

DEPARTMENT OF MATHEMATICS

Report to the Board - Fall 2000

PERSONNEL

Ralph **Wojtowicz** (Visiting Assistant Professor, U of Illinois) continued his appointment for an additional year.

Douglas Limmer completed his one-year appointment and took up a position at Valparaiso University, his alma mater.

Aaron Klebanoff and **Kurt Bryan** returned from sabbatical at the Naval Academy and Rutgers University, respectively. **Robert Lopez** returned from special leave during the 1999-00 year, during which he completed his book. **LeRoy Franklin** returned from leave during winter and spring on a Fullbright Scholarship to Iceland.

Allen Broughton will be working with the TED program in the coming winter quarter and will be on sabbatical in the spring quarter at Mount Holyoke College. Steve Carlson has been appointed to serve as interim department head during those quarters.

GRANTS AND CONTINUING GRANT ACTIVITIES

Elton Graves will be the campus “evaluation fellow” for a 2-year study on the effectiveness of using Maple in teaching calculus. The project will involve up to seven institutions of national rank and furnish \$10,000 to defray the local costs of the program.

Allen Broughton and **Gary Sherman** conducted this summer’s portion of the NSF-REU program. This is the twelfth year of the REU, completing the current installment of the grant. Eight students, including Dennis Lin, a Rose-Hulman student, completed five draft technical reports.

STUDENT ACTIVITIES, PRESENTATIONS, PUBLICATIONS and AWARDS

Summer Research Experiences

Dennis Lin participated in the Rose-Hulman REU producing a draft technical report *Classification of Cwatsets of Order at Most 23*, with coauthor Ben Goodwin.

Janet Trimm participated in an REU at Auburn University in the Discrete and Statistical Sciences Department. A draft paper *A new formula for computing Frobenius numbers in three variables* was jointly written with Overton M. G. Jenda and Stacie E. McClanahan.

Tim Kilbourn participated in an REU at the University of Tennessee preparing the draft paper *On the Probability that a Monic Integral Polynomial is Irreducible*.

Stephen Young participated in an REU at the University of Tennessee with advisor Suzanne Lehnhart, working on a project entitled the *Schroedinger Equation and Optimal Control*.

Jonathan Webster worked on a project in stability at Sandia Labs.

Student Publications and Reports

Robert M. Dirks and Maria T. Slougher, *Quest for Tilings on Riemann Surfaces of Genus Six and Seven*, MSTR 00-08 (REU, advisor Allen Broughton).

FACULTY and STAFF ACTIVITIES

Allen Broughton, along with Gary Sherman worked with eight students in the twelfth year of the NSF sponsored REU program. His contributed article "The Rose-Hulman NSF-REU Program", appeared in the *AMS Proceedings of the Conference on Summer Undergraduate Mathematics Research Programs*. He attended the Joint Statistical Meetings to interview candidates for a statistics position. He continues as the department's webmaster and made substantial revisions to the public and internal websites.

In June **Kurt Bryan** returned from a sabbatical at Rutgers University in New Jersey, where he worked with Michael Vogelius on nonlinear partial differential equations arising in corrosion modeling. He has continued work with Lester Caudill at the University of Richmond, on inverse problems related to thermal imaging. In June they submitted a paper, "Solvability of a Parabolic Boundary Value Problem with Internal Jump Condition" to the IMA Journal of Applied Mathematics. In August Dr. Bryan and David Rader taught the Jump Start program to a group of 26 incoming freshmen.

During the summer of 2000, **Stephan Carlson** worked with John Wiley and Sons, Inc., moving into the final stages of production of his textbook *Topology of Surfaces, Knots, and Manifolds: A First Undergraduate Course*. Carlson attended MathFest 2000, the summer meeting of the Mathematical Association of America, in Los Angeles where he continued his three-year term as the Governor of the Indiana Section of the MAA. In his service to the MAA, he continues as a member of the national Committee on Sections and the MAA Task Force on Special Interest Groups. On campus, Carlson has been appointed Interim Department Head of the Department of Mathematics for the winter and spring terms of the 2000-2001 academic year.

David Finn attended the MAA Mathfest and AMS Math Challenges in Los Angeles, CA, attending several mini-courses and workshops. He continued writing reviews for Mathematical Reviews, and writing research papers on the geometry of bicycle tracks (joint work with J. Tanton of Merrimack College) and the singular Yamabe problem (joint work with R. Mazzeo of Stanford University and R. McOwen of Northeastern University). In addition, he wrote an NSF-CCLI grant proposal "Motivating Geometry through Computation and Visualization" for developing a course on geometric modeling. In the grant proposal, he will be the principal investigator, and Jeff Leader and J.P. Mellor of Computer Science will be co-investigators. He also got married over the summer. This year, he will co-organize (with Tanya Leise) the 18th Rose-Hulman Undergraduate Math Conference, and be advisor/coach to the Math Club.

Leroy Franklin spent the summer thawing out from Iceland, getting 6 months of ignored life events taken care of, and spent three sessions (each of about 3 days) at Hormel foods, Headquarters in Austin, Minn., teaching various statistical topics such as: beginning statistics, advanced statistics, design of

experiments, and acceptance sampling. He began a Rose consulting session with Dr. Karen McNally (Rose Faculty in Biomedical Eng) on sample size determination and power calculations needed to support an experimental study to be done at IU medical center. He attended the Joint Statistical Meetings in Indianapolis as part of the state organizing committee and as treasurer of the Quality and Productivity section.

Elton Graves attended the National ASEE Meetings in St. Louis, in June. He was re-elected to the Board of Directors of the Mathematics Division of ASEE. He also taught a section of Fast-Track Calculus which ran from July 16 to August 18. In addition, he will be the evaluation fellow for a Maple evaluation project mentioned in the grants section.

During the summer of 2000, Professor **Ralph Grimaldi**, in addition to teaching Calculus III, presented a lecture on applications of graph theory during each of the two Fast Forward programs. In addition, he refereed the article “The Tau System, the Z-property of Natural Numbers and the New Geometric Definition of a Number” by Alexey Stakhov for the American Mathematical Monthly, worked on a presentation on the use of technology in discrete mathematics for the upcoming winter MAA meeting in New Orleans, continued his research on compositions of integers, and attended the summer meeting for the American Statistical Society in Indianapolis in August.

After returning from his sabbatical leave at the United States Naval Academy, Professor **Aaron Klebanoff** finished up and submitted “Pi in the Mandelbrot Set” to the American Math Monthly. During the summer, Dr. Klebanoff also taught Fast Track Calculus and gave a poster entitled “Convergence Basins for Davidchack and Lai’s Algorithm for Finding Periodic Orbits” at the SIAM Pacific Rim Dynamical Systems Conference in Maui. While in Maui, Dr. Klebanoff also worked with two coauthors on a paper in progress, “Towards complete detection of unstable periodic orbits in chaotic systems.”

Professor **Roger Lautzenheiser**, in addition to teaching linear algebra and statistics during the first summer session, worked with Elton Graves and Aaron Klebanoff in the Fast Track Calculus Program. He solicited and edited papers for the Fall volume of the Rose Undergraduate Mathematics Journal.

Jeffery Leader spent the summer working on a proposed numerical analysis textbook. The manuscript has received favorable reviews. He also attended the Pacific Rim Dynamical Systems Conference, conferring with research colleagues.

Tanya Leise was selected to be a Project NExT Fellow (New Experiences in Teaching), sponsored by the Mathematics Association of America. She attended the MAA Mathfest 2000 in Los Angeles and participated in the NExT workshops preceding the Mathfest, July 31-August 5, as well as taking a short course on discrete dynamical systems in undergraduate modeling courses. Dr. Leise taught a session of the Fast Forward program on the mathematics and art of Escher-like tessellations in July. In June, she visited Professor Jay Walton of the Texas A&M Math Department to discuss research in crack and contact problems. Dr. Leise will be co-organizing the 18th Annual Rose-Hulman Undergraduate Mathematics Conference with Dr. David Finn.

Robert Lopez continued working to complete the text Advanced Engineering Mathematics that will appear in October. He also attended and spoke at the ASEE meeting in June.

Jerry Muir spent most of two months at the University of Kentucky doing research with Ted Suffridge on their ongoing project in several complex variables. While there, he gave several talks in a complex variables seminar. His paper, "Holomorphic idempotents and retracts in the unit ball of a commutative C^* -algebra with identity," appeared in the Journal of Mathematical Analysis and Applications (vol. 247, pp 156-172). Professor Muir was accepted as a Project NExT fellow. Project NExT (New Experiences in Teaching) is a program of the Mathematical Association of America for new Ph.D.s to meet and discuss teaching-related issues. He attended the MAA Mathfest held at UCLA in August to participate in a Project NExT workshop.

David Rader participated in various scholarly projects during the summer. In August, he attended the 17th International Symposium on Mathematical Programming, where he presented a talk on "Exact methods for finding disjoint solutions to set covering constraints." In addition to working on the research for this talk, he also worked with Brenda Davis, Rose-Human's Women's Volleyball coach, in an attempt to generate new schedules for the conference tournament held in the fall. In addition, during the middle of August, he was coordinator of Jump Start, a program for incoming freshmen who may require additional review on some topics in mathematics.

Professor **John Rickert's** paper *Divisibility of restricted partition functions* was accepted by the Proceedings of the American Mathematical Society. He spent the summer at M.I.T., working at the 2000 Research Science Institute. He began design of a course covering the number-theoretic aspects of cryptography, to be run during the winter term. He administered the freshman Mathematics Diagnostic Exam, administered to all freshmen during registration week. He is working with the Learning Center to remedy the deficiencies of students who performed poorly on the diagnostic exam and is analyzing the results of this and past diagnostic exams.

Gary Sherman continued to develop the theory of cwatsets with four undergraduates in our NSF-REU program. He also refereed two papers and continued to work on his research monograph, *The Theory of Cwatsets*.

Yosi Shibberu spent the summer working as part of a team of 8 faculty, 5 graduate and 14 undergraduate students to design and construct a Wideband Optically Multiplexed Beamformer. The project is sponsored by the Navy and is being conducted jointly by Rose-Hulman and the Naval Surface Warfare Center at Crane. During the course of the project, Professor Shibberu completed a two-week course on lasers and fiber optics and worked with two undergraduate students to implement an active phase stabilization scheme for stabilizing holographic images in photo-refractive crystals.

FACULTY AWARDS, HONOURS AND SOCIETY OFFICES CURRENTLY HELD

Steve Carlson, Governor of the Indiana Section of the MAA.

Leroy Franklin, Treasurer of the Quality and Productivity section of the American Statistical Association.

David Finn, Indiana MAA liaison.

Elton Graves, Board of Directors of the Mathematics Division of ASEE, and Indiana Coordinator of AMC8, AMC10, and AMC12 Mathematics Competitions, MAA National Committee on Applications of Mathematics.

Aaron Klebanoff Indiana MAA student chapter coordinator.

Tanya Leise and **Jerry Muir** were selected to be a Project NExT Fellow (New Experiences in Teaching), sponsored by the Mathematics Association of America.

John Rickert, Coordinator, Indiana American Regions Mathematics League (ARML).

Roger Lautezenheiser and **David Rader**, editors of Rose-Hulman Institute of Technology Undergraduate Mathematics Journal.

PAPERS, PUBLICATIONS AND TECHNICAL REPORTS

Papers and Publications

S. Allen Broughton, *The Rose-Hulman NSF-REU Program*, AMS Proceedings of the Conference on Summer Undergraduate Mathematics Research Programs (appeared).

Kurt Bryan, *Solvability of a Parabolic Boundary Value Problem with Internal Jump Condition*, to the IMA Journal of Applied Mathematics (submitted, MSTR 00-04 preprint).

LeRoy Franklin, *Sample Size Determination for Lower Confidence Limits for Estimating Process Capability Indices*, Computers and Industrial Engineering.

Aaron Klebanoff, *Pi in the Mandelbrot Set*, American Math Monthly (submitted).

Jerry Muir, *Holomorphic Idempotents and Retracts in the Unit Ball of a Commutative C^* -algebra with Identity*, Journal of Mathematical Analysis and Applications, (vol. 247, pp 156-172).

John Rickert, *Divisibility of restricted partition function*, Proceedings of the American Mathematical Society (accepted).

Mathematical Sciences Technical Report Series

MS TR 00-04 *Solvability of a Parabolic Boundary Value Problem with Internal Jump Condition*, Kurt M. Bryan and Lester F. Caudill.

MS TR 00-08 *Quest for Tilings on Riemann Surfaces of Genus Six and Seven*: Robert M. Dirks and Maria T. Slougher.

PRESENTATIONS, SEMINARS and COLLOQUIA

Off Campus

Leroy Franklin, spent three sessions (each of about 3 days) at Hormel foods, Headquarters in Austin, Minn. teaching various statistical topics like: beginning statistics, advanced statistics, design of experiments, and acceptance sampling.

Aaron Klebanoff gave a poster entitled *Convergence Basins for Davidchack and Lai's Algorithm for Finding Periodic Orbits* at the SIAM Pacific Rim Dynamical Systems Conference in Maui.

Robert Lopez presented a session on *New Tools and Pedagogy in Classical Applied Math* at the ASEE meeting in June.

David Rader *Exact methods for finding disjoint solutions to set covering constraints*, 17th International Symposium on Mathematical Programming.

On Campus

Peter Turbek, from Purdue University at Calumet, *Riemann and Klein surfaces*.

PROGRAMS (more details of programs in various locations above)

Professors Elton Graves and Roger Lautzenheiser and Aaron Klebanoff taught this summer's **Fast Track Calculus** program to 47 students. The intensive five-week course covers Calculus I, II, and III. All 47 students successfully completed and were awarded credit for Calculus I, II, and III.

The **RHIT NSF-REU**, coordinated by Allen Broughton and Gary Sherman, ran from June 4th through July 21, 2000. Two research groups, Tilings (SAB) and Cwatssets Theory (GJS), each had four students, producing a total of five draft technical reports.

Jumpstart, a program for incoming freshmen who may require additional review on some topics in mathematics. David Rader, Kurt Bryan.

The **Laptop Orientation** Instructors from the Mathematics Department were: Allen Broughton, David Rader, and John Rickert.