

DEPARTMENT OF MATHEMATICS

Report to the Board - Fall 1997

PERSONNEL

Two new faculty members have joined the Math Department. **Dr. David Rader, Jr.**, comes from Rutgers University specializing in Operations Research and **Dr. Matthew Hopkins** comes from Tulane University specializing in Computational Fluid Dynamics.

Steve Carlson returned from his sabbatical leave during the winter and spring quarters of the 1996-97 academic year. His leave activities included an appointment as a Visiting Scholar and Visiting Professor at Indiana University in Bloomington where he did research and taught a course in topology during IU's spring semester. While at IU, he also completed an undergraduate level textbook "Topology of Surfaces, Knots, and Manifolds: A First Undergraduate Course" which he used in his course at IU and will also use in his RHIT course MA 307 during Fall 1997.

Roger Lautzenheiser and **John Rickert** and will be on sabbatical during the 1997-98 academic year. Professors Lautzenheiser and Rickert will be spending their sabbaticals teaching and working with research colleagues Pennsylvania State U and the Kanazawa Institute of Technology in Ishikawa, Japan, respectively.

GRANTS AND CONTINUING GRANT ACTIVITIES

Nacer Abrouk received a Summer Grant from the Foundation Coalition to build test equipment Apparatus to be used in a Statistics Laboratory, planned for Winter 1997-1998. Several projects in conjunction with the Test Equipment functions were developed.

Allen Broughton was awarded \$30,000 to conduct an NSF-REU in Hyperbolic Geometry and Computational Group Theory. This is the ninth consecutive year that Rose-Hulman has been a REU site. He was also awarded an \$8000 grant (jointly with Ed Doering in the Electrical engineering department) from the Foundation Coalition to develop a course entitled Advanced Mathematical Methods of Image Processing.

Kurt Bryan, with co-investigator Lester Caudill at the University of Richmond, spent the second of three summers in NSF funded research on mathematical inverse problems related to thermal nondestructive testing.

STUDENT ACTIVITIES, PRESENTATIONS, PUBLICATIONS and AWARDS

RHIT REU Patrick Swickard was a participant in the Rose-Hulman Research Experiences for Undergraduates Program.

Student Presentations

Josh Horstman and Jayme Moore presented a talk entitled "Meetings, Bloody Meetings" at the National Pi Mu Epsilon Conference held in August in Atlanta at the MAA Mathfest. This paper was a result of their Modeling Competition submission (along with Jamie Kawabata last spring) last spring.

Awards

Rick Mohr, 1997 Alumni, won the Andree Award from Pi Mu Epsilon for a paper that he wrote in MA 324, Linear Algebra II, based on results from his REU experience at Purdue with Carl Cowen -- The topic was on how near is an arbitrary matrix is to a normal matrix.

Joshua Horstman and Jayme Moore won Outstanding Presentation Award from Pi Mu Epsilon for their presentation, "Meetings, Bloody Meetings", noted above.

Study Abroad

Surat Intasang returned to Rose from Budapest at the completion of his year long participation in the Budapest Semesters in Mathematics program.

FACULTY and STAFF ACTIVITIES

Professor **Nacer E. Abrouk** wrote two technical reports. The first entitled "Statistical Methodology in Engineering Metrology" is a consulting project for The Digital Audio Disc Corporation, Confidential and Proprietary. The second entitled "On Efficient Sampling Procedures for A Distribution Process" is a consulting project for Columbia House Corporation, Confidential and Proprietary. He attended the International Conference on Engineering Education (ICEE) in Chicago, Illinois. Dr. Abrouk created an Industrial Liaison between the Center for Industrial Statistics (RHIT) and Makuta Technics, a manufacturing company in Columbus (IN), with assistance from the TED program at RHIT. Site visits to Makuta Technics were made. A project for the Mid-America Plastics Partners Inc. (MAPP Inc.) is being carried out by the Center for Industrial Statistics (directed by Dr. Abrouk, RHIT). The Industrial Liaison is Mr. Jerry Johnson, Deputy Director, MAPP Inc. Assistance with this project was provided by the RHIT TED program. Dr. Abrouk also received a summer grant from the Foundation Coalition to build test equipment apparatus to be used in a Statistics laboratory, planned for Winter 1997-1998. Several projects were developed in conjunction with the test equipment functions. Dr. Abrouk coordinated a grant proposal effort with Janet Caton of IVYTECH (co-principal investigator). This grant is being modified to implement NSF suggestions (the pre-proposal was approved). Along with teaching summer school, he revised course content, experiments, and classroom projects for MA590, a graduate level course in Statistics required by the Engineering Management Program at RHIT.

Professor **George Berzsenyi** continued his work with the USA Mathematical Talent Search (USAMTS) in an advisory capacity during the summer, assisting the Consortium for Mathematics and Its Applications (COMAP) and the National Security Agency (NSA) with the completion of Year 8 and the launching of Year 9 of that program. He also prepared the 20 problems to be used in Year 9 of the USAMTS (along with Hints/Answers/Solutions to be published in Consortium). In June, the Mathematical Association of America (MAA) published his first book, "The Contest Problem Book V", which was prepared jointly with Professor Stephen B. Maurer of Swarthmore College. His article on the International Mathematical Talent Search (IMTS) also appeared in *Mathematics Competitions*

(volume 10, number 1, pages 74-78), along with his 41st and final "Math Investigations" column in *Quantum*, and his 41st and final "Problems, Puzzles and Paradoxes" column in *Consortium*. He continued to "ghost-write" the IMTS column in *Mathematics and Informatics Quarterly* and the USAMTS column in *Consortium*, even though he already turned those columns over to his successor in January. He also continued to serve on the editorial boards of *Quantum*, *Consortium*, *Mathematics and Informatics Quarterly*, *Math Horizons*, and several other publications, as well as on the "BudaBoard" of the Budapest Mathematics Semesters program, and as the North American Representative to the World Federation of National Mathematics Competitions (WFNMC).

Professor **Allen Broughton** conducted an NSF-REU program in Hyperbolic Geometry and Computational Group Theory with six students. He guided last year's REU student, Dennis Schmidt, in completing the MSTR report 97-03 "Oval Intersections in Tilings on Surfaces". Also, in conjunction with the REU, he wrote report MSTR 97-04 "Counting Ovals on a Symmetric Riemann Surface", which is being submitted for publication. He developed (jointly with Ed Doering in the ECE department) a course entitled "Advanced Mathematical Methods of Image Processing", a part of the Foundation Coalition Upper Division course development program. He also participated in the preparation for and was an instructor in of the Laptop Orientation, and co-chaired the Team Hosts Committee for Sunrayce.

Professor **Kurt Bryan**, with co-investigator Lester Caudill at the University of Richmond, spent the summer in NSF funded research on mathematical inverse problems related to thermal nondestructive testing. They presented their results from last summer at the 3rd conference on differential equations and computer simulations at Mississippi State University in May. A paper on their results will appear in the Electronic Journal of Differential Equations. Professor Bryan also attended the 1997 annual SIAM conference at Stanford University in July. He continued research with Michael Vogelius of Rutgers University on inverse problems and modeling related to electromagnetic eddy currents methods for nondestructive testing. Professor Bryan also refereed a paper for the SIAM journal on Applied Mathematics. Professor Bryan acted as the faculty director of the 1997 Jumpstart Program, which he taught with professors Klebanoff and Mutchler.

Professor **Steve Carlson** has returned to Rose-Hulman following his sabbatical leave during the winter and spring quarters of the 1996-97 academic year. His leave activities included an appointment as a Visiting Scholar and Visiting Professor at Indiana University in Bloomington where he did research and taught a course in topology during IU's spring semester. While at IU, he also completed an undergraduate level textbook "Topology of Surfaces, Knots, and Manifolds: A First Undergraduate Course" which he used in his course at IU and will also use in his RHIT course MA 307 during Fall 1997. He attended Math Fest '97 in Atlanta, Georgia, the national summer meeting of the Mathematical Association of America. Carlson, who is the past-chair of the Indiana MAA Section, attended the MAA section officers meeting as well as the meeting of the national MAA Committee on Sections of which he is a member through the year 2000. While at Math Fest '97, he also presented a talk entitled "Not the Stretch It May Seem: Innovation in the Undergraduate Topology Classroom" in which he discussed the structure of his topology course and textbook and, specifically, course projects which he developed during his sabbatical leave. Having now returned to the RHIT campus, Professor Carlson has resumed his roles in the department as coordinator of the ISU-RHIT-SMWC Joint Mathematics Colloquium series and organizer of the RHIT participants in the annual William Lowell Putnam Mathematical Competition. He has also taken on a new assignment as editor of the Mathematics Department Newsletter.

Professor **Elton Graves** arranged to have Josh Horstman and Jayme Moore present a talk entitled "Meetings, Bloody Meetings" at the national Pi Mu Epsilon Conference which was held in August in Atlanta. Their paper was awarded one of the "Outstanding Presentation" awards, by Pi Mu Epsilon. Dr. Graves was unable to attend the conference since he was the Director for and taught Fast-Track Calculus from July 20 until August 22. Forty-five students successfully completed FTC and are now taking sophomore level mathematics courses at Rose.

Professor **Ralph Grimaldi**, along with teaching in summer school, gave a mathematical presentations to the Fast Forward program. His paper, co-authored with Joe Moser (a RHIT alumnus) "The Catalan Numbers and a Tennis Ball Problem", was accepted by *Congressus Numerantium*.

Professor **Lynn Kiaer** has had a busy summer. June 15-18 saw the culmination of many months of work at the ASEE Annual conference, where she was Mathematics Division Program chair. One of the highlights of that conference was a session on the role of calculus reform in an engineering curriculum, with speakers from outside the traditional engineering schools. The session was very well-received by both mathematicians and engineers, and a similar session is planned for next year. At that meeting, Professor Kiaer was elected division chair for the coming year. The following weekend, Dr. Kiaer attended the Foundation Coalition Faculty Conference in Plymouth, Massachusetts. In addition to conferences, Professor Kiaer has been very active on campus this summer. She taught MA 213, Applied Mathematics II, during the first summer school session, and worked with Professor Graves and Lopez on Fast Track Calculus later in the summer. In addition, she gave two well-received presentations on campus, one to Catapult students on simulation and another to Fast Forward students on the combinatorial game Set. Finally, Professor Kiaer is currently working with Professors Froyd and Mutchler on a paper they were invited to submit to *Communications of the ACM* on how the use of laptop computers enhances and is enhanced by the Integrated First-year Curriculum in Science, Engineering and Mathematics.

Professor **Jack Kinney** participated in the summer work of the Commission on Assessment. This group set goals and methods of assessment for our various academic activities. It is anticipated that the report will be presented to the faculty early in the fall. He attended the Joint Statistical Meetings in Anaheim, California, where he presented a paper on Mathematica and its uses in probability and statistics. He started work on another text, this one in the area of mathematical statistics.

Professor **Aaron Klebanoff** has been involved with various activities since the Spring. He modified and wrapped up some work with the web-site for multi-step calculus problems that he manages. Dr. Klebanoff spent much of his summer devoted to developing a new curriculum model for the First Year Team. He gave a presentation on fractals for Fast Forward, and taught in the Jump Start program as well.

Professor **Roger Lautzenheiser** attended the joint RHIT/KIT international conference on engineering education held at Kanazawa Institute of Technology in Kanazawa, Japan. After the conference, which was held July 6 - July 9, he remained in Kanazawa to begin his sabbatical year at KIT.

Professor **Robert Lopez** spent the bulk of the first half of the summer starting work on a text in Advanced Engineering Mathematics and attending the ASEE conference (he is secretary for the Math Division). He finished the summer as an instructor in Fast Track Calculus.

Professor **John Rickert** Rickert went to MIT for a month where he participated as instructor in RSI a summer program for mathematically and scientifically talented high school students. He then left for his sabbatical at Penn State.

Professor **Gary Sherman** participated in an NSF meeting on technology in discrete mathematics and abstract algebra at Depauw University in June. He also attended the MAA meeting in Atlanta in July where he gave an invited talk to the Project Next Fellows on his approach to using technology in discrete mathematics and group theory. He was recently named chair of the MAA's Allendoerfer Prize Committee and invited to speak to the MAA's NeXT Fellows at the Atlanta Math Fest. Two of his long term projects came to fruition with the publication of "Trying to do Group theory with Undergraduates and Computers" in *Journal of Symbolic Computation*, and the acceptance of "Counting Nilpotent Pairs in Finite Groups" by *Ars Combinatoria*.

Professor **Yosi Shibberu** was sponsored by the Institute for Advanced Study to participate in a three week summer program on symplectic geometry in Park City, Utah, June 29 - July 19, 1997. He was also invited to attend an NSF/CBMS Conference on Numerical Analysis of Hamiltonian Systems at The Colorado School of Mines, in Golden, Colorado, June 1 - June 8, 1997. This summer, Professor Shibberu began collaborative research work on Hamiltonian dynamics with Ander Murua in Spain. He also worked for the Foundation Coalition developing new student projects for the Foundation Coalition Sophomore Curriculum.

PRESENTATIONS, SEMINARS and COLLOQUIA

Off campus presentations:

Kurt Bryan, (with Lester Caudill), "Results on Mathematical Inverse Problems Related to Thermal Non-destructive Testing", Third Conference on Differential Equations and Computer Simulations at Mississippi State University.

Steve Carlson, "Not the Stretch It May Seem: Innovation in the Undergraduate Topology Classroom", Math Fest '97, Atlanta Georgia.

Lynn Kiaer, ASEE Annual conference, Mathematics Division Program Chair.

Jack Kinney, "Mathematica and its uses in Probability and Statistics", Joint Statistical Meetings in Anaheim, California.

Gary Sherman, "Students, Faculty, Mathematics/Algebra, and Technology --- Facts, Religious Convictions, Opinions, Rumors and Advice from the line of scrimmage", Math Fest '97 in Atlanta Georgia.

On Campus Seminars

Peter Turbek, University of Purdue at Calumet. "The defining equations of the Accola-Maclachlan and Kulkarni Surfaces".

PAPERS, PUBLICATIONS AND TECHNICAL REPORTS

Paper and Publications:

Nacer Abrouk, "Statistical Methodology in Engineering Metrology", CIS Consulting Report for Digital Audio Disc Corporation, confidential and proprietary.

_____, "On Efficient Sampling Procedures for A Distribution Process", CIS Consulting Report for Columbia House Corporation, confidential and proprietary.

George Berzsenyi, with Stephen B Maurer of Swarthmore College, The Contest Problem Book V, Mathematical Association of America (MAA).

_____, "The International Mathematical Talent Search" appeared in *Mathematics Competitions*.

Allen Broughton, (with 5 co-authors) Symmetries of the Accola-Maclachlan and Kulkarni Surfaces, accepted by the *Proceedings of the AMS*.

_____, Counting Ovals On a Symmetric Riemann Surface, *Mathematical Sciences Technical Report Series 97-04*.

Steve Carlson, Topology of Surfaces, Knots, and Manifolds: A First Undergraduate Course, manuscript completed.

Ralph Grimaldi with Joe Moser (RHIT alumnus), "The Catalan Numbers and a Tennis Ball Problem", accepted by *Congressus Numerantium*.

Gary Sherman, "Trying to do Group theory with Undergraduates and Computers", *Journal of Symbolic Computation*.

_____, (with 3 REU authors), "Counting Nilpotent Pairs in Finite Groups", accepted by *Ars Combinatoria*.

Mathematical Sciences Technical Report Series:

MS TR 97-03 *Oval Intersections in Tilting on Surfaces*, Dennis A. Schmidt.

MS TR 97-04 *Counting Ovals on a Symmetric Riemann Surface*, S. Allen Broughton.

PROGRAMS (more details of programs in various locations above)

Summer School: Nacer Abrouk, Ralph Grimaldi, Lynn Kiaer,

The Rose-Hulman **NSF-REU** completed it's ninth year with three men and three women working on tilings on Riemann surfaces. Four technical reports are in progress.

The **Fast Track Calculus** program had 45 successful participants this year. Professors Elton Graves, Robert Lopez, and Lynn Kiaer taught the program which began on July 20 and ran to August 22, 1997 and covered three quarters of Calculus.

Jump Start, taught by Kurt Bryan, Aaron Klebanoff, and David Mutchler successfully got 30 students a head start on their studies at Rose.

Laptop Orientation Presenters: Allen Broughton, Kurt Bryan, Steve Carlson, Elton Graves, Matt Hopkins, Lynn Kiaer, Aaron Klebanoff, David Rader.