

## Department of Mathematical Sciences Annual Report for 1998

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## Changes in 1998

The most noticeable change in the Department of Mathematical Sciences is a change of leadership, with Douglas Kurtz returning to a regular faculty assignment and David Finston becoming the next Department Head. However, Professor Finston is currently on leave, and Richard Bagby is Acting Department Head in his place. When Professor Finston resumes his position, Professor Bagby will replace Ray Mines as Associate Department Head.

No new permanent faculty were hired in 1998, but the department has two visiting faculty for the academic year; Professor Susanne Pumpluen, an algebraist, and Professor Zhenyuan Wang, a probabilist. Quite a few temporary College faculty were hired: Elaine Cohen, Norma James, Tuesday Johnson, Eric P. Korsmo, Shakir Manshad, David Muller, Benedict Nmah, Susan Schibel, Judith Wherritt, and Debra Zarret.

Change seems to be a permanent condition in our teaching effort. The renovation of our calculus sequence became complete this fall with the new text and course organization phased into the third course in the sequence. At the same time the differential equations course was updated, and these changes made our student computer lab obsolete. Fortunately funds have been provided by the central administration for the purchase of 24 new computers, and the lab should again be functioning smoothly in the spring. Our teacher education courses are being changed significantly in connection with our new emphasis on mathematics education, and more of the tenure-track faculty are taking an interest in teacher preparation courses. One faculty member developed a new statistics course for Psychology majors, and two developed new Honors courses. Almost all the courses we teach are changing in one way or another, as we explore new ways to get the students more actively involved in the learning process.

The students we serve are changing, and recent shifts on student population has had a major impact on our department. Unfortunately, graduate enrollments and undergraduate mathematics majors have been declining. However, the number of students in our calculus classes is on the way back up, and the number of students in our general education classes is exploding.

The nature of our research effort is changing too; with much more of it done in cooperation with non-mathematicians. Several faculty are heavily involved in joint projects with PSL, and several are also doing joint research with engineering faculty. Quite a few faculty members are writing textbooks as well as research papers. The reputation of our faculty continues to grow; in the last year two received fellowships to study at the Mathematical Sciences Research Center in Berkeley, one was invited to Paris to spend the term at L'Institut des Hautes Etudes Scientifiques, and two participated in the International Congress of Mathematicians in Berlin. Overall, fourteen faculty members gave thirty-five talks in foreign countries during the past year.

Finally, our service role is changing, with much more service taking place outside the university. One faculty member taught a short course in Puerto Rico last summer under the NSF Chattaquua program, and several have recently taught minicourses in connection with the annual national meeting of the American Mathematical Society. Several hold offices or committee assignments in professional organizations and several serve on the editorial boards of journals. Many are involved in outreach to the public schools.

## Teaching Improvement Activities

The department has a standing committee on teaching, charged with monitoring the teaching of graduate assistants and untenured faculty. The committee arranges for classroom observations and written reports. Additionally, the committee works on programs to improve teaching and its evaluation. This year a new form was developed for student evaluations.. Work on a program for mentoring new faculty has resumed; an earlier attempt to begin one was abandoned due to the hiring freeze.

Significant changes in several of our service courses were described in the previous section. In addition, there were a number of changes made by individual faculty members in courses they teach undergraduate mathematics majors or graduate students. The department has a history of encouraging innovations, and the faculty continues to experiment with better ways to teach. Whether or not the new methods are really better, the enthusiasm for teaching that they generate is definitely good.

## Research Activities

The successes of individuals are documented in their annual reports; there are far too many to reproduce here. It's worth noting that in the past year that virtually every tenure track faculty member had something either submitted for publication, accepted for publication, or appearing in print; the only exceptions were a faculty member working in industry while on leave without pay and the outgoing Department Head. We continue to have strong research groups in algebra, analysis, and topology, and our presence in applied mathematics is now significant. Professor Nguyen is an international leader in fuzzy systems, and several others in the department are working with him on joint projects. Professor Barany's work on robotics and dynamical systems is producing a steady stream of joint papers with coauthors from engineering, and he is also working with PSL. Professor Laubenbacher is leading the abstract mathematical side of an enormous project at PSL, and it will involve several other faculty members in the spring.

Many of our faculty members have continuing grant support; this year fourteen of our faculty participated in twenty-seven new grant proposals.

It's worth noting that Professor Salamanca-Riba had a research paper accepted by *Annals of Mathematics*, the most prestigious mathematics journal in the country and perhaps in the whole world. This will be the first time for a member of the department to publish there.

Professors Laubenbacher and Pengelley had a textbook published this year; as did Professor Baggett. Professor Bagby is putting the finishing touches on a textbook to be published by Academic Press, while Professors Laubenbacher, Lodder, and Pengelley have nearly completed a textbook underwritten by the National Science Foundation.

During the spring the department hosted a conference on Harmonic Analysis, and this coming January it will host a holiday symposium on Logic and Algebraic Systems.

## Outreach Activities

The Southwestern Research Institute for Mathematical Sciences program continues to involve numerous faculty working with students and faculty from public schools. One major thrust of the program has been in cryptography, but it has also involved Fourier analysis. About one-third of the faculty gave talks in public schools in the past year. Professor Bagget works constantly with public school teachers and the students in their classrooms. Professor Finston will teach a course for in-service teachers on "The mathematics of everyday experience," designed to help them improve their general mathematics offerings. The department is working to develop a program to bring teachers to NMSU for a year at a time, so that they can take a course or two from us, teach in the learning center, and teach us about what works in the high schools as we teach them more about mathematics.

## Outcomes Assessment

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## Undergraduate majors

We hold exit interviews with graduating seniors and have been attempting to survey recent graduates. Unfortunately, response from the survey has been too meager to use. Graduating seniors are asked the following questions:

1. What are you hoping to do eventually with your major in mathematics? What are your plans for next year?
2. What were the best aspects of your mathematics major program?
3. What were the worst aspects of your mathematics major program? What changes would you suggest to improve the mathematics program?
4. Has your mathematics major program enabled you to: identify a mathematics problem? characterize solutions to it? develop procedures for arriving at solutions? possess the technical skills to carry out a solution?
5. Has your mathematics major program enabled you to: read and understand mathematical writing? write and communicate mathematics in clear and understandable fashion? Has your mathematics major program enabled you to understand proofs of correctness of mathematical results?

Partly as a result of our outcomes assessment activities, we developed a program for a new supplementary major in mathematics. We found that the long range goals of many students would be better served by a combination of mathematics with a major in a discipline that used a great deal of mathematics, and that conversely, many students from other majors could benefit from extensive formal training in mathematics.

## **General education**

We read term papers chosen from students earning approximately B grades, to determine if the goal of having students learn about abstract mathematical systems was being addressed. The courses involved were Math 112G, Math 142G, Math 210G, and Math/Honors 411. We found that while in most cases this goal was being met, in some cases the term papers submitted did not address this requirement at all. As a result, changes are being made in the course outlines to spell this out more clearly.

## **Graduate education**

The assessment of our graduate program includes a survey of graduates with advanced degrees and evaluation of the performance of our graduate students on master's and doctoral examinations. Results are not available at this time

## **Research**

The proposal to assess the research program incorporated the university's mission with proposals from the American Mathematical Society, and involved the research production of faculty members and the participation of graduate undergraduate students in research and creative activities. The research production of the faculty is assessed by the percentage of the tenure-track faculty members who publish research results during each three year period. This percentage should be at or above the average for Carnegie I Research Universities, which was 84% for the fall of 1994.

Currently 100% of our tenure track faculty have published research results in the last three years. Our graduate students have taken research courses in wavelets, dynamical systems, and coding theory. We regularly involve our undergraduates in projects, and for the past summer we placed two of our undergraduate majors in summer research institutes.

## **Changes in assessment procedures**

In response to criticism in the recent North Central Accreditation Report, we will attempt to devise a better scheme to assess outcomes in general education. It will be difficult, since there is no specific knowledge or skill to be tested for and the courses involved are quite diverse. Finding a manageable procedure is also a challenge; for example, this term we offer four general education classes; there are 758 students enrolled in 20 sections and 10 of the instructors are either graduate students or temporary faculty.

## Departmental Colloquia in 1998

### Department Colloquia for 1998.

- David Vogan, Massachusetts Institute of Technology, *The Size of Infinite-Dimensional Representations*, January 29, 1998.
- Marianne K. Körten, Johns Hopkins University, *On the One-phase Stefan Problem Under Minimal Assumptions*, February 5, 1998.
- Vladimir Retakh, University of Arkansas, *Noncommutative Algebra, Noncommutative Geometry and Noncommutative Determinants*, February 12, 1998.
- John Gilbert, University of Texas at Austin, *Multiplication as a Prototypical Bilinear Operation*, February 27, 1998.
- Lanh Tran, Indiana University, *Density and Regression Estimation for Spatial Data*, March 12, 1998.
- Joseph Brennan, North Dakota State University, *Computational Commutative Algebra*, March 13, 1998.
- Klaus Kaiser, University of Houston, *On Peano Algebras and Their Generalizations in Logic Programming*, March 19, 1998.
- Salvador Pérez-Esteve, Instituto de Matemáticas, Cuernavaca, Universidad Nacional Autónoma de México, *Spherical Means and an Inverse Source Problem*, April 2, 1998.
- Oliver Dasbach, Columbia University, New York and University of Duesseldorf, Germany, *The Problem With Words in the Singular Braid Monoid*, April 9, 1998.
- Ted Hodgson, Montana State University, *Texas Instruments' TI-92 Calculator: Overview and Implications*, April 16, 1998.
- Manfred Knebusch, Universität Regensburg, *Generic Splittings of Quadratic Forms*, April 22, 1998.
- Jon Holtzman, New Mexico State University, Department of Astronomy, *Image Processing in Astronomy: Some Examples From the Hubble Space Telescope*, April 23, 1998.
- Gregor Masbaum, University of Paris VII, *Involutions on Moduli Spaces and Refinements of the Verlinde Formula*, April 30, 1998.
- Victor Katz, University of the District of Columbia, *The Transmission of Mathematical Knowledge from Islam to Europe*, May 5, 1998.
- Allen Moy, University of Michigan, *The Orbit Method in Representation Theory*, May 7, 1998.
- Pavel Ptak, Czech Technical University, Prague, *States on Quantum Logics*, August 25, 1998.
- Michael Cain, New Mexico State University, Department of Biology, *Movement in Plants*, September 17, 1998.
- David Pengelley, New Mexico State University, Department of Mathematical Sciences, *Using History in Teaching our Mathematics Courses*, September 24, 1998.
- Patricia Baggett, New Mexico State University, Department of Mathematical Sciences, *Mathematics Courses for Prospective and Practicing K-8 Teachers*, October 1, 1998.
- Bodo Pareigis, University of Munich, Germany, *Automorphism Groups and Quantum Groups in Noncommutative Geometry*, October 8, 1998.
- Bodo Pareigis, University of Munich, Germany, *Reconstruction of Spaces or Systems From Observables or Exterior Measurements*, October 9, 1998.
- Marcus Cohen, New Mexico State University, Department of Mathematical Sciences, *Spinor Geometry of a New Unified Field Theory*, October 15, 1998.

- Brandy Stigler and Michael Kmetz, Undergraduate Mathematics Majors, Department of Mathematical Sciences, New Mexico State University, *Research Experiences in Summer Programs*, October 22, 1998.
- Aaron Ekstrom and Alex Perlis, University of Arizona, Department of Mathematics, *Workshops for High School Students*, October 23, 1998.
- Lev Kapitanski, Kansas State University, *Understanding Attractors*, October 29, 1998.
- Peizhuang Wang, West Texas A&M University, *Factor Spaces*, November 4, 1998.
- David Smith, New Mexico State University, Department of Chemistry and Biochemistry, *New Mexico State University, Extended-System Methods in Molecular Dynamics Computer Simulations*, November 5, 1998.
- Nuria Mata Burgarolas, University of Texas at El Paso, *Basic Geometric Operations in Ruler-and Compass Constraint Solvers Using Interval Arithmetic*, November 10, 1998.
- Alicia Dickenstein, Universidad de Buenos Aires and MSRI, *Algebraic, Geometric and Analytic Aspects of Multidimensional Residues*, November 12, 1998.
- William Faris, University of Arizona, *Renormalization and Universality*, November 19, 1998.
- Chris Barrett, Los Alamos National Laboratories, *Simulation Science*, November 20, 1998.
- Christian Reidys, Los Alamos National Laboratories, *Elements of a Theory of Simulation: Sequential Dynamical Systems*, November 20, 1998.

## Degrees Awarded, Jan. 1998-Dec. 1998

### Name and Degree

Susan Schibel (SP98) Master's Advisor: Susan Hermiller

Diana Olivares (SSII98, Aug. 6) Master's Advisor: Patricia Baggett

David Emery (SP98) Ph.D. Advisor: Josefina Alvarez

Karen Schlauch (SP98) Ph.D. Advisor: Reinhard Laubenbacher

Alex Pogel (SSII98) Ph.D. Advisor: Mai Gehrke

Gregg Waterman (SSII98) Ph.D. Advisor: Caroline Sweezy

## Faculty Publications in 1998

### **Josefina Alvarez**

``Continuity properties for linear commutators of Calderón-Zygmund operators'', *Collectanea Mathematica* 49 (1998), 17-3.

``Teaching mathematics appreciation to non-science majors'', *Journal of the Humanistic Mathematics Network* 16, November 1997, 30-31.

``En memoria de Alberto P. Calderón'', *Newsletter of the Argentinian Mathematical Union* 22, July 1998, 17-18, (in Spanish).

### **Richard Bagby**

``A convergence of limits'', *Mathematics Magazine* 71, No. 4(1998), 270-277.

### **Patricia Baggett**

Breaking away from the math book II: More creative projects for grades K-8. Lancaster, PA: Technomic Publishing Company, with Ehrenfeucht, A. (1998).

Designing and testing a multimedia browsing system based on cohesion. In Gil-Mendieta, J. & Hamza, M.H. (Eds), *Proceedings of the IASTED International Conference Computers and Advanced Technology in Education*, pp. 9-13, Anaheim, CA: IASTED/ACTA Press, with Ehrenfeucht, A., Jungbauer, J., & Villaverde, K. (1998).

### **Ernest Barany**

Colbaugh, R. and E. Barany, ``Control of Nonholonomic Mechanical Systems Using Reduction and Adaptation'', *Robotica*, in press

Colbaugh, R., E. Barany, and K. Glass, ``Adaptive Control of Nonholonomic Robotic Systems'', *Journal of Robotic Systems*, Vol. 15, No. 7, 1998

Barany, E. and R. Colbaugh, ``Global Stabilization of Uncertain Mechanical Systems With Bounded Controls'', *International Journal of Robotics and Automation*, Vol. 13, Vol. 2, 1998

Colbaugh, R., E. Barany, and K. Glass, ``Adaptive Stabilization of Uncertain Nonholonomic Mechanical Systems'', *Robotica*, Vol. 16, No. 2, 1998

Colbaugh, R., E. Barany, and K. Glass, ``Adaptive Control of Constrained Robotic Systems for Waste Management Applications'', *International Journal of Environmentally Conscious Design and Manufacturing*, Vol. 7, No. 1, 1998

Colbaugh, R., K. Glass, and E. Barany, ``Adaptive Control of Electrically Driven Nonholonomic Mechanical Systems'', *Proc. 37th IEEE Conference on Decision and Control*, Tampa, FL, December 1998

Barany, E. and R. Colbaugh, ``Global Stabilization of Uncertain Underactuated Mechanical Systems'', *Proc. 37th IEEE Conference on Decision and Control*, Tampa, FL, December 1998

Barany, E., K. Glass, and R. Colbaugh, "Control of Uncertain Nonholonomic Mechanical Systems Using Differential Flatness", *Proc. 1998 American Control Conference*, Philadelphia, PA, June 1998

Barany, E. and R. Colbaugh, "On the Global Stabilization of Mechanical Systems", *Proc. 1998 American Control Conference*, Philadelphia, PA, June 1998

nal of Modern Physics D, Vol. 7, #5, 1998.

#### **David Finston**

Finston, David R.; and Walcher, Sebastian, "On a Class of Additive Group Actions on Affine Three-Space", *Rocky Mountain Journal of Mathematics*, Vol.28, Num. 2, Summer 1998, pp. 463-485.

#### **John Harding**

Bruns, G., & Harding, J., "Amalgamation of Ortholattices", *Order*, 14:193-209, 1998.

Harding, J., "Regularity in Quantum Logic", *The International J. of Theoretical Physics*, 37 (2):1173-1212, 1998.

Harding, J., "Canonical Completions of Lattices and Ortholattices", *Tatra Mountains Math. Publ.*, 15:85-96, 1998.

#### **William Julian**

Julian, W.H., Kooiman, B.L., and W.L. Sanders. Galaxy Morphology in the Virgo Cluster and in the de Vaucouleurs Groups. *Publications of the Astronomical Society of the Pacific* **109**, 297-299, 1997. (Accepted and appeared in print after last year's review.)

#### **Joseph Lakey**

Lakey, J., Massopust, P. & Pereyra, M.C., "Divergence-free multiwavelets" in *Approximation Theory IX*, Vanderbilt Univ. Press, Nashville, 1998, 161-168.

Gilbert, J., Hogan, J., & Lakey, J., "Atomic decomposition of divergence-free Hardy spaces," *Math. Moravica*, Special Vol., Proc. 5th IWAA (1997) 33-52.

#### **Reinhard Laubenbacher**

"*Great Expeditions, Chronicles by the Explorers*", Springer Verlag, Undergraduate Texts in Mathematics, approx. 270 pp. To appear in early December (with David Pengelley).

"*On higher class groups of orders*", (with Manfred Kolster), *Mathematische Zeitschrift*, Vol. 228, 229-246.

#### **Jerry Lodder**

"Leibniz Cohomology for Differentiable Manifolds," *Annales de l'Institut Fourier*, Grenoble, 48, 1, (1998), p. 73-95.

### **Ray Mines**

Dasenbrock, Reed Way & Mines, Ray, "Nought nowhere was never reached": *Mathematics in Ulysses*, *James Joyce Quarterly*, pp. 25-36, Vol. 35, No.1, (Fall 1997)

Bridges, Douglas S. & Mines, R., *Sequentially continuous linear mappings in constructive analysis*, *The Journal of Symbolic Logic*, Vol. 63, No.2, pp. 579-583 (1998)

### **Patrick Morandi**

Morandi, P. J., and Sethuraman, B. A., *Divisors on division algebras and error correcting codes*, *Communications in Algebra*, **26** (1998), 3211-3221.

### **Hung T. Nguyen**

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*Fuzzy Systems: Modeling and Control* (Co-Editor with M. Sugeno), Kluwer Academic, Boston, 1998.

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Multi-criteria optimization: An important foundation of fuzzy system design (with V. Kreinovich). In *Fuzzy Systems Design* (L. Resnik et al, Eds.), Physica-Verlag, Heidelberg, 24-35, 1998.

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A negative version of Choquet theorem for polish spaces (with N. Nguyen). *East-West Journal of Mathematics*, vol 1, no 1, 61-71, 1998.

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Strict archimedean t-norms and t-conorms as universal approximators (with V. Kreinovich and V. Shekhter). *Intern. J. of Approximate Reasoning*, vol 18, 239-249, 1998.

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Methodology of fuzzy control (with V. Kreinovich). In *Fuzzy Systems: Modeling and Control* (H. Nguyen and M. Sugeno, Eds.). Kluwer Academic, Boston, 19-62, 1998.

-

Fuzzy rule based modeling as a universal approximation tool (with V. Kreinovich and G. Mouzouris). In *Fuzzy Systems: Modeling and Control* (H. Nguyen and M. Sugeno, Eds.). Kluwer Academic, Boston, 135-195, 1998.

### **David Pengelley**

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"Great Expeditions, Chronicles by the Explorers", Springer Verlag, Undergraduate Texts in Mathematics, approx. 270 pp. To appear in early December (with David Pengelley).

## **Susana Salamanca-Riba**

“On the Unitary dual of the classical Lie groups. Representations of  $Sp(p, q)$ ”, *Proceedings of the American Mathematical Society*. Vol. 125, No.10, October, 1997, pp. 3107-3117.

## **Irena Swanson**

“Highway”, a quilt block design, winner in the Transportation (fabric) category of the contest organized by *IEEE Spectrum*, September 1997, published in *IEEE Spectrum* in December 1997.

## **Caroline Sweezy**

“Some Inequalities for Distribution Functions,” *Mathematica Moravica*, Special Volume 1997, Proceedings of the IWAA, 239-250.

“ $B^q$  for parabolic measures” *Studia Mathematica* 131 (2) 1998, 115-135.

## **Tony Wang**

*Belief functions and random sets* (with Hung T. Nguyen), in “Random Sets --- Theory and Applications” J. Goutsias, R. P. S. Mahler and H. T. Nguyen (Eds.). The IMA Volumes in Mathematics and Its Applications, Vol. **97**, 243 - 255 (1997).

*Wishartness of quadratic forms under elliptically contoured settings*, Pub. Inst. Stat. Univ. Paris, XXXI, fasc. 3 (1997), 31-45.

## **Frank Williams**

Williams, F., Wisner, R.J., “On the cohomology of certain congruence subgroups of the modular group,” *Proceedings of the American Mathematical Society*, **126** (1998), pp 1331-1336.

## **Robert Wisner**

Cohomology of certain congruence subgroups of the modular group, with Frank Williams, *Proceedings of the American Mathematical Society*, vol. 126, no.5 May 1998, pp 1331-1336.

MATHEMATICS for the Liberal Arts Student, Preliminary Edition, with Fred Richman, Carol L. Walker, and James W. Brewer, 394 pp., Simon and Schuster, 1998.

## **Joseph Zund**

“An Essay on the Foundations of Gaussian Differential Geometry-II : Imbedding Questions,” *Bollettino di Geodesia e Scienze Affini*, anno LVI, (1997), 407-424.

“A Conjecture on Coordinate Systems in the Marussi-Hotine Theory of Differential Geodesy-II,” *Bollettino di Geodesia e Scienze Affini*, anno LVII, (1998), 61-69.

“Tensors and Differential Geodesy,” *Bollettino di Geodesia e Scienze Affini*, anno LVII, (1998), 165-177.

“Learning from Charlie” in *Memories of Charles Oehring*, published in Blacksburg, Virginia (Virginia Polytechnic Institute and State University),(1998), 3 pages.

Biographical Sketch: "William Bowie (1872-1940)," in Union Medals: American Geophysical Union; electronic publication- <http://www.agu.org/inside/awards/bowie.html>

(2 frames= 2 1/2 pages), posted 1998.

Biographical Sketch: "Charles Arthur Whitten, (1909-1994)," in Union Medals: American Geophysical Union; electronic publication- <http://www.agu.org/inside/awards/whitten2.html>

(2 frames= 2 1/2 pages), posted 1998.

*Doug Kurtz*

*Wed Feb 17 11:25:10 MST 1999*

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*Doug Kurtz*

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