

# Department of Mathematical Sciences Annual Report for 1995

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## 1 Special Accomplishments

The Department of Mathematical Sciences and its faculty members are recognized nationally and internationally for their work on research and curricular activities. Professor Josefina Alvarez presented an invited Special Session talk at the Mexican-American Meeting in Guanajuato, Mexico, in November. Assistant Professor Susan Hermiller conducted research at the University of Stockholm in May and June with funding from the Swedish Research Council. In June and July, Professor Doug Kurtz consulted on educational issues with faculty members at the University of Adelaide and Flinders University, supported by the two schools. Associate Professor Jerry Lodder received funding from the National Center for Scientific Research in France

to allow him to spend the fall semester there conducting joint research. Professor Hung Nguyen was supported over the summer as a US Navy/American Society for Engineering Education Summer Faculty Research Program Seminar Fellow. In April, Professor David Pengelley presented the banquet address at the annual meeting of the Southwest Section of the Mathematical Association of America. Professor Charles Swartz conducted research with mathematicians in Korea and Singapore and spoke at the Southeast Asian Mathematical Conference. Assistant Professor Arkady Vaintrob presented seminar talks at the Independent Moscow University in May and the Université Ecole Polytechnique in Paris in June. Professor Joseph Zund was elected a Fellow of the International Association of Geodesy. The high school curriculum development program received national recognition and continued its impact on mathematics education around the state by its influence on the state's Systemic Initiative on Mathematics and Science Education.

Faculty members are productive researchers and several received continuing support for their research. Ernie Barany was awarded his second Sandia/University Research Program research grant, Mai Gehrke was supported by the National Science Foundation to conduct research in algebra, Joseph Lakey was funded by the National Science Foundation for research in analysis, Susan Lee received a grant from the National Science Foundation for her work in probability theory, and Susana Salamanca-Riba received funding from the National Science Foundation for work in representations of Lie group. In recognition of the work performed by members of the department, an anonymous donor created a new \$5,000 Summer Research Award in the Mathematical Sciences. The high caliber of the applicants led the donor to give another \$1,000 to support Mai Gehrke and Arkady Vaintrob this summer.

Members of the department are active in curricular change, effecting courses ranging from algebra and trigonometry through graduate-level offerings. Reinhard Laubenbacher and David Pengelley were supported by a grant from the National Science Foundation to write a textbook on the teaching of mathematics using historical sources. Faculty members continue to present workshops explaining calculus reform in the department, and faculty members are in demand as speakers at conferences and workshops. Lolina Alvarez presented a workshop at the New Experiences in Teaching (NExT) conference, marking the second year that a member of the department was invited to speak at this conference. Mai Gehrke and David Pengelley presented a three-day Chautauqua workshop for college teachers, funded by the National Science Foundation. Doug Kurtz spent five weeks working with faculty members at universities in Adelaide, South Australia, on implementing writing assignments in their calculus courses. Reinhard Laubenbacher and David Pengelley conducted a mini-course on teaching mathematics using historical sources at the annual mathematics meeting in January. David Pengelley was invited to be an instructor during the summers of 1996 and 1997 at the NSF-funded Institute in the History of Mathematics and its Use in Teaching.

The Mathematics Learning Center continued to develop the college algebra and trigonometry curriculum in order to effectively exploit graphing calculator technology. Beginning this fall, all Learning Center courses use graphing calculators as an integral part of instruction. Mathematics Learning Center faculty members cosponsored a one-day workshop with the Dona Ana Branch Community College.

The high school program mentioned above, supported by the National Science Foundation, has been recognized by the National Council of Teachers of Mathematics, the Southwest Educational Development Laboratory, the Eisenhower Clearinghouse for Mathematics and Science Education, and the Annenberg/CPB Guide to Math and Science Reform for developing a program incorporating discovery learning, cooperative learning and writing in mathematics. Dave Finston, working with local high school mathematics teachers Roger Greer and Marilyn Gutman, received three new grants from the state of New Mexico, funded by the Commission on Higher Education (CHE), the State Department of Education (SDE) and the Systemic Initiative in Math and Science Education (SIMSE). These have supported one-week and three-week workshops to train elementary and middle school teachers from around New Mexico to use writing assignments to teach mathematics. Reinhard Laubenbacher and David Pengelley introduced a new course for high school teachers and graduate students in mathematics education on teaching mathematics using historical sources; this course was supported by the New Mexico Center for Teaching Excellence and the Las Cruces Public School System.

The department's activities in public school education were greatly enhanced by the implementation of a research program in mathematics education. The department hired its first faculty member in this new initiative this year, Pat Baggett. Her research was supported by grants from the National Science Foundation and the Office of Naval Research. She began her teaching career at New Mexico State University by creating a graduate-level special topics course for practicing teachers to run concurrently with her class for elementary teachers, enabling undergraduates to visit classrooms and implement activities from the course. She has presented numerous talks for local public schools.

The department brought in noted speakers from diverse areas of mathematics and attracted many visitors. It continued its Holiday Symposium Series, which brings outstanding mathematicians to campus for a series of in-depth lectures, with a research conference on Gröbner bases and applications held at the end of December, 1994. The main speaker was Professor Bernd Sturmfels of the University of California, who presented a series of ten lectures on "Gröbner bases and convex polytopes". The Holiday Symposium was supported by grants from the National Science Foundation, for the third year in a row, as well as additional funding from the National Security Agency. Professor Sturmfels extended his stay as a Distinguished Visiting Professor. The department has agreed to host the "Third Conference on Mathematical Algorithms", an annual US-Russian conference, for January, 1997, as the next Holiday Symposium.

It hosted the twice yearly New Mexico Geometry and Topology Seminar, which is run in conjunction with the University of New Mexico. The department scheduled weekly colloquia throughout the academic year, involving several outstanding invited speakers as well as department faculty members. (See section 12 for a list of the colloquia presented.)

For the seventh year in a row, the department hosted the Math Challenge for high school students from regional high schools. The Math Challenge consists of three different contests: an individual competition, a team bowl competition, and a team modeling competition. For the first time, the team bowl competition involved a team from Silver City.

Faculty members remained active as officers and committee and board members of regional and national professional organizations. Several faculty members served as chairs and organizers of special sessions at national and international conferences. The majority of faculty members serve as reviewers and referees, and two are journal editors.

The computing facilities in the department grew, due to the purchase of many new computers and the donation of two large file servers from Sun Microsystem Lab, Inc., in California. These latter computers more than double the department's networked computing power and storage capabilities.

As a final note, the department is pleased to record the accomplishments of its mathematics majors and graduate students. Chris Beltran received the College of Arts and Sciences Excellence in the Sciences Award. Graduate assistants Tuesday Johnson and Melanie Martin are CHE fellows, and graduate assistants Vrushali Bokil, Xenia Kramer, Karen Schlauch and Greg Waterman received CHE research awards.

## 2 Personnel Changes

Two faculty members were promoted and one tenured this past year. David Finston and David Pengelley earned promotion to Professor of Mathematics and Gerald Lodder earned tenure.

The department hired one new Professor and three new Assistant Professors this year. Patricia Baggett earned a Ph.D. in cognitive psychology from the University of Colorado and worked most recently in the College of Education at the University of Michigan. She was hired as a senior mathematics educator in the department's new initiative in mathematics education. Joseph Lakey spent three years at the University of Texas at Austin and one year at Texas A&M University after earning his doctorate from the University of Maryland with a specialty in harmonic analysis. In addition to supporting the department's research group in analysis, he conducts research involving computations, a new direction in departmental hiring. James Pommersheim earned his Ph.D. from the University of Chicago before holding positions at the Institute for Advanced Study and the Massachusetts Institute of Technology. After

finishing a Ph.D. at Purdue University, Irena Swanson held a faculty position at the University of Michigan. They were hired as part of a departmental effort to create a research group in algebraic geometry. They replaced Joseph Kist, Arthur Knoebel, Mark Mandelkern, and Gerald Rogers, all of whom have retired. The department will be interviewing during the current year to replace Arthur Kruse, who has retired.

The ability to hire high quality faculty members is aided by the collegiality of the department's faculty members. Almost every candidate interviewed comments on the positive feeling they have while here and the special attention paid them during their visits. Short term visitors respond the same way.

The department has begun discussions to identify research areas of interest and to set hiring goals in those areas. Two years ago, the department targeted statistics and hired two mathematical statisticians. After a yearlong dialogue about mathematics education, the department hired a senior mathematics educator, targeted algebraic geometry as an area of interest and hired two people in that field. These decisions demonstrate the department's resolve to target hiring goals for the benefit of its programs. In the future, the department plans to hire a second mathematics educator to allow it to successfully renew its program in mathematics education.

Two new college-track faculty members were employed this year. Denette Sinclair was hired to support the teaching activities in the Mathematics Learning Center; she replaced Page Paneral who resigned over the summer. Gabriel Lampert was appointed to a new position in the department that was created to support the General Education program.

The department hired several visiting researchers to support research efforts in the department. This spring, Visiting Professor Piotr Antosik, an analyst from in Poland, Visiting Assistant Professor Sebastian Walcher, an algebraist at the Technical University, Munich, Germany, and Visiting Assistant Professor Michael Slack, a topologist, conducted research with NMSU faculty members and taught mathematics courses. Visiting faculty members in the fall included four Visiting Assistant Professors, Mark Brittenham, a topologist, Matt Nicol, a dynamicist, and algebraists David Tao and Sebastian Walcher.

### **3 Curricular Activities**

Through dedication to and innovation in mathematics education, faculty members in the Department of Mathematical Sciences have an impact on college, high school, middle school and elementary curriculum. Members of the department have participated in several diverse educational development programs and activities. The majority of the department's faculty members are involved in at least one of these programs. The internationally recognized "student research projects" program has brought attention to the department. Information from and about the program was included in the January issue of *Undergraduate Mathematics Education Trends*, a

special issue on calculus reform. The program emphasizes discovery learning through the inclusion of student research projects in mathematics courses. It was begun in calculus classes, but has since spread to many other courses at the undergraduate and graduate levels. During the past year, faculty members gave workshops and talks about the projects program, its extensions and other curricular activities in the department at regional and national conferences, and on other campuses. Lolina Alvarez was invited to present at the New Experiences in Teaching (NExT) conference in August, a conference designed for new mathematics professors. Mai Gehrke and David Pengelley presented a three-day Chautauqua course for college teachers titled “Helping Students Become Active Learners in Mathematics”. The course was funded by the National Science Foundation. Doug Kurtz spent June and July in Adelaide, Australia, consulting on calculus curriculum with mathematicians at the University of Adelaide and Flinders University. Reinhard Laubenbacher spoke at the annual meeting of New Mexico mathematics and science teachers. Reinhard Laubenbacher and David Pengelley presented a minicourse on “Recovering Motivation in Mathematics: Teaching with Original Sources”. The course, sponsored by the Mathematical Association of America, was part of the Joint Annual Mathematics Meeting of the American Mathematical Society and the Mathematical Association of America. This has given the department the opportunity to tell the mathematics community about the evolution of its educational ideas and practices.

In a refinement of the original work with projects and motivated by newer faculty members becoming involved in the program, instructors incorporated project-like activities into the classroom of their calculus classes, using assignments they call “themes”. This involves the students in discovery-based cooperative learning activities covering the core material of the course. Faculty members have made several presentations on their use of themes, getting very positive receptions.

The use of projects and themes has been adapted to many other courses in the department, at all levels of instruction. Ideas about discovery learning and cooperative learning have been incorporated into many advanced courses, including some graduate courses.

The book *Student Research Projects in Calculus*, written by Marcus Cohen, Ed Gaughan, Arthur Knoebel, Doug Kurtz and David Pengelley, was published by the Mathematical Association of America, sold over 3000 copies in its first two years, and is now in its second printing. Don Albers, Associate Executive Director of the MAA and Director of Publications said about this book, “It clearly represents to me the need that our members, who are primarily college and university faculty, have for materials that help to directly improve their teaching. [This] book represents a precedent in the association and led to the creation of a new series called *Classroom Resources*.” Faculty members are creating other materials in this vein. Lolina Alvarez, Mai Gehrke, Doug Kurtz, Pat Morandi and Ross Staffeldt have submitted a manuscript for a book titled *Mathematics Courses using Themes* to the Mathematical

Association of America. This manuscript was solicited by the MAA.

Members of the department meet with faculty members from client departments and contact mathematics departments at branch campuses for their feedback concerning the content of mathematics courses. This past year, faculty members met with representatives from agriculture, business, biology and chemistry and biochemistry to discuss Math 142G course, a calculus course that serves students from those departments, as well as Math 230 and Stat 251. Recent discussions with members of the Department of Chemistry and Biochemistry led to a change in their mathematics requirement for their Bachelors of Arts Degree. A meeting with Dean Morgan initiated discussions on faculty exchanges between the Department of Mathematical Sciences and departments in the College of Engineering to improve the understanding of the educational missions of the two units. The department has arranged for two exchanges with departments in that college for the spring, the Departments of Civil Engineering and Mechanical Engineering. In addition, it arranged an exchange with the Department of Physics. Mathematics Learning Center faculty members work closely with faculty at the Dona Ana Branch Community College, and together they sponsored a one-day workshop.

This process of meeting with faculty members in departments that are “customers” of specific mathematics courses serves as an example of Total Quality Management principles in use by the department. The involvement with the Dona Ana Branch Community College and the Las Cruces Public Schools, as well as the state through the SIMSE program, represents avenues of communication with some of the department’s “suppliers”. Departmental faculty members are increasingly making use of Total Quality Management principles in their courses, and much of the curriculum development listed in this report makes use of these principles.

The department runs a computer lab containing computers equipped with the mathematics word processing and computing software, *Scientific WorkPlace*, designed by Adjunct Professor Roger Hunter. The software allows for easy input of mathematical expressions and performs numerical and symbolic computations. Students in several undergraduate courses, such as calculus and linear algebra, and graduate courses use this software, and the number of courses using the lab increases every year. During the year, the twentieth computer was added to this lab, allowing class sessions to meet there. This software is used as the foundation for a test-generation system, developed by *TCI Software Research, Inc.*, for use by the Mathematics Learning Center.

Members of the Mathematics Learning Center faculty have continued activities which support teaching with technology. Faculty members piloted new books which integrate graphing calculators into the teaching of intermediate algebra and college algebra. Beginning this fall, the use of graphing calculators is integral to all three pre-calculus courses, intermediate algebra, college algebra, and trigonometry. New Mexico State University is one of a handful of universities across the country in which

calculator use is required across all course sections rather than being confined to use by a few interested instructors. All graduate teaching assistants receive training and support on using calculator technology in the classroom. This fall, 32 introductory calculator workshops were offered for students using the calculator. The department has continued to offer a leasing program as a low cost alternative to purchasing a calculator, and leased over a hundred calculators this fall. In general, student reaction to the new requirement has been positive.

Several faculty members participate in the Honors program at the university. Reinhard Laubenbacher and David Pengelley developed two courses offered jointly as Honors and Mathematics courses, and both approved for General Education: a sophomore course “Spirit and Evolution of Mathematics” and a senior level course “Great Theorems: The Art of Mathematics”. The sophomore course meets the mathematics General Education requirement and the senior level course meets the “viewing a wider world” General Education requirement. The Honors program has given significant support to these courses. Laubenbacher and Pengelley are working on manuscripts of books from both courses and they have been awarded funding from the National Science Foundation to write a textbook on the teaching of mathematics using historical sources based on the sophomore-level course. Further, they have designed and taught a course to train high school teachers to use similar materials in their own courses. This course was supported by the NM Center for Teaching Excellence and the Las Cruces Public Schools.

The department continued its leadership role in the university’s General Education program. It offers six courses — Math 112G, Math 142G, Math 210G, Hon/Math 275G, Hon/Math 411G, and Stat 210G — that meet the General Education guidelines. Math 112G and Math 142G, courses it offered preceding the General Education program, were expanded to encompass the spirit of General Education. Math 210G (Mathematics Appreciation, formerly numbered 110G) presents a broad view of mathematics, outlining important directions of the discipline. Both Math 210G and Stat 210G (Statistics for Contemporary Living) strive to impart an understanding and appreciation of what mathematics is and how it affects people’s lives. To improve student performance, English 111G will become a prerequisite for Math 210G in fall of 1996. Hon/Math 275G and Hon/Math 411G view mathematics as a human endeavor and discuss great mathematical ideas in the historical context in which they developed.

This year, instructors taught fifty-five sections of General Education mathematics and statistics courses, thirty-two of which represent new offerings to meet the responsibilities placed on the department by General Education requirements. So far, the department has received exactly one new college-track position to meet the need caused by General Education. One tenet of General Education is that tenure-track faculty teach General Education courses. Due to the increase in course load, fourteen courses per semester, and the loss of two faculty positions, the department needs an



additional seven tenure-track faculty members to address its teaching mission. Without the additional support needed, it has been necessary to use graduate teaching assistants to teach many of these sections of General Education courses.

Faculty members supported undergraduate research as McNair advisors. Dave Finston supervised the research of Steve Guzman on problems in algebra and differential equations and Ross Staffeldt has worked with Zenaida Ahumada on algebraic coding theory.

The department awarded twelve master's degrees during the year. It had forty-six mathematics graduate students enrolled this year, with thirty-five full-time students and eleven part-time students. The department continues to successfully attract both women and minorities; two graduate assistants are supported by CHE fellowships. There are two seminars designed specifically for graduate students; one has graduate students make presentations on curricular issues and the other has them give research talks. The Graduate Studies Committee revised the graduate assistant orientation program to provide all new assistants with a more complete introduction to the various courses and teaching innovations in the department. The program included information about the Mathematics Learning Center, general education and calculus curriculum. This fall, the department strengthened the Master's program by increasing the requirements for the degree. The department proposed new courses in mathematical physics (cross-listed with the Department of Physics) and complex analysis. Course additions in mathematics education are currently being discussed.

Student advising is handled by special departmental committees. Undergraduate mathematics majors are advised by members of the Undergraduate Majors/Minor Committee. This committee nominates mathematics majors for scholarships and awards and informs them about study and career opportunities. Advising of graduate students is coordinated by the Graduate Studies Committee, which also makes recommendations for graduate assistant appointments.

As part of the department commitment to helping students with special needs, Sandra Geiger is assigned as Special Students Program Coordinator to monitor students who are handicapped, have learning disabilities, or are experiencing great difficulties in their classes. In particular, she monitors students repeating a Mathematics Learning Center class more than one time and Native American students, and she acts as liaison with the American Indian Program Office and Student Support Services. Sandy is also the departmental Americans with Disabilities Act (ADA) contact.

A major strength of the department's educational program is the participation of graduate students and talented undergraduates as tutors and graders in the Mathematics Learning Center. This provides a history of experience with the peer-tutoring aspect of learning, which is inherent in the cooperative learning projects now taking place in many other classes. It creates a valuable training program for new graduate assistants, introducing them to educational issues under close supervision by experienced educators.

Several courses are currently under revision or development. Faculty members are involved in creating an undergraduate course in topology and a seminar course for senior mathematics majors. Faculty members design and offer special topics undergraduate- and graduate-level courses at the interface of theoretical mathematics and applications. They offered an undergraduate course on differential equations and computers and an interdisciplinary undergraduate course on game theory in the spring; in the fall, they conducted advanced graduate courses on harmonic measure, commutative algebra, and complex variables, as well as one on the use of technology in elementary education. Mathematics faculty members are involved in discussions of a possible new interdisciplinary doctoral program in cognitive science.

The Teaching Committee oversees the coordination of multi-section courses and classroom observations of faculty members and graduate student teaching assistants. In addition to colloquia presented by mathematics educators as part of the hiring process, the department had several colloquia on educational issues. These included presentations on learning disorders, the history of improper integrals, a regional mathematics institute at the University of Arizona, and the General Education course Math 210G, and a colloquium given by three local high school teachers who have worked with members of the department over the last five years.

As mentioned above, the department participates in curricular programs outside the university. Faculty members continued to work with secondary mathematics teachers with support from a National Science Foundation-funded Teacher Enhancement grant. Work on a resource book about the high school projects, designed for high school mathematics teachers, is underway. An outgrowth of this program is the work of Dave Finston on pre-high school curriculum. Last summer, he received three grants from the state to support work with elementary and middle school teachers. Working with local high school teachers Roger Greer and Marilyn Gutman, he ran one-week and three-week institutes to train elementary and middle school teachers from around New Mexico to use writing assignments to teach mathematics and science. This year's three-week institute used the study of the hanta-virus to integrate mathematics and science. These institutes have been highly rated by participants and the SIMSE staff, and they have been used as models of successful institutes for the remaining years of the SIMSE program. Guidelines for institutes were rewritten so that they conform more closely to their format.

## 4 Research Activities

Members of the department continued to be productive researchers. Twenty-nine of the tenure-track faculty members had a total of forty-three papers appear in print, thirty-six papers accepted for publication, and thirty-four papers submitted for publication. They published one elementary education curriculum resource book, one graduate textbook and two research monographs. Eight books accepted for publi-

cation, including one undergraduate and two graduate textbooks, two translations, and three research texts, and three were submitted, one undergraduate resource, one graduate textbook and one research text. Faculty members also have at least five books in preparation, graduate and undergraduate texts, and college- and high school-level educational resource books. One member of the department was commissioned by Oxford University Press to write biographies for the American Council of Learned Societies' multi-volume work, *The American National Biography*. Faculty members delivered forty-four talks on their research at conferences and thirty-one talks at other universities, and presented two workshops on curricular development and mathematics education.

Much of the research being conducted by members of the department was joint work with faculty members at other institutions. Several conducted research while on leave from the university: Susan Hermiller at the University of Stockholm; Susan Lee at the University of California, San Diego, Ross Staffeldt at several institutions in Germany, and Arkady Vaintrob at the University of Utah. Gerald Lodder (Université Louis-Pasteur), Joaquin Loustaunau, Hung Nguyen (University of Southern California), David Pengelley (University of Washington), and Charles Swartz spent part of the year on sabbatical leave working with researchers at other institutions in Asia.

As mentioned above, several faculty members received continuing support for their research. Five faculty members conducted research with funding from the National Science Foundation or Sandia National Laboratory. Five faculty members conducted funded educational research work on seven projects during the past year; some of these projects involved joint work with the high schools in Las Cruces. Funding has come from the National Science Foundation, the Office of Naval Research, the New Mexico State Department of Education, the New Mexico Commission on Higher Education and the Las Cruces Public Schools.

The department hosted the Holiday Symposium in December, 1994, funded in part by the National Science Foundation and the National Security Agency. The conference focused on Gröbner bases and applications. The main speaker was Professor Bernd Sturmfels of the University of California, who delivered a series of ten talks. Mathematicians from all over the world attended this event and took part in presenting numerous additional talks.

The New Mexico Geometry and Topology Seminar was started several years ago by mathematicians at the University of New Mexico and New Mexico State University to bring them together twice a year. The department continued to co-host the seminars and several faculty members spoke this year.

The department sponsors several weekly seminars and a weekly colloquium. The seminars specialize in algebra, analysis, algebraic topology, dynamical systems, mathematics education and statistics. One research seminar is run by graduate students. A new "Friday Afternoon Seminar" is a more informal, general interest seminar. Al-

most all faculty members and many graduate students attend at least one of the seminars.

Faculty members are participating in interdisciplinary research. Ernie Barany is conducting joint research with faculty members in the College of Engineering and statisticians Hung Nguyen and Tony Wang consult with researchers around campus. Ray Mines and Frank Williams study Total Quality Management in education. Ray Mines is studying the mathematics in James Joyce's works with a professor of English. Joaquin Loustaunau is directing an interdisciplinary doctoral thesis student; several faculty members advise doctoral students from other departments.

To give a sense of the active research groups in the department, below is a list of areas of research and the faculty members active in those areas.

**Algebra:** Faculty members in algebra include Dave Finston, Mai Gehrke, Susan Hermiller, Reinhard Laubenbacher, Ray Mines, Patrick Morandi, Irena Swanson and Carol Walker. New faculty member James Pommersheim will interact with this group next year. Three algebraists were supported on research grants.

**Analysis:** Analysts include Josefina Alvarez, Richard Bagby, Doug Kurtz, Joseph Lakey, Joaquin Loustaunau, Charles Swartz, and Caroline Sweezy. One was funded on a research grant.

**Topology:** Gerald Dunn, Susan Hermiller, Gerald Lodder, David Pengelley, Ross Staffeldt and Frank Williams work in various areas of topology.

**Geometry:** Susana Salamanca-Riba, Arkady Vaintrob and Joseph Zund work in areas of pure and applied geometry. One was supported on a research grant.

**Logic, Foundations and Philosophy:** Mai Gehrke conducts research in logic and foundations. Ray Mines has research interests mathematical philosophy. Ray Mines and Bill Julian contribute in areas of constructive mathematics. One was supported on a research grant.

**Statistics and Probability:** Susan Lee, Hung Nguyen, and Tonghui Wang contribute in statistics and probability. One was supported on a research grant.

**Applied and Computational Mathematics:** Ernest Barany (mathematical physics), Marcus Cohen (mathematical physics and biology), William Julian (mathematical astronomy), Arkady Vaintrob (mathematical physics) and Joseph Zund (mathematical geodesy) are active applied mathematicians. One faculty member in this area was supported on research grants.

**Mathematics Education:** Pat Baggett conducts research in mathematics educations. She was funded by the National Science Foundation and the Office of Naval Research. Two National Science Foundation education grants were in effect during 1995, with Principal Investigators Dave Finston, Doug Kurtz, Reinhard Laubenbacher and David Pengelley. Dave Finston was awarded three grants by the state of New Mexico, with funding from CHE, SDE and SIMSE to run workshops about projects for elementary and middle school teachers. Ray Mines and Frank Williams study meaningful ways to implement Total Quality Management techniques in the

classroom.

## 5 Professional Service Contributions

Members of the department play an important service role in the mathematical community. The department is an institutional member of several mathematics organizations, including the American Mathematical Society, the Mathematical Association of America, the Society for Industrial and Applied Mathematics and the Association for Women in Mathematics. It is an institutional sponsor of the *Pacific Journal of Mathematics* and a member of the Rocky Mountain Mathematics Consortium. Faculty members served on the editorial boards of six journals. Twenty members of the department served as referees for journals and books, reviewers for the two major mathematical abstract journals, and referees for grant proposals to the National Science Foundation. Faculty members took part on conference organizing committees. Several faculty members serve on committees of mathematics organizations. Lolina Alvarez chaired the AMS Committee on Academic Freedom, Tenure, and Employment Security and was a member of its Western Section Program Committee and the MAA Panel of Visiting Lecturers. She was a member of the advisory panel for the NSF's International Junior Investigator and Postdoctoral Fellowship Program. Kitty Berver was editor of the Newsletter of the Southwest Section of the MAA. Ray Mines served as the department's representative to the Mathematical Association of America and as a member of the board of directors of the Pacific Journal of Mathematics. Hung Nguyen was an Associate Editor of five journals. David Pengelley was a member of the MAA Committee on the Participation of Women and the Panel of Visiting Lecturers, and a member of one Editorial Board. Charles Swartz was the department's representative to the Rocky Mountain Mathematics Consortium. Carol Walker served on the AMS Committee on the Agenda. Joe Zund was a member of three Special Commissions of the International Association of Geodesy, and the chair of one Special Subcommission. He also served on one committee of the American Geophysical Union. Doug Kurtz served on an advisory board for an educational program.

There were members of the department on the Advisory Council on Administrative Policy, the Campus Planning Committee, the Distinguished Visiting Professor Committee, the Educational Diagnostician Advisory Council, the Faculty Library Committee, the Faculty Senate, the General Education Course Certification Committee, the Outcomes Assessment Committees I and III, the Parking Committee, the Ralph B. Crouch Memorial Prize Committee, the University Committee on Statistics, the University Discipline Committee, the University Fellowship Committee, and the University Research Council. Members of the department served on three self-study review teams, for the departments of Chemical Engineering, Computer Science and Electrical Engineering, serving as chair of the last one. The department had rep-

representatives on the College Council, and the Curriculum and Educational Policies, Faculty Affairs, Improvement of Instruction and Student Relations, Networking and Research Affairs Committees. Faculty members served as outside members on tenure and promotions committees for eight departments in the college — Art, Astronomy, Communication Studies, Criminal Justice, English, Geology, History and Physics. Faculty members also served as advisors in the College of Arts and Sciences Advising Center and as advisors to student organizations. All department faculty members participated in committee work within the department.

## 6 Local Community Relations

The department finished the fourth year of the high school mathematics program, directed by principal investigators Dave Finston and Doug Kurtz, which incorporates discovery learning, cooperative learning and writing in mathematics. This work is funded by the Teacher Preparation and Enhancement program of the National Science Foundation. Over thirty mathematics teachers from Las Cruces, Mayfield and Oñate High Schools have participated in the program, and new teachers continue to join the program. This program has been recognized by the National Council of Teachers of Mathematics, the Southwest Educational Development Laboratory, the Eisenhower Clearinghouse for Mathematics, and Science Education and the Annenberg/CPB Guide to Math and Science Reform. This program is listed in databases managed by the last three organizations.

As mentioned above, Dave Finston worked with local high school teachers to run one-week and three-week institutes for elementary and middle school teachers from around New Mexico. These workshops are part of the state's Systemic Initiative in Math and Science Education program. Through the interaction with SIMSE, the department has influenced the teaching of mathematics and science throughout the state of New Mexico.

For the seventh year in a row, the department hosted the "NMSU Math Challenge", three competitions for high school students. Students from Las Cruces High School, Mayfield High School, Oñate High School, Mesilla Valley Christian School, Gadsden High School and Silver High School participated. Nine student teams from three of these high schools spent a weekend solving an original modeling problem, "The Art Dealer's Dilemma." The top two teams were invited to the campus on April 22, 1995, to present their solutions orally to the judges and interested spectators. Later that same day, there was a quick-answer, fast-paced bowl contest where ten four-member high school teams competed against the clock and each other to solve problems from algebra, geometry, and calculus. In addition to the two team activities, 489 students from the six high schools competed in a two-part sequence of written examinations. Five top-scoring students were recognized with awards of calculators.

The department maintains several display cases in public areas in Science Hall, near the department office. These help to introduce visitors to the members of the department and to give timely information about mathematical topics of current interest.

Three faculty members serve on a joint committee with members of the Dona Ana Branch Community College mathematics faculty. Their activities include working to develop a smooth transition from branch college to main campus mathematics courses and arranging mini-conferences involving members of both faculties at the beginning of each semester.

The department supports local and state activities by providing needed space for homeless organizations. It has housed the university's Women's Studies Program for several years. Recently, it converted a seminar room into the office of the southern coordinator for the New Mexico MESA (Mathematics Science Engineering Achievement) program.

## 7 Outside Relations

The department continued to take an active part in the national and international mathematics communities, and has been visible through publications, presentations and appointments to professional organizations. Several faculty members spent funded visits at prestigious institutions. The department continued to attract distinguished visitors to present lectures during their visits to New Mexico State University. The Holiday Symposium Series brought outstanding mathematicians to campus for a series of in-depth lectures. The department hosted the twice yearly New Mexico Geometry and Topology Seminar, which is run in conjunction with the University of New Mexico. This seminar meets semi-annually, alternating between Las Cruces and Albuquerque.

The current research of Adjunct Professor Roger Hunter for his company *TCI Software Research, Inc.*, has an impact on mathematicians around the world. This work centers on improving the interface between symbolic and numeric computations. This project began with the creation of the *Scientific Word* word processing system, an interface between the simplicity of the *Microsoft Windows* operating system and the computer type-setting system  $\text{\TeX}$ , the current standard for the preparation of mathematical documents. The latest version of the software, *Scientific WorkPlace*, incorporates the power of the computer algebra system, *Maple*, to perform mathematical operations while working inside of *Scientific Word*. This gives the user a natural-language setup to input mathematics to *Maple*.

Another way the department gains recognition is through the performances of its students, who compete on the Putnam Examination and the national Mathematics Modeling Competition. On a more regional level, one mathematics major was awarded the College of Arts and Sciences Excellence in the Sciences Award.

## 8 Outcomes Assessment Activities

Members of the department have developed proposals for assessing the outcomes of student learning of undergraduate majors and graduate students and of the department's research program. Though they have worked with little direction and no funding, they have devised useful models to begin the implementation of outcomes assessment for the department. The department's leadership role in this area is enhanced by the participation of Richard Bagby on the university's Outcomes Assessment Committee I and Carol Walker on Outcomes Assessment Committee III.

The department's original undergraduate program evaluation included a seminar course for mathematics majors and a survey for graduates of the undergraduate program. Members of the Undergraduate Majors/Minors Committee drafted questions for the survey, which were revised by the university's Institutional Studies office and sent out during the spring. Unfortunately, only one student responded to the survey. As faculty members discussed the course over the past two years, it became clear that the department was working in the wrong order. It had begun by considering a course that could be used for outcomes assessment, not one that met the department's goals for its students. The department decided first to create the course it wanted for its students, then to determine if the course could be used for outcomes assessment. Consequently, at the end of the spring semester, the department decided to revise its outcomes assessment proposal and replace this course by exit interviews.

To begin this process, members of the Undergraduate Majors/Minors Committee created a collection of questions and arranged for student interviews. Based on the objectives of the original outcomes assessment proposal, they devised a set of eight questions for exit interviews for graduating undergraduate majors. In practice, the answers given by students reduced this to the following five 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 of 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?



Departmental advisors were able to interview five mathematics majors, representing over a third of the department's graduates.

The Graduate Studies Committee submitted a proposal for the graduate program. This involves a survey of graduates with advanced degrees and it has been submitted to the Institutional Studies office. That office sent out the survey during the spring and received only two responses.

The proposal to assess the research program incorporated the university's mission with recent proposals from the American Mathematical Society, and involved the research production of faculty members and participation of graduate and undergraduate students in research and creative activities. The department already has data concerning its research effort.

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. Over 93% of the tenure-track faculty members published research results during the past three years. The research activities of students are tracked through course offerings and methods of teaching, and their participation in national mathematical competitions. All of these objectives were reached this year. In addition, faculty members are directing the research of two McNair students.

## 9 Department Self-Study

Another part of the university's review process is university-wide self-studies, which began this spring. The department volunteered to be one of the first departments in the College of Arts and Sciences to perform a self-study. The self-study report was written by Associate Department Heads Frank Williams and Kitty Berver.

The quality of the department's self-study document can be seen by two observations. After identifying some minor areas for improvement, the outside review team concluded by saying:

The mathematics department "ain't broke" and we see little need to "fix it."

Doreen Alexander, the institution's NCA Self-Study Coordinator, considered the self-study to be a model report. Several departments who will be reviewed in the fall have asked for models and she will use it for them.

## 10 Computing Facilities

The department currently has nineteen *Sun* computers, nine *NCI X*-Windows terminals, one *NeXT* computer, seven *IBM* compatible 586-based PC's, forty-seven *IBM* compatible 486-based PC's, five *IBM* compatible 386-based PC's, some PC's of an earlier vintage, two *Power Macintoshes* and one *Macintosh*, and an assortment of terminals. These machines are used by faculty members and graduate students for research and for the preparation of teaching materials and the handling of student grade records. One of the department's major accomplishments this year was to place a computer in the office of every continuing faculty member, including the entire Mathematics Learning Center staff.

The department has created a computer lab incorporating state-of-the-art equipment and software. A small equipment grant from *IBM*, support from the Arts & Sciences Research Center, and a software grant from *TCI Software Research, Inc.* allowed the department to purchase and network eight 486-based PC's. This lab has been used for students in calculus, linear algebra and several graduate-level courses. This year, the department used money from Instructional Equipment Bond Issue Funds and other sources to add the twentieth computer to the lab, achieving a long-term goal to have enough computers to allow classes to meet in the lab. The department has a lab for use by graduate students, equipped with 7 UNIX machines, one *NeXT* and two personal computers. Three 286-based PC's, provided with educational software that addresses the development of skills in algebra and trigonometry, are being used by students in the Mathematics Learning Center.

Last fall, the department received a major donation from Sun Microsystem Lab, Inc., which donated two Sun 4/490 file servers. Each computer has 128 Megabytes of RAM and 4 gigabytes of data storage. They are three years old and originally listed for \$150,000 each. These machines more than double the departments networked computing power and storage capabilities.

During the recent past, the department has reconstructed the entire computer network in Walden Hall, upgraded the main server for UNIX machines and installed a *Novell* network for DOS machines. It equipped a twenty station undergraduate and ten station graduate student labs. One of the biggest concerns of the department is that the negative impact the budget recision will have on the progress it has made in the past.

## 11 Advanced Degrees Awarded 1995

Name	Degree
Ali Mahdi H. Ahmad Advisor: Reinhard Laubenbacher	Master's
Diane Marie De Santis Advisor: Arthur Kruse	Master's
Hideo Naghashi Advisor: S. Salamanca-Riba	Master's
L. Dean Risinger Advisor: David Finston	Master's
Helen Nam Advisor: Susana Salamanca-Riba	Master's
Pankayatslevan Sinnathamby Advisor: Joaquin Loustaunau	Master's
Mark Sprinkle Advisor: Ross Staffeldt	Master's
Noel Sagullo Mai Gehrke	Master's
Dimitrios Tsagkarakis Advisor: Charles Swartz	Master's
Yajni Warnapala Advisor: Ray Mines	Master's
Chatt Williamson Advisor: Ernest Barany	Master's
Eric York Advisor: Joseph Zund	Master's

## 12 Departmental Colloquia in 1995

Mark Brittenham, University of Texas at Austin, *Exploring Two-bridge Knots*, 12/1/94.

David Muller, New Mexico State University, *Alternating Automata*, 12/8/94.

Bernd Sturmfels, University of California, Berkeley, *Solving Polynomial Equations*, 1/16 - 1/20/95.

Igor Verbitsky, Wayne State University, *Weighted Trace Inequalities and Partial Differential Equations*, 1/19/95.

Romuald Dabrowski, Columbia University, *Exponential Sums and Oscillatory Integrals*, 2/20/95.

Mark Brittenham, University of Texas at Austin, *Foliations and Anosov Flows on 3-manifolds*, 2/21/95.

Irena Swanson, University of Michigan, *Cores and the Briançon-Skoda Theorem*, 2/24/95.

James Pommersheim, Massachusetts Institute of Technology, *Toric Varieties and Counting Lattice Points in Polyhedra*, 2/27/95.

Michael Slack, New Mexico State University, *Homology and Homotopy of Infinite Loop Spaces*, 2/28/95.

Joseph Lakey, Texas A & M University, *Characterization of Hardy Spaces by Singular Integral Operators*, 3/1/95.

Manfred Kolster, McMaster University, *Higher Class Number Formulas for Number Fields*, 3/14/95.

Ian Melbourne, University of Houston, *Chaotic Dynamics and Symmetry*, 3/23/95.

Vladimir Retakh, Oklahoma State University, *Hypergeometric Functions and Geometry of Grassmanians*, 3/24/95.

Patricia Baggett, The University of Michigan, *Modernizing Elementary School Mathematics*, 3/28/95.

Gerald Kulm, Montana State University, *Assessment Strategies in Undergraduate Science and Mathematics Course Reform*, 3/29/95.

John Meier, Lafayette College, *Variations on Coxeter Group Actions*, 3/30/95.

- Patrick Scott, University of New Mexico, *Mathematics Education Research — A Particular Journey*, 4/3/95.
- V. Frederick Rickey, Bowling Green State University, *The History of Improper Integrals*, 4/7/95.
- Barry Mazur, Harvard University, *Rational Points On Curves*, 4/12/95.
- David Ruch, Sam Houston State University, *Multi-wavelets: Some Theory, an Application, and Some Open Problems*, 4/27/95.
- Stephen S. Farmer, Special Education/Communication Disorders, NMSU, *Adaptive Language-learning Disorders: Manifestations in Mathematics*, 4/13/95.
- Marilyn Gutman, Jim Greene, Maude Beakley, Mayfield, Las Cruces, and Oñate High Schools, *Writing and Project Use: NMSU—High School—Mid- and Elementary Schools*, 5/4/95.
- Phillip Schultz, The University of Western Australia, *The Baer-Kaplansky Theorem*, 5/5/95.
- François Guénard, Université Paris-Sud, *Impact of Mathematics Research on College-level Teaching*, 5/12/95.
- François Guénard, Université Paris-Sud, *Peano Curves Via a Fixed Point Theorem*, 5/15/05.
- Bodo Pareigis, University of Munich, Germany, *Derivations, Braidings and Lie Algebras*, 9/7/95.
- Lolina Alvarez, New Mexico State University, *Mathematics Appreciation*, 9/14/95.
- Emily Stone, Utah State University, *Archetypal Analysis of Complex Spatio-Temporal Data Sets*, 9/21/95.
- William Yslas Velez, University of Arizona, *Southwest Regional Institute in the Mathematical Sciences*, 9/27/95.
- David Dennis, University of Texas at El Paso, *The Historical Role of Geometric Curve Drawing Devices in the Genesis of Calculus*, 10/5/95.
- David Cruz-Uribe, Purdue University, *Piecewise Monotonic Doubling Weights*, 10/12/95.
- Susanne Pumpluen, Fernuniversität Hagen, *Composition Algebras Over a Ring of Fractions*, 10/19/95.

Kai Lai Chung, Stanford University, *From Newton to Probability*, 10/26-10/27/95.

Sebastian Walcher, New Mexico State University, *Algebras and Differential Equations*, 11/2/95.

Volker Metz, University of Bielefeld and University of California, San Diego, *Brownian Motion on Nested Fractals*, 11/16/95.

## 13 Faculty Publications in 1995

### Josefina Alvarez

“Spectral invariance and tameness of pseudo-differential operators on weighted Sobolev spaces,” (with J. Hounie) *Journal of Operator Theory*, **30**, (1993), 41-67. [Actually published in 1995]

“Continuity of Calderón-Zygmund type operators on the pre-dual of a Morrey space,” *Clifford algebra in analysis and related topics*, CRC Press, Inc., (1995), 21-37.

### Richard Bagby

“Calculating normal probabilities,” *Amer. Math. Mon.*, **102** (1995), No. 1, pp 46-49.

### Patricia Baggett

*Breaking away from the Math Book: Creative Projects for Grades K-6*, (with A. Ehrenfeucht) Lancaster, PA: Technomic Publishing Company, (1995).

### Ernest Barany

“Adaptive Output Stabilization of Manipulators,” (with R. Colbaugh and K. Glass) *Proc. 33rd IEEE Conference on Decision and Control*, Orlando, FL, December, 1994.

“Stability Analysis for a class of Neural Networks,” (with R. Colbaugh) *Proc. 1995 IEEE Symposium on Intelligent Control*, Monterey, CA, August, 1995. (Note that this paper was submitted, accepted and published within the span of one year).

### Marcus Cohen

“Quantization of Helicity on a Compact Spacetime,” *Found. of Physics*, **25**, #7 (Aug. 1995), pp. 995-1028.

### Gerald Dunn

“ $E_n$ -Monoidal Categories and Their Group Completions,” *Jour. Pure and Applied Algebra*, **95** (1994) 27-39.

### David Finston

“Algebraic Aspects of Additive Group Actions on Complex Affine Space,”  
*Automorphisms of Affine Space*, Kluwer Academic Publ. 1995.

“A proper  $G_a$  action on  $\mathbb{C}^5$  which is not locally trivial,” *Proc. Amer. Math. Soc.*, **123**, March, 1995.

“ $G_a$  actions on  $\mathbb{C}^3$  and  $\mathbb{C}^7$ ,” *Comm. Algebra*, **22**, 1994.

### Mai Gehrke

“Robison Lattices and their Spectra,” *Algebra Universalis*, **32**(1994), 204-223.

“ $G_a$  Actions on  $\mathbb{C}^n$ ,” with J.K. Deveney and D.R. Finston, *Comm. in Algebra*, **22**(12), 4977-4988(1994).

“Uniquely Representable Posets,” *Ann. N.Y. Acad. Sci.*, **728**, 32-40(1994).

### Susan Hermiller

“Algorithms and geometry for graph products of groups,” *Journal of Algebra*, **171** (1995), 230-257.

### Douglas S. Kurtz

“A Case Study of a Partnership of Equals: Calculus Meets Precalculus,” (with A. Kneobel and D. Pengelley) in *Preparing for a New Calculus* (Anita Solow, ed.), proc. conf., U. of Illinois (1993), Mathematical Association of American, 1994, pp. 117–120.

### Joseph Lakey

“Extensions of the Heisenberg Group by Dilations and Frames,” (with J. A. Hogan) *Appl. Comp. Harmonic Anal.*, **2** (1995), 174–199.

“Trace Inequalities, Maximal Inequalities, and Weighted Fourier Transform Estimates,” *J. Fourier Anal. Appl.*, **1** (1994), 201–232.

“Wavelets of Composite Type,” (with J. E. Gilbert) *Proc. IEEE-ICASSP '94*, Adelaide pp. IV-117–120.

“Weighted Fourier Transform Inequalities via Mixed Norm Hausdorff–Young Inequalities,” *Canad. J. Math.*, **46** (1994), 586–601.



“The Definition of the Fourier Transform for Weighted Norm Inequalities,”  
(with J. J. Benedetto) *J. Funct. Anal.*, **120** (1994), 403–439.

### **Reinhard Laubenbacher**

“Almost Split Sequences for Dedekind-like Rings II,” (with D. Arnold) *Comm. Algebra*, **23**, pp. 111-130.

“History of Mathematics and the Internet,” *Newsletter of the British Society for the History of Mathematics*, **28**, pp. 56-57.

### **Susan Lee**

“Optimal Drift on  $[0,1]$ ,” *Trans. Amer. Math. Soc.*, **346** (1994), pp. 159-175.

### **Jerry Lodder**

“Leibniz Homology and the James Model,” *Math. Nach.*, **175** (1995), p. 209–229.

### **Patrick Morandi**

“Kummer subfields of tame division algebras,” (with B.A. Sethuraman) *J. of Algebra*, **172** (1995), 554-583.

“On defective division algebras,” *Proceedings of Symposia in Pure Mathematics*, **58.2** (1995), 359-367.

“Bézout orders and Henselization,” (with D. Haile and A. Wadsworth) *J. of Algebra*, **173** (1995), 394-423.

“Noncrossed product division algebras with a Baer ordering,” (with B.A. Sethuraman) *Proc. Amer. Math. Soc.*, **123** (1995), 1995-2003.

### **Hung T. Nguyen**

*Fundamentals of Uncertainty Calculi with Applications to Fuzzy Inference*,  
(Research Book, with E. Walker and M. Grabisch) Kluwer Academic (1995).

*Theoretical Aspects of Fuzzy Control*, (Co-editor with M. Sugeno, R. Tong,  
and R. Yager) J. Wiley (1995).

“A measure of average sensitivity for fuzzy logics,” (with V. Kreinovich and  
D. Tolbert) *Intern. J. of Uncertainty, Fuzziness and Knowledge-Based  
Systems*, **4**, No. 4, 361-375 (December 1994).

“A history and introduction to the algebra of conditional events and probability logic,” (with E. Walker) *IEEE Trans. Systems, Man and Cybernetics*, 24, No. 12, 1671-1675 (December 1994).

“Some mathematical tools for decision-making under partial knowledge,” *Mathematical Models for Handling Partial Knowledge in Artificial Intelligence* (G. Coletti et al, Eds.), pp. 129-156, Plenum Press (1995).

“Mathematical foundations of conditionals and their probabilistic assignments,” (with I.R. Goodman) *Intern. J. Uncertainty, Fuzziness and Knowledge-Based Systems*, **3**, No. 3, pp. 247-339, (Sept. 1995).

“Towards theoretical foundations of soft computing applications,” (with V. Kreinovich) *Intern. J. Uncertainty, Fuzziness and Knowledge-Based Systems*, **3**, No. 3, pp. 341-373, (Sept. 1995).

### David Pengelley

“A Case Study of a Partnership of Equals: Calculus Meets Precalculus,” (with A. Knoebel and D. Kurtz) in *Preparing for a New Calculus* (ed. Anita Solow), proc. conf., U. of Illinois (1993), Mathematical Association of American, 1994, pp. 117–120.

### Ross Staffeldt

“The approximation theorem and the  $K$ -theory of generalized free products,” (with Roland Schwänzl), *Trans. Amer. Math. Soc.*, **347**(1995), no. 9, 3319–3345.

### Irena Swanson

“Joint reductions, tight closure and the Briançon-Skoda theorem, II,” *J.l of Algebra*, **170** (1994), 567-583.

“Cores of ideals in two dimensional regular local rings,” (with C. Huneke) *Michigan Math. J.*, **42** (1995), 193-208.

### Charles Swartz

“Boundedness and Continuity for Bilinear Operators,” (with P. Antosik) *Studia Sci. Math. Hung.*, **29** (1994), 387-395.

“Subseries Convergence in Spaces with a Schauder Basis,” *Proc. Amer. Math. Soc.*, **129** (1995) 455-457.

“Automatic Continuity and Boundedness of Matrix Mappings,” *Bull. Polish Acad. Sci.*, **43** (1995), 19-28.

“Antosik’s Interchange Theorem,” *Function Spaces, the Second Conference*, Dekker, N.Y., (1995), 361-370.

“Continuity of Superposition Operators on Sequence Spaces,” (with Lee Peng Yee) *New Zealand J. Math.*, **24** (1995), 41-52.

### **Arkady Vaintrob**

“Conformal Lie superalgebras and moduli spaces,” *Journal of Geometry and Physics*, **15** (1995), 109-122.

### **Tony Wang**

“Cochran’s theorems for a multivariate elliptically contoured model,” (with C. S. Wong) *J. Statist. Planning and Inference*. 43 (1995), 257-270.

### **Frank Williams**

“Hopf constructions and higher projective planes for iterated loop spaces,” (with N. Kuhn and M. Slack) *Trans. Amer. Math. Soc.*, **347** (1995), 1201-1238.

“Total Quality Management in the Classroom,” *Intern. J. Math. Ed. Sci. Tech.*, **26** (1995), 743-747.

### **Joseph Zund**

*Foundations of Differential Geodesy*, Springer-Verlag, 1994. (373-page research monograph/graduate textbook)

“A Status Report on the Marussi-Hotine Theory of Geodesy,” *Bollettino de Geodesia e Scienze Affini, anno LIII* (1994), 375-392.

“A Final Report on the Marussi Hypothesis in Differential Geodesy,” *Phillips Laboratory Research Report 94-2207* (1994), 28 pages.

“Bromwich’s Method for Solving the Source-Free Maxwell Equations,” (with J.M. Wilkes) *Tensor N.S.*, **55** (1994), 192-196.

“Tensorial Methods in Classical Differential Geometry-IV: Spherical Representation,” *Tensor N.S.*, **55** (1994), 202-208.

## 14 Summary of Grants and Grant Proposals in 1995