taught by him in spring 2001.

Stimulated by a mandate of its five-year NSF VIGRE grant, the Mathematics Department began a comprehensive review of its entire curriculum in late 1999 and continued it throughout the spring of 2000 and the entire 2000–01 academic year. This review has been spearheaded by the department's curriculum committee, chaired by Professor John Guckenheimer. Its main fruits to date are, first, changes in the titles and catalog descriptions of a number of undergraduate courses so that they would conform more closely to the actual content of the courses and, second, a reorganization and revision of the undergraduate curriculum in analysis. In 2000–01 the following courses were, for the first time, offered with new titles and somewhat revised descriptions: Math 105 (*Finite Mathematics for the Life and Social Sciences*), Math 106 (*Calculus for the Life and Social Sciences*), Math 420 (*Differential Equations and Dynamical Systems*) and Math 422 (*Applied Complex Analysis*). In fall 2001 the department's 300-level applicable analysis course, Math 321, will be offered with the new title *Manifolds and Differential Forms* and with a rather extensively revised syllabus that will treat vector calculus on manifolds and its applications to partial differential equations, fluid mechanics and electromagnetism.

In addition to Math 402 and Math 424 (discussed above), the department's VIGRE-inspired curriculum review has led to a third new course, Math 311 (*Introduction to Analysis*), which will be offered each spring semester beginning in 2002. Designed for mathematics majors who do not take the honors calculus sequence Math 223–224, the course provides a transition from calculus to theoretical analysis and emphasizes the understanding and construction of proofs in that area of mathematics.

Interdisciplinary Instructional Activity

Mathematics/Engineering Liaison: In the spring of 2000 the Mathematics Department adopted, with the approval of the Engineering College, revisions in the organization and syllabi of the four-semester engineering calculus sequence that had been proposed by the Engineering-Mathematics Liaison Committee. These changes were phased in during the spring semester and summer session of 2000. The main features of the revisions are the following:

(1) The second-year courses, Math 293 and Math 294, may be taken in either order (i.e., Math 293 is no longer a prerequisite for Math 294).

(2) Much of the multivariable calculus in the engineering curriculum has been moved from Math 293 to the second-semester course, Math 192.

(3) Essentially all of the material on ordinary and partial differential equations is now contained in Math 293 and the linear algebra in Math 294.

(4) The first-semester courses were renumbered as Math 190 (for students with no previous successful experience with calculus) and Math 191 (for students with some background in calculus).

Engineering Restructuring: The Department of Mathematics, in collaboration with the Department of Theoretical and Applied Mechanics in the College of Engineering, completed the fourth year of an experimental program for the restructuring of the teaching of engineering calculus. The object of this program is the delivery of instruction in small classes for the second-semester engineering calculus course, Math 192, during the fall semesters. The program thus continues a process, begun in the early 1990s, of replacing large lectures by

small classes in all of the first-year engineering calculus courses. Thirty-two classes in these three courses — Math 190, 191 and 192 — were offered in fall 2000, with an average class size of 25 students.

According to the restructuring agreement, part of the instructional resources needed to staff the small classes is supplied by faculty recruited from scientific departments throughout the university. These faculty, who are highly qualified to teach the mathematics relevant to engineering calculus, complement faculty and instructional teaching assistants provided by the two core departments, Mathematics and T&AM. In fall 2000 we were pleased and fortunate to have recruited the following faculty:

- Bingham Cady (T&AM),
- P. C. Tobias de Boer (Mechanical and Aerospace Engineering),
- Michael Duncan (Chemical Engineering),
- Timothy Healey (T&AM),
- Chung-Yuen Hui (T&AM),
- Richard Lovelace (Applied & Engineering Physics),
- Christopher Papadopolous (Mathematics),
- Christine Shoemaker (Civil and Environmental Engineering),
- Jane Wang (T&AM).

This was Prof. Duncan's third year in the program and Prof. Shoemaker's fourth. Professor Duncan will continue with the program next fall.

The restructuring experiment was originally planned for a duration of three years; however, in the spring of 1999, with the encouragement and support of Dean Phil Lewis of the College of Arts and Sciences and Dean John Hopcroft of the College of Engineering, the program was extended in its current form through the fall semester of 2001. Hence it is expected that during the next academic year, the fifth year of the restructuring program, this promising experiment will be carefully evaluated and a decision made regarding its future.

Department Publicity

The Cornell Mathematics Department appeared in the press six times this year, as listed below. For more Cornell Mathematics news, check out our web site (www.math.cornell.edu/News) or request a copy of our department newsletter from Catherine Stevens, cls15@cornell.edu, (607) 254-8993.

1. Ian Stewart, *The Lorenz Attractor Exists*, Nature **August 31** (2000), pp. 948–949.
   — Features the work of Warwick Tucker.

2. *Real estate in hyperbolic space: investment opportunities for the new millenium*, Cornell Chronicle and Cornell Daily Sun, December 2000.
   — Kieval Lecture given by Colin Adams.

3. Dana Mackenzie, *Taking the measure of the wildest dance on earth*, Science **290** (2000).
   — Features the work of Gregory Lawler together with Wendelin Werner and Oded Schramm.

4. Marcelo Viana, *What's new on Lorenz strange attractors*, Mathematical Intelligencer **22** no. 3 (2000).
   — Features the work of Warwick Tucker.

5. *Mathematics Explorer's Club build large geometric structures*, Cornell Chronicle, December 6, 2000.

6. *Harry M. Gehman lecture given by Robert Connelly at the annual spring meeting*, Seaway Current Newsletter **24** no. 2, spring 2001.

7. *How to unfold a Carpenter's rule in the plane*, Ithaca Journal, April 2001.
   — Mathematics Awareness Month lecture given by Robert Connelly.

New Faculty Members

Kai-Uwe Bux

H. C. Wang Assistant Professor

Kai-Uwe Bux received his Ph.D. in mathematics in 1998 from the Johann Wolfgang Goethe-University of Frankfurt in Germany. His Ph.D. advisor was Robert Bieri. Professor Bux is interested in the interaction between geometry and algebra, more specifically in geometric group theory, buildings and finiteness properties of groups. His current research involves applications of combinatorial Morse theory to finiteness of groups and connectivity of certain spaces. From September 1999 to June 2001, he was a research associate at the University of Utah.

Martin Dindoš

H. C. Wang Assistant Professor

Martin Dindoš received a Ph.D. in mathematics (real analysis) in 2000 from Comenius University in Bratislava, Slovakia. He also received a Ph.D. in mathematics (harmonic analysis and partial differential equations) in May 2001 from the University of North Carolina at Chapel Hill, where his advisor was Michael E. Taylor. Prof. Dindoš' current research interests include linear and nonlinear partial differential equations on Lipschitz domains in Riemannian manifolds, layer potentials on Lipschitz and C1 domains and Hardy spaces on 'rough' domains. From 1997 to 2001 he was an instructor at the University of North Carolina. Prior to that, he was an instructor at Comenius University from 1995 to 1997.

Matthew Fickus

VIGRE Assistant Professor

Matthew Fickus received a Ph.D. in mathematics in May 2001 from the University of Maryland. His Ph.D. advisor was John J. Benedetto. Prof. Fickus' research interests include applicable harmonic analysis: wavelets, non-uniform sampling and the general theory of frames. His current research focuses on normal tight frames in finite dimensions and their relationship with equidistribution of points, and reconstruction of a signal from a sufficient number of non-uniform samples of a wavelet transform.

Gregory Lawler

Professor

Gregory Lawler received his Ph.D. in mathematics from Princeton University in 1979. His major fields of interest are probability and stochastic processes, and their applications to statistical physics. Prior to coming to Cornell in July 2001, he was a professor of mathematics at Duke University, where he has been a member of the faculty since 1979. Professor Lawyer was awarded an Alfred P. Sloan Fellowship in 1986, and he became a fellow at the Institute of Mathematical Statistics in 1991. Professor Lawler is known internationally as an expert on the theory of random walks. He is the author of a well-known monograph on the subject. His recent work with Schramm and Werner on intersection exponents for Brownian motion is the subject of an article in the journal *Science*.

Anita Mareno

VIGRE Assistant Professor

Anita Mareno received a Ph.D. in applied mathematics in August 2001 from Cornell University, where her Ph.D. advisor was Timothy Healey. Her research interests are in the area of partial differential equations and elasticity. Her work involves global continuation in higher-order gradient elasticity.

Irina Mitrea

H. C. Wang Assistant Professor

Irina Mitrea received her Ph.D. in mathematics from the University of Minnesota in May 2000. Her Ph.D. advisors were Carlos E. Kenig and Mikhail Safonov. Prof. Mitrea's work is in the areas of harmonic analysis, partial differential equations and industrial mathematics. She is particularly interested in the study of PDE problems arising from mathematical physics with emphasis on the study of fluid dynamics, elasticity and electromagnetism. Professor Mitrea spent the 2000–2001 academic year at the Institute for Advanced Study in Princeton, New Jersey.

Jason Schweinsberg

H. C. Wang Assistant Professor

Jason Schweinsberg received his Ph.D. in statistics from the University of California at Berkeley in May 2001. His Ph.D. advisor was James Pitman. Prof. Schweinsberg's current research interests are probability theory and stochastic process, especially processes of coalescence and fragmentation. Professor Schweinsberg is the recent recipient of a National Science Foundation postdoctoral fellowship.

Alexander Vladimirsky

H. C. Wang Assistant Professor

Alexander Vladimirsky received a Ph.D. in applied mathematics from the University of California at Berkeley in May 2001. His Ph.D. advisor was James Sethian. His current research interests include numerical analysis, nonlinear PDEs, fast methods for PDEs, bifurcation theory, computability and complexity, network algorithms, and directed random search techniques. Professor Vladimirsky has been a research assistant at the Lawrence Berkeley Laboratory since 1996, and he has a National Science Foundation postdoctoral fellowship.

Milen Yakimov

H. C. Wang Assistant Professor

Milen Yakimov received his Ph.D. in mathematics in May 2001 from the University of California at Berkeley. His thesis advisor was Nicolai Reshetikhin. His areas of interest are quantum groups, Poisson-Lie groups, Kac-Moody and vertex algebras, deformation quantization, integrable systems, unitary representations of Lie groups, Gelfand pairs and spherical functions, and special functions.

Mathematics Course Enrollment Statistics

Course and Title		Format	Instructor	Enroll	Cr Hrs	Semester
103	Mathematical Explorations	Lecture	B. West, J. West	63	189	Fall 2000
103	Mathematical Explorations	Lecture	Henderson, N. Miller, Morley	65	195	Spring 2001
105	Finite Mathematics for Biologists	Lec/Sec	M. Terrell	153	459	Fall 2000
106	Calculus for Biologists	Lec/Sec	Durrett	165	495	Spring 2001
111	Calculus	Lecture	DeSilva, Manzer, Morley (Czar), Tisch	328	1,312	Fall 2000
111	Calculus	Lecture	M. Terrell (Czar), Tisch	136	544	Spring 2001
112	Calculus	Lecture	Sen (Czar), Zaks	165	660	Fall 2000
112	Calculus	Lecture	DeSilva, Manzer, Piche, Wahlbin (Czar)	203	812	Spring 2001
121	Modern Calculus	Lecture	Saloff-Coste	9	36	Fall 2000
122	Calculus	Lec/Sec	Saloff-Coste, Salur	61	244	Fall 2000
122	Calculus	Lec/Sec	Salur	29	116	Spring 2001
171	Statistical Theory and Applications	Lec/Sec	Bendikov, Bock, Hwang	96	384	Fall 2000
171	Statistical Theory and Applications	Lec/Sec	Bendikov, Bock, Hwang, Nyman	101	404	Spring 2001
189	FWS: Reasoning about Reasoning	Lecture	N. Miller	17	51	Fall 2000
190	Calculus for Engineers	Lec/Sec	Healey (T&AM)*	37	148	Fall 2000
191	Calculus for Engineers	Lec/Sec	de Boer (M&AE), Guckenheimer (Czar), Hui (T&AM)*, Kable, Papadopoulos, Shoemaker (C&EE), Z. Wang (T&AM)*	287	1,148	Fall 2000
191	Calculus for Engineers	Lec/Sec	Connelly	20	80	Spring 2001
192	Calculus for Engineers	Lec/Sec	Cady (T&AM)*, Duncan (Chem. Eng.), Gasharov, Lovelace (A&EP), Peeva (Czar), Ramírez, van Willigenburg	469	1,876	Fall 2000
192	Calculus for Engineers	Lec/Sec	R. Terrell	309	1,236	Spring 2001
213	Calculus	Lec/Sec	Back	11	44	Fall 2000
213	Calculus	Lec/Sec	Back	25	100	Spring 2001
221	Linear Algebra & Calculus	Lec/Sec	Billera, Conant, Kahn, Sunik	116	464	Fall 2000
221	Linear Algebra & Calculus	Lec/Sec	Gross, Nerode, Vogtmann	77	308	Spring 2001
222	Calculus	Lec/Sec	R. Miller, Speh, Yamada	49	196	Fall 2000
222	Calculus	Lec/Sec	Sunik, J. West, Yamada	95	380	Spring 2001
223	Honors Linear Algebra and Calculus	Lec/Sec	Ramakrishna, Tsai	41	164	Fall 2000
224	Honors Linear Algebra and Calculus	Lec/Sec	Ramakrishna	21	84	Spring 2001
231	Linear Algebra	Lecture	Chase	21	63	Spring 2001
281	Formal Logic	Lecture	Hodes (Philosophy)	0	0	Fall 2000
293	Engineering Mathematics	Lec/Sec	Burns (T&AM)*, Schatz	427	1,708	Fall 2000
293	Engineering Mathematics	Lec/Sec	Kable, Rand (T&AM)*	453	1,812	Spring 2001
294	Engineering Mathematics	Lec/Sec	Connelly, Phoenix (T&AM)*	347	1,388	Fall 2000
294	Engineering Mathematics	Lec/Sec	Rosakis (T&AM)*	417	1,668	Spring 2001
321	Applicable Analysis	Lec/Sec	Bailey	31	124	Fall 2000
332	Algebra and Number Theory	Lecture	Speh	36	144	Fall 2000
336	Applicable Algebra	Lecture	K. Brown, Kahn, van Willigenburg	103	412	Spring 2001
356	Groups and Geometry	Lecture	Cohen	22	88	Spring 2001
401	Honors Seminar: Topics in Modern Math.	Lecture	Sjamaar	6	24	Spring 2001
402	Smorgasbord Seminar	Seminar	Strichartz	16	16	Fall 2000
403	History of Mathematics	Lecture	Taimina	11	44	Spring 2001
408	Mathematics in Perspective	Lecture	B. West	14	56	Spring 2001
411	Introduction to Analysis	Lecture	Tucker	17	68	Fall 2000
413	Introduction to Analysis	Lecture	Bendikov, Kesten	49	196	Fall 2000
414	Introduction to Analysis	Lecture	Kesten	21	84	Spring 2001
418	Function Theory of One Complex Var.	Ind Stud	Morley	1	4	Fall 2000
418	Function Theory of One Complex Var.	Lecture	Dynkin	13	52	Spring 2001
420	Applicable Analysis	Lecture	Tucker	19	76	Fall 2000
420	Applicable Analysis	Lecture	Tucker	30	120	Spring 2001
422	Applicable Analysis	Lecture	Earle	20	80	Fall 2000
424	Wavelets and Fourier Series	Lecture	Strichartz	27	108	Spring 2001
425	Num. Solutions of Differential Equations	Lecture	Schatz	19	76	Spring 2001
427	Intro. to Ordinary Differential Equations	Lecture	Yamada	9	36	Fall 2000
428	Intro. to Partial Differential Equations	Lecture	Ramírez	7	28	Spring 2001
431	Introduction to Algebra	Lecture	Berest, Smithline	34	136	Fall 2000
432	Introduction to Algebra	Lecture	Smithline	11	44	Spring 2001
433	Introduction to Algebra	Lecture	K. Brown	34	136	Fall 2000
434	Introduction to Algebra	Lecture	Sen	20	80	Spring 2001
442	Introduction to Combinatorics	Lecture	Rybnikov	8	32	Spring 2001
451	Euclidean and Spherical Geometry	Lecture	Rybnikov	14	56	Fall 2000
452	Classical Geometries	Lecture	Conant	9	36	Spring 2001
453	Introduction to Topology	Lecture	Hatcher	20	80	Fall 2000
454	Introduction to Differential Geometry	Lecture	Swartz	4	16	Spring 2001
471	Basic Probability	Lecture	Limic	27	108	Fall 2000

Course and Title		Format	Instructor	Enroll	Cr Hrs	Semester
472	Statistics	Lecture	Nussbaum	7	28	Spring 2001
481	Deductive Logic	Lecture	R. Miller	7	28	Spring 2001
482	Topics in Logic	Lecture	Hodes (Philosophy)	2	8	Spring 2001
486	Applied Logic	Lecture	Constable (Computer Science)	2	8	Spring 2001
490	Supervised Reading and Research	Ind Stud	Faculty	4	16	Fall 2000
490	Supervised Reading and Research	Ind Stud	Faculty	7	23	Spring 2001
500	College Teaching	Lecture	M. Terrell	9	9	Fall 2000
503	History of Modern Mathematics	Lecture	Nerode	3	12	Spring 2001
508	Math. for Secondary School Teachers	Lecture	Bock	3	3	Fall 2000
508	Math. for Secondary School Teachers	Lecture	Bock	4	4	Spring 2001
611	Real and Complex Analysis	Lecture	Dynkin	20	80	Fall 2000
612	Real and Complex Analysis	Lecture	Strichartz	11	44	Spring 2001
613	Topics in Analysis	Lecture	Strichartz	3	12	Fall 2000
618	Smooth Ergodic Theory	Lecture	Guckenheimer	6	24	Spring 2001
621	Measure Theory and Lebesgue Integration	Lecture	L. Gross	4	16	Fall 2000
622	Applied Functional Analysis	Lecture	L. Gross	10	40	Spring 2001
628	Complex Dynamical Systems	Lecture	Ilyashenko	6	24	Fall 2000
631	Algebra	Lecture	Chase	21	84	Fall 2000
632	Algebra	Lecture	Dennis	7	28	Spring 2001
649	Lie Algebras	Lecture	Barbasch	8	32	Fall 2000
651	Introductory Algebraic Topology	Lecture	Cohen	17	68	Spring 2001
652	Differentiable Manifolds	Lecture	Sjamaar	12	48	Fall 2000
653	Differentiable Manifolds	Lecture	Sjamaar	5	20	Spring 2001
661	Geometric Topology	Lecture	Cohen	5	20	Fall 2000
671	Probability Theory	Lecture	Kesten	16	64	Fall 2000
672	Probability Theory	Lecture	Dynkin	17	68	Spring 2001
674	Introduction to Mathematical Statistics	Lecture	Nussbaum	3	12	Spring 2001
681	Logic	Lecture	Artemov	8	32	Spring 2001
712	Seminar in Analysis	Seminar	Escobar	4	16	Spring 2001
713	Functional Analysis	Lecture	Rothaus	2	8	Spring 2001
728	Seminar in Partial Differential Equations	Seminar	Wahlbin	5	20	Fall 2000
728	Seminar in Partial Differential Equations	Seminar	Bendikov	6	24	Spring 2001
731	Seminar in Algebra	Seminar	Stillman	3	12	Fall 2000
732	Seminar in Algebra	Seminar	Dennis	4	16	Spring 2001
735	Topics in Algebra	Lecture	Billera	20	80	Fall 2000
739	Topics in Algebra II	Lecture	Berest	2	8	Fall 2000
739	Topics in Algebra II	Lecture	K. Brown	1	4	Spring 2001
740	Homological Algebra	Lecture	Berest	3	12	Spring 2001
751	Seminar in Topology	Seminar	Vogtmann	5	20	Fall 2000
752	Seminar in Topology	Seminar	Pittet	3	12	Spring 2001
753	Algebraic Topology	Lecture	Kahn	7	28	Fall 2000
754	Algebraic Topology	Lecture	Hatcher	3	12	Spring 2001
757	Topics in Topology	Lecture	Swartz	5	20	Fall 2000
758	Topics in Topology	Lecture	Kahn	3	12	Spring 2001
762	Seminar in Geometry	Seminar	Connelly	6	24	Spring 2001
767	Algebraic Geometry	Lecture	Ramakrishna	8	32	Fall 2000
771	Seminar in Probability and Statistics	Seminar	Seminar	0	0	Fall 2000
772	Seminar in Probability and Statistics	Seminar	Seminar	1	4	Spring 2001
774	Asymptotic Statistics	Lecture	Nussbaum	4	16	Fall 2000
777	Stochastic Processes	Lecture	Durrett	20	80	Fall 2000
778	Stochastic Processes	Lecture	Saloff-Coste	4	16	Spring 2001
781	Seminar in Logic	Seminar	Shore	4	16	Fall 2000
782	Seminar in Logic	Seminar	Nerode	6	24	Spring 2001
784	Recursion Theory	Lecture	Shore	9	36	Spring 2001
787	Set Theory	Lecture	Shore	10	40	Fall 2000
788	Topics in Applied Logic	Lecture	Artemov	8	32	Fall 2000
790	Supervised Reading and Research	Ind Stud	Faculty	14	71	Fall 2000
790	Supervised Reading and Research	Ind Stud	Faculty	10	47	Spring 2001

TOTALS	Courses	Lectures	Enroll	Dept* Cr Hrs	Total Cr Hrs
Academic Year	121	209	5,872	18,989	22,925
Fall Semester	59	117	3,229	10,418	12,614
Spring Semester	62	92	2,643	8,571	10,311

* The Dept. of Theoretical and Applied Mechanics shares the teaching of engineering calculus and is accredited with 50% of the credit hours for Math 190 and 191 in the fall and Math 293 and 294 in the fall and spring; the remainder are accredited to Mathematics.

Note: Enrollment figures in seminars may not reflect total attendance. Faculty and graduate students do not normally register.

Mathematics Department Directory 2000–01

Professors:
Dan Barbasch
Louis Billera
Kenneth Brown
Stephen Chase, associate chair
Marshall Cohen
Robert Connelly
R. Keith Dennis
Richard Durrett
Eugene Dynkin
Clifford Earle
José Escobar
Leonard Gross
John Guckenheimer
Allen Hatcher
David Henderson
John Hubbard
Gene Hwang
Yulij Ilyashenko
Peter Kahn
Harry Kesten
Michael Morley
Anil Nerode
Michael Nussbaum
Oscar Rothaus
Laurent Saloff-Coste
Alfred Schatz
Shankar Sen
Richard Shore
John Smillie, chair
Birgit Speh
Michael Stillman
Robert Strichartz
Karen Vogtmann
Lars Wahlbin
James West

Professors Emeritus:
James Bramble
Roger Farrell
G. Roger Livesay
Lawrence Payne
Alex Rosenberg
Moss Sweedler

Associate Professors:
Richard Platek
Reyer Sjamaar

Assistant Professors:
Yuri Berest
Irena Peeva
Ravi Ramakrishna

Acting Professor:
Allen Back

Adjunct Professor:
Graeme Bailey

Adjunct Associate Professor:
Robert Terrell

Postdoctoral Associate:
Ricardo Oliva

H.C. Wang Assistant Professors:
Gregery Buzzard
Vesselin Gasharov
Anthony Kable
Vlada Limic
José Ramírez
Konstantin Rybnikov
Harrison Tsai
Warwick Tucker

VIGRE Assistant Professors:
James Conant
Russell Miller
Lawren Smithline
Edward Swartz

Senior Lecturers:
Avery Solomon
Maria Terrell
Beverly West

Field Members from Other Departments:
Timothy Healey (T&AM)
Dexter Kozen (Computer Science)
Philip Protter (OR&IE)
Richard Rand (T&AM)
James Renegar (OR&IE)

Visiting Faculty:
Sergei Artemov
Alexander Bendikov
David Bock
Christopher Papadopoulos
Christophe Pittet
Sema Salur
Zoran Sunik
Daina Taimina
Stephanie van Willigenburg
Sumio Yamada
Joseph Zaks

Visiting Program Participants:
Carolyn DeSilva
William Manzer
Robert Piché
Nancy Tisch

Visiting Scholars:
Stephen Andrea
Ryuichi Fukuoka
Martin Grothaus
Masanori Hino
Thomas Rishel
Hajime Taniguchi
George Wilson

Teaching Associates:
John Chiment
Michael Coleman
Richard Furnas

Graduate Students:
Henrique Araujo
James Belk
David Benbennick
Janet Best
Cynthia Bowers
David Brown
Ryan Budney
Kristin Camenga
Nelia Charalambous
Dan Ciubotaru
Jean Cortissoz
Alan Robert Demlow
Christopher Francisco
Yuval Gabay
Suman Ganguli
Ferenc Gerlits
Lee Gibson
Leah Gold

Noam Greenberg
Radu Haiduc
Spencer Hamblen
Christopher Hardin
Matthew Horak
Geoffrey Christopher Hruska
Samuel Hsiao
Todd Kemp
Evgueni Klebanov
JaEun Ku
Dmitriy Leykekhman
Hway Kiong Lim
Lek-Heng Lim
Yi Lin
Jennifer Suzanne Lynch
Swapneel Mahajan
Fernando Marques
Brian A. Meloon
Jeffrey Mermin
Florian Milanovici
Joseph Stephen Miller
Nathaniel G. Miller
Antonio Montalban
Steven Morris
Kathryn Louise Nyman
Melanie Pivarski
Rajmohan Rajagopalan
David Robert Revelle
William Gordon Ritter
Roland Roeder
Gil Rosenberg
Franco Saliola
Everilis Santana-Vega
Hasanjan Sayit
Rebecca Schuller
Fernando Schwartz
Steven Sinnott
Serguei Slavnov
Maria Sloughter
Aaron Solo
Sarah Spence
Catherine Anne Stenson
Roman Tymkiv
Brigitta Vermesi
Shawn Walker
Russell Woodroofe
Yan Zeng
Yan Zhang
Huibin Zhou

Visiting Graduate Student:
Amy Szczepanski

Administrative Support Staff:
Nora Balfour
Gayle Davis
Arletta Havlik
Joy Jones
Michelle Klinger
Donna Smith
Catherine Stevens
Colette Walls, manager

Computer Consultants:
Douglas Alfors
Robert Terrell

Instructional Computer Lab:
Allen Back, director

Mathematics Support Center:
Douglas Alfors, director
Richard Furnas

Mathematics Library Staff:
Lee Ringland
Steven Rockey, librarian

Changes for 2001–02

New Professor:
Gregory Lawler

New H.C. Wang Asst. Professors:
Kai-Uwe Bux
Martin Dindoš
Irina Mitrea
Jason Schweinsberg
Alexander Vladimirsky
Milen Yakimov

New VIGRE Asst. Professors:
Matthew Fickus
Anita Mareno

New Graduate Students:
Bryant Adams
Jason Bode
Edoardo Carta
Farkhod Eshmatov
William Gryc
Pavel Gyrya
Henri Johnston
Jason Martin
Vadims Moldavskis
Achilleas Sinefakopoulos
John Thacker
José Trujillo Ferreras
Jonathan Turnes
Treven Wall

New Staff:
Linda Clasby
Brenda Jones

Faculty Departures:
Gregory Buzzard
Vesselin Gasharov
Anthony Kable

Staff Departures:
Nora Balfour

Faculty Leaves:
Stephen Chase, spring 2002
Peter Kahn, fall 2001
Harry Kesten, academic year
Gregory Lawler, fall 2001
Michael Morley, spring 2002
Irena Peeva, academic year
Richard Shore, spring 2002
Reyer Sjamaar, spring 2002
Robert Strichartz, spring 2002

Special Programs and Activities

An Old Problem Solved

Nearly four decades ago, Edward Lorenz introduced a simplified model of atmospheric dynamics in his now famous article *Deterministic non-periodic flow* published in the *Journal of Atmospheric Sciences*. The simple system of differential equations produced amazingly complicated solutions. One stunning property was that solutions starting very close together were separated at an exponential rate. This gave rise to the concept of the "butterfly effect" and seriously undermined the idea of a deterministic world.

Since Lorenz published his article, hundreds of articles have appeared addressing the peculiar system of differential equations. Although the area of dynamical systems had been steadily undergoing fundamental developments since the 1960s, Lorenz's equations defied all attempts at proving that they exhibit a "strange attractor." (See Smale's list of outstanding open problems for the next (this!) century published in *The Mathematical Intelligencer*.)

A positive solution was announced about two years ago by Warwick Tucker, then a graduate student at Uppsala University, working under the supervision of Lennart Carleson. By using a novel combination of pure and applied mathematics, Tucker managed to prove that the equations do indeed give rise to a strange attractor.

Moreover, the attractor is robust, i.e., all nearby systems will display similar strange attractors. The proof has two main ingredients: rigorous numerics, which produce information about the global behavior of the system, and normal form theory, which deals with subtle local properties of the solutions.

Tucker's article *The Lorenz attractor exists* (available at www.math.uu.se/~warwick/papers.html) appeared in the French journal *Comptes Rendus* and has been described in other journals such as *The Mathematical Intelligencer* (by Marcelo Viana) and in *Nature* (by Ian Stewart). (See p. 13 for complete references.)

The Math Explorers Club

This year, the department began a new program for high school students, the Math Explorers Club. The Saturday meetings are open to all interested students at no charge. The goal of the club is twofold: to stimulate an interest in mathematics by exposing students to material not usually encountered in the high school curriculum and to provide a peer group of students who share an interest in mathematics.

Participants get to choose among modules that provide instruction in interesting areas of mathematics, computer lab activities and problem-solving sessions. Two intense hour-long sessions are separated by a break, during which participants of all modules can get together to relax and talk things over. The program is run by four graduate students (Lee Gibson, Sharad Goel, Maria Sloughter and Tiberiu Tomita) and has modules taught by faculty members. Typically there are two 6-week modules offered at a time, allowing new students to enter the club several times during the year. This year's modules were *Secret Codes and Cryptography* (Ravi Ramakrishna), *Fractals* (Robert Strichartz), *Math and Art* (Robert Connelly and Maria Terrell), *Symmetry and Complex Numbers* (Yulij Ilyashenko), *Graph Theory* (Stephanie van Willigenburg), *Probability* (Vlada Limic) and *The Four Numbers Game* (Russell Miller).

During the first year of operation, more than thirty students overall participated in the program. Attendance was stronger in the fall (averaging about twenty) than in the spring (averaging about ten).

The program is funded by the VIGRE grant, which provides stipends for the graduate students and pays for the refreshments. This is a great opportunity for the graduate students to interact with faculty in an informal setting and to gain valuable experience in education and outreach that will help them in future job searches. Participants enjoy the challenge of communicating the excitement of mathematics to young and eager minds, and spreading the word that mathematics is a cool subject. We expect the program to evolve and grow in response to the needs and interests of the participants.

Kieval Lecture

Colin Adams, the Francis C. Oakley Third Century Professor in the Department of Mathematics and Statistics at Williams College, gave the Harry S. Kieval Lecture at Cornell on September 29, 2000. The lecture, *Real Estate in Hyperbolic Space: Investment Opportunities in the Next Millennium*, was held in Malott Hall.

Adams explained how our regular geometric notions of things like area are very different in hyperbolic geometry, but he did so with a twist. For his informative and humorous talk, Adams assumed the persona of tacky real estate agent Mel Slugbate. Mel pitched real estate in hyperbolic space as opposed to the regular Euclidean space, along the way explaining the mathematics of this different geometry. (For instance, the area of a circle in hyperbolic space increases exponentially with the radius — there's more land to buy!) Adams assumed his role during the reception prior to the lecture, distributing his brochures to the approximately one hundred students and faculty in attendance.

Adams' lecture, designed for undergraduate students and members of the public who have a basic scientific and mathematical knowledge, was funded through a bequest of the late Dr. Harry S. Kieval '36, a longtime professor of mathematics at Humboldt State University in Arcata, California, who died in 1994.

Summer Program

We offered thirteen courses in the three-week, eight-week and six-week sessions in the summer of 2000, covering subjects such as applicable algebra, calculus and engineering mathematics. By offering a variety of summer courses, we enable students to fulfill their graduation requirements or just to get ahead. One of our most popular offerings, *Mathematical Explorations* (Math 103), was taught in both the three-week and the six-week sessions. David Henderson's topic in the three-week session was *The Heart of Mathematics*, while Piergiorgio Odifreddi covered a variety of topics in the six-week session from *Math and Religion* to *Math and Music*. Even for traditional calculus courses, the special characteristics of summer study allow a much greater interaction between students and faculty, which makes for a more exciting educational experience for both.

We enrolled a total of 255 students in the summer session, including students from Cornell, other colleges and high schools. One of the major attractions for high school students coming to Cornell is the opportunity to experience the vitality of mathematical life here, so much so that many of these students apply for undergraduate study at Cornell the following year. In addition to our own department faculty members, faculty visiting from colleges and universities in Pennsylvania, Oklahoma and as far away as Italy join us in the summers to teach. Mathematics graduate students appointed as teaching assistants provided support to our instructors.

Spring Concert Series

On the evening of Sunday, May 6, 2001, a group of talented faculty, visitors, graduate students, undergraduates, family and friends of the Mathematics Department performed before an appreciative audience in the department's eleventh annual Spring Concert, held at the A. D. White House. As the program below shows, performers entertained the audience with a variety of selections, ranging from classical to modern.

Prelude and Fugue in C Major (BMV 870) from the Well-Tempered Clavier book 2, Johann Sebastian Bach: Noam Greenberg — piano.

Sonata No. 4 (4 movements), John Ernest Galliard, realization by Karl Heinz Fussl: Peter Smillie — bassoon; Graeme Bailey — piano.

Clarinet Concerto (2nd movement), Wolfgang A. Mozart: Tingting Chen — violin; Michael Suppe — clarinet.

String Quartet No. 4, Op. 18 (1st movement), Ludwig Beethoven: Gregery Buzzard — violin; Carla Martin — violin; Nancy Sundell — viola; Graeme Bailey — cello.

Ballade Op. 23, Frederic Chopin: Dickson Wang — piano.

anyone lived in a pretty how town, e. e. cummings (poetry), Robert Strichartz (music): Clifford Earle — bass; Kathryn Nyman — mezzo-soprano; Wendy de Heer — violin; Robert Strichartz — piano.

Center Alley (a dramatization from Anguished English), H. L. Chance: Douglas Alfors, Kathryn Nyman, Donna Smith, Carolyn DeSilva, G. Christopher Hruska, Suzanne Hruska, Joseph Miller, Richard Furnas, Wendy de Heer.

What Do Grad Students Do?, Alan J. Lerner (music), Joseph Miller and Frederick Loewe (words), freely

adapted from the musical Camelot: Kathryn Nyman — soprano; G. Christopher and Suzanne Hruska, Joseph Miller, Nathaniel Miller — dancers; Lee Gibson — tenor; Robert Strichartz — piano.

String Quintet in C Major, Op. 163 (1st movement), Franz Schubert: Gregery Buzzard — violin; Carla Martin — violin; Nancy Sundell — viola; Graeme Bailey — cello; Nathaniel Miller — cello.

Ardo e Scopir, Claudio Monteverdi: Kristin Camenga, Todd Kemp — vocalists; Clifford Earle — accompanist.

An den Abendstern, Robert Schumann: Kristin Camenga, Todd Kemp — vocalists; Clifford Earle — accompanist.

Piano Sonata No. 8 (Pathetique, 2nd movement), Ludwig Beethoven: Weining Qiu — piano.

If I Were a Rich Man, J. Bock and S. Harnick: Todd Kemp — vocalist; Kristin Camenga — accompanist.

L'Histoire de Babar, le petit éléphant, Francis Poulenc (music), Jean de Brunhoff (text): Laurent Saloff-Coste — reader; Graeme Bailey — piano; Claire Saloff-Coste — Marthe Bosredon; Samuel Saloff-Coste — André Lecoeur.

Topology Festival

The topology/geometry group of the Mathematics Department hosted the thirty-eighth annual Topology Festival on May 5–7 this year. Now an internationally known tradition, the festival was founded in part by Paul Olum in 1963 as a small regional conference that celebrated the return of spring and reviewed the outstanding results in topology during the preceding year. We were pleased to be able to hold this year's festival in our new home, Malott Hall.

The current festival attracts fifty to eighty topologists and geometers annually and is funded by the National Science Foundation. In the current era of highly specialized conferences, the Topology Festival is noteworthy in that—representing the interests of the current faculty—it presents a broad spectrum of current mathematics, usually featuring topics in geometric and algebraic topology, geometric group theory and geometry.

The festival consists of seven or eight one-hour lectures interspersed with thirty-minute breaks for discussion of results, conjectures and new theorems. Other activities include an opening reception, a dinner, an open house and a picnic. This format encourages a lively and open exchange of ideas and promotes mathematical collaboration. This year's featured speakers and their topics were:

Miguel Abreu, Technical University of Lisbon: *The Topology of Symplectomorphism Groups*

Daniel Allcock, Harvard University: *Reflection groups on the octave hyperbolic plane*

Danny Calegari, Harvard University: *Promoting Essential Laminations*

Robin Forman, Rice University: *The Differential Topology of Combinatorial Spaces*

John Rognes, University of Oslo: *Two-Primary Algebraic K-Theory of Pointed Spaces*

Dev Sinha, Brown University: *The Topology of Spaces of Knots*

Peter Teichner, University of California at San Diego: *L-Theory of Knots*

Gang Tian, Massachusetts Institute of Technology: *Symplectic Surfaces in Rational Complex Surfaces*

The 40th Cornell Topology Festival will be held May 3–5, 2001.

Preparing Future Professors

The department's Preparing Future Professors program continues to prepare graduate students for the professorate while it attracts attention from outside administrative agencies. The program was funded this year by the Office of the Dean of the Arts College, under the direction of Dr. Maria Terrell.

Cornell graduate students gave eight talks on such topics as Quantum Physics, Functional Approximation, Game Theory, Visualizing the Fourth Dimension, Permutations and the Number e to mixed audiences of faculty and students at Hobart and William Smith, Wells and Ithaca Colleges. This experience afforded participants the opportunity to talk about their work in ways that anticipate both professional meetings and job searches. Graduate students Sarah Spence, Kathyrn Nyman and David Brown coordinated the talks.

Kathryn Nyman participated in a PFF panel at the January MAA/AMS joiont meeting held in New Orleans. Kathryn shared information about the Cornell program and answered questions about how to get a program started.

Expanding Your Horizons

Expanding Your Horizons is an annual day of hands-on workshops in mathematics and science for 7th and 8th grade girls. The program is organized and run by women in mathematics and science, with the intention of generating interest in these subjects and of motivating the girls to continue taking mathematics and science courses throughout high school. On April 28, 2001, the graduate women of the Mathematics Department once again contributed to the success of the day, by participating in two exciting workshops. The Mathematics Department sponsored a workshop on origami and symmetry, run by several women in the department, and the IGERT program (an intradisciplinary nonlinear dynamics program) sponsored a workshop on chaos and music, organized by mathematics graduate student Suzanne Hruska.

In the first workshop, *Origami imagirO*, Angela Baldo, Leah Gold, Debra Goldberg, Kathryn Nyman, Melanie Pivarski, Suzanne Shontz, Maria Sloughter and Eileen Tan worked with the girls using kami (origami paper) to study symmetry. The girls created units that were the building blocks for the polyhedra. The units themselves had a symmetry, as many of us discovered; right-handed units would only fit with other right-handed units, and left-handed with other left-handed. The girls paired up and used these units to create a cube. Then, each pair of girls was challenged to create a cube that was a mirror image of the first cube. After playing with the two mirror-image cubes for a while, we discovered that there was no way to rotate one to get the other.

In the IGERT workshop, *The Butterfly Effect*, Suzanne Hruska, along with applied math students Maria Mercedes Franco, Judy Rosenstein, Duncan Calloway, Matt Salganik and Cedric Langbort, used interactive computer programs to illustrate the ideas of chaos. We were able to do this in the Mathematics Instructional Computing lab (Stimson 206), under the direction of Allen Back. After discussing the ideas of mathematical modeling, the girls used the program "IDE" (Interactive Differential Equations), written by Cornell faculty Beverly West and Steve Strogatz, along with Jean McDill and John Cantwell, to explore some of the typical behavior of nonlinear equations used in mathematical modeling. Once they understood the ideas of chaos (e.g., sensitive dependence on initial conditions), they applied these characteristics to create bizarre and interesting *Fractal Music*, with shareware found on the web.

Mathematics Awareness Month

April is Mathematics Awareness Month, and again this year the department organized several activities as our contribution to this national event. A number of faculty offered their services as guest speakers in local schools, and the general public was invited to come to Malott Hall for the second annual public lecture, aimed at presenting interesting new developments in mathematics to a wider audience.

Public Lecture

This year's lecture was *Unfolding the Carpenter's Rule*, given by Robert Connelly. The audience — composed of high school students, secondary math teachers, staff and students from both Cornell and Ithaca College, and members of the general public — was quite appreciative.

Combining hands-on models and computer simulations with humor and insight, Professor Connelly described the history and significance of the carpenter's rule problem. The talk considered a planar linkage, a polygon consisting of rigid bars connected together with hinges at their ends. (This is the ruler that a carpenter folds up in a pocket.) Connelly and his coauthors proved that the linkage can be continuously moved so that it becomes straight and no bars cross, while preserving the bar lengths. Furthermore, the motion is smooth, does not decrease the distance between any pair of hinges and preserves any symmetry present in the initial configuration. The problem has a long history, and several people have worked on this and related problems. This is joint work with Erik Demaine and Guenter Rote.

Mathematics Awareness Week at Area Schools

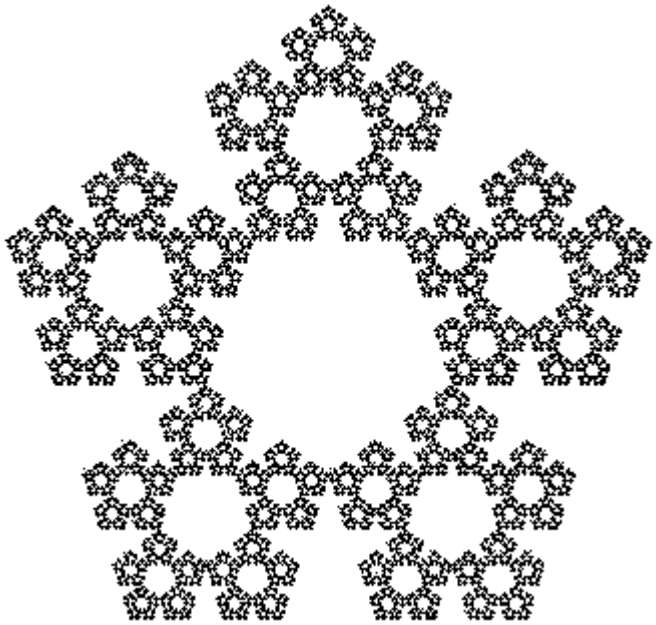
The American Mathematical Society encourages universities to support the idea of a math awareness week in April at area schools. We have participated in this practice since its inception. Once again this year we sponsored a T-shirt design contest, won this year by Andy Siegert of Dryden High School (a participant in the Math Explorer's Club). The Departments of Mathematics at Cornell University and Ithaca High School underwrote the cost of producing over 100 shirts that were distributed to staff and students at Cornell and several area schools. At Ithaca High, students won the shirts as prizes for solving a math problem of the day, or a more extensive week-long challenge.

Research Experiences for Undergraduates Program

Analysis on Fractals

Since 1996, REU students have been doing research on fractals with Prof. Strichartz and Alexander Teplyaev (a 1998 Cornell Ph.D. who is currently an NSF postdoctoral fellow at the University of California, Riverside). The goal of the project is to create a kind of calculus for functions defined on fractals, following up on ideas originated by Jun Kigami. Already the cumulative work of the REU students has had a major impact on the field (the expository article *Analysis of Fractals*, Notices AMS **46** (1999), 1199–1208, describes this area). Some of the accomplishments of the summer 2000 students are the following:

Bryant Adams (Washington and Lee) and Alex Smith (Cornell) worked on creating numerical analysis algorithms on the pentagasket, shown here, and used these



algorithms to begin exploring the spectrum of the Laplacian on this fractal. Greg Padowski (Cornell) created programs to study harmonic mappings of the Sierpinski gasket into the 2-sphere and the hyperbolic plane. He produced counter-examples to naïve conjectures that would have oversimplified the theory and found numerically the boundary between uniqueness and non-uniqueness for stable energy minimizing maps into the 2-sphere. Jeremy Stanley (Wichita State) discovered a remarkable energy partition principle on fractals that has no analog on smooth manifolds. On fractals, as well as on Euclidean space, it is natural to write the total energy of a function as a sum of directional energies. On Euclidean space the directional energies are independent of each other, but in fractals each directional energy must be a fixed proportion of the total energy. Andy Yingst (University of North Texas) studied level sets of harmonic functions on the Sierpinski gasket and showed that generically all level sets are built up in a statistically identical way from small pieces.

Mathematical Problems from Biology

Students worked with Prof. Durrett and graduate students Janet Best and Peter Calabrese, in consultation with Cornell biologists in three areas:

Predator-prey models. Robert Reynolds (University of New Hampshire) and Frank Yeager (Cornell) studied differential equation models, asking the question: "How many prey species can coexist in an environment with a predator species?" The simplest models indicated an upper bound of $n+1$, but by introducing more sophisticated (and biologically reasonable) interactions they were able to construct models with one predator and more than two prey species coexisting.

Chromosome size evolution. Arkendra De (Purdue), Michael Ferguson (Cornell) and Suzanne Sindi (Cal State Fullerton) studied a model of Sankoff and Ferretti to predict the distribution of sizes of chromosomes and the changes over time in the distributions. There were serious discrepancies between the predictions of the model and biological data. They were able to modify the model to obtain a better fit with the data from eight species.

Microsatellites. De, Ferguson and Sindi, working with recent Cornell graduate James Signorovich, studied the distribution of repeat DNA sequences (microsatellites) in the noncoding part of the genome for humans and C. elegans. This portion of the genome tolerates a much wider variation among individuals than the coding portion (genes), since mutations are usually harmless, and so it is useful in evolutionary studies and DNA fingerprinting. The mathematical models help to test the biological assumptions about the types of mutations that occur.

Algebraic Combinatorics

Graduate student Leah Gold assisted students working with Richard Ehrenborg and Margaret Readdy on four individual projects. Debbie Grier (Cornell) studied the flag vector of hyperplane arrangements in Euclidean spaces of arbitrary dimension. The flag vector encodes all the combinatorial properties of containment among

the intersections of the hyperplanes. The *cd*-index of the flag vector further compresses this information into a polynomial in noncommuting variables c and d. She obtained a recursion relation that characterizes the *cd*-index for a special class of arrangements. Adnan Rubai (SUNY Binghamton) studied a variant of the game Nim played on a simplicial complex, where the rules for removing chips involve the structure of the simplicial complex. (The chips are placed in piles on the vertices of the complex.) He was able to characterize winning strategies for some examples. Geir Helleloid (Wisconsin) studied the structure of certain infinite groups of permutations related to juggling patterns. In particular, he was able to compute the generating function for the number of group elements expressible in terms of n elements from a standard set of generators for the group. Michael Levin (Harvard) studied certain conjectured inequalities relating to the number of ups and downs in a permutation (the descent set statistics). He had the brilliant inspiration to relate the question to a probability question involving ups and downs of a random sequence of numbers. This question led to conjectured integral inequalities for certain polynomials and their derivatives. He was able to prove several of these, thus verifying a number of the original conjectures for permutations.

Summer 2001 Program

The REU program continues in 2001. The projects will be Analysis on Fractals, directed by Robert Strichartz, Geometry of Numbers directed by Konstantin Rybnikov (an H.C. Wang assistant professor) and Computational Discrete Geometry, directed by Károly Bezdek (a visitor form Eötvös University in Budapest.)

Summer Research Minigrants

The VIGRE program also provides small grants during the summer to undergraduates who wish to do research with faculty members not involved in the REU program, with the expectation that this work will lead to writing a senior thesis. In 2000, these grants were awarded to three students: Jesse Alt, working with Sergei Artemov in logic; Anselm Levskaya, working with John Hubbard on Maxwell's equations; Chan-Ho Suh, working with Ravi Ramakrishna on number theory. These grants will again be available for summer 2001.

Centers for Mathematics Research at Cornell

Center for Applied Mathematics

Cornell's Center for Applied Mathematics (CAM) was established to promote research and advanced study in applied mathematics and to bring together students and professors with interests in various branches of the subject. Terrence L. Fine was appointed director of CAM effective July 1, 1999.

The environment for applied mathematics at Cornell today is rich and varied. Viewed nationally, Cornell is a major center of activity in applied mathematics and scientific computations, and its students are among the best at Cornell. The 80 center faculty are drawn from the Department of Mathematics and 14 other departments in engineering and the sciences.

The following Mathematics Department faculty are members of CAM: L. Billera, R. Connelly, R. Durrett, E. B. Dynkin, J. F. Escobar, L. Gross, J. Guckenheimer, J. H. Hubbard, H. Kesten, A. Nerode, L. Saloff-Coste, A. H. Schatz, J. Smillie, M. Stillman and L. B. Wahlbin.

Center for the Foundations of Intelligent Systems

The Center for the Foundations of Intelligent Systems, directed by Anil Nerode, was part of a consortium of Berkeley, Stanford and Cornell devoted to all aspects of intelligent systems, funded by DOD under a MURI (multiple university research initiative), administered by the Army Research Office. The center was active until June 2001, when it closed.

Mathematics Library

The Mathematics Library has added a number of paintings and put items of interest on display. Most notable is a collection of oil paintings of early faculty of the department, including a large portrait of James Edward Oliver, who started the department colloquium series in 1891, now called the Oliver Club. The library continues to have a high level of use such that one often finds most of the library computers and many seats full. An increasing portion of the journals in the library collection are now available either on paper in the library or online to all Cornell users. A small number of titles are now available only online where the University Library has negotiated site license contracts that make the online-only option financially favorable and provide archival reliability. New online resources are important but they are not less expensive than the printed resources they will eventually replace.

Gifts to the library endowment and improved endowment payout have made endowment income a very significant source for the purchase of library materials. The university appropriated budget for the library continues to grow but not as fast as the cost of library materials.

Thanks to the continued support of our donors, endowment income has grown from 1.5% of our budget in 1990 to 21.5% for the coming fiscal year. Gifts are the difference between an excellent library and a mediocre one.

The Math Library collection at Cornell is one of the finest in the nation and supports research and instruction in mathematics and statistics for the Cornell community. The research collection consists of works on mathematics, statistics, applied mathematics, mathematics education and the history of mathematics. For undergraduates with an interest in mathematics, the library is a wonderful resource for materials to support instructional and career needs as well as expository and recreational reading. The library collection has great historic depth and breadth and includes materials from around the world in many languages.

The Mathematics Library encourages and welcomes all patrons in the Cornell community to use its resources. Reciprocal interlibrary loan agreements with other institutions make Cornell's resources available throughout the world and opens the world to Cornell researchers. The need for quantification, analysis and more mathematical sophistication in the social, biological and engineering sciences attracts a spectrum of patrons from across the campus and generates frequent use of the collection. A full range of reference, circulation, printing and photocopy services are available in person and via phone, e-mail or the world wide web.

The library staff consists of Steven Rockey, the Director of the Library, Lee Ringland, Access Services Supervisor, and approximately a dozen part-time undergraduate employees. The veteran professional staff and the competent student employees are always ready to serve the public and they welcome feedback. A primary goal is to make the library experience for the staff and patrons interesting, productive and enriching in a small and personal environment.

The Mathematics Library's world wide web home page (www.math.cornell.edu/~library/) has information about the Mathematics Library including services, hours of operation, pointers to relevant databases such as MathSciNet, links to mathematical science resources and an extensive bibliography of "collected works" of mathematicians. Library personnel are always adding new and relevant links to this home page. Visit our library, our home page, or contact us electronically or by telephone to find out how the Mathematics Library can serve you.

Digital Books

Five hundred seventy-six out-of-print and out-of-copyright mathematics books have been scanned into a digital storage system and archival quality hard copy produced for each. These books are a significant fraction of all research-level mathematics books from the late nineteenth and early twentieth centuries. The Mathematics Library is on the leading edge of digital imaging for preservation of brittle books. The bibliography of the books that have been scanned includes pricing and ordering information and is available via the Mathematics Library home page. It can also be reached directly at www.math.cornell.edu/~library/reformat.html.

To date we have sold several hundred books printed from the digital files to individuals and other libraries. A new viewer has been developed for remote access to the full text of the book that is much more reliable and easier to use. You can view the books remotely on the web at library5.library.cornell.edu/math.html.

The electronic version of the first reviewing journal in mathematics, Die Jahrbuch über die Fortschritte der Mathematik (1868–1942) (www.emis.de/projects/JFM) has links to most of these books, as well as other retrodigitized mathematical publications.

The Cornell Library, jointly with those of Göttingen and the University of Michigan, have received a joint DFG-NSF Digitial Libraries Grant to develop a system to distribute digitized math books. When finished, the system should deliver easy, searchable, electronic access to several thousand mathematics books from the three universities.

The Cornell Library is currently negotiating with publishers to become an archive for digitized mathematics resources. A significant announcement is expected during the summer of 2001.

Project Euclid

Project Euclid (web site: projecteuclid.org) aims to help independent journals of mathematics and statistics by setting up an infrastructure that will empower the participating journals to publish on the web and to increase their visibility through a combined online presence. The Euclid site represents a new model of scholarly communication as it will support the entire span of scholarly publishing from preprints to the distribution of published journals. It will also provide journal editors with a toolkit with which they can streamline their editorial and peer review processes and publish their issues in a timely and cost-effective manner.

The Euclid repository is being implemented using an extended version of the Dienst protocol and software. The system will allow for easy implementation of the Open Archives software, meeting the requirements of the Sante Fe Convention and making Project Euclid interoperable within the Open Archives framework.

Project Euclid is managed by Zsuzsa Koltay, Cornell University Library's coordinator of electronic publishing. For more information about Project Euclid,

visit euclid.library.cornell.edu/project/ on the web or contact Zsuzsa Koltay, (607) 255-7964, zk10@cornell.edu.

Mirror Site for Zentralblatt für Mathematik

Cornell University Library has also set up a "mirror" web site to MATH, a major European resource, allowing the campus community and subscribers in the U.S. to more quickly access this online publication. A licensed database, MATH is the electronic version of Zentralblatt für Mathematik und ihre Grenzgebiete, the leading European indexing and reviewing service for the discipline. The mirror site can be found at: euclid.library.cornell.edu.

Special Instructional Support

Computer Lab

There was a major re-equipping of the lab this year. Our frontline resources now include thirteen 1.4 gigahertz Pentium 4 computers dual booting Windows 2000 and Redhat Linux 7.1. They are backed up by two new SCSI Pentium 3 servers each with DDS4 tape drives. A fine new LCD projector was also installed, and lab networking was switched from thinwire ethernet to twisted pair.

Major classes using the lab this year were Statistical Theory (Math 171), Mathematical Explorations (Math 103), Multivariable Calculus/Differential Equations (Math 213), Mathematics in Perspective (Math 408) and one section of Multivariable Calculus (Math 222). There was also some limited use by Algebra and Number Theory (Math 332), Differential Equations and Dynamical Systems (Math 420), and one section of elementary Calculus (Math 112). Occasionally students from the new course Wavelets and Fourier Series (Math 424) would use the lab as would students in Numerical Solutions of Differential Equations (Math 425).

The new Math Explorers Club for high school students was a heavy user of the lab many Saturday mornings. As usual, the Research Experiences for Undergraduates program spent much time in the lab during the summer. Other uses of the lab during the year included teacher workshops, a geometry conference and the Expanding Your Horizons program for middle school girls.

A new approach was tried in our elementary statistics course Math 171, in the spring. The weekly recitations were changed to an almost exclusive "work on a computer lab" focus instead of the previous practice of a more broadly aimed class. Most of the lab activities were authored under the leadership of visiting lecturer Dave Bock.

Mathematics Support Center

An academic support wing of the Mathematics Department, the Mathematics Support Center provides free one-on-one and small group tutoring, workshops and review sessions on topics of common concern in mathematics, approximately fifty brief printed capsules on various mathematical topics, and advice, encouragement or referrals for students. Although the center focuses on support of introductory courses, it employs both undergraduates and postgraduates (about eight each year) of diverse backgrounds and provides some limited tutoring even in upper-level courses. Douglas S. Alfors directs the operations of the MSC and coordinates its efforts with the instructors of the introductory calculus sequence.

In its quarters in 256 Malott Hall, the MSC is located on a main thoroughfare through the building and is consequently quite accessible and visible to students. This may explain the continued additional traffic experienced this year (about a 15% increase over levels in White Hall). The increased space available to us in Malott Hall has greatly enhanced our service to students. We have several tutoring areas, which are sufficiently separated from one another, so that some privacy and noise issues are addressed, yet are not so widely separated that we lose contact with someone who is working on something. Our 'reception area' can accommodate students who are waiting for their turn at being tutored, and we have a couple of sites that work nicely for small groups. The small library of texts that we maintain can now be easily accessed by tutors and clients, and some mathematics computer programs provide additional support when needed.

Management of the facility, strictly speaking, remains as before. We continue weekday hours of service (10:00 AM–5:00 PM), as well as Sunday afternoons (1:30–5:30 PM). During the past two summers we have made modest use (for the first time) of mathematics videos in support of a limited portion of the mathematics curriculum (Mathematics 105). It is too early to have a clear indication of its value, but we hope to explore this more in the future, given the opportunity to purchase additional materials. We hope also to have a more visible web presence as time goes on and to replace some antiquated computer equipment.

The Mathematics Support Center continues to benefit greatly from Emeritus Professor Roger Farrell's very kind and generous donation of tutoring time during the past year; he has been a popular tutor, and we are very grateful.

Learning Strategies Center

The Learning Strategies Center (LSC) provides academic support in a variety of subjects across campus, including biology, chemistry, physics, economics, writing, study skills and mathematics. The mission of the LSC is to provide academic assistance to students during their transition from high school students to accomplished Cornell students. Studies have shown that students who successfully complete their freshman year generally go on to graduate from Cornell. Therefore, most of the LSC's efforts are directed to supporting large, primarily freshmen, courses.

In the 2000–01 academic year, the LSC provided academic support for Math 105, Math 106, Math 111 and Math 112. Support included respective supplemental courses Math 005, Math 006, Math 011 and Math 012. These courses consisted of a ninety-minute weekly lecture held on either Sunday, Monday or Wednesday evening, which reviewed material covered in the parent course, with an emphasis on problem solving and prelim preparation. In addition, extensive tutoring hours were provided by the supplemental course instructors and their assistants.

Support for Math 171, as well as other undergraduate statistics courses, was also provided by the LSC in the Academic Support Center for Undergraduate Statistics (ASCUS). The tutor-staffed lab was open three evenings and two afternoons per week, equipped with statistical software and respective problem sets for the courses supported.

During the 2001–02 academic year, support will continue to be provided as described above for Math 105, Math 106, Math 111, Math 112 and Math 171.

NSF Undergraduate Faculty Enhancement Workshop

The Undergraduate Faculty Enhancement Workshop is funded by a grant from the National Science Foundation administered by the Mathematical Association of America. This was the seventh in a series of such workshops held at Cornell for college and university faculty who teach (or soon will teach) an undergraduate geometry course, such as courses typically attended by future or in-service teachers. This year's workshop was five full days in duration and was designed to provide opportunities for the participants to experience different ways of teaching geometry. There was also a strong component on the history of geometry. The workshop was attended by 19 participants from across the USA and Canada. The leaders of this year's workshop were: David Henderson (Cornell University), Daina Taimina (Cornell University) and Kelly Gaddis (Lewis and Clark University).

Mathematics Education

Cornell/Schools Mathematics Resource Program

The Cornell/Schools Mathematics Resource Program was initiated in 1985 by Cornell's Committee on Education and the Community. It was developed and initially taught by David Henderson and Avery Solomon, and this year it was directed by David Bock. The project has received continued funding from Cornell, area school districts and yearly Title II EESA Grants awarded through New York State.

The CSMRP is aimed at improving the state of mathematics teaching and learning by providing in-service mathematics courses and workshops for teachers, researching and developing materials for the classroom that follow a broader approach to mathematics, and initiating and supporting cooperative efforts among Cornell University and local schools.

The primary focus of CSMRP during 2000–01 was in the area of probability and statistics. The enhanced New York State Core Curriculum requires that students develop increased depth and breadth of understanding of probability, correlation, linear and nonlinear modeling, and statistical inference. Many of these concepts are new to secondary curricula, and CSMRP offered a series of Saturday workshops to allow secondary teachers to improve their understanding, develop sound pedagogical approaches, and explore and evaluate new NSF-sponsored instructional programs. Among those making presentations were David Bock, Robert Strichartz and David Henderson, as well as John Rosenthal and John Maceli of Ithaca College and Tom Mariano and Steve Weissburg of Ithaca High School. Attendees included several Cornell preservice teachers, Sue Piliero of the TEAMS program and 28 secondary math teachers from as far away as Utica and Buffalo.

Teacher Education in Agriculture, Mathematics and Science

Sponsored jointly by the departments of Mathematics and Education, this five-year program seeks to recruit and prepare students to become secondary mathematics teachers, allowing participants to attain a Master of Arts in Teaching and New York State certification. This year we sought to improve student and faculty awareness of the program, through discussions with several

other university departments, preparation and dissemination of informational materials, and open forums for interested students. With the creation of a new position in Mathematics Education in the Education department and active interest among several members of the Mathematics Department, we hope Cornell will soon be able to assume a leadership role in addressing the critical national need for mathematics teachers.

Mathematics Department Endowments

Once again, the department is thankful to alumni, friends and family who support the department endowments. Without their generosity, we would be unable to provide many of the offerings that make our department unique. The first two endowments are new this year.

The **Cornell University Department of Mathematics Award** is presented to an Ithaca High School student who has excelled in mathematics and who has demonstrated originality and innovative power in mathematics. The recipient of this award is selected by interviews with members of the Department of Mathematics. We would like to create an endowment that will allow us to increase the size of this award, which is currently quite small.

We are instituting new departmental teaching awards for graduate students and faculty. We would like to endow the **Teaching Award for Graduate Students** so that a generous prize can accompany it.

The **Colloquium Endowment Fund** was instituted to invite distinguished scientists to speak at Cornell. Earnings from this endowment are used to pay for honoraria and travel expenses for guest lecturers who speak at the Oliver Club seminars during the academic year. The Oliver Club was founded (as the Mathematical Club of Cornell University) in January 1891 by James E. Oliver, who was then chair of the department.

The **Eleanor Norton York Endowment** was established in honor of Eleanor Norton York, with the intent of recognizing outstanding graduate students in both Astronomy and Mathematics. The income from this endowment is used to provide annual prizes to a continuing graduate student at Cornell.

The **Faculty Book Endowment** is dedicated to the goal of providing the Cornell community with immediate access to one of the world's finest collections of mathematics books and publications.

The **Israel Berstein Memorial Fund** was established in honor of Israel Berstein, who was a professor in this department from 1962 through 1991. The memorial fund has as its central purpose helping young mathematicians in the field of topology. An award has been established for an outstanding graduate student in topology or neighboring areas.

The **Logic Endowment** was established as the direct result of a very generous gift from a former Cornell undergraduate. This endowment seeks to actively support promising logic students in the areas of institutional memberships and travel expenses to the Association for Symbolic Logic meetings and events, as well as other activities in the field of logic.

The **Robert John Battig Endowment** was established by his parents in December 1997, after the untimely death of Robert Battig, a graduate student in mathematics. The current purpose of this fund is to provide an annual prize to an outstanding continuing graduate student in Mathematics at Cornell.

Degrees Granted 2000–01

Doctoral Degrees

August 2000

Anke Barbara Walz

On the Bellows Conjecture

BS, Technical University of Berlin (Germany), 1992
Committee: Connelly, Billera, Kahn
First Position: visiting assistant professor, Gettysburg College

Abstract: This work is a report on the Bellows Conjecture. It summarizes the results that are known so far, gives a number of new results and raises several open questions.

In 1813 A. L. Cauchy proved that convex polyhedra are rigid. However, there are flexible non-convex polyhedra, and the Bellows Conjecture arose naturally from the study of these three-dimensional flexible polyhedral surfaces. The surfaces are given by their vertices and incidence relations, and they can be continuously deformed while keeping the faces congruent. It was observed that the volume enclosed by the surfaces stays constant during the deformation, and this led to the following general conjecture: *"The generalized volume of a flexible polyhedron in* $\mathbf{R}^n$ *stays constant during a continuous flex."*

I. Sabitov was the first to give a proof of the conjecture for $n = 3$ in 1995, and the subsequent research has been based on his ideas. Instead of directly proving the Bellows Conjecture, we are focusing on proving the so-called Integrality Conjecture: *"The volume of a flexible polyhedron in* $\mathbf{R}^n$ *is integral over the ring generated by the squared edge lengths of the polyhedron over the rational numbers* $\mathbf{Q}$*."* We show that the Integrality Conjecture implies the Bellows Conjecture.

After carefully defining the terms and objects, we give a detailed exposition of the algebraic methods that are involved. We discuss the theories of places and valuations and how they can be used to prove integrality. After stating the geometric lemmata involved, we give a proof of the Integrality Conjecture for dimension $n = 3$, as well as partial results for higher dimensions, carefully pointing out the difficulties that arise. We also present examples for non-trivial flexible polyhedra in dimension $n = 4$.

Walker McMillan White

Characterizations for Computable Structures

MS Special, Cornell University (Comp. Sci.), 1998
BS, Dartmouth College, 1993
Committee: Shore, Nerode, Kozen
First Position: assistant professor, University of Dallas

Abstract: A major theme in computable model theory is the study of necessary and sufficient conditions for the existence of certain types of computable structures. These characterizations may either be syntactic, as in the work of Millar [36], or semantic, as in the work of Goncharov [16]. Presented in this dissertation is a general framework for proving syntactic characterizations for the existence of computable models of various theories. This framework is used to show that an axiomatizable $\forall_2$ theory has a computable, existentially closed model if and only if it has an existentially conservative 1-completion for which the set of universal theorems is decidable. Several other uses of this framework are given; one answers an open question of Baldwin and Kueker [4] in the classical model theory of existentially closed, algebraically prime models. Semantic characterizations of computable structures are also investigated. By analyzing the computational complexity of various classes of computable structures, it is shown that various model theoretic properties have no essentially simpler characterization. For example, it is shown that the classes of computable homogeneous structures, computable atomic structures, and computable computably saturated structures are all $\Pi^0_{\omega+2}$-complete. Other results include the fact that the class of hyperarithmetically categorical structures is Π^1_1-complete, and that the set of computably categorical structures is Π^0_4-hard.

January 2001

Catherine Stenson

Linear Inequalities for Flag f-Vectors of Polytopes

MS Special, Cornell University, 1998
BS, Brown University, 1994
Committee: Billera, Connelly, Helmann
First Position: assistant professor, Juniata College

Abstract: Here we study the combinatorics of polytopes. A polytope P is the convex hull of a finite set of points in $\mathbf{R}^d$, and its boundary is a collection of lower-dimensional polytopes known as the faces of P. The flag f-vector of P counts the faces of each dimension and their incidences with one another. We would like to know what linear inequalities the entries of the flag f-vector satisfy.

First we present some of the history of this problem, along with the necessary mathematical background. We discuss several special classes of polytopes, including simplicials, simples, cubicals and zonotopes, whose flag f-vectors satisfy inequalities not satisfied by all polytopes.

Then we define Stanley's toric g-vector, which can be used to generate many linear inequalities for flag f-vectors. We prove Meisinger's conjecture that some of these inequalities are implied by others. In addition, we consider the $\mathbf{c}d$-index, another source of many inequalities. We show that not all of these are consequences of the non-negativity of the toric g-vector.

We then use linear inequalities satisfied by lower-dimensional polytopes to generate linear relations satisfied by simplicial, simple, k-simplicial and k-simple polytopes, and cubical zonotopes. We also examine a g-vector for cubical polytopes proposed by Adin and give evidence that supports the conjecture $g_2 \geq 0$. In particular, we show this to hold for the class of almost simple cubical polytopes, where one might expect it is most likely to fail. Next we improve upon previously known linear inequalities satisfied by zonotopes. Finally, we construct examples of another special class of polytopes, the self-dual polytopes.

Brian Meloon

Construction of Markov Partitions for Linear and Nonlinear Automorphisms of Tori

MS Special, Cornell University (Comp. Sci.), 2001
BS, University of Wisconsin, 1994
Committee: Guckenheimer, Smillie, Colman
First Position: algorithm developer, Compugen, Inc.

Abstract: We construct and investigate Markov partitions for hyperbolic linear and nonlinear maps of the torus. Our approach is based upon the arithmeticsofic partitions constructed by Kenyon and Vershik. We improve their construction by showing how to produce an irreducible sofic systemin every case. In addition, we describe a method for determining the boundaries of the rectangles, and use this to calculate their Hausdorff dimension in simple cases. We also investigate the construction of Markov partitions for nonlinear maps of the torus. Our method involves computing an approximation to a conjugacy with a linear map via the Shadowing Lemma, and using this conjugacy to define a Markov partition for the nonlinear map as the image of one for the linear map.

May 2001

Henrique Morais Araújo

On the Total Scalar Curvature Plus Total Mean Curvature Functional

BS, Universidade Federal de Pernambuco, 1993
Committee: Escobar, Strichartz, Cohen
First Position: postdoctoral assistant professor, Universidade Federale de Pernambuco

Abstract: The total scalar curvature plus total mean curvature functional, defined on the space of Riemannian metrics of a compact manifold with boundary, arises in connection with the Yamabe problem for manifolds with boundary, its critical points on a given conformal class of metrics (subject to various volume and area constraints) being metrics of constant scalar curvature and constant mean curvature on the boundary. We characterize the critical points of this functional when the conformal class restriction is lifted, and the metrics are subject only to various volume and area constraints. We compute its second variation at critical points, and show that every critical point is a saddle point by giving examples of

variations with positive second derivative (most conformal variations), zero second derivative (Lie derivatives of the metric) and negative second derivative (traceless tensor fields with positive dimensional null spaces). We show existence of minimizers on a given conformal class with Sobolev quotient strictly less that that of the upper half sphere, and show a compactness result for the set of all minimizers when metrics are allowed to vary on a small neighborhood of the space of metrics.

Suman Ganguli

Effective Completeness Theorems for Modal Logics

MS Special, Cornell University, 2000
BS, University of Chicago, 1995
Committee: Nerode, Shore, Kozen

Abstract: We initiate the study of computable model theory of modal logic, by establishing effective completeness theorems for a variety of modal logics. For each of the logics we consider, we give a natural definition of a decidable Kripke model, and then show how to construct such a decidable Kripke model of a given decidable theory.

Our new technique of constructing Kripke models is inspired by the Henkin construction for classical logic. The Henkin construction, however, depends in an essential way on the Deduction Theorem. In its usual form the Deduction Theorem fails for modal logic. In our constructions, the Deduction Theorem is replaced by a result about objects called finite Kripke diagrams. We give an argument that this result can be viewed as an analogue of the Deduction Theorem for modal logic.

We prove effective completeness theorems for the following modal logics:

- Constant domain first-order modal logic with the Box and Diamond modalities, initially with no restriction on the possibility relation (i.e., the logic K).
- Logics corresponding to special possibility relations: T, K4, K5, S4, S5.
- Two generalizations of constant domains for first-order modal logic: varying domains and monotonic domains.
- Propositional modal logics which contain "infinitary" modalities: temporal logic, epistemic logic, and dyamic logic.

Nathaniel G. Miller

A Diagrammatic Formal System for Euclidean Geometry

BS, Princeton University, 1994
Committee: Henderson, Shore, Kozen
First Position: assistant professor, University of Northern Colorado

Abstract: It has long been commonly assumed that geometric diagrams can only be used as aids to human intuition and cannot be used in rigorous proofs of theorems of Euclidean geometry. This work gives a formal system **FG** whose basic syntactic objects are geometric diagrams and which is strong enough to formalize most if not all of what is contained in the first several books of Euclid's *Elements*. This formal system is much more natural than other formalizations of geometry have been. Most correct informal geometric proofs using diagrams can be translated fairly easily into this system, and formal proofs in this system are not significantly harder to understand than the corresponding informal proofs. It has also been adapted into a computer system called **CDEG** (Computerized Diagrammatic Euclidean Geometry) for giving formal geometric proofs using diagrams. The formal system **FG** is used here to prove meta mathematical and complexity theoretic results about the logical structure of Euclidean geometry and the uses of diagrams in geometry.

Master of Science Special

(No Thesis Required)

August 2000

Sarah Agnes Spence, Mathematics
BS, University of Richmond, 1997
Committee: Kozen, Wicker, Billera

January 2001

Nelia Sofocli Charalambous, Mathematics
BS, University of North Carolina at Chapel Hill, 1998
Committee: Escobar, Gross, Saloff-Coste

Yi Lin, Mathematics
BS, Sichuan University, 1994
Committee: Sjamaar, Stillman, Kahn

Brian A. Meloon, Computer Science
BS, University of Wisconsin, 1994
Committee: Guckenheimer, Smillie, Coleman

Roman Mykhailovich Tymkiv, Mathematics
BS, Franco Lviv University, 1998
Committee: Shore, Nerode, Morley

May 2001

Steven Anthony Morris, Mathematics
BS, University of Oregon, 1998
Committee: Kahn, Sjamaar, Hatcher

Bachelor of Arts

August 2000

Alexander Rakhlin †
Cum Laude in Mathematics

January 2001

Mikhail Sargey Kobyakov
Myriam Isa Qureshi
Itrat Sayeed

May 2001

Jesse McCarthy Alt †
Magna Cum Laude in Mathematics
Yuriy Berkovich †
Cum Laude in Mathematics
Brad Albert Bouley †
Mishaal Tayyab Chotani
Vladimir Alexandrovitch Dizhoor
Alexander Druyan
Anika Michelle Green
Oren Harel
Catherine Yih-Chyi Ho
Mansi J. Kanuga
Nirattaya Khamsemanan
Cum Laude in Mathematics
Alex Kordun
Jennifer Susan Lamontagne
Yoon Ha Lee †
Mon-Jed Liu †
Magna Cum Laude in Computer Science
Cum Laude in Mathematics
Sarah Rose Loebman
Sarah Dorothy Maguire
Rakhee Mehta
Jesse Benjamin Mez †
Michael Peress
Maureen Carroll Pozzi
Maria Kasiani Sammut
Jeremiah Edward Shipman †
Magna Cum Laude in Physics
Christopher Michael Snyder
Chan-Ho Suh
Cum Laude in Mathematics
Alexander V. Tsukernik
Milos Vujanic
Matthew Raymond Whearty
Richard R. Williams †
Magna Cum Laude in Computer Science
Cum Laude in Mathematics
Yimin Wu
Franky Lee Yeager
Mikhail Zatsman
Fan Zhang †

† **Distinction in all subjects**

Department Colloquia

Analysis Seminar

September 2000

Sudeb Mitra, University of Connecticut: *Teichmüller contractions in generalized Teichmüller spaces*

Jun Kigami, Kyoto University (Japan): *Quasidistance and heat kernel asymptotics on self-similar sets*

Sema Salur, Cornell University: *A gluing theorem for special Lagrangian submanifolds*

Clifford Earle, Cornell University: *Contraction properties of holomorphic maps from the unit disk to itself or to Teichmüller spaces*

October 2000

José Ramírez, Cornell University: *Short time asymptotics of heat semigroups*

Laurent Saloff-Coste, Cornell University: *On the Dirichlet heat kernel in the exterior of a compact set*

Waldemar Hebisch, Wroclaw University (Poland): *Spectral multipliers on groups having exponential volume growth*

Robert Strichartz, Cornell University: *Energy partition on fractals*

November 2000

Alexander Bendikov, Cornell University: *Volume growth and diagonal heat kernel behavior in infinite dimensions*

Andrzej Hulanicki, Wroclaw University (Poland) and Purdue University: *Bounded harmonic and pluriharmonic functions on symmetric Siegel domains*

January 2001

Ilia Binder, Harvard University: *Harmonic measure and polynomial Julia sets*

Yu Yuan, University of Texas at Austin: *A priori estimates for fully nonlinear elliptic equations*

February 2001

Lei Zhang, Rutgers University: *Liouville and Harnack type theorems for semilinear elliptic equations*

Martin Dindos, University of California: *Semilinear elliptic problem on Lipschitz domains in Riemannian manifolds*

Andrea Fraser, University of New South Wales (Australia): *Multiplier operators on the Heisenberg group*

Adam Sikora, Australian National University (Australia): *The methods of Gaussian bounds and the methods of wave equation in harmonic analysis*

March 2001

Anders Oberg, University of Gavle (Sweden): *Invariant measures for iterated function systems*

Chikako Mese, Connecticut College: *Harmonic mappings into singular surfaces and the Teichmüller theorem*

Howard Masur, University of Illinois at Chicago: *Counting problems in billiards and flat surfaces*

April 2001

Geetha S. Rao, University of Madras (India): *Highlights of the theory of best coapproximation*

Yang Wang, Georgia Institute of Technology: *Tilings and Wavelets*

Laurent Saloff-Coste, Cornell University: *A Harnack inequality due to Cheng and Yau (1975) and some generalizations*

Alan Demlow, Cornell University: *Sharply localized maximum norm estimates for mixed finite element methods*

Gerald Goodman, University of Florence (Italy) and University of Minneapolis: *The chaos game algorithm and statistical mechanics*

Combinatorial and Algebraic Geometry Seminar

September 2000

Stephanie van Willigenburg, Cornell University: *Descent algebras and fields of finite characteristic*

Harrison Tsai, Cornell University: *D-modules on smooth toric varieties*

October 2000

Thomas Zaslavsky, Binghamton University: *Perpendicular dissections, composed partitions and deformations of the braid arrangement*

Liana Sega, Purdue University: *Effective results for homology of powers of the maximal ideal*

Srikanth Iyengar, University of Sheffield (United Kingdom): *Detecting smoothness of an algebraic variety*

November 2000

Jonathan Farley, Vanderbilt University: *The Stanley-Neggers conjecture and unimodality*

Kathryn Nyman, Cornell University: *Incidence numbers for line and pseudo-line arrangements*

Xun Dong, University of Minnesota: *Topology of bounded-degree graph complexes*

January 2001

Edward Swartz, Cornell University: *h-vectors of independence complexes*

February 2001

Edward Swartz, Cornell University: *h-vectors of broken circuit complexes*

Nantel Bergeron, York University: *Pieri operators on graphs and Aguiar theory*

Christopher Francisco, Cornell University: *Hilbert functions and graded Betti numbers*

Matthias Beck, Binghamton University: *On Sperner's inequality and its generalizations*

March 2001

Swapneel Mahajan, Cornell University: *Projection maps and shellings*

Marcelo Aguiar, University of Montreal (Canada): *A universal approach to quasisymmetric generating functions*

April 2001

Kenneth Brown, Cornell University: *Road coloring and semigroups: work of Budzban and Mukherjea*

Victor Reiner, University of Minnesota: *Local cohomology modules of Stanley-Reisner rings with supports in monomial ideals*

Konstantin Rybnikov, Cornell University: *Gain graphs, Schlegel diagrams and C_r^{r-1}-splines*

Vesselin Gasharov, Cornell University: *Polynomial rings with restricted powers of the variables*

Discrete Geometry and Graph Theory Seminar

September 2000

Robert Connelly, Cornell University: *Two-distance preserving functions from Euclidean space*

Konstantin Rybnikov, Cornell University: *Big holes in lattices* (in two parts)

Franco Saliola, Cornell University: *First-order rigidity in Cayley-Klein geometries*

October 2000

Konstantin Rybnikov, Cornell University: *Empty lattice simplexes and cell structures of lattices*

Cornel Sultan, Tensegra, Inc.: *Analytical solutions and deployment strategies for tensegrity structures*

Erik Demaine, University of Waterloo (Canada): *Folding and unfolding linkages, paper and polyhedra*

November 2000

Joseph Zaks, University of Haifa (Israel) and Cornell University: *Clique numbers of graphs*

Joseph Zaks, University of Haifa (Israel) and Cornell University: *Neighborly families of convex d-polytopes*

December 2000

Robert Connelly, Cornell University: *Generic global rigidity for bar frameworks, a criterion*

February 2001

Robert Connelly, Cornell University: *Grunbaum and Barnett's extension of Steinitz theorem*

March 2001

Konstantin Rybnikov, Cornell University: *Gain graphs and Maxwell-Cremona correspondence*

Dynamics and Geometry Seminar

September 2000

John Smillie, Cornell University: *Complex dynamics in two variables: the next frontier*

Gregery Buzzard, Cornell University: *How I made my fortune with Henon maps*

Yutaka Ishii, Cornell University: *Horseshoes and a kneading theory in dimension two*

October 2000

Suzanne Hruska, Cornell University: *Understanding parameter space of the complex Henon family*

Warwick Tucker, Cornell University: *The Lorenz attractor exists*

John Smillie, Cornell University: *Hyperbolicity and the John condition*

Sasha Bufetov, Princeton University: *Ergodic theorem for free group actions*

Sasha Bufetov, Princeton University: *Ergodic properties of skew-products over the shift*

November 2000

Sergei Yakovenko, Weizmann Institute (Israel) and University of Toronto (Canada): *Meandering of integral trajectories of polynomial vector fields, effective noetherianity and iterations of polynomial maps*

Vadims Moldavskis, Moscow (Russia): *Solution of Arnold's problem about rotation numbers and moduli of elliptic curves*

Pavel Bachurin, Moscow (Russia): *Time averages and minimal attractors*

Alexey Fishkin, Moscow (Russia): *Misiurewicz-Prshetitski theorem for group actions*

December 2000

Vadim Kaloshin, New York University: *Newton interpolation polynomials and their application to dynamics*

Educational Issues in Undergraduate Mathematics Seminar

January 2001

Daina Taimina and David Henderson, Cornell University and University of Latvia: *Can we teach the same course in two cultures?*

February 2001

David Henderson, Cornell University: *What counts as teaching and learning mathematics depends on what counts as mathematics*

David Henderson, Cornell University: *Discussion and critique of Where Mathematics Comes From by Lakoff and Núñez* (in five parts)

Lie Groups Seminar

September 2000

Marcelo Aguiar, University of Montreal (Canada): *On the associative analog of Lie bialgebras*

Birgit Speh, Cornell University: *Geometric and topological invariants of locally symmetric spaces and representation theory*

Kenneth Brown, Cornell University: *Introduction to twin buildings*

J. M. Landsberg, Université de Toulouse (France) and Georgia Institute of Technology: *Freudenthal's magic, Deligne's numerology and Vogel's conjectured "Universal Lie Algebra"*

Lawren Smithline, Cornell University: *Bounding slopes of p-adic modular forms*

October 2000

Peter Trapa, Harvard University: *An L-formalism for the metaplectic group*

Lizhen Ji, University of Michigan: *Scattering matrices and scattering geodesics of locally symmetric spaces*

Anthony Kable, Cornell University: *Tensor products, the Gelfand-Graev representation of GL(2,q) and identities for special sums*

November 2000

Yuri Berest, Cornell University: *Varieties of quasi-invariants of finite reflection groups*

Vesselin Gasharov, Cornell University: *Smooth Schubert varieties*

December 2000

Ravi Ramakrishna, Cornell University: *Taylor's program for the two-dimensional Artin conjecture*

Logic Seminar

August 2000

Jennifer Davoren, Australian National University (Australia): *Logic-based design and synthesis of controllers for hybrid systems*

Noam Greenberg, Cornell University: *Admissibility and regularity* (in two parts)

September 2000

Alex Usvyatsov, Hebrew Univ.(Israel): *Simple theories*

Russell Miller, Cornell University: *Computable categoricity and trees*

Noam Greenberg, Cornell University: *Regularity and hyperregularity*

Noam Greenberg, Cornell University: *Post's problem for alpha recursion theory* (in two parts)

Vladimir Uspensky, Lomonosov State University of Moscow (Russia): *Kolmogorov's information theory versus Shannon's one*

Roman Tymkiv, Cornell University: *Elementary invariants for Boolean algebras* (in two parts)

October 2000

Yuval Gabay, Cornell University: *Finite injury priority arguments in alpha recursion theory* (in two parts)

Itai Ben-Yaacov, Ecole Normale Superieure (France): *Hyperimaginaries and simple theories* (in two parts)

Russell Miller, Cornell University: *Definability of incompleteness for Friedberg splittings*

Yuval Gabay, Cornell University: *Dynamic methods and blocking*

Nathaniel Miller, Cornell University: *Diagrams in Euclidean geometry: diagram satisfaction is NP-hard and a new hierarchy of diagrammatic Euclidean geometries*

November 2000

Yuval Gabay, Cornell University: *The splitting theorem in alpha-recursion theory*

Rajmohan Rajagopalan, Cornell University: *Density of the alpha-r.e. degree* (in four parts)

Charles Steinhorn, Vassar College: *An approach to model theory for finite structures*

January 2001

Christopher Hardin, Cornell University: *Reverse mathematics and the mean value theorem* (in three parts)

Joseph Miller, Cornell University: *Effective completeness theorem*

February 2001

Joseph Miller, Cornell University: *Model completeness and decidability*

Yuval Gabay, Cornell University: *Forcing and hyperdegrees* (in three parts)

Rajmohan Rajagopalan, Cornell University: *Omitting types and decidability*

Rajmohan Rajagopalan, Cornell University: *Effective omitting types theorem* (in two parts)

Richard Shore, Cornell University: *Decidable prime models*

March 2001

Yuval Gabay, Cornell University: *Minimal hyperdegrees*

Suman Ganguli, Cornell University: *Decidable models for modal logics with infinitary modalities: dynamic logic, temporal logic, epistemic logic*

Christopher Hardin, Cornell University: *Decidable saturated models* (in three parts)

Denis Hirschfeldt, University of Chicago: *Measures of relative randomness*

April 2001

Joseph Miller, Cornell University: *Characterizing fixed point sets for effective functions*

Christopher Hardin, Cornell University: *Decidable homogeneous models*

Michael Morley, Cornell University: *Finitely axiomatizable theories* (in two parts)

Noam Greenberg, Cornell University: *Vaught's theorem fails for decidable models*

Noam Greenberg, Cornell University: *Decidable $Aleph_1$ categorical theories*

Jesse Alt, Cornell University (undergraduate): *Strong normalization and confluence in reflective lambda-calculus*

May 2001

Vivian Morley, Ithaca, New York: *Indescernibles and decidability* (in two parts)

Oliver Club

August 2000

Wolfgang Woess, Technische Universitaet Graz (Austria): *Bounded harmonic functions on infinite graphs*

September 2000

Karen Vogtmann, Cornell University: *The geometry of spaces of finite labelled trees*

Craig Huneke, University of Kansas: *What is the dimension of a ring?*

J. M. Landsberg, Université de Toulouse (France) and Georgia Institute of Technology: *Construction and classification of complex simple Lie algebras via geometry*

Gregory Lawler, Duke University: *Calculating the intersection exponents for planar Brownian motion*

October 2000

Robert Erdahl, Queen's University (Canada): *Minkowski sums of Voronoi polytopes and commensurate Delaunay tilings*

Yakov Sinai, Princeton University: *Burgers' equation with random forcing*

Tony Iarrobino, Northeastern University: *What is a Hilbert scheme?*

Sumio Yamada, Cornell University: *Thurston classification of surface diffeomorphisms and Weil-Petersson geometry of Teichmüller spaces*

November 2000

Stephen Lichtenbaum, Brown University: *Zeta-functions and Euler characteristics*

Sergei Yakovenko, Weizmann Institute (Israel) and University of Toronto (Canada): *Transcendental algebraic-like functions*

Harvey Friedman, Ohio State University: *Does normal mathematics need new axioms?*

Vadim Kaloshin, New York University: *Growth of the number of periodic points for generic diffeomorphisms*

January 2001

Alexander Postnikov, University of California at Berkeley: *Schubert calculus and quantum cohomology*

February 2001

Ravi Vakil, Massachusetts Institute of Technology: *Branched covers of the sphere and the moduli space of curves: geometry, physics, representation theory, combinatorics*

Weimin Chen, State University of New York at Stony Brook: *Loop spaces of orbifolds*

Yuri Berest, Cornell University: *Differentially isomorphic curves*

Leonard Gross, Cornell University: *Dirichlet forms in holomorphic function spaces*

March 2001

Eleny Ionel, University of Wisconsin at Madison: *Symplectic sum formula for Gromov-Witten invariants and its applications*

Robert Ghrist, Georgia Institute of Technology: *Contact structures and the topology of fluids*

Gregory Margulis, Yale University: *Random walks on finite volume homogeneous spaces*

George Wilson, Imperial College (United Kingdom): *Bispectral symmetry and some related topics*

April 2001

Victor Reiner, University of Minnesota: *The geology of Gale diagrams*

Martin Grothaus, University of Bonn (Germany) and University of Bielefeld (Germany): *Scaling limit of stochastic dynamics in classical continuous systems — analytic and geometric aspects*

Joel Hass, University of California at Davis and the Institute for Advanced Study: *Geometry, topology and computational complexity*

Burak Ozbagci, Michigan State University: *Lefschetz fibrations*

May 2001

Gang Tian, Massachusetts Institute of Technology: *Symplectic surfaces in rational complex surfaces*

Olivetti Club

August 2000

Todd Kemp, Cornell University: *A new computational grid for colliding black holes; or, Why differential geometry is cool*

September 2000

David Revelle, Cornell University: *How to lose money gambling*

Noam Greenberg, Cornell University: *Non-standard analysis*

Richard Durrett, Cornell University: *Opportunities for graduate students in our VIGRE program*

Steven Sinnott, Cornell University: *Minimal polynomials and discriminants*

October 2000

Joseph Miller, Cornell University: *The semi-algebraic sets are closed under projection; and, Why a logician proved it*

Ferenc Gerlits, Cornell University: *Turning spheres inside out*

James Belk, Cornell University: *Algebraic graph theory*

G. Christopher Hruska, Cornell University: *Nonpositive curvature and the CAT(0) inequality*

November 2000

Suzanne Hruska, Cornell University: *An introduction to the complex Henon map*

W. Gordon Ritter, Cornell University: *Mathematics and physics of mirror symmetry*

Christopher Francisco, Cornell University: *Hilbert functions*

Swapneel Mahajan, Cornell University: *Quantum groups and differential forms*

January 2001

David Revelle, Cornell University: *Homeward bound: the inefficient journey*

February 2001

Ryan Budney, Cornell University: *Configuration spaces*

Todd Kemp, Cornell University: *An algebraic proof of Wiener's theorem*

Swapneel Mahajan, Cornell University: *Kontsevich made easy*

Christopher Hardin, Cornell University: *What set existence axioms are needed to prove the mean value theorem?*

March 2001

Alan Demlow, Cornell University: *Mixed methods: the ups and downs of approximating saddle point problems*

Nelia Charalambous, Cornell University: *Volume comparison and the growth of the fundamental group on Riemannian manifolds*

April 2001

Amy Szczepanski, Cornell University: *Nullstellensatz variations*

Nathaniel Miller, Cornell University: *Diagrams in geometry and the relationship between formal and informal mathematics*

Rajmohan Rajagopalan, Cornell University: *Finite injury and the Turing degrees: life isn't fair, but it's close enough*

Huibin Zhou, Cornell University: *Wavelets and statistics*

May 2001

Lee Gibson, Cornell University: *Exploring mathematical biology*

Probability Seminar

September 2000

Anita Winter, University of Erlangen (Germany): *Spatial branching models under the palm distribution: how to bring into focus the exceptional 'surviving mass'?*

Wolfgang Woess, Technische Universitaet Graz (Austria): *Identifying the Poisson boundary of random walks on graphs*

Masanori Hino, Kyoto University (Japan): *Exponential decay of positivity preserving semigroups on L^p*

Philip Protter, Cornell University: *Superhedging in incomplete markets*

October 2000

Krishna Athreya, Cornell University: *Random logistic maps*

Peter Winkler, Bell Labs: *Hard constraints on the Bethe lattice*

Vlada Limic, Cornell University: *Attracting edge property for a class of reinforced random walks*

Ed Perkins, University of British Columbia (Canada): *Super-chains and degenerate stochastic differential equations*

November 2000

David Griffeath, University of Wisconsin: *A mathematical model for traffic jams: some results and conjectures*

Gennady Samorodnitsky, Cornell University: *Strange intervals of a stochastic process and long range dependence*

Richard Durrett, Cornell University: *Some new results for the stepping stone model*

Orjan Stenflo, Georgia Institute of Technology: *Invariant measures of iterated function systems*

December 2000

Sigurd Assing, University of Bielefeld (Germany): *Infinite dimensional Langevin equations: uniqueness and rate of convergence for finite dimensional approximations*

January 2001

David Revelle, Cornell University: *Rate of escape of random walk on wreath products*

February 2001

Laurent Saloff-Coste, Cornell University: *Lower bound for convergence in total variation: D. Wilson's lemma*

Joseph Yukich, Lehigh University: *Limit theory for random sequential packing*

Thomas Salisbury, York University (Canada): *Conditioned super Brownian motion*

José Ramírez, Cornell University: *Short term Gaussian behavior of reversible processes*

March 2001

Vygantas Paulauskas, Vilnius University (Lithuania) and Georgia Institute of Technology: *On random convex compact sets in Banach spaces*

Balint Virag, Massachusetts Institute of Technology: *Fast graphs for the random walker*

Alexander Bendikov, Cornell University: *Short time behavior of Brownian motion on compact groups*

April 2001

Martin Grothaus, University of Bonn (Germany) and University of Bielefeld (Germany): *Scaling limit of stochastic dynamics in classical continuous systems*

Christophe Pittet, University of Toulouse (France) and Cornell University: *Random walks on finitely generated groups*

Harold Widom, University of California at Santa Cruz: *A growth model in a random environment*

Vladas Sidoravicius, Instituto de Matemática Pura e Aplicada (Brazil): *Mixing properties for mechanical motion of a charged particle in a random medium*

Rafail Khasminskii, Wayne State University: *On the averaging principle for diffusion processes with null-recurrent fast component*

Smorgasbord Seminar (Math 402)

August 2000

Ravi Ramakrishna, Cornell University: *Fermat's last theorem*

September 2000

Clifford Earle, Cornell University: *Conformal and quasiconformal maps*

Sergei Artemov, Cornell University: *Computability and logic: the limits of exact knowledge*

Robert Strichartz, Cornell University: *The shape of the error*

Yulij Ilyashenko, Cornell University: *Dynamical systems: determinism or chaos?*

October 2000

Irena Peeva, Cornell University: *Lexicographic ideals*

Kenneth Brown, Cornell University: *Symmetric functions and probability*

Robert Connelly, Cornell University: *Straightening polygonal arcs: the Carpenter's rule problem*

Allen Hatcher, Cornell University: *A stroll through the garden of knots*

November 2000

Vlada Limic, Cornell University: *Edge reinforced random walks*

Konstantin Rybnikov, Cornell University: *Coverings with overlapping spheres and Delaunay tilings*

Lars Wahlbin, Cornell University: *Superconvergence in projection approximations*

Topology and Geometric Group Theory Seminar

September 2000

Ryan Budney, Cornell University: *A faithful representation of the mapping class group of the genus two surface*

G. Christopher Hruska, Cornell University: *Quasiconvexity in nonpositively curved spaces with isolated flats*

John Meakin, University of Nebraska at Lincoln: *Geodesics in surface groups*

James Conant, Cornell University: *An introduction to Vassiliev invariants* (in two parts)

James Conant, Cornell University: *Finite type invariants, gropes and claspers*

October 2000

Zoran Sunik, Cornell University: *Periodic groups of tree automorphisms with intermediate word growth* (in two parts)

Laurent Bartholdi, University of Geneva (Switzerland): *Spectra of fractal groups and parabolic subgroups*

An-Min Li, Sichuan University (China): *Gluing formula for Gromov-Witten invariants and applications*

Ryan Budney, Cornell University: *Mapping class groups of genus two 3-manifolds*

November 2000

Sema Salur, Cornell University: *The deformation theory of special Lagrangian submanifolds*

John Meier, Binghamton University and Lafayette College: *Why $P\Sigma_4$ is simply connected at infinity*

Laura Anderson, Texas A&M University: *Matroid bundles*

February 2001

Zoran Sunik, Cornell University: *Branch groups*

G. Christopher Hruska, Cornell University: *CAT(0) groups with well-defined boundaries*

James Conant, Cornell University: *Finite type invariants in different categories*

Christophe Pittet, Cornell University: *Quadratic Dehn functions*

March 2001

Karen Vogtmann, Cornell University: *Quotients of automorphism groups of free groups*

Ryan Budney, Cornell University: *Linear representations of mapping class groups of surfaces*

James Conant, Cornell University: *A transfinite induction in the theory of knots*

April 2001

Enric Ventura, Universitat Politècnica de Catalunya (Spain): *A description of auto fixed subgroups in free groups*

Benoit Chaluleau, University of Toulouse (France): *Examples of homogeneous Riemannian manifolds not quasi-isometric to any finitely-generated group*

Abby Thompson, University of California at Davis: *Tunnel number one knots*

Tara Brendle, Columbia University: *On the linearity problem for mapping class groups*

May 2001

Konstantin Rybnikov, Cornell University: *Gain graphs and the Maxwell-Cremona correspondence*

Undergraduate Mathematics Club

September 2000

Louis Billera, Cornell University: *Geometry of the space of phylogenic trees*

October 2000

Kenneth Brown, Cornell University: *Mobius inversion and Euler's formula*

Debbie Grier, Cornell University (undergraduate): *The combinatorics of hyperplane arrangements*

Alex Smith, Cornell University (undergraduate): *The music of fractals*

November 2000

Robert Connelly, Cornell University: *Why things don't fall down, and why arms open*

Chan-Ho Suh, Cornell University (undergraduate): *A quick and dirty introduction to public key cryptography; or, all you need to encrypt a love letter*

January 2001
Robert Strichartz, Cornell University: *Summer research experiences for undergraduates*

February 2001
Richard Durrett, Cornell University: *Lego brick models of chromosome evolution*

March 2001
Jordan Barry, Cornell University (undergraduate): *Information theory and cannibalism*

Oded Yacobi, Cornell University (undergraduate): *Proving the existence of a Hamiltonian circuit*

Chan-Ho Suh, Cornell University (undergraduate): *Being wild: a series of counterintuitive embeddings into Euclidean 3-space*

April 2001
Carolyn Sealfon, Cornell University (undergraduate): *The calculus of variations and Noether's theorem*

Stephanie van Willigenburg, Cornell University: *Zigzags and algebra*

VIGRE Colloquium

In connection with the department's VIGRE grant, this monthly colloquium is held with the purpose of introducing graduate students and professors in the department to some of the possible applications of mathematics, by inviting faculty from other departments at Cornell to give talks. Since the idea of the talk is to expose the audience to research possibilities, speakers are asked to talk about something that has not yet reached a definitive final form and to indicate open problems.

October 2000
Eva Tardos, Computer Science: *How bad is selfish routing?*

November 2000
Stephen P. Ellner, Ecology and Evolutionary Biology: *Understanding simple population dynamics*

Steven Tanksley, Plant Breeding: *Genomics: the fusion of life sciences, computation and engineering*

January 2001
Steven H. Strogatz, Theoretical and Applied Mechanics: *Exploring complex networks*

February 2001
Walter Mebane, Government: *Mathematical sciences and the law lecture series: Evidence of excessive Buchanan vote share in Palm Beach County, Florida*

March 2001
Paul Edelman, Mathematics and Law, Vanderbilt University: *Mathematical sciences and the law lecture series: Cooperative games, voting power and the Supreme Court*

Theodore Eisenberg, Law School, and Martin Wells, Biometry and the Law School: *Mathematical sciences and the law lecture series: Forecasting life and death*

Jon Kleinberg, Computer Science: *Classification with pairwise relationships: metric labeling and Markov random fields*

April 2001
Philip Protter, Operations Research and Industrial Engineering: *Asset pricing theory for mathematicians*

May 2001
David Mermin, Physics: *Quantum mechanics and computation*

2000–01 Faculty Publications

Dan Barbasch and Allen Moy, *A new proof of the Howe conjecture*, JAMS **13** (2000), 639–650.

Dan Barbasch, *Orbital integrals of nilpotent orbits*, Proceedings of Symposia in Pure Mathematics **68** (2000), 97–110.

Yuri Berest and George Wilson, *Automorphisms and ideals of the Weyl algebra*, Math. Ann. **318** no. 1 (2000), 127–147.

Yuri Berest, *On the structure of singularities of integrable Schrodinger operators*, Lett. Math. Phys., to appear.

Yuri Berest, *Integrable systems and noncommutative algebra geometry*, Proceedings of the Conference "Mathematical Methods of Regular Dynamics," Leeds, UK, April 2000, to appear.

Louis Billera and Gábor Hetyei, *Linear inequalities for flags in graded partially ordered sets*, J. Comb. Theory, Series A, **89** (2000), 77–104.

Louis Billera and Richard Ehrenborg, *Monotonicity of the cd-index for polytopes*, Math. Z. **233** (2000), 421–441.

Louis Billera and N. Liu, *Noncommutative enumeration in graded posets*, J. Algebraic Combinatorics **12** (2000), 7–24.

Louis Billera and Gábor Hetyei, *Decompositions of partially ordered sets*, Order **17** (2000), 141–166.

Louis Billera, Susan Holmes and **K. Vogtmann**, *Geometry of the space of phylogenetic trees*, Advances in Applied Mathematics, to appear.

Louis Billera and Persi Diaconis, *A geometric interpretation of the metropolis algorithm*, Statistical Science, to appear.

James Bramble and Xuejun Zhang, *Multigrid methods*; a chapter in the Handbook for Numerical Analysis (P. Ciarlet and J. L. Lions, eds.), North Holland, 2001.

Marshall Cohen and Colin Rourke, *The surjectivity problem for one-generator, one-relator extensions of torsion-free groups*, Geometry and Topology **5** (2001), 127–142.

Robert Connelly, Erik Demaine and Günter Rote, *Every polygon can be untangled*, Proceedings of the 16th European Workshop on Computational Geometry, March 31–15, 2000, to appear.

Ted Cox, **Richard Durrett** and Ed Perkins, *Rescaled voter models converge to super-Brownian motion*, Ann. Prob. **28** (2000), 185–234.

Richard Broughton, **Richard Durrett** and S. Stanley, *Quantification of homoplasy for nucleotide transitions and transversions and a reexamination of assumptions in weighted phylogenetic analysis*, Systematic Biology **49** (2000), 617–627.

Richard Durrett and Simon Levin, *Lessons on pattern formation from planet WATOR*, J. Theor. Biol. **205** (2000), 201–214.

Daniel Brown, **Richard Durrett**, David Shmoys, Steven Tanksley and Todd Vision, *Selective mapping: a strategy for optimizing the construction of high-density linkage maps*, Genetics **155** (2000), 407–420.

Chip Aquadro, **Richard Durrett**, Semyon Kruglyak and Malcolm Schug, *Distribution and abundance of microsatellites in the yeast genome can be explained by a balance between slippage events and point mutations*, Mol. Biol. Evol. **17** (2000), 1210–1219.

Richard Durrett, *Probability Theory: An Introduction to its Applications*, Mathematics Unlimited 2001 and Beyond, Springer-Verlag, New York, 2001.

Richard Durrett, *Mutual invadability implies coexistence in spatial models*, Memoirs of the AMS, to appear.

Richard Durrett and **Vlada Limic**, *On the quantity and quality of single nucleotide polymorphisms in the human genome*, Stoch. Proc. Appl., to appear.

Persi Diaconis and **Richard Durrett**, *Chutes and ladders in Markov chains*, J. Theor. Prob., to appear.

Arkendra De, **Richard Durrett**, Michael Ferguson and Suzanne Sindi, *The equilibrium distribution for a generalized Sankoff-Ferretti model accurately predicts chromosome size distributions in a wide variety of species*, J. Appl. Prob., to appear.

Eugene Dynkin, *A probabilistic approach to the equation* $Lu = -u^2$, J. Functional Analysis **170** (2000), 450.

Eugene Dynkin, *Solutions of semilinear differential equations related to harmonic functions*, J. Functional Analysis **170** (2000), 464.

Eugene Dynkin, *Probability and nonlinear analysis*, Canadian Mathematical Society Conference Proceedings **28** (2000), 139.

Eugene Dynkin and Sergei Kuznetsov, *Rough boundary trace for solutions of* $Lu = \psi(u)$, Probability Theory and its Applications **45** (2000), 740.

Eugene Dynkin, *Branching exit Markov systems and superprocesses*, Annals of Probability, to appear.

Clifford Earle, *The Ahlfors mollifiers*; in "In the tradition of Ahlfors and Bers," Contemporary Mathematics **256** (2000), 11–16.

Clifford Earle, Frederick Gardiner and Nikola Lakic, *Asymptotic Teichmüller space, Part I: The complex structure*, Contemporary Mathematics **256** (2000), 17–38.

Clifford Earle and Sudeb Mitra, *Variation of moduli under holomorphic motions*, Contemporary Mathematics **256** (2000), 39–67.

Clifford Earle and Adam Epstein, *Quasiconformal variation of slit domains*, Proc. Amer. Math. Soc., to appear.

José Escobar, *A comparison theorem for the first nonzero Steklov eigenvalue*, J. Functional Analysis.

José Escobar, *On the prescribed scalar curvature problem on compact manifolds with boundary*, Differential Geometric Methods in the Control of PDEs, Contemporary Mathematics **268**.

Vesselin Gasharov and **Irena Peeva**, *Deformations of codimension 2 toric varieties*, Compositio Mathematica **123** (2000), 225–241.

Vesselin Gasharov, *Sufficiency of Lakshmibai-Sandhya singularity conditions for Schubert varieties*, Compositio Mathematica **126** (2001), 47–56.

Vesselin Gasharov, Irena Peeva and Volkmar Welker, *Coordinate subspace arrangements and monomial ideals*, Proceedings of the Osaka Meeting on Commutative Algebra and Combinatorics, to appear.

Marc Chardin, **Vesselin Gasharov** and **Irena Peeva**, *Extremal Betti numbers*, Proceedings AMS, to appear.

Fernando Galaz-Fontes, **Leonard Gross** and Stephen Sontz, *Reverse hypercontractivity over manifolds*, Arkiv for Mathematik, to appear.

Thomas Deck and **Leonard Gross**, *Hankel operators over complex manifolds*, Pacific J. Math., to appear.

John Guckenheimer and Alexander Khibnik, *Torus maps from weak coupling of strong resonances*, Contemporary Mathematics, Amer. Math. Soc. Transl. (2) (2000), 205–218.

Won Gyu Choe and **John Guckenheimer**, *Using dynamical systems tools in Matlab*, Proceedings of IMA Workshops, **IMA 119** (2000), 85–114.

John Guckenheimer and Allan Willms, *Analysis of a subcritical Hopf-homoclinic bifurcation*, Physica D **139** (2000), 195–216.

John Guckenheimer and Brian Meloon, *Computing periodic orbits and their bifurcations with automatic differentiation*, SIAM J. Sci. Stat. Comp. **22** (2000), 951–985.

John Guckenheimer, *Periodic orbits of vector fields: computational challenge*, International Conference on Differential Equations, Berlin 1999 (B. Fiedler, K. Gröger and J. Spreckels, eds.), World Scientific (2000), 899–915.

John Guckenheimer, Kathleen Hoffman and Warren Weckesser, *Numerical computation of canards*, International J. Bifurcation and Chaos **10** (2000), 2669–2687.

John Guckenheimer, Kathleen Hoffman and Warren Weckesser, *Global bifurcations of periodic orbits in the forced van der Pol equation*, Takens Festschrift (2001), in press.

John Guckenheimer, *Numerical analysis of dynamical systems*, Handbook of Dynamical Systems, in press.

John Guckenheimer, *Computing periodic orbits*; in Fluid Mechanics and the Environment (J. Lumley, ed.), in press.

Timothy Healey and Hansjorg Kielhöfer, *Global continuation via higher-gradient regularization and singular limits in forced one-dimensional phase transitions*, SIAM J. Math. Anal. **31** (2000), 1307.

Christophe Gugg, **Timothy Healey**, Hansjorg Kielhöfer and Stanislaus Maier-Paape, *Nonlinear standing and rotating waves on the sphere*, Nonlinear Standing and Rotating Waves on the Sphere **166** (2000), 402.

Timothy Healey, *Global continuation in displacement problems of nonlinear elastostatics via the Leray-Schauder degree*, Arch. Rational Mech. Anal. **152** (2000), 273.

Timothy Healey, Hansjorg Kielhöfer and Errol Montes, *Free nonlinear vibrations for plate equations on the equilateral triangle*, Nonlinear Anal. TMA, to appear.

Gabor Domokos and **Timothy Healey**, *Hidden symmetry of global solutions in twisted elastic rings*, J. Nonlinear Science, to appear.

David Henderson, *Square roots in the Sulba Sutras*; a chapter in Geometry at Work: Papers in Applied Geometry (C. Gorini, ed.), MAA Notes **53**, 2000, 39–45.

David Henderson and Daina Taimina, *Experiencing Geometry in Euclidean, Spherical and Hyperbolic Spaces*, Prentice-Hall, 2001.

David Henderson and Daina Taimina, *Crocheting the hyperbolic plane*, Mathematical Intelligencer **23** no. 2 (2001), 17–28.

David Henderson, *Differential geometry*, invited article in Encyclopaedia Britannica, to appear.

David Henderson and Daina Taimina, *Non-Euclidean geometry*, invited article in Encyclopaedia Britannica, to appear.

John Hubbard, Peter Papadopol and Vladimir Veselov, *A compactification of Hénon mappings in $\mathbb{C}^2$ as dynamical systems*, Acta Math. **184** no. 2 (2000), 203–270.

Gregery Buzzard and **John Hubbard**, *A Fatou-Bieberbach domain avoiding a neighborhood of a variety of codimension 2*, Mathematische Annalen **316** (2000), 699–702.

Clara Bodelón, Robert Devaney, Lisa Goldberg, Michael Hayes, **John Hubbard** and Gareth Roberts, *Dynamical convergence of polynomials to the exponential*, J. Difference Equations and Applications **6** (2000), 275–307.

John Hubbard, Dierk Schleicher and Scott Sutherland, *How to really find roots of polynomials by Newton's method*, Inventiones Mathematicae, to appear.

Xavier Buff, Christian Henriksen and **John Hubbard**, *Farey curves*, J. Exper. Math., to appear.

Samer Habre, **John Hubbard** and **Beverly West**, *The convergence of an Euler approximation of an initial value problem is not always obvious*, Amer. Math. Monthly, to appear.

John Hubbard and Ralph Oberste-Vorth, *Linked solenoid mappings and the non-transversality locus invariant*, Indiana Math. Journal, to appear.

Lawrence Brown, **J. T. Gene Hwang** and Axel Munk, *The bioequivalence problems — finding a compromise between theory and practice*, Biomedical Journal **49** (2000), 531–552.

J. T. Gene Hwang and Ming Yang, *An optimality theory for mid p-values in* 2×2 *contingency tables*, Statistica Sinica, to appear.

J. T. Gene Hwang and Weizhen Wang, *A nearly unbiased test for individual bioequivalence*, Stat. Inference and Planning, to appear.

Yulij Ilyashenko, *Hilbert type numbers for Abel equations, growth and zeros of holomorphic functions*, Nonlinearity **13** (2000), 1337.

Anton Gorodetski and **Yulij Ilyashenko**, *Some properties of skew products over a horseshoe and solenoid*, Proceedings of the Steklov Institute **231** (2000), 96.

John Guckenheimer and **Yulij Ilyashenko**, *The duck and the devil: canards on the staircase*, Moscow Mathematical Journal **1** (2001), 37.

Freddy Dumortier, **Yulij Ilyashenko** and Christiane Rousseau, *Normal forms near a saddle-node and applications to finite cyclicity of graphics*, Ergodic Theory and Dynamical Systems, to appear.

Amir Dembo, Alberto Gandolfi and **Harry Kesten**, *Greedy lattice animals: negative values and unconstrained maxima*, Ann. Probab., to appear.

Yuji Hamana and **Harry Kesten**, *A large deviation result for the range of random walk and for the Wiener sausage*, Probab. Theory Rel. Fields, to appear.

Yuji Hamana and **Harry Kesten**, *Large deviations for the range of an integer valued random walk*, Ann. Inst. Henri Poincaré, to appear.

David Harel, **Dexter Kozen** and Jerzy Tiuryn, *Dynamic Logic*, MIT Press, 2000.

Russell Miller, *The* Δ^0_2*-spectrum of a linear order*, Journal of Symbolic Logic **66** (2001), 470–486.

Russell Miller, *Definable incompleteness and Friedberg splittings*, Journal of Symbolic Logic, to appear.

Russell Miller, *Orbits of computably enumerable sets: low sets can avoid an upper cone*, Annals of Pure and Applied Logic, to appear.

Anil Nerode, *Foreword to principles of modeling and asynchronous distributed simulation of complex systems*, IEEE Press, 2000.

Mark Foresti, **Anil Nerode**, Jaideep Srivastava and Duminda Wijesekera, *Human perception of media and synchronization losses*, ACM Multimedia Systems (2000).

Bakhadyr Khoussainov and **Anil Nerode**, *Automata Theory on Finite and Infinite Strings*, Birkhaüser Boston, 2001.

Jennifer Davoren and **Anil Nerode**, *Logics for hybrid systems*; in special IEEE Transactions issue on hybrid systems (P. Antsaklis, ed.), 2001.

Xiaolin Ge, Sumit Ghosh, Wolf Kohn, Tony Lee, Jin Lu and **Anil Nerode**, *A mathematical framework for asynchronous, distributed, decision-making systems with semi-autonomous entities: algorithm synthesis, simulation and evaluation*, IEICE Transactions on Fundamentals (2001).

M. Ganesh, **Anil Nerode**, Jaideep Srivastava and Duminda Wijesekera, *Normal forms and syntactic completeness proofs for functional dependencies*, J. Theoretical Computer Science (2001).

Anil Nerode, Shwetal Parikh, Jaideep Srivastava, Srivastan Varadarajan and Duminda Wijesekera, *Performance evaluation of media losses in the continuous media toolkit*, ACM workshop in Software Engineering Issues in Multimedia (2001); IEEE workshop in Quality of Service (2001).

M. Ganesh, **Anil Nerode**, Jaideep Srivastava and Duminda Wijesekera, *Normal forms for functional independencies*, J. Theoretical Computer Science (2001).

Valentine Genon-Catalot, Catherine Laredo and **Michael Nussbaum**, *Asymptotic equivalence of estimating a Poisson intensity and a positive diffusion drift*, Annals of Statistics, to appear.

Lawrence Payne and Brian Straughan, *Unconditional nonlinear stability in temperature dependent viscosity flow in a porous medium*, Studies in Applied Mathematics **105** (2000), 59.

Karen Ames and **Lawrence Payne**, *Saint Venant type decay results for ill posed elliptic problems*, Math. Models and Methods in Applied Sciences **10** (2000), 771–783.

Lawrence Payne and J. C. Song, *Spatial decay for a model of double diffusion convection in Darcy and Brinkman flows*, ZAMP **51** (2000), 867–889.

Lawrence Payne and Gérard Philippin, *On the spatial decay of solutions to a quasilinear parabolic initial-boundary value problem and their derivatives*, SIAM J. Math. Anal. **32** (2000), 291–303.

Lawrence Payne and J. C. Song, *Convergence results for generalized heat conduction as the relaxation time tends to zero*, J. Math. Anal. Appl. **256** (2001), 175–189.

Lawrence Payne, José-Francisco Rodrigues and Brian Straughan, *Effect of anisotropic permeability on*

Darcy's law, Math. Methods in the Appl. Sciences **24** (2001), 427–438.

Luchezar Avramov and **Irena Peeva**, *Finite regularity and Koszul algebra*, Amer. J. Math. **123** (2001), 275–281.

Irena Peeva, *Hyperplane arrangements and linear strands in resolutions*, Transactions of the American Mathematical Society, to appear.

Irena Peeva and **Michael Stillman**, *The toric Hilbert scheme*, Duke Mathematics Journal, to appear.

Irena Peeva and **Michael Stillman**, *Local equations of the toric Hilbert scheme*, J. Pure and Applied Algebra, to appear.

José Ramírez, *Short time asymptotics in Dirichlet spaces*, Comm. Pure Appl. Math. **54** (2001), 259–293.

Richard Rand, *Nonlinear Vibrations*, a downloadable book located at www.tam.cornell.edu/randdocs/.

K. M. Cipolla, W. L. Keith, Deepak Ramani and **Richard Rand**, *Theoretical study of a submarine towed-array lifting device*, Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in AD-Vol. 61 "Control of Vibration and Noise: New Millenium", eds. H. Tzou, M. Golnaraghi, C. Radcliffe, pp. 39–50, ASME, 2000.

Richard Rand, *The dynamics of resonant capture*, Proceedings of the First International Symposium on Impact and Friction of Solids, Structures and Intelligent Machines, June 27–30, 1998, Ottawa, pp. 91–94, World Scientific, 2000.

Deepak Ramani and **Richard Rand**, *Relaxing nonholonomic constraints*, Proceedings of the First International Symposium on Impact and Friction of Solids, Structures and Intelligent Machines, June 27–30, 1998, Ottawa, pp. 113–116, World Scientific, 2000.

Leslie Ng and **Richard Rand**, *Bifurcations in a Mathieu equation with cubic nonlinearities*, Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in AMD-Vol. 241 "Nonlinear Dynamics and Stochastic Mechanics," eds. W. Xie, N. Namachchivaya, B. Balachandran, pp. 1–12, ASME, 2000.

Richard Rand and A. K. Sen, *Dynamics of two time-delay coupled relaxation oscillators of the van der Pol type*, Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in DE-Vol. 108/DSC-Vol. 68 "Dynamics, Acoustics and Simulations", eds. R. Han, K. Lee, A. Luo, pp. 53-60, ASME, 2000.

H. C. Howland, T. Li, **Richard Rand** and E. T. Wirkus, *A mathematical model of a retinal oscillator*, Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in BDE-Vol. 48 "2000 Advances in Bioengineering" ed. T. Conway, pp. 89–90, ASME, 2000.

Robert Erdahl, **Konstantin Rybnikov** and S. Ryshkov, *On traces of d-stresses in the skeletons of lower dimensions of homology d-manifolds*, Europ. J. Combin. (2001), to appear.

Persi Diaconis and **Laurent Saloff-Coste**, *Bounds for Kac's master equation*, Communications Mathematical Physics **209** (2000), 729–755.

Alexander Bendikov and **Laurent Saloff-Coste**, *Off- and on-diagonal heat kernel behaviors on certain infinite dimensional local Dirichlet spaces*, Amer. J. Mathematics **122** (2000), 1205–1263.

Christophe Pittet and **Laurent Saloff-Coste**, *On the stability of the behavior of random walks on groups*, J. Geometric Analysis **10** (2001), 713–737.

Laurent Saloff-Coste, *Aspects of Sobolev Type Inequalities*, London Mathematical Society Lecture Note Series, Cambridge University Press, 2001.

Waldemar Hebisch and **Laurent Saloff-Coste**, *On the relation between elliptic and parabolic Harnack inequalities*, Annales de l'Institut Fourier, to appear.

Alexander Bendikov and **Laurent Saloff-Coste**, *Central Gaussian semigroups of measures with continuous densities*, J. Functional Analysis, to appear.

Alexander Bendikov and **Laurent Saloff-Coste**, *On the absolute continuity of Gaussian measures on locally compact groups*, J. Theoretical Probability, to appear.

T. Coulhon, Ilkka Holopainen and **Laurent Saloff-Coste**, *Harnack inequality and hyperbolicity for subelliptic p-Laplacians with applications to Picard type theorems*, Geometric and Functional Analysis, to appear.

Alexander Bendikov and **Laurent Saloff-Coste**, *Brownian motion on compact groups in infinite dimension*, Proc. of an Edinburgh-ICMS Conference, to appear.

Alfred Schatz, *Pointwise error estimates and asymptotic error expansion inequalities for the finite element method on irregular grids; Part II: Local estimates*, SIAM J. Numerical Analysis (2000).

W. Hoffmann, **Alfred Schatz, Lars Wahlbin** and G. Wittum, *Asymptotically exact a posteriori estimators for the pointwise gradient error on each element in irregular meshes; Part I: A smooth problem with globally quasi-uniform meshes*, Math. Comp., to appear.

Karl Ambos-Spies, Denis Hirschfeldt and **Richard Shore**, *Undecidability and 1-types in intervals of the c.e. degrees*, Annals of Pure and Applied Logic **106** (2000), 1–48.

Bakhadyr Khoussainov and **Richard Shore**, *On the solution of the Goncharov-Ash problem and the spectrum problem in the theory of computable models*, Dokl. Akad. Nauk **371** (2000), 30–31 (Russian); English version: Doklady Mathematics **61** (2000), 178–179.

P. Fejer and **Richard Shore**, *Every incomplete computably enumerable truth-table degree is branching*, Archive for Mathematical Logic **40** (2001), 113–123.

Denis Hirschfeldt, Bakhadyr Khoussainov, **Richard Shore** and A. Slinko, *Degree spectra and computable dimension in algebraic structures*, Annals of Pure and Applied Logic, to appear.

Richard Shore and Ted Slaman, *A splitting theorem for n-REA degrees*, Proc. Amer. Mathematical Society, to appear.

Richard Shore, *Computable structures: presentations matter*, Proceedings of the Int'l Cong. LMPS, to appear.

Richard Shore and Y. Yang, *A $nonlow_2$ r.e. degree with the extension of embeddings properties of a low_2 degree*, Mathematical Logic Quarterly, to appear.

Samuel Buss, Alexander Kechris, Anand Pillay and **Richard Shore**, *The prospects for mathematical logic in the twenty-first century*, Bulletin of Symbolic Logic **7** (2001), 169–196.

Arkady Berenstein and **Reyer Sjamaar**, *Coadjoint orbits, moment polytopes and the Hilbert-Mumford criterion*, J. Amer. Math. Soc. **13** no. 2 (2000), 433–466.

Reyer Sjamaar and Luis O'Shea, *Moment maps and Riemannian symmetric pairs*, Math. Ann. **317** no. 3 (2000), 415–457.

Eric Bedford and **John Smillie**, *Polynomial diffeomorphisms of $\mathbb{C}^2$ VIII: Quasi-expansion*, Amer. J. Mathematics, to appear.

Jun Kigami, Daniel Sheldon and **Robert Strichartz**, *Green's functions on fractals*, Fractals, to appear.

Robert Strichartz, *The Laplacian on the Sierpinski gasket via the method of averages*, Pacific J. Mathematics, to appear.

Jun Kigami, **Robert Strichartz** and Katharine Walker, *Constructing a Laplacian on the diamond fractal*, Experimental Mathematics, to appear.

Robert Strichartz, *Harmonic mappings of fractals I: mapping the Sierpinski gasket to the circle*, Proc. AMS, to appear.

Toshinoru Oaku, Nobuki Takayama and **Harrison Tsai**, *Polynomial and rational solutions of holonomic systems*, Journal of Pure and Applied Algebra, to appear.

Harrison Tsai and Uli Walther, *Computing homomorphisms between holonomic D-modules*, Journal of Symbolic Computation, to appear.

Mircea Mustata, Gregory Smith, **Harrison Tsai** and Uli Walther, *D-modules on smooth toric varieties*, Journal of Algebra, to appear.

Harrison Tsai, *Algorithms for associated primes, Weyl closure and local cohomology of D-modules*, Proceedings of Guanajuato conference on local cohomology, to appear.

Warwick Tucker, *Computational algorithms for ordinary differential equations*, EQUADIFF 99, World Scientific, Singapore, 2000.

Warwick Tucker, *A rigorous ODE solver and Smale's 14th problem*, Foundations of Computational Mathematics, to appear.

Gilbert Levitt and **Karen Vogtmann**, *Whitehead's algorithm for surface groups*, Topology **39** no. 6 (2000), 1239–1251.

Martin Bridson and **Karen Vogtmann**, *Automorphisms of automorphisms of free groups*, J. Algebra **229** no. 2 (2000), 785–792.

Martin Bridson and **Karen Vogtmann**, *The symmetries of Outer space*, Duke Math. J., to appear.

Sava Krstic, Martin Lustig and **Karen Vogtmann**, *An equivariant Whitehead algorithm*, Proceedings of the Edinburgh Mathematical Society, to appear.

Vidar Thomée and **Lars Wahlbin**, *Stability and analyticity in maximum-norm for simplicial Lagrange finite element semidiscretizations of parabolic equations with Dirichlet boundary conditions*, Numer. Math. **87** (2000), 373–389.

Ricardo Nochetto and **Lars Wahlbin**, *Positivity preserving finite element approximation*, Math. Comp., to appear.

The Faculty and their Research

•**Dan M. Barbasch**, Professor; Ph.D. (1976) University of Illinois; Representation theory of reductive Lie groups.

Yuri Berest, Assistant Professor; Ph.D. (1997) Université de Montreal (Canada); Partial differential equations, mathematical physics, algebraic geometry.

Louis Billera, Professor; Ph.D. (1968) City University of New York; Geometric and algebraic combinatorics.

James H. Bramble, Professor Emeritus; Ph.D. (1958) University of Maryland; Numerical solutions of partial differential equations.

Kenneth S. Brown, Professor; Ph.D. (1971) Massachusetts Institute of Technology; Algebra, topology, group theory, probability.

Stephen U. Chase, Professor and Associate Chair; Ph.D. (1960) University of Chicago; Algebra, algebraic number theory, homological algebra.

Marshall M. Cohen, Professor; Ph.D. (1965) University of Michigan; Topology, geometric (combinatorial) group theory.

Robert Connelly, Professor; Ph.D. (1969) University of Michigan; Geometry, rigidity, topology.

•**R. Keith Dennis**, Professor; Ph.D. (1970) Rice University; Commutative and non-commutative algebra, algebraic K-theory, group theory, mathematical bibliography.

Richard Durrett, Professor; Ph.D. (1976) Stanford University; Problems in probability theory that arise from ecology and genetics.

Eugene B. Dynkin, Professor; Ph.D. (1948), Dr. of Science (1951) Moscow University; Probability theory, Lie groups.

Clifford J. Earle, Professor; Ph.D. (1962) Harvard University; Complex variables, Teichmüller spaces.

José F. Escobar, Professor; Ph.D. (1986) University of California at Berkeley; Partial differential equations; differential geometry.

Roger H. Farrell, Professor Emeritus; Ph.D. (1959) University of Illinois; Mathematical statistics, measure theory.

Leonard Gross, Professor; Ph.D. (1958) University of Chicago; Functional analysis, constructive quantum field theory.

John M. Guckenheimer, Professor; Ph.D. (1970) University of California at Berkeley; Dynamical systems.

Allen Hatcher, Professor; Ph.D. (1971) Stanford University; Geometric topology.

Timothy Healey, Professor of Theoretical and Applied Mechanics; Ph.D. (1985) University of Illinois; Nonlinear elasticity, nonlinear analysis, partial differential equations.

•**David W. Henderson**, Professor; Ph.D. (1964) University of Wisconsin; Geometry, educational mathematics.

•**John H. Hubbard**, Professor; Doctorat d'Etat (1973) Université de Paris Sud; Analysis, differential equations, differential geometry.

J.T. Gene Hwang, Professor; Ph.D. (1979) Purdue University; Statistics, confidence set theory.

Yulij Ilyashenko, Professor; Ph.D. (1969) Moscow State University; Dynamical systems.

Peter J. Kahn, Professor; Ph.D. (1964) Princeton University; Symplectic topology/geometry.

Harry Kesten, Goldwin Smith Professor; Ph.D. (1958) Cornell University; Probability theory, limit theorems, percolation theory.

Dexter Kozen, Professor of Computer Science; Ph.D. (1977) Cornell University; Computational theory, computational algebra and logic, logics and semantics of programming languages.

G. Roger Livesay, Professor Emeritus; Ph.D. (1952) University of Illinois; Differential topology, group actions.

Michael D. Morley, Professor; Ph.D. (1962) University of Chicago; Mathematical logic, model theory.

Anil Nerode, Professor and Director of the Center for Foundations of Intelligent Systems; Ph.D. (1956) University of Chicago; Mathematical logic, recursive functions, computer science, mathematics of AI, control engineering.

Michael Nussbaum, Professor; Ph.D. (1979) Academy of Sciences Berlin (Germany); Mathematical statistics.

Lawrence E. Payne, Professor Emeritus; Ph.D. (1950) Iowa State University; Partial differential equations, ill-posed and nonstandard problems.

Philip Protter, Professor of Operations Research and Industrial Engineering; Ph.D. (1975) University of California at San Diego; Stochastic analysis, stochastic finance theory and Markov processes.

Irena Peeva, Assistant Professor; Ph.D. (1995) Brandeis University; Commutative algebra and algebraic geometry.

•**Richard Platek**, Associate Professor; Ph.D. (1966) Stanford University; Mathematical logic, recursion theory, set theory, computer science.

Ravi Ramakrishna, Assistant Professor; Ph.D. (1992) Princeton University; Algebraic number theory.

Richard Rand, Professor of Theoretical and Applied Mechanics; Sc.D. (1967) Columbia University; Applied mathematics and differential equations.

James Renegar, Professor of Operations Research and Industrial Engineering; Ph.D. (1983) University of California at Berkeley; Optimization algorithms.

•**Oscar S. Rothaus**, Professor; Ph.D. (1958) Princeton University; Several complex variables, combinatorics, Sobolev inequalities.

Laurent Saloff-Coste, Professor; Ph.D. (1983) and Doctorat d'Etat (1989) Université Paris VI; Analysis, potential theory, stochastic processes.

Alfred H. Schatz, Professor; Ph.D. (1964) New York University; Numerical solutions of partial differential equations.

Shankar Sen, Professor; Ph.D. (1967) Harvard University; Algebraic number theory.

Richard A. Shore, Professor; Ph.D. (1972) Massachusetts Institute of Technology; Mathematical logic, recursion theory, set theory.

Reyer Sjamaar, Assistant Professor; Ph.D. (1990) Rijksuniversiteit te Utrecht (RUU), the Netherlands; Symplectic geometry.

John Smillie, Professor and Chair; Ph.D. (1977) University of Chicago; Dynamical systems.

•**Birgit E. Speh**, Professor; Ph.D. (1977) Massachusetts Institute of Technology; Lie groups, automorphic forms.

•**Michael E. Stillman**, Professor; Ph.D. (1983) Harvard University; Algebraic geometry, computational algebra.

Robert S. Strichartz, Professor; Ph.D. (1966) Princeton University; Harmonic analysis, partial differential equations, analysis on fractals.

Moss E. Sweedler, Professor Emeritus; Ph.D. (1965) Massachusetts Institute of Technology; Algebra, algorithms.

Karen Vogtmann, Professor; Ph.D. (1977) University of California at Berkeley; Topology, geometric group theory.

Lars B. Wahlbin, Professor; Ph.D. (1971) University of Göteborg, Sweden; Numerical solutions of partial differential equations.

James E. West, Professor; Ph.D. (1967) Louisiana State University; Geometric topology, infinite-dimensional topology.

•*Faculty on sabbatical or other leave during all or part of the 2000–01 academic year.*

Faculty Profiles

Graeme Bailey

Professor of Computer Science
Director of the Computer Science MEng Program
Adjunct Professor of Mathematics

Originally working in low-dimensional topology and combinatorial group theory, through an odd mixture of circumstances I have become actively involved in research in mathematics and medicine. One of two ongoing research projects in this area is the modelling of lung inflation, together with a research group at the Class One Trauma Center in Syracuse. This is in the early stages of a program to extend to various pathologies affecting elasticity and aimed towards effective clinical treatments. We've been fortunate to have made some significant advances in answering some questions which had remained unsolved for over 30 years. The other project is in understanding deformations of transmembrane proteins used in cell-signalling processes. This is a carefully constrained version of the protein-folding problems which have been exciting the mathematical biology community in recent years; the application of a topological viewpoint in collaborating with molecular pharmacologists and structural biologists has already yielded some intriguing insights. With the recent successes at Syracuse in determining scroll waves with the thickness of cardiac muscle, I've become interested again in modelling dynamic aspects of cardiac electrophysiology.

Outside the primarily research front, this past year I've given a number of invited talks to student and alumni groups, was voted ACSU "Faculty of the Year," received the Kenneth A. Goldman Excellence in Teaching award, served on the Rhodes, Marshall, Churchill and Fulbright Fellowship committees for the nth year — again the university was successful in having several winners — was involved in continuing university discussions on developing more vital faculty/student interactions (serving on the University Program House Committee and the North Campus Committee), was the faculty advisor for the Judo Club, remained involved with Cornell EMS, enjoyed my eleventh year as a Faculty Fellow at Risley and gave the usual plethora of concerts.

Dan Barbasch

Professor of Mathematics
Director of Graduate Studies (fall)

My research is in the field of representation theory of reductive Lie groups. I am particularly interested in the classification of the unitary dual for groups over local fields, and its relation to the orbit structure of the Lie algebra. Furthermore I am interested in the relation of these representations to problems arising from number theory, more precisely automorphic forms.

Professional Activities: Referee for *Transactions of the AMS*, *American Journal of Mathematics* and the National Science Foundation.

Invited Lectures:

Unitary representations and endoscopy, AMS Regional Conference, Maryland.

Selected Publications:

The dual reductive pairs correspondence for complex groups (with J. Adams), J. Func. Anal. **132** (1995).

The dual reductive pairs correspondence for odd orthogonal groups (with J. Adams), J. Func. Anal. (1996).

Classification of 1-K type representations (with A. Moy), Proc. AMS, to appear.

Unitary spherical spectrum for split classical p-adic groups, Acta Applicandae Mathematicae **44** (1996).

The spherical dual for p-adic groups (with A. Moy), Proc. of Conf. in Cordoba, Argentina.

The associated variety of an induced representation (with M. Bozicevic), Proc. AMS (1998).

Local character expansions (with A. Moy), Ann. Sci. de L'Ecole Norm. Sup. (1997).

The associated variety of unipotent representations, preprint.

Yuri Berest

Assistant Professor of Mathematics

My interests are in mathematical physics, algebraic geometry and noncommutative algebra. To be a bit more specific, let me mention a few different topics that I am trying to bring together in my research.

The Nature of Wave Fronts. The mathematical problem has a practical origin: to understand what happens when a short signal (light or sound, say) is omitted from point A, travels through a medium and arrives at point B. There are many possibilities. There could be focusing, diffraction, persistence of faint echoes or still a short ('clean-cut') signal at B. Analysis is difficult because explicit solutions are usually not available, and because the wave front may have complicated geometry. My efforts in this direction focus on the study of propagation of 'clean-cut' wave signals (in particular, the conditions under which such signals could exist). Posed by J. Hadamard more than 80 years ago, this classical problem still remains unsolved even in the simplest cases (for example, for analytic wave operators on flat spaces).

Integrable Systems. This field has seen remarkable development during the past thirty years. 'Integrable systems' is an imprecise term, covering ordinary and partial differential equations, statistical mechanics models, Yang-Mills theories, string theory, random matrices — almost any problem that 'looks complicated' but can be solved more or less explicitly. Miraculously, the explanations for solvability always turn out to be related, even when the underlying (physical or mathematical) models appear to have nothing in common.

Noncommutative Algebra and Algebraic Geometry. In recent years, there have been a number of important applications of techniques and ideas from algebraic geometry to noncommutative algebra. By efforts of M. Artin and his collaborators a far-reaching noncommutative version of projective algebraic geometry has been developed. Roughly speaking, the key idea behind this generalization is to view the category of graded modules modulo torsion over a noncommutative graded ring as the noncommutative analogue of a projective variety. This intuition has led to a remarkable number of nontrivial results in noncommutative algebra and representation theory. It turns out that the geometry of noncommutative projective surfaces is intrinsically related to certain integrable systems. My current research project (pursued jointly with G. Wilson) is aimed at clarifying this relation. Remarkably, the link to integrable systems sheds new light on some old and (traditionally perceived as) difficult questions in algebraic geometry. One of our recent results is a complete classification of rings of global differential operators on affine algebraic curves.

Awards and Honors: Canadian Mathematical Society Doctoral Prize (1998). A. P. Sloan Research Fellowship (2001).

Professional Activities: Editor of the *Journal of Nonlinear Mathematical Physics*. Reviewer for *Mathematical Reviews*. Referee for the NSF and several journals.

Invited Lectures:

Lacunas for hyperbolic differential operators with variable coeffients, plenary talk, CMS Winter meeting, Kingston, Canada (Dec. 1998).

Calogero-Moser particles and infinite dimensional algebraic groups, plenary talk, British Math. Colloquium, Leeds, UK (Apr. 2000).

Integrable systems and noncommutative geometry, plenary talk, XXIII International Conference 'Group Theoretical Methods in Physics,' Dubna, Russia, (Aug. 2000).

Lacunas for hyperbolic operators with variable coeffients, Petrovskii Centenary Conference, Moscow, Russia (May 2001).

Geometry without points, CMS Summer meeting, Saskatoon, Canada (June 2001).

Huygens' operators and Hadamard's conjecture, CMS Summer meeting, Saskatoon, Canada (June 2001).

Selected Publications:

Hadamard's problem and Coxeter groups: new examples of Huygens' equations (with A. P. Veselov), Func. Anal. and Appl. **28** no. 1 (1994), 3–12.

Huygens' principle and integrability (with A. P. Veselov), Russian Math. Surveys **49** no. 6 (1994), 7–77.

Lacunae of hyperbolic Riesz kernels and commutative rings of partial differential operators, Lett. Math. Phys. **41** no. 3 (1997), 227–235.

Huygens' principle in Minkowski spaces and soliton solutions of the Korteweg-de-Vries equation (with I. Loutsenko), Comm. Math. Phys. **190** no. 1 (1997), 113–132.

Hierarchies of Huygens' operators and Hadamard's conjecture, Acta Appl. Math. **53** no. 2 (1998), 125–185.

Classification of rings of differential operators on affine curves (with G. Wilson), Internat. Math. Res. Notices **2** (1999), 105–109.

The problem of lacunas and analysis on root systems, Trans. Amer. Math. Soc. **352** no. 8 (2000), 3743–3776.

Automorphisms and ideals of the Weyl algebra (with G. Wilson), Math. Ann. **318** no. 1 (2000), 127–147.

Ideal classes of the Weyl algebra and noncommutative projective geometry (with G. Wilson), preprint AG/0104248 (2001), 35 pp.

Louis J. Billera

Professor of Mathematics
Director of Graduate Studies (spring)

For some time, my research has centered on combinatorial properties of convex polytopes and their relations to algebraic and geometric questions. Some problems are related to the facial structure of polytopes, for example, enumeration of faces or identification of their lattice structure. Others have to do with subdivisions of polytopes, how they might depend on the geometry (as opposed to the combinatorics) of the underlying set, or how the algebraic properties of objects related to a given subdivision, for example the algebra of smooth piecewise polynomial functions (splines) defined on it, might depend on both combinatorial and geometric issues.

A common theme in much of this has been the construction of polytopes to given specifications: for example the construction with Carl Lee of polytopes satisfying the conditions of McMullen's g-conjecture, showing these conditions to be sufficient to describe the enumeration of faces of all simplicial convex polytopes; or the construction with Bernd Sturmfels of fiber polytopes, showing that certain sets of polyhedral subdivisions of polytopes themselves had the structure of convex polytopes; or the construction with A. Sarangarajan of faces of the traveling salesman polytope, showing this polytope to have every possible 0-1 polytope as a low-dimensional face.

More recently, my attention has turned to applying these ideas to an interesting problem arising in biology (structure of phylogenetic trees) and to connections, via duality of Hopf algebras, with various algebras of quasisymmetric functions.

Professional Activities: Member of the editorial boards of *Discrete and Computational Geometry* and the *Journal of Algebraic Combinatorics*. Served on the AMS Committee to Select Invited Speakers, Eastern Region and the SIAM Committee to award the Polya Prize.

Invited Lectures: Delivered an invited talk on quasisymmetric functions and Eulerian enumeration at the Oberwolfach meeting on Combinatorial Convexity and Algebraic Geometry, January 2001. Delivered the talk *Geometry of the space of phylogenetic trees* at a department colloquium at Binghamton University, April 2001. Delivered the talk *Linear inequalities for flag numbers* at a geometry seminar at the Courant Institute, New York University, April 2001.

Selected Publications:

Linear inequalities for flags in graded partially ordered sets (with G. Hetyei), J. Comb. Theory, Series A, **89** (2000), 77–104.

Monotonicity of the cd-index for polytopes (with R. Ehrenborg), Math. Z. **233** (2000), 421–441.

Noncommutative enumeration in graded posets (with N. Liu), J. Algebraic Combinatorics **12** (2000), 7–24.

Decompositions of partially ordered sets (with G. Hetyei), Order **17** (2000), 141–166.

Geometry of the space of phylogenetic trees (with S. Holmes and K. Vogtmann), Advances in Applied Mathematics, to appear.

A geometric interpretation of the metropolis algorithm (with P. Diaconis), Statistical Science, to appear.

James H. Bramble

Professor Emeritus of Mathematics

For the past 25 years I have been interested in the development of the theoretical foundation of finite-element methods for the approximation of solutions of elliptic and parabolic partial differential equations. Recently I have concentrated on questions concerning rapid solution of large-scale systems that result from such approximations. Such a question is: Among all the theoretically good approximations to a general class of problems, are there some that can be solved efficiently by taking advantage of modern computer architectures such as parallelism? Answers to questions like this one can bring many problems into the realm of practical feasibility. My current research interest is the design of approximations to solutions to problems in partial differential equations that adequately describe the problem and that can be efficiently solved using modern computing power.

Professional Activities: Distinguished Professor of Mathematics at Texas A&M University.

Invited Lectures:

Interpolation between subspaces of Hilbert spaces and multilevel scales and norms, invited address, symposium honoring John Osborn, University of Maryland, College Park, September 2000.

Selected Publications:

Multigrid methods (with X. Zhang); a chapter in the Handbook for Numerical Analysis (P. Ciarlet and J. L. Lions, eds.), North Holland, 2001.

Kenneth Brown

Professor of Mathematics

Until recently my main interests have been algebra and topology. I have especially enjoyed using topological methods to study infinite discrete groups. In some of my early work, for instance, I studied Euler characteristics of groups. I obtained formulas relating the Euler characteristic (a topological concept) to purely algebraic properties of groups. When applied in special cases, these formulas unexpectedly led to new results in algebraic number theory. Later, I found topological methods for studying two interesting families of groups: infinite simple groups, and groups which can be presented by means of a complete rewriting system.

I have recently incorporated methods of probability theory into my research. In work with L. Billera and P. Diaconis, for example, we combine tools from geometry, topology, and probability to analyze an interesting family of random walks.

Awards and Honors: Clark Teaching Award, Cornell University (1987).

Professional Activities: Referee for various journals and government agencies. Served on the committee to select algebra speakers for the 1982 Int'l Congress of Mathematicians and on the organizing committees for many conferences on topological methods in group theory.

Invited Lectures:

Cohomology of infinite groups, International Congress of Mathematicians, Helsinki (1978).

Buildings lecture series, Univ. Hong Kong (June 1999).

Selected Publications:

Euler characteristics of discrete groups and G-spaces, Invent. Math. **27** (1974), 229–264.

Cohomology of Groups, Springer-Verlag, New York, 1982 (Graduate texts in mathematics 87).

Buildings, Springer-Verlag, New York, 1989.

Random walks and hyperplane arrangements (with P. Diaconis), Ann. Prob. **26** (1998), 1813–1854.

Semigroups, rings and Markov chains, J. Theoretical Probability **13** (2000), 871–938.

Gregery Buzzard

H. C. Wang Assistant Professor of Mathematics

Most of my research has been in several complex variables and dynamical systems. My work in several complex variables has centered on the construction of holomorphic maps with certain prescribed properties. In joint work with Franc Forstneric, we proved a version of Mittag-Leffler interpolation for automorphisms of complex n-space. Related ideas led to a joint paper with Steven Lu in which we characterized the set of algebraic surfaces such that there is a holomorphic map of generic rank 2 from complex 2-space into the surface.

In dynamics, much of my work has involved recasting results from real dynamics into the setting of holomorphic maps of two variables. In particular, I proved the existence of persistent homoclinic tangencies and the validity of the Kupka-Smale theorem in the holomorphic setting. This work is part of a more general program to understand the stability of holomorphic maps of two variables: that is, if you change the map a little, does the dynamical behavior of the map change in a correspondingly small way?

Awards and Honors: NSF Postdoctoral Fellowship (1998). Invited guest of Institut des Hautes Études Scientifiques (summer 1999).

Professional Activities: Reviewer for *Mathematical Reviews* and referee for several journals.

Invited Lectures:

Tame sets, dominating maps and complex tori, Hayama Symposium on SCV, Hayama, Japan (1998).

Stability of holomorphic automorphisms, special semester in holomorphic dynamics, Pisa (1999).

Selected Publications:

An embedding of $\mathbb{C}$ in $\mathbb{C}^2$ with hyperbolic complement (with J. E. Fornæss), Math. Ann. **306** no. 3 (1996), 539–546.

A Carleman type theorem for proper holomorphic embeddings (with F. Forstneric), Ark. Mat. **35** (1997), 157–169.

Infinitely many periodic attractors for holomorphic maps of 2 variables, Ann. Math. **145** (1997), 389–417.

Complex dynamics in several variables (with J. Smillie); expository paper in Flavors of Geometry, MSRI Publications, Volume 31, 1997.

Kupka-Smale theorem for automorphisms of $\mathbb{C}^n$, Duke Math. J. **93** no. 3 (1998), 487–503.

Nondensity of stability for polynomial automorphisms of $\mathbb{C}^2$, Indiana U. Math. J. **48** no. 3 (1999), 857–866.

Algebraic surfaces holomorphically dominable by $\mathbb{C}^2$, Invent. Math **139**, no. 3 (2000), 617–659.

An interpolation theorem for holomorphic automorphisms of $\mathbb{C}^n$ (with F. Forstneric), J. Geom. Anal., to appear.

Stephen U. Chase

Associate Chair and Professor of Mathematics
Director of Undergraduate Studies

My main areas of interest are algebra and algebraic number theory. With the exception of my early work in module theory and homological algebra, the unifying theme of my research has been the Galois theory of rings and fields, and variations of these theories in which the role of the classical Galois group is played by some related structure such as a group scheme, Hopf algebra, or groupoid. This work impinges upon and utilizes techniques from other areas in which I also have strong interests, such as category theory and homological algebra, group schemes and Hopf algebras, algebraic K-theory, representation theory, and class field theory. In the recent past the main focus of my research was on certain questions involving Galois module structure in algebraic number fields, especially the structure of the ring of integers in a Galois extension of such fields as a module over the Galois group. My current interest is the subject of quantum groups, which I expect to study for at least several years.

Selected Publications:

Galois theory and Galois cohomology of commutative rings (with D. K. Harrison and A. Rosenberg), Amer. Math. Soc. Memoir **52** (1965).

Hopf Algebras and Galois Theory (with M. E. Sweedler), Lecture Notes in Math **97**, Springer-Verlag, 1969.

Infinitesimal group scheme actions on finite field extensions, Amer. J. Math. **98** (1976), 441–480.

Ramification invariants and torsion Galois module structure in number fields, J. Algebra **91** (1984), 207–257.

Marshall M. Cohen

Professor of Mathematics

I am a geometric topologist and a combinatorial group theorist. Much of my work has dealt with the introduction of combinatorial and algebraic themes into geometric problems or geometric themes into combinatorial and algebraic problems. The work has involved the intermingling of topological manifolds, combinatorial topology, the foundations of piecewise linear topology, simple-homotopy theory, automorphisms of free groups, and spaces of length functions on groups. Currently the second best description of me is *geometric group theorist*.

The title which I most covet is that of *teacher*. The writing of a research paper and the teaching of freshman calculus, and everything in between, falls under this rubric. Happy is the person who comes to understand something and then gets to explain it.

In addition to research and teaching, I deeply value and enjoy my role as a faculty advisor to undergraduates.

Awards and Honors: Winner of the Dean's Award for Advising in 1992, the first year in which this award was given. (It is now called the Robert A. and Donna B. Paul Award for Excellence in Advising.)

Professional Activities: Member of the AMS and MAA.

Invited Lectures:

The surjectivity problem for one-generator, one-relator extensions of torsion-free grous, delivered at the Albany Group Theory conference, October 2000, and the AMS special session on Combinatorial Group Theory at Columbia University, November 2000.

Car crashes, group extensions and h-cobordisms, invited address delivered at the University of Maryland Topology Seminar, November 2000, and the Hebrew University Departmental Colloquium, March 2001.

Selected Publications:

Simplicial structures and transverse cellularity, Annals of Math. (2) **85** (1967), 218–245.

A Course in Simple-Homotopy Theory, Graduate Texts in Mathematics **10**, Springer Verlag, 1973.

Whitehead torsion, group extensions and Zeeman's conjecture in high dimensions, Top. **16** (1977), 79–88.

What does a basis of $F(a, b)$ *look like?* (with W. Metzler and A. Zimmermann), Math. Ann. **257** (1981), 435–445.

On the dynamics and the fixed subgroup of a free group automorphism, Inv. Math. **96** (1989), 613–638.

Very small group actions on R-trees and Dehn twist automorphisms, Topology **34** (1995), 575–617.

The conjugacy problem for Dehn twist automorphisms of free groups, Commentarii Mathematici Helvetici **74** (1999), 179–200.

The surjectivity problem for one-generator, one-relator extensions of torsion-free groups, Geometry and Topology **5** (2001), 127–142.

Robert Connelly

Professor of Mathematics

Discrete geometry, with emphasis on the geometry of rigid and flexible structures, is my main area of interest. A tensegrity is a structure composed of sticks held in mid-air with strings which, nevertheless, holds its shape. This can be modeled very nicely as a configuration of points with upper and lower bounds on the distances between certain pairs of points. This in turn leads to interesting problems in, and applications to, distance geometry and the theory of packings and coverings of spheres as well as applications to robotics, protein folding, motion planning and percolation problems in physics and probability.

Another subject of interest is the theory of flexible surfaces. There are triangulated surfaces that flex, keeping their edges at a fixed length, and it has recently been shown that such surfaces maintain a fixed volume while they flex. There is no perfect mathematical bellows. This is also related to a polynomial that relates the volume of the surface to the lengths of its edges. This is at the intersection of discrete geometry, algebraic geometry and topology.

Professional Activities: Member of the AMS and the MAA. Reviewer for the *Mathematical Reviews*. Referee for various journals. Editor for *Beiträge für Algebra und Geometrie*. Organized the Fourth Geometry Festival (with K. Bezdek, A. Bezdek and K. Boroczky), Budapest, Hungary (1999). Organized a workshop on discrete geometry (with B. Erdahl, W. Whiteley and M. Senechal) at the AMS Conference in Lowell, MA (Apr. 2000).

Invited Lectures:

The bellows conjecture, Conference on Discrete and Computational Geometry, Ascona, Switzerland (June 1999); Case Western, Ohio (Aug. 1999); University of Illinois at Urbana-Champaign (Aug. 1999).

Symmetric tensegrities, ICAAM Conference at Edinburgh, Scotland (July 1999), University of Laramie (Aug. 1999).

Two-distance functions, Budapest, Hungary (July 1999).

Two-distance preserving functions, University of Illinois at Urbana-Champaign (Aug. 1999); Western Washington University (Nov. 1999); Technical University of Vienna, Austria (Dec. 1999).

Tension percolation, Geometry Festival at Budapest, Hungary (Nov. 1999); ETH Zurich, Switzerland (Dec. 1999).

Several talks on *Rigidity* and *The carpenter's rule problem*, Workshop on Discrete and Computational Geometry (associated with McGill Univ., Canada) at Barbados (Jan.–Feb. 2000).

The carpenter's rule problem, Reed College (2000).

Selected Publications:

Rigidity; Chapter 1.7 in Handbook of Convex Geometry (P. M. Gruber and J. M. Wills, eds.), North Holland, 1993, pp. 223–271.

Higher-order rigidity — What is the proper definition? (with H. Servatius), Discrete Comput. Geom. **11** (1994), 193–200.

Finite and uniform stability of sphere coverings (with A. Bezdek and K. Bezdek), L. Fejes Tóth Festschrift, Special Volume of Discrete and Comput. Geom. **13** no. 3–4 (1995), 313–319.

Globally rigid symmetric tensegrities (with M. Terrell), Structural Topology **21** (1995), 59–78.

Second-order rigidity and prestress stability for tensegrity frameworks (with W. Whiteley), SIAM J. Discrete Mathematics **9** no. 3 (1996), 453–491.

The bellows conjecture (with I. Sabitov and A. Walz), Contrib. to Alg. and Geom. **38** no. 1 (1997), 1–10.

Finite and uniform stability of sphere packings (with A. Bezdek and K. Bezdek), Discrete and Comput. Geom. **20** (1998), 111–130.

Mathematics and tensegrity (with A. Back), American Scientist March-April (1998), 142–151.

Tensegrity structures: why are they stable?; in Rigidity Theory and Appl. (M. F. Thorpe and P. M. Duxbury, eds.), Kluwer Academic/Plenum, 1999, 47–54.

Tension percolation (with K. Rybnikov and S. Volkov), submitted.

Straightening polygonal arcs and convexifying polygonal cycles (with E. Demaine and G. Rote), in preparation.

R. Keith Dennis

Professor of Mathematics

Most of my research has been in the field of algebraic K-theory. This field is, in some sense, a fancy generalization of linear algebra to arbitrary rings. As such, it has applications in many other areas of mathematics such as topology, algebraic geometry, and even the theory of Markov processes. I have been most interested in the computational aspects of the subject, in particular the computation of quotients of rings of algebraic integers and in the computation of the Whitehead group for finite abelian groups.

Parts of this work have involved the use of computers to understand a number of examples before formulating and proving the general results. This work has led to the study of questions about group rings, number theory, and theory of finite groups. My current interest lies in studying a number of problems relating to commutators, structure, and invariants of finite groups which can be investigated by computer computations.

While I was executive editor of *Mathematical Reviews*, I became interested in problems dealing with mathematical communication, databases and mathematical bibliography, and how to convert the older mathematical literature into searchable electronic form. I have mainly been involved with these issues during the last several years.

Professional Activities: Consulting editor for *Mathematical Reviews*. Served on the board of advisors for the American Institute of Mathematics (AIM). Chaired the AIM Library Board. Served on the AMS Library Committee. Coeditor with B. Wegner on the Jahrbuch Project (www.eims.de/projects/JFM). Part of the project to digitize the *Duke Mathematics Journal*. Served on the committee to arrange digitization of the *Pacific Journal of Mathematics*.

Administrative Activities: Chaired the University Library Board and worked with the University Librarian on Project Euclid.

Invited Lectures: Delivered the keynote invited address at the conference "Retrodigitization of mathematical journals and their integration into searchable digital libraries," Essen, Germany, August 2000.

Selected Publications:

Noncommutative Algebra (with B. Farb), Springer-Verlag, 1993.

Homogeneous functions and algebraic K-theory (with Reinhard Laubenbacher), to appear.

The number of groups of order N, to appear.

Totally non-abelian finite groups, in preparation.

Generic product decompositions of finite groups, in preparation.

Richard Durrett

Professor of Mathematics

My research concerns problems in probability theory that arise from ecology and genetics. Most of my efforts in the first direction have been joint work with Simon Levin in Ecology and Evolutionary Biology at Princeton. At the borderline between genetics and ecology, I have studied hybrid zones with Rick Harrison in Ecology and Evolutionary Biology. For the last four years I have been working closely with Chip Aquadro in Molecular Biology and Genetics. Most of our joint work has focused on modelling the evolution of DNA repeat sequences, genetic markers that are useful in locating genes or in studying population structure on the time scale of hundreds or thousands of generations.

More recently I have expanded my horizons, completing two projects with members of Steve Tanksley's lab and tackling new questions concerning the evolution of whole genomes by inversions, reciprocal translocations and duplications. Part of the latter work was performed with students in Cornell's REU program.

Professional Activities: Associate editor of *Notices of the American Mathematical Society* and the *Journal of Theoretical Probability*. Served on the NSF Committee of Visitors to perform an external review of the Division of Mathematical Sciences.

Selected Publications:

Rescaled voter models converge to super-Brownian motion (with T. Cox and E. Perkins), Ann. Prob. **28** (2000), 185–234.

Quantification of homoplasy for nucleotide transitions and transversions and a reexamination of assumptions in weighted phylogenetic analysis (with R. Broughton and S. Stanley), Systematic Biology **49** (2000), 617–627.

Lessons on pattern formation from planet WATOR (with S. Levin), J. Theor. Biol. **205** (2000), 201–214.

Selective mapping: a strategy for optimizing the construction of high-density linkage maps (with D. Brown,

D. Shmoys, S. Tanksley and T. Vision), Genetics **155** (2000), 407–420.

Distribution and abundance of microsatellites in the yeast genome can be explained by a balance between slippage events and point mutations (with C. Aquadro, S. Kruglyak and M. Schug), Mol. Biol. Evol. **17** (2000), 1210–1219.

Probability Theory: An Introduction to its Applications, Mathematics Unlimited 2001 and Beyond, Springer-Verlag, New York, 2001.

Mutual invadability implies coexistence in spatial models, Memoirs of the AMS, to appear.

On the quantity and quality of single nucleotide polymorphisms in the human genome (with V. Limic), Stoch. Proc. Appl., to appear.

Chutes and ladders in Markov chains (with P. Diaconis), J. Theor. Prob., to appear.

The equilibrium distribution for a generalized Sankoff-Ferretti model accurately predicts chromosome size distributions in a wide variety of species (with A. De, M. Ferguson and S. Sindi), J. Appl. Prob., to appear.

Eugene B. Dynkin

Professor of Mathematics

A. R. Bullis Chair

Lie groups were the main subject of Dynkin's earlier research. "Dynkin's Diagrams" are widely used by mathematicians and physicists. After 1954, probability theory became the central field of his interests. Principal efforts were devoted to Markov processes and their connections with potential theory and partial differential equations. Other work includes research in mathematical statistics (sufficient statistics, exponential families), optimal control (optimal stopping, control with incomplete data) and mathematical economics (economic growth and economic equilibrium under uncertainty). More recently, he has been working on the relationship between Markov processes and random fields which arise in statistical physics and quantum field theory. Since 1988, branching measure-valued processes have become the main subject of his research (the name "superprocesses" suggested by him for these processes is now standard in mathematical literature). He established connections between superdiffusions and a class of nonlinear partial differential equations that makes it possible to apply powerful analytic tools for investigating the path behavior of superdiffusions and that provides a new probabilistic approach to problems on nonlinear PDEs. Since 1996 the main efforts were devoted to new directions in this field: the description of all positive solutions of a certain class of nonlinear equations and the study of boundary singularities of such solutions. A systematic and improved presentation of the results is the subject of a monograph in preparation.

Professional Activities: Served on the advisory board of *Probability Theory and its Applications* and *Mathematics in Operations Research*. Scientific advisor of the International Center for Mathematical Sciences, Edinburgh, Great Britain.

Invited Lectures: Delivered an invited lecture at the International Conference on Potential Theory and Related Fields, Bielefeld, Germany, March 2001. Gave a plenary address at the conference "Perspectives in Partial Differential Equations and Probability," Minneapolis, Minnesota, May 2001.

Selected Publications:

A probabilistic approach to the equation $Lu = -u^2$, J. Functional Analysis **170** (2000), 450.

Solutions of semilinear differential equations related to harmonic functions, J. Functional Analysis **170** (2000), 464.

Probability and nonlinear analysis, Canadian Mathematical Society Conference Proceedings **28** (2000), 139.

Rough boundary trace for solutions of $Lu = \psi(u)$ (with S. Kuznetsov), Probability Theory and its Applications **45** (2000), 740.

Selected Papers of E. B. Dynkin with Commentary, American Mathematical Society and International Press (A. Onishchik, G. Seitz and A. Yushkevich, eds.), 2000.

Branching exit Markov systems and superprocesses, Annals of Probability, to appear.

Clifford Earle

Professor of Mathematics

Most of my research concerns invariants belonging to Riemann surfaces. I am especially interested in learning how these invariants change when the complex structure of the Riemann surface is modified. A useful technique is to consider a family of Riemann surfaces depending holomorphically on some parameters and to study how the invariants of the surface change as we move about in the parameter space. Quasiconformal maps and Kleinian groups have proved to be fundamental tools for the construction of good parameter spaces, so I have studied and used them extensively.

Professional Activities: Managing editor of *Proceedings of the American Mathematical Society* through January 31, 2001. One of three U.S. members of the organizing committee for the Second Iberoamerican Congress on Geometry, Guanajuato, Mexico, January 2001.

Administrative Activities: Served on the Arts College Ad Hoc Committee on Faculty Salaries.

Invited Lectures: Attended and lectured at the Second Iberoamerican Congress on Geometry, Guanajuato, Mexico, January 2001. Delivered invited lectures at the University of Warwick, University College London and a function theory meeting in Oberwolfach, Germany, February 2001.

Selected Publications:

A fibre bundle description of Teichmüller theory (with J. Eells), J. Differential Geometry **3** (1969), 19–43.

A fixed point theorem for holomorphic mappings (with R. S. Hamilton), Global Analysis, Proc. Symp. Pure Math., Vol. XVI, Berkeley, Calif. (1968), Amer. Math. Soc., Providence, 1970, pp. 61–65.

Conformally natural extension of homeomorphisms of the circle (with A. Douady), Acta Math. **157** (1986), 23–48.

Quasiconformal Isotopies (with C. McMullen), Holomorphic functions and moduli, Vol. I, Math. Sci. Res. Inst. Publ. 10, Springer, New York-Berlin, 1988, pp. 143–154.

Teichmüller disks and Veech's $\mathcal{F}$-structures (with F. P. Gardiner), Extremal Riemann surfaces, Contemp. Math. **201** (1997), 165–189.

José F. Escobar

Professor of Mathematics

My research has focused on the study of linear and non-linear partial differential equations arising in differential geometry. The basic purpose of geometry is to give a good description of a class of geometric objects. The geometric objects I study are the so-called Riemannian manifolds. These are spaces endowed with analytical structures, like the metric which provide us with a way to measure lengths and angles. It is natural to study deformations of these structures to realize what properties in the space remain stable under such perturbations. The description of all these deformations is usually governed by differential equations. The curvature tensor of a Riemannian manifold (a measure for the "non-euclideanness" of a Riemannian space) usually makes such equations non-linear, although as in physics, most of them are of variational nature. I have been able to develop the existence theory of solutions to semilinear elliptic equations with non-linear boundary conditions. These equations appear in the problem of conformal deformation of a Riemannian metric on a manifold with boundary and in some non-linear problems in physics.

Awards and Honors: Presidential Faculty Fellowship (1992–1999), created by President Bush to be given to 15 scientists in the nation each year. Colciencias Award, Category A (1996). Alejandro Angel Escobar Foundation: Mention of Excellence in Science (1995).

Professional Activities: Member of the AMS and the Colombian Mathematical Society. Correspondent member of the Colombian Academy of Sciences. Chairman of III Escuela de Verano en Geometría Diferencial, Ecuaciones en Derivadas Parciales y Análisis Numérico, Universidad de los Andes, Bogotá, Colombia (1995). Chairman of Physical Sciences, Mathematics and Engineering Panel for the 1995, 1996, 1997 & 1998 Ford Foundation Dissertation and Postdoctoral Fellowships.

Editorial Board of the Electronic Journal of Differential Equations since 1993 and Revista Colombiana de Matemáticas since 1992. International editor of Innovación y Ciencia since 1992. Referee for the Journal of the AMS, Journal of Diff. Geometry, Duke Mathematical Journal, Indiana Mathematical Journal, Proceedings

of the AMS, Communications in Analysis and Geometry, among others, and the NSF.

Invited Lectures:

Conformal geometry, US-Chinese Conference on Recent Developments in Differential Equations and Applications, Hangzhou, P. R. China (1996).

The geometry of the first Steklov eigenvalue, Southern California Geometry Analysis Seminar, Irvine, California (1998).

An isoperimetric inequality and the Steklov eigenvalue, Brazilian School of Geometry, Belo Horizonte, Brazil (1998).

New results on conformal deformation of metrics, Workshop on Geometric Partial Differential Equations, Pacific Institute, UBC, Vancouver, Canada (2001).

Selected Publications:

Conformal metrics with prescribed scalar curvature (with R. Schoen), Invent. Math. **86 (2)** (1986), 243–254.

Uniqueness theorems on conformal deformations of metrics, Sobolev inequalities and an eigenvalue estimate, Comm. on Pure and Appl. Math. **43** no. 7 (1990), 857–883.

Conformal deformation of a Riemannian metric to a scalar flat metric with constant mean curvature on the boundary, Ann. Math. **136** (1992), 1–50.

The Yamabe problem on manifolds with boundary, J. Diff. Geom. **25** (1992), 21–84.

Conformal metrics with prescribed mean curvature on the boundary, Calculus of Variations and PDE's **4** (1996), 559–592.

Conformal deformation of a Riemannian metric to a constant scalar curvature metric with mean curvature on the boundary, Indiana U. Math. Jour. **45** no. 4 (1996), 917–943.

The geometry of the first non-zero Steklov eigenvalue, J. Func. Anal. **150** no. 2 (1997), 544–556.

An isoperimetric inequality and the first Steklov eigenvalue, J. Func. Anal. **165** (1999), 101–116.

Roger Farrell

Professor Emeritus of Mathematics

Retired as of July 1, 1999, I am still semi-active in the department and try to come in most days to audit classes and work some in the Math Support Center. I am not active in research.

My research concerned the application of decision theory methods to statistical problems to try and characterize completely good and bad methods of estimation and testing. Useful decision theory methods can involve development of inequalities, compactification of spaces, and study of the way sequences of measures converge.

Professional Activities: Member of the IMS, AMS and ASA. Occasional reviews for *Mathematical Reviews* and occasional refereeing.

Selected Publications:

Multivariate Calculation, Springer-Verlag, 1985.

Proof of a necessary and sufficient condition for admissibility in discrete multivariate problems (with L. D. Brown), J. Mult. Anal. **24** (1988), 46–52.

All admissible linear estimators of the vector of Gamma state parameters with application to random effects models (with W. Klonecki and S. Zontek), Ann. Statist. **17** (1989), 268–281.

A lower bound for the risk in estimating the value of a probability density (with L. D. Brown), Jour. Amer. Statist. Assoc. **85** (1990), 1147–1153.

Estimations of accuracy in testing (with J. T. G. Hwang, G. Casella, C. Robert and M. T. Wells), Ann. Statist. **20** (1992), 490–509.

Spitzer and Bohnenblust, revisited (1997), preprint.

Vesselin Gasharov

H. C. Wang Assistant Professor of Mathematics

My work is in commutative algebra and algebraic combinatorics. I am especially interested in the interplay of ideas and the rich connections between these two fields. More specifically, I am interested in Hilbert functions, symmetric functions, free resolutions, total positivity, Schubert varieties, toric varieties, Gröbner bases theory and monomial ideals.

Professional Activities: Coorganizer of a special session in Algebraic and Geometric Combinatorics at the AMS Meeting in Providence, RI (1999). Referee for various journals.

Selected Publications:

Incomparability graphs of $(\mathbf{3}+\mathbf{1})$*-free posets are s-positive*, Discrete Math. **157** (1996).

Complete intersection dimension (with L. Avramov and I. Peeva), Publ. Math. IHES **86** (1997).

On the Neggers-Stanley conjecture and the Eulerian polynomials, J. Combin. Theory (A) **82** (1998).

Factoring the Poincaré polynomials for the Bruhat order on S_n, J. Combin. Theory (A) **83** (1998).

Hilbert functions and homogeneous generic forms II, Compositio Mathematica **116** (1999).

The lcm-lattice in monomial tesolutions (with I. Peeva and V. Welker), Math. Res. Lett. **6** (1999).

Rationality for generic toric rings (with I. Peeva and V. Welker), Mathematische Zeitschrift **233** (2000).

Deformations of codimension 2 toric varieties (with I. Peeva), Compositio Mathematica **123** (2000), 225–241.

Sufficiency of Lakshmibai-Sandhya singularity conditions for Schubert varieties, Compositio Mathematica **126** (2001), 47–56.

Coordinate subspace arrangements and monomial ideals (with I. Peeva and V. Welker), Proceedings of the Osaka Meeting on Commutative Algebra and Combinatorics, to appear.

Extremal Betti numbers (with M. Chardin and I. Peeva), Proceedings AMS, to appear.

Leonard Gross

Professor of Mathematics

My research could, for the most part, be described as analysis over infinite dimensional spaces. This has sometimes been motivated by problems of mathematical physics, specifically statistical mechanics and the problem of existence of quantum fields. There is usually a naturally arising probability measure on the infinite dimensional space of interest to me which links functional analytic questions to probability theory. In recent years, I have been interested in properties of the Dirichlet form associated to pinned Brownian motion on loop groups. A long range goal is proof of a Hodge-deRham theorem for these manifolds of maps. This has led, most recently, to a study of Dirichlet forms in holomorphic function spaces over a complex manifold.

Awards and Honors: Guggenheim Fellow (1974–75). Humboldt Prize (1993). Bourbaki Lecture, Paris, France (1998).

Professional Activities: Editorial boards of the *Journal of Functional Analysis*, *Reviews in Mathematical Physics*, *Soochow Journal of Mathematics*, *Revista Colombiana de Matemématicas* and *Electronic Research Announcements of the American Mathematical Society*. Board of Governors of the Institute of Mathematics and Its Applications, Minnesota (1989–91). Co-organizer of special session at American Mathematical Society meeting (Apr. 1998). Co-organizer of satellite of IMP, Warwick, UK (July 2000).

Invited Lectures:

Quantization on compact Lie groups and the universal enveloping algebra, Von Neumann Symp., MIT (1994).

Hilbert spaces of holomorphic functions on complex Lie groups, Taniguchi Symp., Warwick, England (1994).

The mathematical ramifications of Wiener's program in statistical physics, Wiener Centenary Symposium, Lansing, MI (1994).

Hall's transform via the Segal-Bargmann Map, London Mathematical Society (1995).

Hall's transform and quantum mechanics, Probability Towards 2000, Columbia University (1995).

Hilbert spaces of holomorphic functions on complex Lie groups, Paris, France (1996); Bochum, Germany (1996); Mannheim, Germany (1996).

Hypercontractivity over complex manifolds, Paris (1998); London (1998).

Analysis on loop groups, Kusadaci, Turkey (1998).

Selected Publications:

Abstract Wiener spaces, Proceedings of 5th Berkeley Symposium on Mathematical Statistics and Probability, Vol 2, pt. 1 (1965), 31–41.

The Cauchy problem for the coupled Maxwell and Dirac equations, Comm. Pure App. Math. **19** (1966), 1–15.

Existence and uniqueness of physical ground states, J. Func. Anal. **10** (1972), 52–109.

Logarithmic Sobolev inequalities, Amer. J. Math. **97** (1975), 1061–83.

Convergence of $U(1)_3$ lattice gauge theory to its continuum limit, Comm. Math. Phys. **92** (1983), 137–162.

A Poincaré lemma for connection forms, J. Func. Anal. **63** (1985), 1–46.

Logarithmic Sobolev inequalities on loop groups, J. Func. Anal. **102** (1991), 268–313.

Uniqueness of ground states for Schrödinger operators over loop groups, J. Func. Anal. **112** (1993), 373–441.

A local Peter-Weyl theorem, Trans. AMS **352** (1999), 413–427.

Hypercontractivity over complex manifolds, Acta Math. **182** (1999), 159–206.

John Guckenheimer

Professor of Mathematics

My research involves dynamical systems. The theory seeks to elucidate general phenomena that occur over long periods of time when a system is governed by deterministic rules. Much of my theoretical work has involved study of the iterations of a single real valued function. Though at first glance these models seem too simple to reflect the dynamics observed in the real world, detailed analysis of their properties has revealed many features subsequently observed in diverse experimental realms. I have also investigated the influence of symmetry on generic features of dynamical systems.

In addition to extending the theory, I am also interested in its application to many fields of science and engineering. I have worked with applications in biology, chemistry, engineering and physics. My current work focuses upon applications to the neurosciences and to problems of control. Computation plays a large role in this work. The term bifurcation describes the changes in qualitative properties of a system that occur as parameters are varied. The development of more effective algorithms for computing bifurcations is a central theme in my research.

Professional Activities: President of SIAM. Member of the SIAM Board of Trustees. Ex officio member of the Joint Policy Board on Mathematics and the Conference Board on Mathematical Sciences. Editorial board of the *Journal of Experimental Mathematics* and the *International Journal of Bifurcation and Chaos*. Founding Chair, SIAM Activity Group on Life Sciences. Theoretical Division Review Committee, Los Alamos National Lab (2000–).

Administrative Activities: Member of the FABIT committee, Arts College Committee on Curriculum and served on panel of Appeals Committee (fall 1999).

Invited Lectures: Charles Amick Lecturer, University of Chicago (June 1999); Keynote lecture, Equadiff Symposium, Berlin (Aug. 1999); Frontiers Lecturer, Texas A&M University (Mar. 2000); Erskine Professor, Canterbury University, New Zealand (May–June 2000); New Zealand Society of Math. Lecturer (May–June 2000).

Selected Publications:

Computing periodic orbits with high accuracy (with W. G. Choe), Computer Methods in Applied Mechanics and Engineering **170** (1999), 331–341.

SIAM past president's address, SIAM News (Oct. 1999).

Using dynamical systems tools in Matlab (with W. G. Choe); in Numerical Methods for Bifurcation Problems and Large-Scale Dynamical Systems, IMA119 (2000), 85–114.

An improved parameter estimation method for Hodgkin-Huxley models (with A. R. Willms, D. J. Baro and R. M. Harris-Warrick), J. Comp. Neuroscience, in press.

Book review: dynamical systems and numerical analysis by Stuart and Humphries, Ergodic Theory and Dynamical Systems, in press.

Torus maps from weak coupling of strong resonances (with A. Khibnik), Contemp. Math., Amer. Math. Soc. Transl. (2) (2000), 205–218.

Analysis of a subcritical Hopf-homoclinic bifurcation (with A. Willms), Physica D **139** (2000), 195–216.

Numerical analysis of dynamical systems; in Handbook of Dynamical Systems, in press.

Computing periodic orbits and their bifurcations with automatic differentiation (with B. Meloon), SIAM J. Sci. Stat. Comp. **22** (2000), 951–985.

Numerical computation of canards (with K. Hoffman & W. Weckesser), Intl. J. Bifurcation & Chaos **10** (2000), 2669–2687.

Allen E. Hatcher

Professor of Mathematics

A common thread through much of my research is the idea of studying the space of all topological objects of a certain kind, for example, the space of all finite polyhedra, the space of all diffeomorphisms of a manifold, or the space of all knots. Recently I have also been writing a couple of graduate-level textbooks in topology.

Timothy J. Healey

Professor of Theoretical and Applied Mechanics

I am interested in nonlinear elasticity and nonlinear analysis, with applications to flexible structures and solids and also to matensitic phase transitions. In particular, I am interested in the use of bifurcation theory in such problems governed by partial differential equations. The two primary goals of the work are to uncover new physical and/or mathematical phenomena and to develop efficient solution strategies for the analysis of such problems.

Selected Publications:

Global continuation via higher-gradient regularization and singular limits in forced one-dimensional phase transitions (with H. Kielhöfer), SIAM J. Math. Anal. **31** (2000), 1307.

Nonlinear standing and rotating waves on the sphere (with C. Gugg, S. Maier-Paape and H. Kielhöfer), Nonlinear Standing and Rotating Waves on the Sphere **166** (2000), 402.

Global continuation in displacement problems of nonlinear elastostatics via the Leray-Schauder degree, Arch. Rational Mech. Anal. **152** (2000), 273.

Free nonlinear vibrations for plate equations on the equilateral triangle (with E. Montes and H. Kielhöfer), Nonlinear Anal. TMA, to appear.

Hidden symmetry of global solutions in twisted elastic rings (with G. Domokos), J. Nonlinear Science, to appear.

David W. Henderson

Professor of Mathematics

I would classify my work as pertaining to aspects of mathematics that impinge on the teaching and learning of mathematics — the emphasis is on the mathematics not on education. My main theme is that we should enliven our conception of what "proof" is and that proofs should be a central part of mathematics teaching at all levels, where my definition of "proof" is: A convincing communication that answers — Why?

In addition, I am currently involved in extensive curriculum innovation projects in undergraduate mathematics. My first book, *Experiencing Geometry on Plane and Sphere*, published in August 1995, has been requested by faculty in 50 countries so far and has been translated into Portugese. My second book *Differential Geometry: A Geometric Introduction* appeared in July of 1997, and is now being used around the world. My third book, *Experiencing Geometry in Euclidean, Spherical and Hyperbolic Spaces*, appeared in summer 2000. It is an extensive revision and expansion of my first book. Other books are in process.

Professional Activities: Served on the National Advisory Board for NSF's CCLI-EMD project. Referee and reviewer for various journals and publishers. Led an NSF-sponsored week-long workshop (*Teaching Undergraduate Geometry*) for mathematics professors at colleges and universities. (The workshop, June 2001, was the seventh such workshop that I have led at Cornell.)

Administrative Activities: Faculty member for the Teacher Education in Agriculture, Mathematics, and Science (TEAMS) program, the Visual Studies Program and the South Asia Program.

Invited Lectures: Gave talks at the University of Latvia, October 2000, and the Liepaja Pedogogical Institute, Latvia, November 2000. Delivered invited lectures at the Latvian Physics Society, November 2000; Tartu University, Estonia, December 2000; the Latvian Mathematics Society, January 2001; and the University of Rochester, February 2001.

Selected Publications:

Square roots in the Sulba Sutras; a chapter in Geometry at Work: Papers in Applied Geometry (C. Gorini, ed.), MAA Notes **53**, 2000, 39–45.

Experiencing Geometry in Euclidean, Spherical and Hyperbolic Spaces (with D. Taimina), Prentice-Hall, 2001.

Crocheting the hyperbolic plane (with D. Taimina), Mathematical Intelligencer **23** no. 2 (2001), 17–28.

Differential geometry, invited article in Encyclopaedia Britannica, to appear.

Non-Euclidean geometry (with D. Taimina), invited article in Encyclopaedia Britannica, to appear.

John Hubbard

Professor of Mathematics

Differential equations are the main way in which mathematical models of real systems are constructed, and understanding their behavior is the main contribution a mathematician can make to applications. I am interested in understanding the behavior of differential equations and their close relatives: iterative systems. In particular, I try to see how such systems behave in the complex domain, largely because complex analysis brings new and powerful techniques to bear on the problems.

The availability of powerful computers and computer graphics has changed the way this sort of research is done. In the course of investigations of even such simple iterative systems as quadratic polynomials, amazing pictures show up, rather as artifacts to be investigated than as man-made objects. I anticipate that this sort of experimental mathematics will become a major trend.

Most of my research over the last five years has been devoted to dynamics in several complex variables. I have co-authored four foundational papers in the field. I am also writing three books on a very advanced level, one giving a treatment of Teichmüller space and its applications in theorems of Bill Thurston, the second on dynamics of one complex variable, and the third on differential geometry.

During the summer I also directed an NSF-funded REU program for four students (two from Harvard, one from Cornell, one from Iowa). The resulting presentation by one of these students at the MAA MathFest in Toronto was chosen as one of the outstanding talks at the MAA Student Paper Sessions. During the school year I continued to work with undergraduates on research projects. One of these students, a physics major, was selected as a Merrill Presidential Scholar, and named me as "the faculty member who has had the most positive influence on his education at Cornell."

Of the papers accepted for publication in the past year, two stand out. *A compactification of Hénon mappings in* $\mathbb{C}^2$ *as dynamical systems* (with P. Papadopol and V. Veselov), which will appear in Acta Mathematica, builds a bridge between dynamics and algebraic or analytic geometry. The paper uses blow-ups to show that there is a topology on $\mathbb{C}^2 \sqcup S^3$ homeomorphic to a 4-ball such that the Hénon mapping extends continuously. In doing so it proves a result suggested by Milnor, involving embeddings of solenoids in S^3 which are topologically different from those obtained from Hénon mappings. I am currently exploring the application of this method to other problems.

The forced damped pendulum: chaos, complication and control, which will appear in the American Mathematical Monthly, shows how a computer can yield amazing but rigorous results about differential equations using methods accessible to undergraduates. It explores the dynamics of the forced pendulum, as described by the differential equation $x'' + Fx' + \sin \omega x = A \cos t$, for the parameter values $F = 0.1$, $\omega = 1$ and $A = 1$. This pendulum has an attracting periodic oscillation of period 2π, but if you color the plane of initial conditions $x(0)$, $x'(0)$ according to how many times the pendulum goes over the top before settling down to this oscillation, the corresponding "basins of attraction" are extremely wild; in fact they form "lakes of Wada": every point in the boundary of one basin is in the boundary of all the infinitely many others.

I spent the spring semester on leave in Marseille, France, and took advantage of it to give a number of lectures in Paris and other French cities, and to give invited lectures at meetings in Pisa and Crete.

J. T. Gene Hwang

Professor of Mathematics

In recent years, I have been focusing mainly on the theory of statistical intervals. Statistical intervals, such as confidence intervals, prediction intervals and tolerance intervals, are one of the major areas in statistics. By providing intervals, statisticians demonstrate the possible range of the interested parameters or future observations.

Much of my research is stimulated by scientific and engineering applications. Although my primary interest is in theory, the solutions often can be used directly in application. My recent joint work with the National Institute of Standards and Technology is one example.

Another recent endeavor is in genetics statistics. I just started to work on identification of quantitative trait loci (QTL) among other statistics problems related to gene expressions.

Awards and Honors: I. W. Burr Award (1979). NSF grant awards,1980–1996. IMS Fellow (1988). Elected Member of the Int'l Statistical Institute (1989). Senior Research Fellowship at NIST (Sept. 1–Nov. 30, 1993).

Professional Activities: Referee for *JASA*, *Ann. Stat.*, *J. Multivariate Analysis*, *Sankhya*. Member of the ASA

and ICSA. Served as statistical consultant for the National Institute of Standards and Technology (NIST).

Invited Lectures: Delivered colloquium talks at Academia Sinica, Taiwan, August 2000; Dong-Hua University, Taiwan, August 2000; and Iowa State University, October 2000.

Selected Publications:

Construction of improved estimators in multiparameter estimation for discrete exponential families (with Malay Ghosh and Kam-Wah Tsui), Ann. Stat. **11**, no. 2, (1983), 351–367. Discussions by James O. Berger, H. M. Hudson and Carl Morris. Reply with Ghosh and Tsui, 375–376.

The nonexistence of $100\,(1-\alpha)\%$ *confidence sets of finite expected diameter in errors-in-variables and related models* (with L. Gleser), Ann. Stat. **15** (1987), 1351–1362.

Estimation of accuracy in testing (with G. Casella, C. Robert, M. Wells and R. Farrell), Ann. Stat. **20**, (1992), 490–509.

Is Pitman closeness a reasonable criterion? (with C. Robert and W. E. Strawderman), JASA **88** (1993), 57–63. Discussed by 8 statisticians. Reply, 74–76.

Confidence interval estimation subject to order restrictions (with S. D. Peddada), Ann. Stat. **22** (1994), 67–93.

Confidence intervals associated with tests for bioequivalence (with J. Hsu, H. K. Liu and S. J. Ruberg), Biometrika **81** (1994), 103–114.

Fieller's problems and resampling techniques, Statistica Sinica **5** (1995), 161–171.

Optimal confidence sets, bioequivalence and the limacon of Pascal (with L. D. Brown and G. Casella), JASA **90** (1995), 880–890.

Maximum likelihood estimation under order restricted parameters by the prior feedback method (with C. Robert), JASA **91** (1996), 167–172.

An unbiased test for the bioequivalence problem (with L. D. Brown and Axel Munk), Ann. Stat. **25** (1997), 2345–2367.

Prediction intervals in artificial neural network (with A. Adam Ding), JASA **92** (1997), 748–757.

Prediction intervals, factor analysis models and high-dimensional empirical linear prediction (HELP) (with A. Adam Ding), JASA **94** (1999), 446–455.

The bioequivalence problems — finding a compromise between theory and practice (with L. Brown and A. Munk), Biomedical Journal **49** (2000), 531–552.

An optimality theory for mid p-values in 2×2 *contingency tables* (with M. Yang), Statistica Sinica, to appear.

A nearly unbiased test for individual bioequivalence (with W. Wang), Stat. Inference and Planning, to appear.

Yulij Ilyashenko

Professor of Mathematics

My research interests are several branches of dynamical systems, both in real and complex domains. They include: limit cycles in real and complex planes; analytic differential equations, with relations to complex analysis and algebraic geometry; local and nonlocal bifurcations and so on. Some main objects to study are: (1) Limit cycles of polynomial vector fields in the real plane. For instance, in *Finiteness Theorems for Limit Cycles* I proved that for a fixed polynomial vector field the number of limit cycles is finite. (2) Geometric properties of foliations determined by analytic vector fields in the complex plane. (3) Bifurcations of planar polycycles (separatrix polygons). (4) New nonlocal bifurcations in higher-dimensional spaces, and many others.

Professional Activities: Editor-in-Chief of the *Moscow Mathematical Journal* (www.ams.org/distribution/mmj). Member of the editorial boards of *Functional Analysis and Its Applications*, *Dynamical and Control Systems*, *Ergodic Theory and Dynamical Systems*, *Proceedings of the Moscow Mathematical Society* and *Mathematical Enlightenment*.

Administrative Activities: Coorganizer of the Math in Moscow program; president of the Independent University of Moscow.

Invited Lectures: Delivered a talk at the Harvard-MIT-Brandeis-Northeastern Colloquium, November 2000.

Selected Publications:

Hilbert type numbers for Abel equations, growth and zeros of holomorphic functions, Nonlinearity **13** (2000), 1337.

Some properties of skew products over a horseshoe and solenoid (with A. Gorodetski), Proceedings of the Steklov Institute **231** (2000), 96.

The duck and the devil: canards on the staircase (with J. Guckenheimer), Moscow Mathematical Journal **1** (2001), 37.

Normal forms near a saddle-node and applications to finite cyclicity of graphics (with F. Dumortier and C. Rousseau), Ergodic Theory and Dynamical Systems, to appear.

Anthony Kable

H. C. Wang Assistant Professor of Mathematics

My main research interests are in analytic number theory, more specifically the study of various zeta and L-functions in order to obtain number-theoretic information. The L-functions I study come from two sources, namely automorphic functions (or representations) and prehomogeneous vector spaces. The latter are particularly fascinating because, while they have deep arithmetic applications, they do not seem to fit directly into the standard framework for understanding arithmetically important L-functions.

Selected Publications:

Prehomogeneous vector spaces and field extensions II (with Akihiko Yukie), Inventiones Mathematicae **130** (1997), 315–344.

The mean value of the product of class numbers of paired quadratic fields I & II (with Akihiko Yukie), submitted.

The tensor square of an exceptional representation on the general linear group, submitted.

Peter J. Kahn

Professor of Mathematics

I am a differential and algebraic topologist focusing currently on symplectic topology/geometry. Specifically, I am interested in various problems on the interface of this area with algebraic topology, for example, the topology of symplectomorphism groups.

Awards and Honors: Humboldt Senior Scientist Award, 1975–76 and Summer 1981.

Professional Activities: Member of the AMS, MAA and AAAS. Reviewer for *AMS Reviews* and *Zentralblatt*. Referee for the *AMS Proceedings*.

Administrative Activities: Member of the Education Policy Committee (1991–93). Chair of the Committee on Quantitative and Formal Reasoning (1991–). Author of report on the Cornell Mathematics Major (1993). Chair of the Department of Mathematics, Cornell University (1993–95). Associate Dean of the College of Arts and Sciences (1995–97, summer and fall 1999).

Selected Publications:

Characteristic numbers and oriented homotopy type, Topology **3** (1965), 81–95.

Self-equivalences of $(n-1)$-connected $2n$-manifolds, AMS Bull. **72** (1966), 562–566.

Chern numbers and oriented homotopy type, Topology **7** (1968), 69–93.

The non-finite homotopy type of some diffeomorphism groups, (with P. Antonelli and D. Burghelea), Topology **11** (1972), 1–49.

The Concordance-Homotopy Groups of Geometric Automorphism Groups (with P. Antonelli and D. Burghelea), Springer Lecture Notes **215** (1972).

Mixing homotopy types of manifolds, Topology **14** (1975), 203–216.

Homotopy-dimension and simple cohomological dimension of spaces (with K. Brown), Comment. Math. Helv. **52** (1977), 111–127.

Counting types of rigid frameworks, Inventiones Math. **55** (1979), 297–308.

Steenrod's Problem and k-Invariants of Certain Classifying Spaces, Springer Lecture Notes **967** (1982).

Equivariant homology decompositions, AMS Trans. **298** (1986), 245–271.

Rational Moore G-spaces, AMS Trans. **298** (1986), 273–287.

A paradigm for robust geometric algorithms (with J. Hopcroft), Algorithmica **7** (1992), 339–380.

Harry Kesten

Goldwin Smith Professor of Mathematics

I am a probabilist. My main research interests are percolation theory and random walks, and in general I like to dabble in models inspired by statistical mechanics.

One model I have recently returned to is the first-passage percolation model. To each edge e of the integer lattice in d dimensions one assigns a passage time $X(e)$. These $X(e)$ are assumed independent, identically distributed and nonnegative. One is interested in the random set $B(t)$ of points which can be reached from the origin by time t. In particular how big are the fluctuations of the boundary of $B(t)$? This is a special example of the fluctuations of a random surface. In the case of $B(t)$ I proved the first upper bound for these fluctuations in terms of a power of t. These have now been improved by K. Alexander and lower bounds for the fluctuations have been given by C. Newman and M. Piza. The chal-

lenge now is to close the gap between these upper and lower bounds.

Awards and Honors: Awarded the 2001 Leroy P. Steele Prize for Lifetime Achievement.

Professional Activities: Member of the editorial board of the *Indiana Journal of Mathematics* and the *New York Journal of Mathematics*. Honorary board member of *Journal d'Analyse Mathématique*.

Invited Lectures: Delivered invited lectures at a conference in honor of D. Stroock and S. R. S. Varadhan at Courant Institute, November 2000, and at the IMPA Summer School at Temuco, Chile, January 2001.

Selected Publications:

Greedy lattice animals: negative values and unconstrained maxima (with A. Dembo and A. Gandolfi), Ann. Probab., to appear.

A large deviation result for the range of random walk and for the Wiener sausage (with Y. Hamana), Probab. Theory Rel. Fields, to appear.

Large deviations for the range of an integer valued random walk (with Y. Hamana), Ann. Inst. Henri Poincaré, to appear.

Dexter Kozen

Professor of Computer Science
Joseph Newton Pew, Jr., Professor in Engineering
www.cs.cornell.edu/kozen/

My research interests include the theory of computational complexity, especially complexity of decision problems in logic and algebra, program logic and semantics, and computational algebra. Recent work includes: new polynomial-time algorithms for type inference in type systems with subtypes and recursive types; algorithms solving systems of set constraints as used in program analysis; a unification algorithm for set constraints and a new constraint logic programming language based on set constraints; development of the theory of rational spaces and their relationship to set constraints; an algorithm for decomposition of algebraic functions; a new polynomial-time algorithm for resolution of singularities of plane curves; efficient algorithms for optimal transmission of encoded video data; optimality results for digital interleavers; and complexity and completeness results for Kleene algebras with tests. Recently I have begun to investigate the application of Kleene algebra and the modal mu-calculus to problems in software security.

Professional Activities: Program committee of Foundations of Software Science and Computation Structure, Mathematical Foundations of Computer Science. Editorial board of the *Journal of Relational Methods in Computer Science*, the *Journal of Algorithms* (special issue). Supervisory Board, Centre for Basic Research in Computer Science (BRICS), Aarhus University.

Awards and Honors: Class of 1960 Scholar, Williams College.

Administrative Activities: College of Engineering Undergraduate Admissions Committee. University Arbitration Panel. Faculty advisor for Cornell Men's Rugby, Football Club and Johnson Graduate School of Management Rugby.

Invited Lectures:

Parikh's Theorem in commutative Kleene algebra, FLOC '99, Trento, Italy (July 1999).

On Hoare logic and Kleene algebra with tests, FLOC '99, Trento, Italy (July 1999).

On Hoare logic, Kleene algebra and types, International Congress for Logic, Methodology and Philosophy of Science, Kracow, Poland (Aug. 1999).

On the completeness of prepositional Hoare logic, RelMiCS 5 Conf., Quebec City, Canada (Jan. 2000).

Language-based security, 24th Conference on Mathematical Foundations of Computer Science, Wroclaw, Poland (Sept. 1999); Dartmouth College (March 2000).

Selected Publications:

Parikh's theorem in commutative Kleene algebra (with M. Hopkins), Proc. Conference Logic in Computer Science (LICS '99), IEEE (1999), 394–401.

On Hoare logic, Kleene algebra and types, Cornell University, Computer Science, TR99-1760 (1999); in Proc. Conference Logic in Computer Science (LICS '99), IEEE (1999), 167–172.

Language-based security; in Proc. Conference of Mathematical Foundations of Computer Science (MFCS '99), ed. M. Kutylowski, L. Pacholski, and T. Wierbicki, volume 1672 of Lecture Notes in Computer Science, Springer-Verlag (1999), 284–298.

On the completeness of propositional Hoare logic (with J. Tiluryn), Cornell University, Computer Science, TR99-1766 (1999).

Certification of compiler optimizations using Kleene algebra with tests (with M. Patron), Cornell University, Computer Science, TR99-1779 (1999).

On the completeness of prepositional Hoare logic (with J. Tiluryn); in Proc. of the Fifth International Seminar Relational Methods in Computer Science (RelMiCS 2000), ed. J. Desharnais (2000), 195–202.

Dynamic Logic (with D. Harel and J. Tiluryn), MIT Press, Cambridge, MA, 2000.

Vlada Limic

H. C. Wang Assistant Professor of Mathematics

I enjoy studying probabilistic models. My thesis was on characterization of certain coalescence processes, which are a model of infinitely many dust particles merging together over a long period of time and forming meteors, planets, etc. I am also interested in problems related to queues and queueing systems. Stochastic queueing systems are models of a factory production cycle, or a telephone exchange or the internet. These mathematical realizations are still quite complicated to analyze directly, so it is important to find useful approximations in order to answer questions about the qualitative behavior of the corresponding queueing system. During the past year, Rick Durrett got me interested in several problems motivated by genetics, and I also became interested in random walks with reinforcement, which are a model of thinking process and memory.

Selected Publications:

The entrace boundary of the multiplicative coalescent (with D. Aldous), EJP **3** (1998), paper 3.

On the behavior of LIFO preemptive resume queues in heavy traffic, ECP **5** (2000), paper 2.

A LIFO queue in heavy traffic, Ann. Appl. Prob., to appear.

On the quantity and quality of single nucleotide polymorphisms in the human genome (with Rick Durrett), Stoch. Processes Appl. (2001).

G. Roger Livesay

Professor Emeritus of Mathematics

My major area of research is in topology, 3-dimensional manifolds with finite cyclic fundamental groups.

Russell Miller

VIGRE Assistant Professor of Mathematics

I study computability theory, the branch of mathematical logic concerned with finite algorithms and the mathematical problems which such algorithms can or cannot solve. By relativizing, one forms a partial order of the degrees of difficulty (the *Turing degrees*) of such problems. Computable model theory, one of my specialties, applies such techniques to general mathematical structures such as trees, linear orders, groups and graphs. Other interests of mine include automorphisms of the lattice of computably enumerable sets (i.e., sets whose elements can be listed by an algorithm) and undecidability of the partial order of Turing degrees of those sets. Finally, one can use computability-theoretic approaches to consider randomness, the question of what we mean when we say that a particular set or real number is "random," and I have begun examining questions in this area.

Selected Publications:

The Δ^0_2-spectrum of a linear order, Journal of Symbolic Logic **66** (2001) 470–486.

Definable incompleteness and Friedberg splittings, Journal of Symbolic Logic, to appear.

Orbits of computably enumerable sets: low sets can avoid an upper cone, Annals of Pure and Applied Logic, to appear.

Michael Morley

Professor of Mathematics

Professor Morley's primary interest and contribution to the department lies in his devotion to the students. His skill, wisdom, commitment and sensitivity in advising is very well-known throughout the Arts College. Comments about Michael Morley speak to his devotion: "[Mike Morley] is exactly the sort of advisor that Cornell needs..."; "...has a creative and total commitment to taking care of students..."; "...has been available to everyone's advisees who wander in unhappy." These comments speak eloquently of Prof. Michael D. Morley.

Professor Morley's primary research interests lie in the areas of advanced mathematical logic and model theory.

Awards and Honors: Robert A. and Donna B. Paul Award for Excellence in Advising (1996).

Professional Activities: President of the Association for Symbolic Logic (1986–89).

Administrative Activities: Department advising committee (1995–). Associate Chair and Director of Undergraduate Studies (1984–95).

Anil Nerode

Goldwin Smith Professor of Mathematics

A decade in the works, the book *Automata Theory and its Applications*, by Bakhadyr Khoussainov and Anil Nerode, was published in February 2001 by Birkhäuser (ISBN 0-8176-4027-2). This book makes available in one place material that is used all the time for decidability results in computer science. The basic theme is the correspondence between classes of automata and languages for finite automata, Buchi automata, Rabin automata and the corresponding games and strategies for those games. It is suitable for a one-semester graduate course or a two-semester undergradaute course.

Constructive concurrent dynamic logic, by Anil Nerode and Duminda Wijesekera, was finished this year and will appear in the *Annals of Pure and Applied Logic* shortly . This was a project also of 10 years duration, primarily because of the number of cases involved in the intuitionistic treatment, which fortunately decreased from 120 to about 50, for the completeness theorem.

Nerode's principal project is a research monograph with engineer Wolf Kohn on the use of Finsler manifolds we associate with distributed optimal control problems throughout engineering to extract close-to-optimal controls in the form of finite automata. They dubbed this area "hybrid systems" in 1991, and many now work in it.

Kohn and Nerode founded a research and development company, Hynomics, some years ago, with venture capital, in Seattle, and it is about to unleash on a client a prototype 25,000 agent distributed system for supply chain management, entirely based on new mathematical-computer science technology.

Professional Activities: Former Vice President of the AMS. Member of the MAA, ACM and IEEE. Former Director of the Mathematical Sciences Institute; Director of the Center for Foundations of Intelligent Systems, a DOD Multiple Univ. Research Inst. (MURI) program. Editorial boards of *Annals of Mathematics and Artificial Intelligence*, *Computer Modeling and Simulation*, *Constraints*, and *Annals of Pure and Applied Algebra*.

Administrative Activities: Member of the graduate fields of Mathematics, Applied Math., Computer Science, Science and Tech. Studies, and Cognitive Studies.

Selected Publications:

Logic programs, well-orderings and forward chaining (with V. Marek and J. Remmel), Festschrift on the Occasion of Rohit Parikh's 60th Birthday, Ann. Pure Appl. Logic **96** no. 1–3 (1999), 231–276.

Computability and Complexity in Analysis, including papers from the seminar held at Castle Dagstuhl, April 1997 (A. Nerode, K.-I. Ko and K. Weihrauch, eds.), Theoret. Comput. Sci. **219** no. 1–2 (1999); Elsevier Science, B.V., Amsterdam, 1999, pp. ix–xii, 1–510.

Scalable data and sensor fusion via multiple agent hybrid systems (with W. Kohn and J. Remmel); in Hybrid Systems V, 1999, pp. 122-141.

QoS based evaluation of the Berkeley Continuous Media Toolkit (with S. Parikh, S. Srivastava, S. Varadarajan and D. Wijesekera); in Multimedia Tools and Applications, 1999.

Experimental evaluation of loss perception in continuous media (with M. Foresti, D. Wijesekera and S. Srivastava), ACM Multimedia Journal (1999).

A mathematical framework for asynchronous, distributed decision-making systems with semi-autonomous entities: algorithm synthesis, simulation and evaluation (with X. Ge, S. Ghosh, T. Lee, J. Lu and W. Kohn), Proceedings of the Fourth International Symposium on

Autonomous Decentralized Systems, ISADS99, Tokyo, Japan, 1999, pp. 206–212.

Hybrid Systems V (P. Antsaklis, W. Kohn, S. Sastry, eds.), Lecture Notes in Computer Science **1567**, Springer-Verlag, 1999.

Normal forms for functional independencies (with D. Wijesekera, M. Ganesh and J. Srivastava), Theoretical Computer Science (2001).

Performance evaluation of synchronization losses in the Continuous Media Toolkit (with D. Wijesekera, J. Srivastava, S. Varadarajan and S. Parikh), IEEE Workshop in Quality of Service in Multimedia (2000), to appear.

Performance evaluation of media losses in the Continuous Media Toolkit (with S. Parikh, J. Srivastava, S. Varadarajan and D. Wijesekera), ACM workshop in Software Engineering Issues in Multimedia (2001); IEEE workshop in Quality of Service (2001).

Quantum wave processor (with W. Kohn), Technical Report CFIS 00-05 (2000).

Logics for hybrid systems (with J. Davoren); in special IEEE Transactions issue on hybrid systems (P. Antsaklis, ed.), 2001.

Decidable Kripke models for modal logics (with S. Ganguli), Technical Report CFIS 00–02 (2000).

Human perception of media and synchronization losses (with D. Wijesekera, J. Srivastava and M. Foresti), ACM Multimedia Systems (2000).

A mathematical framework for asynchronous distributed decision-making systems with semi-autonomous entities: algorithm synthesis, simulation and evaluation (with X. Ge, S. Ghosh, W. Kohn, T. Lee and J. Lu), IEICE Transactions on Fundamentals (2001).

Foreword to: *Principles of Modeling and Asynchronous Distributed Simulation of Complex Systems* by S. Ghosh, IEEE Press, 2000.

Constructive Logics and Lambda Calculi (with G. Odifreddi), 500 pp., book in preparation.

Automata Theory and Its Applications (with B. Khoussainov), Birkhauser, 2000, 480 pp., in press.

Agent Control, Enterprise Models and Supply Chain Systems (with W. Kohn), book in preparation.

Normal forms and syntactic completeness proofs for functional independencies (with M. Ganesh, J. Srivastava and D. Wijesekera), J. Theoretical Computer Science (2001).

Michael Nussbaum

Professor of Mathematics

My research program focuses on developing a better theoretical understanding of the asymptotic theory of statistical experiments, in connection with statistical smoothing and curve estimation and nonparametric inference for stochastic processes. Current topics include Gaussian and Poisson approximation of nonparametric experiments in the Le Cam sense, constructive realization of equivalence, asymptotic risk bounds for density estimation and nonparametric regression, nonparametric models for point processes, diffusion processes and autoregression, functional limit theorems for empirical processes, statistical treatment of inverse and ill-posed problems.

Awards and Honors: Fellow of the Institute of Mathematical Statistics.

Professional Activities: Member of the editorial boards of *Annals of Statistics*, *Annales de l'Institut Henri Poincaré*, *Probabilités et Statistiques* and of *ESAIM*, *Probability and Statistics*.

Invited Lectures:

Nonparametric function estimation, neural nets and risk asymptotics, summer course at Oberwolfach, Germany (DMV-seminar), jointly with A. Barron, Yale and Laszlo Gyorfi, Budapest (June 2000).

Selected Publications:

Asymptotic equivalence of density estimation and Gaussian white noise, Ann. Stat. **24** (1996), 2399–2430.

Asymptotic equivalence for nonparametric generalized linear models (with I. Grama), Probability Theory and Related Fields **111** (1998), 167–214.

Diffusion limits for nonparametric autoregression (with G. Milstein), Probability Theory and Related Fields **112** (1998), 167–214.

The asymptotic minimax constant for sup-norm loss in nonparametric density estimation (with A. Korostelev), Bernoulli **5** no. 6 (1999), 1099–1118.

Minimax risk: Pinsker bound; in Encyclopedia of Statistical Sciences, Vol. 3 (S. Kotz, ed.), John Wiley, New York (1999), 451–460.

Lawrence Payne

Professor Emeritus of Mathematics

My research interests lie in several areas of partial differential equations: isoperimetric inequalities, ill-posed and nonstandard problems, growth decay and/or blowup of solutions, and applications to various problems in solid and fluid mechanics. My most recent interests have been in the study of overdetermined systems and Saint Venant type problems for nonlinear equations.

Invited Lectures: Delivered talks at the STAMM Conference in Galway, Ireland, July 2000, and at a conference in honor of Ian Sneddon in Glasgow, Scotland, November 2000.

Selected Publications:

Unconditional nonlinear stability in temperature dependent viscosity flow in a porous medium (with B. Straughan), Studies in Applied Mathematics **105** (2000), 59.

Saint Venant type decay results for ill posed elliptic problems (with K. A. Ames), Math. Models and Methods in Applied Sciences **10** (2000), 771–783.

Spatial decay for a model of double diffusion convection in Darcy and Brinkman flows (with J. C. Song), ZAMP **51** (2000), 867–889.

On the spatial decay of solutions to a quasilinear parabolic initial-boundary value problem and their derivatives (with G. A. Philippin), SIAM J. Math. Anal. **32** (2000), 291–303.

Convergence results for generalized heat conduction as the relaxation time tends to zero (with J. C. Song), J. Math. Anal. Appl. **256** (2001), 175–189.

Effect of anisotropic permeability on Darcy's law (with J. F. Rodrigues and B. Straughan), Math. Methods in the Appl. Sciences **24** (2001), 427–438.

Irena Peeva

Assistant Professor of Mathematics

My research is on problems at the interface between commutative algebra, algebraic geometry, topological combinatorics, and non-commutative algebra. More specifically: I have worked on problems involving free resolutions, toric varieties, Hilbert schemes, complete intersections, subspace arrangements, monomial resolutions, Castelnuovo-Mumford regularity, Koszul algebras, shellings and Ext-algebras.

Professional Activities: Organized the Route 81 Conference on Commutative Algebra and Algebraic Geometry with Michael Stillman and Leah Gold.

Selected Publications:

Deformations of codimension 2 toric varieties (with V. Gasharov), Compositio Mathematica **123** (2000), 225–241.

Finite regularity and Koszul algebra (with L. Avramov), Amer. J. Math. **123** (2001), 275–281.

Hyperplane arrangements and linear strands in resolutions, Transactions of the American Mathematical Society, to appear.

The toric Hilbert scheme (with M. Stillman), Duke Mathematics Journal, to appear.

Coordinate subspace arrangements and monomial ideals (with V. Gasharov and V. Welker), Proceedings of the Osaka Meeting on Commutative Algebra and Combinatorics, to appear.

Extremal Betti numbers (with M. Chardin and V. Gasharov), Proceedings AMS, to appear.

Local equations of the toric Hilbert scheme (with M. Stillman), J. Pure and Applied Algebra, to appear.

Richard A. Platek

Associate Professor of Mathematics

Professor Platek founded Odyssey Research Associates (ORA), Inc., an Ithaca based private research and development organization, in 1982 and currently serves as CEO. ORA is primarily concerned with applying the techniques of mathematical logic to software development in order to increase assurance that resulting systems are correct. These techniques include: the development of formal specification languages; the development of formal semantics for requirements, specifications, and implementations of languages; the development of sound logics for these semantics; and the implementation of these concepts in software tools and verification environments. ORA is particularly concerned with hardware/software system safety and security. ORA's per-

sonnel is largely drawn from the academic community with a strong logic contingent. ORA tools are based on a variety of ideas in the forefront of applied logic.

Professor Platek is the senior technical advisor on all projects at ORA. As such he frequently presents the results and current status of projects at numerous meetings, symposiums, etc. Most recently, he is an invited speaker at the 12th International Conference on Automated Deduction, CADE-12, in the summer of 1994.

Professor Platek and ORA are recognized in technology policy making circles as leading advocates for increased rigor in software engineering with mathematical logic playing the primary role as the underlying scientific discipline.

Ravi Ramakrishna

Assistant Professor of Mathematics

My research is in Galois theory. This is the branch of mathematics concerned with symmetries of solutions of equations. There is an object that encodes all symmetries of solutions to all equations, the absolute Galois group of the rational numbers. I study this object and its relations with number theory. The study of these symmetries has gained an increasingly important role in number theory in recent years. In particular, Galois theory played an important role in the solution of Fermat's Last Theorem.

Professional Activities: Referee/reviewer for the *American Journal of Mathematics*, the *Journal of Number Theory*, *Mathematical Research Letters* and *Mathematical Reviews*.

Administrative Activities: Regional representative for the Budapest Semesters in Mathematics Program.

Invited Lectures: Delivered invited talks at the University of Michigan, September 2000; Binghamton University, September 2000; Boston University, December 2000; The Tata Institute of Fundamental Research, January 2001; the University of Toronto, Canada, January 2001; and the University of Utah, March 2001.

José Ramírez

H. C. Wang Assistant Professor of Mathematics

My main focus of research is on the intersection between analysis (PDEs) and probability. I study parabolic operators. The main objective is to try to prove "Gaussian type bounds" on heat kernels, that is, transition probabilities for the associated processes. The premise here is that there should be some kind of (Gaussian) universality in the behavior of such processes when time is made small. The particularities of different generators (operators) are mainly given through a metric. The need for a very general setting led me to work on Dirichlet spaces.

Another problem of interest to me is that of studying the asymptotics of the distribution of the lowest eigenvalue for one dimensional Schrödinger operators with random potential. I have also started to wander into the problem of recurrence of certain reinforced random walks, that is random processes that like to travel through places that they already visited.

Selected Publications:

Short time asymptotics in Dirichlet spaces, Comm. Pure Appl. Math. **54** (2001), 259–293.

Richard H. Rand

Professor of Theoretical and Applied Mechanics

My research involves using perturbation methods and bifurcation theory to obtain approximate solutions to differential equations arising from applications in nonlinear dynamics and biology.

Current projects include applications to submarine dynamics, effects of biorhythms on retinal dynamics and cardiac arrythmias. These projects are conducted jointly with graduate students at Cornell and with experts in the respective application area.

Selected Publications:

Nonlinear Vibrations, a downloadable book located at www.tam.cornell.edu/randdocs/.

Bifurcations in a Mathieu equation with cubic nonlinearities (with L. Ng), Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in AMD-Vol. 241 "Nonlinear Dynamics and Stochastic Mechanics", eds. W. Xie, N. Namachchivaya, B. Balachandran, ASME, 2000, pp. 1–12.

Theoretical study of a submarine towed-array lifting device (with D. V. Ramani, W. L. Keith and K. M. Cipolla), Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in AD-Vol. 61 "Control of Vibration and Noise: New Millenium", eds. H. Tzou, M. Golnaraghi, C. Radcliffe, ASME, 2000, pp. 39–50.

Dynamics of two time-delay coupled relaxation oscillators of the van der Pol type (with A. K. Sen), Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in DE-Vol. 108/DSC-Vol. 68 "Dynamics, Acoustics and Simulations", eds. R. Han, K. Lee, A. Luo, ASME, 2000, pp. 53-60.

A mathematical model of a retinal oscillator (with E. T. Wirkus, T. Li and H. C. Howland), Proceedings of the 2000 ASME International Mechanical Engineering Congress and Exposition, Nov. 5–10, 2000, Orlando, FL, in BDE-Vol. 48 "2000 Advances in Bioengineering" ed. T. Conway, ASME, 2000, pp. 89–90.

The dynamics of resonant capture, Proceedings of the First International Symposium on Impact and Friction of Solids, Structures and Intelligent Machines, June 27–30, 1998, Ottawa, World Scientific, 2000, pp. 91–94.

Relaxing nonholonomic constraints (with D. Ramani), Proceedings of the First International Symposium on Impact and Friction of Solids, Structures and Intelligent Machines, June 27–30, 1998, Ottawa, World Scientific, 2000, pp. 113–116.

James Renegar

Professor of Operations Research and Industrial Engineering

I am currently devoting the majority of my research efforts to devising new algorithms for linear programming, i.e., for solving systems of linear inequalities. Unlike the situation for linear equations, surprisingly basic problems remain unresolved for linear inequalities. For example, it is unknown whether there exists an algorithm which can solve a general system of linear inequalities using a number of arithmetic operations which is bounded polynomially in the number of variables and the number of inequalities in the system. By contrast, elementary Gaussian elimination (i.e., high-school mathematics) solves a system of n linear equations in n unknowns in roughly n^3 operations.

I am also interested in devising algorithms for more general problems involving hyperbolic polynomials. (A hyperbolic polynomial p is a real multivariate polynomial for which there exists a vector v such that all univariate polynomials obtained by restricting p to lines in the direction v have only real roots.) These polynomials have played an especially important role in optimization in recent years.

Professional Activities: Associate editor for the *SIAM Journal on Optimization*.

Invited Lectures: Semiplenary speaker at the 17th International Symposium on Mathematical Programming.

Oscar Rothaus

Professor of Mathematics

I spent most of the fall term on sabbatic in France, visiting Paris, l'Institut Henri Poincaré, Toulouse, Université Paul Sabatier, and Strasbourg, Université Louis Pasteur. I attended lectures and lectured myself at Toulouse and Strasbourg, principally on log-Sobolev inequalities and incidentally on coding theory.

After several years' research on log-Sobolev inequalities, I am returning to an earlier interest in combinatorics, in this instance linear coding theory. I am working on the fundamental problem of finding the parameters for optimal linear codes and have achieved significant progress, but I am not yet ready to publish. I have found peculiar connections to my earlier work on "bent" functions.

Selected Publications:

A combinatorial problem in the symmetric group (with J. Thompson), Pac. Jour. Math. **18** (1966), 175–178.

On bent functions, Jour. Comb. Theory A **20** no. 3 (1976), 300–305.

On the non-triviality of some groups given by generators and relations, Ann. Math. **106** (1977), 599–612.

Lower bounds for eigenvalues of regular Sturm-Liouville operators and the logarithmic Sobolev inequality, Duke Math. Jour. **45** no. 2 (1978), 351–362.

Analytic inequalities, isoperimetric inequalities and logarithmic Sobolev inequalities, J. Func. Anal. **64** (1985), 296–313.

Semigroups of finite matrices, Semi-Group Forum **49** (1994), 59–65.

Herbst inequalities for super contractive semigroups (with L. Gross), Jour. Math. Kyoto Univ. **38** no. 2 (1998).

Sharp log-Sobolev inequalities, PAMS **126** no. 10 (1998), 2903–2904.

Konstantin Rybnikov

H. C. Wang Assistant Professor of Mathematics

My research focuses on combinatorial and geometric properties of graphs and polyhedra. These properties are studied from the viewpoints of combinatorics, computational geometry, rigidity theory, and geometry of numbers.

In combinatorics one of my main interests is the theory of k-stresses for piecewise-linear manifolds and its relations to the combinatorics of convex polytopes. I am especially interested in how the theory of stresses on polyhedra relates to the lower bound type results (e.g., $g_2 > 0$) and the problem of reconstruction of convex polytopes from partial geometric or combinatorial information. A major focus of this research is on relating the numbers of faces and chains of faces in polytopes to rigidity properties of their skeletons. Another focus is on the reconstruction of polytopes or their face-lattices from partial information such as, for instance, the polytope graph. Algorithmic and combinatorial information sought here may be of value to various areas of applied mathematics and computer science dealing with linear programming and reconstruction of polyhedral scenes. Now I am also interested in gain graphs; they are important to polyhedral geometry, in particular, to generalizations of Maxwell-Cremona correspondence that I have constructed.

Rigidity and flexibility properties of graphs are of importance to many fields of engineering, physics, computational chemistry, molecular biology, etc. Since 1998 I, with my coauthors, have been working on rigidity related geometric properties of infinite random graphs. We have analyzed percolation of the loss of tension for 2D continuous media and lattices in the plane.

Lattices and quadratic forms are fundamental mathematical objects important to number theory, the theory of finite groups, error-correcting codes, cryptography, and crystallography. One of my principal lines of research is the study of Delaunay polytopes and tilings of lattices and their relationship to the reduction theories for quadratic forms, in particular to the theory of perfect and extreme forms.

Selected Publications:

On the density of three-dimensional compacta, Doklady Mathematics **48** (1993), 110–113.

Generatrice: the problems of Maxwell and Voronoi (with S. Ryshkov), Doklady Mathematics **54** (1996), 614–617.

The theory of quality translation with applications to tilings (with S. Ryshkov), Europ. J. Combin. **18** no. 4 (1997), 431–445.

Stresses and liftings of cell-complexes, Discrete and Comput. Geom. **21** (1999), 481–517.

On traces of d-stresses in the skeletons of lower dimensions of homology d-manifolds (with R. Erdahl and S. Ryshkov), Europ. J. Combin. (2000), accepted.

Laurent Saloff-Coste

Professor of Mathematics

I am an analyst who enjoys touching on other areas including probability theory and geometric group theory. I study different aspects of heat diffusion on manifolds from the point of view of both partial differential equations and stochastic processes. I am mainly interested in those properties that relate to the large scale geometry of the underlying space. For instance, I have recently been trying to understand how heat diffusion is affected by the existence of more than one end on a manifold. Potential theory and functional analysis often provide the framework and tools to study these properties.

I also work on random walks on groups. For instance, card shuffling methods can be modelized as random walks on the symmetric group. In this example, the group is finite but, in general, it can be infinite. What interests me most in this subject is relating the behavior of random walks to the algebraic structure of the group and to the geometry of its Cayley graphs.

Random walks on finite groups are special examples of finite Markov chains. In the past 10 years, I have worked on quantitative estimates for ergodic finite Markov chains. Some of the most interesting examples of such chains are connected to combinatorial problems that are not tractable by deterministic algorithms but for which a reasonable stochastic algorithm exists. These stochastic algorithms often involve a finite Markov chain as one of the main building blocks. In this context, obtaining quantitative estimates is essential.

Professional Activities: Editor for *Mathematische Zeitschrift*. Associate Editor of *Stochastic Processes and their Applications*, the *European Series of Industrial and Applied Mathematics* (Probability and Statistics), and *Annales de la Faculté des Sciences de Toulouse*.

Selected Publications:

Bounds for Kac's master equation (with P. Diaconis), Communications Mathematical Physics **209** (2000), 729–755.

Off- and on-diagonal heat kernel behaviors on certain infinite dimensional local Dirichlet spaces (with A. Bendikov), Amer. J. Mathematics **122** (2000), 1205–1263.

On the stability of the behavior of random walks on groups (with C. Pittet), J. Geometric Analysis **10** (2001), 713–737.

Aspects of Sobolev-Type Inequalities, London Mathematical Society Lecture Note Series, Cambridge University Press, 2001.

On the relation between elliptic and parabolic Harnack inequalities (with W. Hebisch), Annales de l'Institut Fourier, to appear.

Central Gaussian semigroups of measures with continuous densities (with A. Bendikov), J. Functional Analysis, to appear.

On the absolute continuity of Gaussian measures on locally compact groups (with A. Bendikov), J. Theoretical Probability, to appear.

Harnack inequality and hyperbolicity for subelliptic p-Laplacians with applications to Picard type theorems (with T. Coulhon and I. Holopainen), Geometric and Functional Analysis, to appear.

Alfred H. Schatz

Professor of Mathematics

My field of research is numerical analysis. I have been principally involved in the analysis and construction of finite element methods for the approximate solution of partial differential equations. In particular I have been investigating both the local behavior of such matters and another phenomena associated with them called superconvergence. Many physical problems have solutions that are smooth in some places and are nonsmooth (having singularities) in others. In the numerical solution of these problems, the singular part of the solution is not only difficult to approximate but often lowers the quality of (pollutes) the approximation even where the solution is nice. I have been involved in understanding this phenomena and finding a way to improve the approximations.

Another facet of the research is to find properties of the computed approximate solutions which, when taken into account, can be used to produce better approximations than one has before. These are so called superconvergent approximations and their importance resides in the fact that the original approximations are usually difficult to obtain but usually the new approximates may be orders of magnitude better and easily computed from them.

Selected Publications:

Superconvergence in finite element methods & meshes which are locally symmetric with respect to a point (with I. Sloan and L. Wahlbin), SIAM Journal of Numerical Analysis, to appear.

Interior maximum norm estimates for Ritz Galerkin methods part II (with L. Wahlbin), Mathematics of Computation, to appear.

Some new error estimates for Ritz Galerkin methods with minimal regularity assumptions (with J. Wang), Mathematics of Computation, submitted.

Shankar Sen

Professor of Mathematics

Most of my research concerns invariants associated with representations of Galois groups of p-adic fields and algebraic number fields. These invariants, though of an arithmetic nature, are related to classical invariants arising in complex algebraic geometry; their study should shed light on geometric aspects of equations over number fields or p-adic fields. Recently, I have studied families of Galois representations depending analytically on p-adic parameters, and how the invariants for such families change with the parameters. Techniques from p-adic analytic function theory and functional analysis have proved useful in this connection.

Invited Lectures: Delivered a talk at the Nottingham conference on Number Theory (1996); at Cambridge University, England (1996); at a Conference on Arithmetic, Algebra and Geometry, Braga, Portugal (1997); and at the Durham conference on Group Theory and Number Theory (3 lectures, 1997).

Selected Publications:

Lie algebras of Galois groups arising from Hodge-Tate modules, Annals of Math. (1973).

On explicit reciprocity laws, J. Reine Angew Math. (1980 & 1981).

Continuous cohomology and p-adic Galois representations, Inventiones Math. (1980).

Integral representations associated with p-adic field extensions, Inventiones Math. (1988).

The analytic variation of p-adic Hodge structure, Annals of Math. (1988).

An infinite-dimensional Hodge-Tate theory, Bulletin Math. Soc. France (1992).

Galois cohomology and Galois representations, Inventiones Math. (1993).

Richard A. Shore

Professor of Mathematics

My major research interests have centered around analyzing the structures of relative complexity of computation of functions on the natural numbers. The primary measure of such complexity is given by Turing reducibility: f is easier to compute than g, if there is a (Turing) machine which can compute f if it is given access to the values of g. I have also worked with various other interesting measures of complexity that are defined by restricting the resources available primarily in terms of access to g. The general thrust of my work has been to show that these structures are as complicated as possible both algebraically and logically (in terms of the complexity of the decision problems for their theories). These results also allow one to differentiate among different notions of relative complexity in terms of the orderings they define.

Another major theme in my work has been the relationship between these notions of computational complexity and ones based on the difficulty of defining functions in arithmetic. Restricting the computational resources more directly in terms of time or space leads out of recursion theory and into complexity theory. Relaxing the restrictions by allowing various infinitary procedures leads instead into generalized recursion theory or set theory.

The methods developed in these investigations are also useful in determining the effective content of standard mathematical theorems (when can existence proofs be made effective) and the inherent difficulty of combinatorial theorems in proof theoretic terms. Recently, I have also been working on issues in effective model theory and algebra connected with the problem of how the computational properties of algebraic structures can vary with different (but always computable) presentations of the models.

Professional Activities: Managing Editor of the *Bulletin of Symbolic Logic* (through January 1, 2001). Editor of the North-Holland book series Studies in Logic and the Foundations of Mathematics. President of the Association for Symbolic Logic.

Invited Lectures: Spoke at a special session on reverse mathematics, ASL, Philadelphia, Pennsylvania, March 2001.

Selected Publications:

α-recursion theory; in Handbook of Mathematical Logic (J. Barwise, ed.), North-Holland, 1977, pp. 653–680.

The homogeneity conjecture, Proceedings of the National Academy of Sciences **76** (1979), 4218–4219.

Definable degrees and automorphisms of $\mathcal{D}$ (with L. Harrington), Bull. Amer. Math. Soc. (NS) **4** (1981), 97–100.

The degrees of unsolvability: the ordering of functions by relative computability; in Proc. Inter. Congress of Mathematicians (Warsaw) (1983) PWN-Polish Scientific Publishers, Warsaw 1984, Vol. 1: 337–346.

The structure of the degrees of unsolvability; in Recursion Theory (A. Nerode and R. A. Shore, eds.), Proceedings of The Symposia in Pure Mathematics **42**, AMS, Providence, R. I. (1985), 33–51.

Recursive limits on the Hahn-Banach theorem (with A. Nerode and G. Metakides), Contemporary Mathematics **39** (1985), 85–91.

On the strength of König's theorem for infinite bipartite graphs (with R. Aharoni and M. Magidor), J. Comb. Theory (B) **54**, (1992), 257–290.

The p-T-degrees of the recursive sets: lattice embeddings, extension of embeddings and the two quantifier theory (with T. Slaman), Theoretical Computer Science **92** (1992), 263–284.

Logic for Applications (with A. Nerode), Texts and Monographs in Computer Science, Springer-Verlag, New York, 1993; second edition, Graduate Texts in Computer Science, Springer-Verlag, New York, 1997.

Definability in the recursively enumerable degrees (with A. Nies and T. Slaman), Bull. Symb. Logic **2** (1996), 392–404.

Defining the turing jump (with T. Slaman), Math. Research Letters **6** (1999), 711–722.

On the solution of the Goncharov-Ash problem and the spectrum problem in the theory of computable models (with B. Khoussainov), Dokl. Akad. Nauk **371** (2000), 30–31 (Russian); English version: Doklady Mathematics **61** (2000), 178–179.

The prospects for mathematical logic in the twenty-first century (with S. Buss, A. Kechris and A. Pillay), Bulletin of Symbolic Logic **7** (2001), 169–196.

Reyer Sjamaar

Associate Professor of Mathematics

I study actions of Lie groups on symplectic manifolds. This is an area of differential geometry related to algebraic geometry and mathematical physics. Some of my recent work concerns moment polytopes and leads to improved versions of certain eigenvalue inequalities in matrix analysis.

Selected Publications:

Coadjoint orbits, moment polytopes and the Hilbert-Mumford criterion (with A. Berenstein), J. Amer. Math. Soc. **13** no. 2 (2000), 433–466.

Moment maps and Riemannian symmetric pairs (with L. O'Shea), Math. Ann. **317** no. 3 (2000), 415–457.

John Smillie

Professor of Mathematics

My area of interest is dynamical systems. I have done work on polygonal billiards and dynamics of flows on Teichmüller space; analysis of algorithms; and diffeomorphisms of surfaces. I am currently working on complex dynamics in two dimensions.

Professional Activities: Served on the NSF Panel on Dynamical Systems and Ergodic Theory.

Selected Publications:

Polynomial diffeomorphisms of $\mathbb{C}^2$ VI: connectivity of J (with E. Bedford), Annals of Mathematics **148** (1998), 695–735.

Polynomial diffeomorphisms of $\mathbb{C}^2$ VII: hyperbolicity and external rays (with E. Bedford), Ann. Scient. Ec. Norm. Sup. **4** (32) (1999), 455–497.

Billiards on rational-angled triangles (with R. Kenyon), Comment. Math. Helv. **75** (2000), 65–108.

The dynamics of billiard flows in rational polygons; in Encyclopedia of Mathematical Sciences, vol. 100 (edited by Yu. Sinai), Springer-Verlag, 1999.

Polynomial diffeomorphisms of $\mathbb{C}^2$ VIII: quasi-expansion (with E. Bedford), Amer. J. Mathematics, to appear.

Lawren Smithline

VIGRE Assistant Professor of Mathematics

This past year, I investigated applications of p-adic analysis to generalization of modular forms. I composed two papers on the spectrum of the Atkin U operator, which are nearly ready for publication.

I taught a course in linear algebra (Math 431) and one in abstract algebra (Math 432). I was delighted to be on the selection committee for the department's annual Ithaca High School Senior Prize.

Avery Solomon

Senior Lecturer of Mathematics

My position involves me in mathematics, math education and outreach programs in several area schools. I teach courses in mathematics at Cornell and teach a variety of sections of the special course Math 508 — *Mathematics for Secondary Teachers* — both at Cornell and at local sites within a 50 mile radius of Ithaca. My position in the Teacher Education in Agriculture, Mathematics and Science program in the Department of Education has involved me in supervising student teachers and co-teaching the math/science methods course Educ 602.

In addition to these courses, I am the director of the Cornell/Schools Mathematics Resource Program (CSMRP). Through this program I organize and co-teach Saturday workshops and summer programs, consult with school districts, work with teachers directly to develop curriculum and programs, visit classrooms and occasionally teach classes in middle schools or high schools, teach workshops in schools and at BOCES.

For the past eight years the CSMRP has held teacher workshops meeting four Saturdays a year. These workshops focus on both content and pedagogy, giving teachers a chance to immerse themselves for a time in mathematical problems, share ideas, and get inspiration for their classes. We often examine basic mathematics concepts from a more mature standpoint, and also present interesting and relevant topics to get teachers interested in their own mathematical explorations, as well as presenting new curricula and introducing software environments as teaching tools. We now have a core group of about 25 teachers, and a larger group of about 50 others who are part of our e-mail list and occasionally attend.

Our week long summer institute for mathematics teachers, given for the past eleven years, has recently focused on teaching geometry, especially exploring geometry on spheres and other surfaces, and *Geometer's Sketchpad* software.

Our program in the classrooms focuses on a few exemplary teachers, supporting their efforts to develop modules and activities in the classroom, and share these with other teachers through visits, workshops, and actual classroom intervention. One of our middle school teachers taught a model two-week unit at two different middle schools while the 7th and 8th grade teachers watched, and then they taught the lessons to their other sections. Math lab activities and structure developed with high school teachers is being used in classrooms in several districts.

My current interests include developing exploratory units for high school mathematics, the use of *Sketchpad* as an environment for learning geometry, and integrating mathematics and philosophy in a humanist context. A long range plan is to produce materials for a manual for 6-12 mathematics teachers which would provide essential insights into selected topics, interrelations and meanings. This text would also serve pre-service teachers of mathematics, helping them to look back at their own pre-college experiences from a more mature standpoint. I am interested in studying the role of intuition in mathematical exploration, and in continuing to pursue the relation of philosophy and mathematics as a route to self-knowledge.

Grants: Twelve DDE Title IIA grants awarded by the New York State Department of Education to support in-service programs for teachers, 1986–present. Participant in UFE grant through NSF for enhancement of college teaching, with David Henderson, 1995–present.

Articles/Videos:

A manual of mathematics labs to accompany Course I mathematics (with Amy Davis of Moravia High School), self published.

Puppies Pen, a video of a pilot intervention program for Middle School Mathematics.

Levels of knowledge submitted for publication in Parabola, 1997.

A constructivist dilemma: an episode from middle school mathematics.

Geometric patterns in nature, being prepared for publication.

Proportions and levels of meaning in mathematics; in For the Learning of Mathematics, 1991.

What is a line?; in For the Learning of Mathematics, 1991.

A fractal outline of a fractal course, AMTYS journal, 1989.

Birgit Speh

Professor of Mathematics

I am interested in representation theory of semisimple Lie groups as well as in arithmetic groups and analytic number theory. In the last few years most of my work concerned the cohomology of arithmetic groups, the Arthur Selberg trace formula and its application to problems in automorphic forms and number theory.

Professional Activities: Editor of the *Journal of Representation Theory* and the *New York Journal of Mathematics*. Served on the AMS Committee on Academic Freedom, Tenure and Employment Security.

Invited Lectures: Delivered a lecture at Analytic and Geometric Aspects of the Langlands Program, Tel Aviv University, March 2001 and at the Max Plank Institut fuer Mathematik, June 2001.

Selected Publications:

Convergence of the Arthur Selberg trace formula for Gl(n) (with W. Mueller), preprint.

Pseudo Eisenstein series and the cohomology of arithmetic groups II (with J. Rohlfs), preprint.

Michael Stillman

Professor of Mathematics

My main areas of interest are computational algebra and algebraic geometry, commutative algebra, and algebraic geometry. My original interest in computational methods was their application to problems in algebraic geometry. Since then, my work has proceeded in several related directions. I have studied the complexity of the algorithms (mainly Gröbner bases). I have been developing algorithms for computing in commutative algebra and algebraic geometry. For example, I have developed algorithms for manipulating line bundles in algebraic geometry (with M. Brundu), computing Hilbert functions (with D. Bayer), and finding integral closures of polynomial rings.

My original interest in these methods was to actually use them in my research in algebraic geometry. D. Bayer (of Columbia) and I have designed and implemented a specialized computer algebra system, which we call "Macaulay", which includes many of these algorithms. Hundreds of researchers use this system. The latest version includes algorithms for a large number of useful operations in algebraic geometry (written with D. Eisenbud).

Selected Publications:

A criterion for detecting m-regularity (with D. Bayer), Invent. Math. **87** (1987), 1–11.

A theorem on refining division orders by the reverse lexicographic order (with D. Bayer), Duke Math. J. **55** (1987), 321–328.

Determinantal equations for algebraic curves of high degree (with D. Eisenbud and J. Koh), Amer. J. Math. **110** (1988), 135–147.

On the complexity of computing syzygies (with D. Bayer), J. Symbolic Comp. **6** (1988), 135–147.

Computing the equations of a variety (with M. Brundu), Trans. AMS (1991), to appear.

Some matrices related to Green's conjecture (with D. Bayer), Sundance Conference Proceedings on Free Resolutions (1991), to appear.

Robert S. Strichartz

Professor of Mathematics

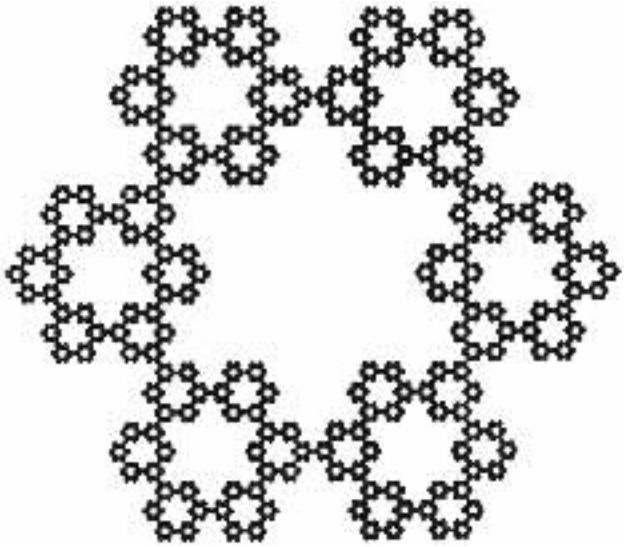
Mathematics is an adventure. As a research mathematician, I have wandered along many paths, always enjoying the discoveries that have come my way and never knowing exactly where I might be heading next. I have certainly not been following a geodesic! Perhaps its has been just a random walk. Yet sometimes I think there has been some purpose behind it, to bring me to the work I am doing today. So here is a synopsis of where I have been and what it might add up to.

In my thesis I studied Sobolev spaces, an important class of function spaces useful in the theory of partial differential equations, and gave an important characterization of Sobolev spaces with smoothness coefficient not equal to an integer. (*Multipliers on fractional Sobolev spaces*, J. of Math Mech. **16** (1967), 1031–1060)

In my early work I studied applications of harmonic analysis to wave equations (*Convolutions with kernels having singularities on spheres*, Trans. Amer. Math. Soc. **148** (1970), 461–478; *A priori estimates for the wave equation and some applications*, J. Func. Anal. **5** (1970) 218–235; and *Restrictions of Fourier transforms to quadratic surfaces and decay of solutions of wave equations*, Duke Math J. **44** (1977), 705–714) and made contributions to the theory of pseudo-differential operators (*A functional calculus for elliptic pseudo-differential operators*, Amer. J. Math. **94** (1972), 711–722) and harmonic analysis on semi-simple symmetric spaces (*Harmonic analysis on hyperboloids*, J. Func. Anal. **12** (1973), 341–383).

Beginning in the 1980s, my work became more geometric. I applied harmonic analysis to integral geometry (L^P *estimates for radon transforms on Euclidean and non-Euclidean spaces*, Duke Math J. **48** (1981), 699–727), in which the central problem is to reconstruct a function from its integrals over geometrically simple sets such as straight lines or planes. This is the mathematical theory that underlies the modern advances in X-ray diagnoses. I used Riemannian geometry as a kind of metaphoric prism to understand the significance and relationships among the basic concepts and constructions of harmonic analysis (*Analysis of the Laplacian on a complete Riemannian manifold*, J. Func. Anal. **52** (1983), 48–79, and *Harmonic analysis a spectral theory of Laplacians*, J. Func. Anal. **87** (1989), 51–148). I also studied a generalization of Riemannian geometry which I am trying to call "Sub-Riemannian" (as opposed to the unwieldy name "Carnot-Caratheodory"). This geometry is related to sub-elliptic differential equations, and arises naturally in the theory of nilpotent Lie groups (*Sub-Riemannian geometry*, J. Diff. Geom. **24** (1986), 221–263).

In the 1990s I began working on fractal geometry and the theory of wavelets. The underlying theme in both these areas is the idea of *self-similarity*, in which the whole is written as a sum of parts, each of which is similar to the whole. A simple example is an interval, which can be broken into two pieces, and each piece expands to recover the original interval. More interesting examples include the von Koch snowflake, the Sierpinski gasket, or the hexagasket, or "fractal Star of David," shown here.

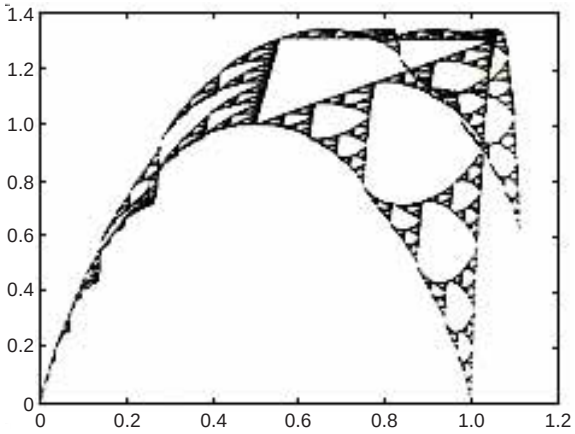


I have developed the idea of a Fractal Plancherel Theorem, both in the general case (*Fourier asymptotics of Fractal measures*, J. Func. Anal. **89** (1990), 154–187)

and for self-similar measures (*Self-similar measures and their Fourier transforms I, II, III*, Indiana U. Math. J. **39** (1990), 797–817; **42** (1993), 367–411; Trans. Amer. Math. Soc. **336** (1993), 335–361), in which I showed how the fractal properties of a measure show up in the asymptotic behavior of its Fourier transform.

In connection with this work I have become involved with what might be called "experimental mathematics." The idea is to use computer experiments to explore mathematical problems, with the goal of generating interesting conjectures that can then be proven using conventional mathematical reasoning. This has already led to a number of interesting results (*Numerical experiments in Fourier asymptotics of Cantor measures and wavelets* (with Prem Janardhan and David Rosenblum), Exper. Math. **1** (1992), 249–273; *Densities of self-similar measures* (with Arthur Taylor and Tong Zhang), Exper. Math. **4** (1995), 101–128; *Exact Hausdorff measure and intervals of maximum density for Cantor measures* (with E. Ayer), Trans. AMS **351** (1999), 3725–3741; and *Nonlinear self-similar measures and their Fourier transforms* (with D. Glickenstein), Indiana U. Math. J. **45** (1996), 205–220.). See also the web sites mathlab.cit.cornell.edu/~gibbons and mathlab.cit.cornell.edu/~tillman.

For the past four years I have been working on analysis on fractals. The idea is to develop the analog of calculus for functions defined on fractals and to study the resulting fractal differential equations that might be used to model physical processes taking place in fractal objects. Through the work of Jun Kigami, it is possible to define the analog of a Laplacian on some fractals, including the hexagasket shown above, as a limit of difference quotients. This Laplacian has some strange properties, such as: 1) there exist localized eigenfunctions; 2) there exist harmonic functions locally constant, but not globally constant; 3) if the Laplacian of u is defined, then the Laplacian of u^2 is not defined (unless u is constant); 4) the associated wave equation does not have a finite propogation speed. I have been working on learning more about this Laplacian, and I have developed tools of numerical analysis to approximate solutions to various fractal differential equations. The graph of the ground state eigenfunction on the Sierpinski gasket is shown below.



Since the Laplacian is a second order differential operator, it seems natural to look for analogs of first order operators, such as the gradient. I have begun to study these, but the story turns out to be more complicated. I am also beginning to study questions that are suggested by ideas coming from partial differential equations, analysis on manifolds and harmonic analysis. An expository article, *Analysis on fractals*, was published in Notices AMS **46** (1999), 1199–1208, explaining some of these ideas. I see this area as a rapidly developing field with many connections to other areas of mathematics, and I am pleased to be able to bring my own perspective, based on my past experience, to help its development. Perhaps this is my mathematical destiny. My experimental research has been done in collaboration with undergraduate students, with the support of the REU (Research Experiences for Undergraduates) Program sponsored by the NSF. Starting in the summer of 1994, I have directed an REU site program at Cornell that involves ten undergraduate students and three faculty members.

In addition to my research, I have maintained an interest in mathematical exposition. I received a Lester Ford Award from the Mathematical Association of America in 1983 for expository writing, and in 1982 I won the first prize in the French Museum Competition sponsored by the Mathematical Intelligencer. I have recently published two textbooks. *A Guide to Distribution Theory and Fourier Transforms*, CRC Press, 1993 and *The Way of Analysis*, Jones and Bartlett, 1995, based on course notes that have been used at Cornell for many years in Math 413, 414, 422 and 515.

Edward Swartz

VIGRE Assistant Professor of Mathematics

My research revolves around connections between geometry/topology and combinatorics. Specifically, I have used a close connection between quotients of spheres by abelian p-groups and matroids in order to better understand both. More recently I have become interested in matroid bundles. These are combinatorial analogues of real vector bundles.

Invited Lectures:

Matroids and quotients of spheres, Arrangements of Hyperplanes, Columbia University, Nov. 2000.

h-vectors of independence complexes, colloquium, Texas A&M University, April 2001.

Selected Publications:

Matroids and quotients of spheres, Mathematische Zeitschrift, to appear.

Moss Sweedler

Professor Emeritus of Mathematics

First I worked in the area of Hopf algebras and wrote *Hopf Algebras*, which came to be the standard reference book on the subject. H. Allen and I used Hopf algebras to prove a 25 year old conjecture of Jacobson. Over the ensuing years until about the mid eighties, I worked and published in the areas of commutative algebra and algebraic geometry, real-algebraic geometry, homological algebra, algebraic groups, purely inseparable field extensions and general positive characteristic phenomena, simple algebras and generalizations of the Brauer group, and differential algebra. Since the mid eighties I have primarily worked in the area of computer algebra, especially computational commutative algebra. This has produced both theoretical and applied results with applications beyond mathematics, such as to error control codes and resulted in my position as Director of the Army Center of Excellence for computer algebra.

Maria S. Terrell

Adjunct Associate Professor of Mathematics
Teaching Assistant Coordinator

Maria Terrell's recent interests have included tensegrities, the history of mathematics and mathematics education. With the help of an NSF curriculum development grant she has developed an introductory level course which explores geometry, optics and perspective.

Robert E. Terrell

Adjunct Associate Professor of Mathematics
www.math.cornell.edu/~bterrell

Bob Terrell enjoys teaching mathematics and has written software for teaching partial differential equations. He was once an engineer, and might be the only member of the department with patents on machinery.

Harrison Tsai

H. C. Wang Assistant Professor of Mathematics

I am interested in the application of algebraic algorithms in mathematics and science. In the past, my research has been in the development of algorithms for finding algebraic solutions to systems of linear partial differential equations. Currently, I am becoming interested in the optimization of polynomials. For polynomials with many variables, heuristic methods are necessary for practical purposes and the behavior of algorithms can be unpredictable. However, for certain special classes of polynomials, algorithms can be robust. I am interested in identifying such situations and investigating their relevant mathematical properties.

Awards and Honors: NSF Postdoctoral Fellowship (2000–2003). Japan Society for the Promotion of Science (JSPS) Fellowship (spring 2001, Kobe University).

Selected Publications:

Polynomial and rational solutions of holonomic systems (with T. Oaku and N. Takayama), Journal of Pure and Applied Algebra, to appear.

Computing homomorphisms between holonomic D-modules (with U. Walther), Journal of Symbolic Computation, to appear.

D-modules on smooth toric varieties (with M. Mustata, G. Smith and U. Walther), Journal of Algebra, to appear.

Algorithms for associated primes, Weyl closure and local cohomology of D-modules, Proceedings of Guanajuato conference on local cohomology, to appear.

Warwick Tucker

H. C. Wang Assistant Professor of Mathematics

Mainly, I have been studying auto-validating algorithms for ordinary differential equations. In particular, I have focused on Taylor methods using automatic differentiation tools combined with interval arithmetic. In a second project, I have been collaborating with Mike Coleman of Cornell's Human Power and Robotics Lab on a project on passive dynamic walking. In a third project, I have been working with the Cornell Big Red Artificial Intelligence Navigator team. The goal of this project is to "advance the state-of-the-art Autonomous Underwater Vehicles (AUVs) by challenging a new generation of engineers to perform realistic missions in the underwater environment." The competition is to be held July 11–15, 2001, and takes place at the United States Naval Academy in Annapolis, Maryland.

Awards and Honors: The Swedish Mathematical Society's Wallenberg Prize.

Professional Activities: Reviewer for *Mathematical Reviews*. Referee for *Foundations of Computational Mathematics*. Supervised Ben Szekely, a Math 420 student, on a project aimed at visualizing ODEs using Java.

Invited Lectures: Delivered invited talks at the University of Maryland, Penn State University, Queen Mary's College (UK) and at Cornell's CAM Colloquium. Invited lecturer at the conference "Recent Trends in Dynamics," University of Porto, Portugal, 2001.

Selected Publications:

Computational algorithms for ordinary differential equations, EQUADIFF 99, World Scientific, Singapore, 2000.

A rigorous ODE solver and Smale's 14th problem, Foundations of Computational Mathematics, to appear.

Karen Vogtmann

Professor of Mathematics

A fundamental technique for studying a group G is to view G as a group of automorphisms of geometric object C. Geometric and topological properties of C can then be used to study algebraic properties of G. Beautiful classical examples of this are the theory of arithmetic and S-arithmetic groups acting on homogeneous spaces and buildings, including work of Borel and Serre on cohomological properties of these classes of groups, and the theory of groups of surface homeomorphisms acting on the Teichmüller space of the surface. My main area of research interest is in developing geometric theories for other classes of groups. In particular, I have worked with orthogonal and symplectic groups, SL_2 of rings of imaginary quadratic integers, groups of automorphisms of free groups, and mapping class groups of surfaces.

Awards and Honors: NSF Visiting Professorships for Women, Cornell University (1984–85). Invited hour address, AMS Summer Meeting, Provo, Utah (1986). NSF Career Advancement Award, MSRI (1989). Research Professorship, MSRI (1995).

Professional Activities: Executive committee of the Council of the AMS. Referee for professional journals. Committee on Meetings and Conferences of the AMS. Associate Editor for Research-Expository articles, Bulletin of the AMS. Research board of the American Institute of Mathematics.

Selected Publications:

Spherical posets and homology stability for $O_{n,n}$, Topology **20** (1981), 119–132.

Moduli of graphs and automorphisms of free groups (with M. Culler), Inventiones **84** (1986), 91–119.

Equivariant outer space and automorphisms of free-by-finite groups (with S. Krstic), Comment. Math. Helvetici **68** (1993) 216–262.

A group-theoretic criterion for property FA (with M. Culler), Proc. AMS **124** no. 3 (1996), 677–683.

Cerf theory for graphs (with A. Hatcher), Jour. London Math. Soc. **58** part 3 (1998), 633–655.

Whitehead's algorithm for surface groups (with G. Levitt), Topology **39** no. 6 (2000), 1239–1251.

Lars B. Wahlbin

Professor of Mathematics

At present one can compute "solutions" to very tough nonlinear, singular problems on, say, a supercomputer. Most often, numerical analysis does not furnish theorems that cover a practical situation, but it provides insight into the behavior of the relevant numerical method on carefully chosen model problems with, at best, some of the most pertinent difficulties of the real problem present.

My work in numerical analysis is aimed at gaining a fundamental understanding of numerical methods. Such insight is also necessary for constructing better algorithms. My particular interest is in methods for partial differential equations, and lately I have been studying the precise and detailed behavior of the finite-element methods in a variety of problems; the most interesting ones contain singularities of various degrees of nastiness.

Professional Activities: Managing editor for *Mathematics of Computation*.

Selected Publications:

Local behavior in finite element methods; in Handbook of Numerical Analysis (P. G. Ciarlet and J. L. Lions, eds.), Vol. II (Part 1), North Holland (1991), 353–522.

Superconvergence in Galerkin Finite Element Methods, Springer Lecture Notes in Mathematics **1605**, Springer-Verlag New York, 1995.

Beverly H. West

Senior Lecturer of Mathematics

My chief interest is in mathematics teaching, using interactive computer graphics, particularly in differential equations, multivariable/vector calculus, and dynamical systems (both real and complex).

Awards and Honors: Invited address, *Computer graphics in mathematics education*, at the Grand Opening of Fields Institute, Waterloo, Ontario (1992). Plenary address, *Computer graphics in differential equations*, at Seventh International Congress on Mathematical Education (ICME7), Quebec (1992). Guest Editor of The College Mathematics Journal for Nov. 1994 issue devoted to innovations in the teaching of differential equations.

Professional Activities: Member of the MAA, SIAM, AWM, NYAS, NCTM, and CODEE (NSF Differential Equations Consortium with Harvey Mudd College, Rensselaer Polytechnic Institute, St. Olaf College, Washington State University and West Valley Community College to promote computer graphics experimentation in differential equations courses and provide workshops).

National Advisory Board for Silvia Heubach's California State University at Los Angeles NSF project on An Innovative Modeling Approach at the Freshman/Sophomore Level (1997–99) and for J. McDill's Cal Poly San Luis Obispo NSF project on interactive business calculus.

Invited Lectures:

MAA Short Course on Teaching Differential Equations (with Paul Blanchard et. al.; July 1999).

Successful take-home examinations: multivariable calculus and differential equations, International Conference on Technology in Collegiate Mathematics (ICTCM), San Francisco (Nov. 1999).

Real time dynamics: why it makes a difference (with J. McDill), International Conference on Technology in Mathematics Teaching (ICTMT), Plymouth, England (Aug. 1999) and MAA Winter Meetings (Jan. 2000); Women in Science Delegation to Egypt.

Selected Publications:

*Analyzer** (with D. Alfors), an exhaustive software package for studying functions of a single variable (1990 EDUCOM/NCRIPTAL Distinguished Mathematics Software Award), Addison Wesley, 1992.

MacMath (with J. Hubbard), 12 interactive graphics programs for the Macintosh, to accompany the Differential Equations texts, second edition, Springer-Verlag, 1994; new expanded version in progress.

A new look at the Airy equation with fences and funnels (with J. Hubbard, J. McDill and A. Noonburg), College Mathematics Journal (1994); Proceedings of the Organic Mathematics Project (1996); CECM at Simon Fraser University (1997).

Differential Equations: A Dynamical Systems Approach (with J. Hubbard), Springer-Verlag; Part I: One-Dimensional Equations, 1991, 1997; Part II: Higher-Dimensional Equations, 1995.

Interactive Differential Equations (with S. Strogatz, J. M. McDill, J. Cantwell and H. Hohn), a CD-ROM with laboratory workbook, Addison Wesley Interactive, 1996, 1.1 for Mac and 2.0 for Windows, 1997.

ODE Architect (with C•ODE•E, NSF Consortium for ODE Experiments), John Wiley and Sons, 1998. An interactive teaching, learning and research environment on CD Rom with Companion Book of 269 pages. This package won an Invision '98 award as one of "The 9 Best CD-Roms on the Planet" (against all sorts of nonmathematics competitors)!

Technology in differential equations courses: my experiences, student reactions, a chapter for an MAA volume on teaching differential equations "in the new millenium" (M. Kallaher, ed.).

Differential Equations and Linear Algebra (a combined text with J. Stanley Farlow, James E. Hall and Jean Marie McDill), Prentice Hall, 2001, 600 pages.

James West

Professor of Mathematics

My research has focused on the topology and symmetries of manifolds of finite and infinite dimensions, and on the related topics of polyhedra, absolute neighborhood retracts, function spaces and spaces of sets.

An example of the interplay between these theories is that manifolds modeled on the Hilbert cube appear naturally in several ways as limits of stabilization processes for finite-dimensional objects, and, unlike standard function space stabilization, retain more of their important properties, e.g., simple homotopy type. Study of the Hilbert cube manifolds has produced several of the initial breakthroughs in introducing control into the homeomorphism theory of finite-dimensional manifolds. This in turn, has been useful in analyzing the failure of the classical matrix algebra to describe equivariant homeomorphisms and homotopy types of manifolds with locally linearizable transformation groups, which in turn has led to new results on the topological classification of linear representations of finite groups. I have been involved in these studies.

Professional Activities: Member of the editorial board of *Fundamenta Mathematicae*.

Administrative Activities: Faculty reader of Arts College freshman admissions applications.

Invited Lectures: Delivered an invited talk at the Universidad Nacional Autónoma de México.

Visiting Faculty Program Participants

Robert Piché

Tampere University of Technology (Finland)

I participated in the Cornell Mathematics Department's visiting program during the spring semester of 2001. I learned about the program from John Hubbard and saw that it was a great opportunity to experience life in the USA, in a leading university.

I enjoyed teaching first-year arts and science students. I found Cornell students to be diligent and responsive. It was a pleasure working with the graduate students and other visiting faculty under the "czarship" of Lars Wahlbin.

I attended seminars and guest lectures, and audited a couple of numerical optimization courses in the Computer Science Department. I got an account on the Cornell Theory Center's supercomputer and tried out some of their parallel computing software.

My wife and I got to know a lot of people by participating in activities on campus and in Ithaca. We had a busy half-year, and we are quite happy with our experience.

Nancy Tisch

Cornell University Biometrics Department

I am fortunate to have spent two academic years (1999–2001) as visiting assistant professor in the Mathematics Department. Most of my teaching experience prior to this appointment was in the field of biology. I found that teaching mathematics is a challenging but very rewarding experience. During my appointment in the Mathematics Department, I taught two sections of Math 111 for three semesters and each semester was under the leadership of a different "czar." Professors Marshall Cohen, Michael Morley and Maria Terrell each had a different emphasis and approach for the course, so that I came away with an enriched teaching experience. I especially enjoyed the "prelim writing teams" that Professor Terrell organized. This was my first opportunity to be involved in writing math exams, and under her guidance I learned a great deal about how to write a good exam (math or other subjects). I am grateful to each of the czars for their patience, guidance and support.

I have also been working in a graduate research seminar in computational biology (organized through the Biometrics Department). This has provided me the opportunity to interact with professors Durrett and Guckenheimer. I appreciate the time and input that they have extended to our group.

I also extend my thanks to Stephen Chase, to Doug Alfors and the math support group, and to the staff members of the department. Each has helped to make my visit enjoyable and successful.

Staff Profiles

Administration

Nora Balfour, Undergraduate Coordinator (1998): Nora was the undergraduate coordinator through February 2001. She was the primary resource person for the undergraduate program, which included 88 majors at the end of the academic year. The undergraduate coordinator acts as liaison between faculty and their advisees, both majors and over 200 students with undeclared majors. She coordinates the application process for the summer Research Experiences for Undergraduates (REU) program and maintains various departmental web sites. She is also the department receptionist, conducts the annual faculty recruitment effort and provides administrative support both for the undergraduate program and the administrative manager. In 2000–2001, this position included the responsibilities of editing the department newsletter, *Math Matters*, and supervising undergraduate graders.

Gayle Davis, Accounts Coordinator (1998): Gayle provides administrative, financial and personnel support for the department. In accordance with university and agency regulations, she develops research budgets and oversees proposal submissions to the Office of Sponsored Programs. She monitors account transactions, approves expenditures and maintains account information and records. She also processes nonacademic appointments, maintains nonacademic personnel records, oversees time collection, processes payroll vouchers and distributes paychecks. Gayle assists the administrative manager in the day-to-day operations of the department and serves as acting manager when the administrative manager is unavailable. She is the functional supervisor for the administrative staff.

Arletta Havlik, Department Registrar (1968): Arletta provides secretarial and administrative support for the instructional and research programs of the Mathematics Department faculty. Her responsibilities include coordinating the paperwork, course enrollments and inquiries pertaining to enrollment in math courses, and she oversees the department's presence at the central course exchange each semester. In her role as department registrar, she coordinates course enrollments, evaluations and grade submissions. She is the primary technical typist for the department and prepares complex documents involving sophisticated typesetting software (TEX) which involves designing, editing and formatting.

Joy Jones, Building Coordinator (1980): Joy is the building coordinator and copy room specialist for the department. She coordinates the day-to-day service operations provided to faculty, visitors, staff and students. She orders supplies, processes purchase orders and performs records and facilities maintenance, information gathering and data input. Joy assists the accounts coordinator with travel reimbursements, cash deposits, records management and accounts payable. She oversees the operations of the mailroom, maintains repair and renovation records and secures the building at night. Joy is the person to whom any building issues (e.g., repairs, heating and cooling) are reported. In addition, she coordinates the refreshments for the weekly seminar series.

Michelle Klinger, Teaching Program Coordinator (1993): Mikki provides administrative support for the mathematics teaching program, assisting the associate chair and the teaching assistant coordinator. She works directly with the teaching assistant coordinator to generate the department course schedules. Mikki oversees room assignments and changes, course file management and textbook ordering and screens inquiries pertaining to course offerings. She also acts as backup technical typist, processing original entry and editing of highly technical mathematical manuscripts. Mikki works with the administrative manager to compile information for and publish the annual report. She is the backup department receptionist, coordinates the annual capital equipment inventory, publishes a weekly seminar bulletin and maintains the department directory database and related reports. Mikki updates and maintains many departmental web pages. She also issues keys and maintains the department's access device log for all keyholders.

Donna Smith, Graduate Field Coordinator (1997): Donna is responsible for the administration of the department's graduate program, beginning with the admissions process and continuing through graduation. She provides primary support to the director of graduate studies, maintains matriculated student records, processes appointments and generally oversees the administrative functions of the graduate program, consisting of about 63 graduate students. She works with the administrative manager and the teaching assistant coordinator to monitor the annual teaching assistant budget. In addition, she coordinates, schedules, plans and oversees all department social functions. Donna provides backup support to the accounts representative for the depart-

ment's time collection and payroll effort and serves as the department's telephone coordinator.

Catherine Stevens, Assistant to the Chair (1969): Cathy provides executive, administrative and secretarial support to the chair and faculty of the Mathematics Department. Cathy maintains the chair's calendar, screens calls and schedules appointments. She assigns office space and works with the chair to compile teaching and committee assignments. Cathy coordinates faculty searches, processes academic personnel forms and maintains academic personnel files. She assists foreign nationals in obtaining proper visa status, arranges lectures and accommodations for prospective faculty and visitors and schedules benefits counseling for new academic employees. Cathy plays a key administrative role in overseeing the summer session course offerings, including budget development, teaching assistant assignments and grader support.

Colette Walls, Administrative Manager (1996): As business manager, Colette directs the financial, personnel, facilities, communications and funds procurement operations. Her responsibilities include planning, managing and evaluating the general administrative operations of the department. She assists the chair (and others) in administering selected academic activities including the course count, budget process, leave replacement funding and TA budget. She maintains, monitors and reconciles departmental appropriated, gift and endowment accounts and acts as liaison with central college and university offices. She oversees and participates in the publication of newsletters, the annual report and various external surveys and generates a variety of department, college and university reports. Colette interviews, hires, assigns workloads and supervises the administrative support staff. She is also responsible for updating and maintaining the department's web-based *Survival Manual for Faculty and Teaching Assistants*, which can be found at www.math.cornell.edu/~colette/Survival/survival.toc.html.

Computer Support

Douglas Alfors, Computer Consultant and Advisor (1998): Doug provides organizational and administrative computer support for the Department of Mathematics. He has primary responsibility for the administrative computer server, including backup, software and hardware installation, operations, inventory and security. He provides computer consulting, diagnostic and troubleshooting support for department members. Doug assists the network administrator in maintaining the departmental network.

Robert Terrell, Network Administrator (1997): As network administrator, Bob is responsible for the departmental computer servers, including networking, backup, software and hardware installation, operations and security. He maintains some of the departmental web pages, provides maintenance for the department computer systems — including UNIX, Sun, Macintosh and PC operating systems — and provides computer consulting, diagnostic and troubleshooting support for department members.

Mathematics Support Center

Douglas Alfors, Director (1983): Doug directs and coordinates MSC academic support for mathematics, principally for introductory courses. Such support includes the interviewing, hiring and supervision of student tutors; the day-to-day running of the MSC office; preparation and distribution of written support capsules; and planning and conducting various workshops on topics of common interest (e.g. graphing, infinite series, integration, etc.). He also oversees the use of the computers in the MSC.

Richard Furnas, Teaching Associate (1981): Richard has been a mainstay of the Mathematics Support Center since its inception in the early 1980s. He serves as a tutor, review session leader and general Macintosh guru. Graduate students from other departments often benefit from his counsel on the use of a variety of mathematical techniques in their field of research. Dick also assisted this year in the instruction of Math 171 (*Statistical Theory and Application in the Real World*).

Mathematics Instructional Computer Lab

Allen Back, Director (1993): Allen is responsible for the primary computer instruction laboratory for the teaching of mathematics. The lab is a teaching arm of the Mathematics Department, and the director addresses pedagogic issues in appropriate instructional uses of computers, acting as a resource person in all related areas. He is responsible for the installation and upkeep of hardware and software, as well as addressing all personnel issues of the lab including selection, training and supervision. Allen also contributes to the development of sample materials, assignments, and help documentation and software of interest to faculty and staff. He gives demonstrations, helps with software use, serves as an advisor on technical issues and assists in relevant grant proposals.

Mathematics Library

Lee Ringland, Access Services Supervisor (1999): Lee oversees the operation of the Math Library's circulation and reserve services. She is also responsible for the hiring, training and supervision of student employees. Lee can help you with reference questions and is in charge of the library when Steve is not available.

Steven Rockey, Mathematics Librarian (1972): Steve is in charge of the library and makes all policy, management and budget decisions. He is the contact for questions about book, journal or other format purchases for the library. Drawing on many years of experience in the library, he can often find an answer or solution for most any question or problem. Walk right in, send an e-mail or give him a call any time at work or at home.