

**NEWSLETTER
DEPARTMENT OF MATHEMATICS
SOUTHERN METHODIST UNIVERSITY – 2006**

Welcome. This is the first in what we hope will be a series of annual newsletters on the activities of the Mathematics Department at SMU. For many of you this will be the first contact you have had with us in quite some time. Much has changed since your days at SMU. I hope you find the newsletter informative and stimulating.

The department has 19 tenure and tenure track faculty. There are eight Full Professors: John Chen, Ian Gladwell, Rich Haberman, Peter Moore, George Reddien, Doug Reinelt, Larry Shampine (Clements Chair of Mathematics), and Richard Williams. We have five Associate Professors: Tom Carr, Robert Davis, Mogens Melander, Montie Monzingo and Johannes Tausch. The six Assistant Professors are Vladimir Ajaev, Bruce Ayati, Yeo-jin Chung, Takashi Nishikawa, Sheng Xu, and Yunkai Zhou. Our Starr Visiting Assistant Professor is Allen Tesdall. Our teaching is supplemented by two lecturers: Judy Newell and Carol Seets.

The department is entering a period of significant transition. Over the next three years three of our senior faculty will be retiring, Ian Gladwell, George Reddien and Montie Monzingo. They will be sorely missed since they have served in many critical capacities including Department Chair, Graduate Coordinator and Undergraduate Coordinator.

Teaching

The department graduated 29 undergraduate majors in 2005-2006. Most of them had a double major with engineering. One of our undergraduate majors, Chase Zachary, was a summer research intern working with Professors Moore and Horsthemke (SMU – Chemistry). The Department offers undergraduate scholarships to promising students through the generosity of donors. There were three Strow Scholars and seven Carrie and Edwin Mouzon Scholars in the academic year 2005-2006 and we made several awards for academically outstanding students from endowed funds (McCaw, Pipes).

There were 27 graduate students enrolled during 2005-2006. Two of these students were supported by grants, one was a University research assistant, 19 served as Teaching Assistants and 5 were part-time students with jobs in industry. Eight of our students graduated with a Master's degree, five of whom are continuing on in our Ph.D. program. Two students (Risser, Wang) completed Ph.D.'s. Several of our graduate students were able to attend conferences during the year with support from SMU and an endowed fund. The Department is recognized nationally as graduating the most (tied for first in mathematics departments of our size) women with Ph.D.s.

One of our outstanding majors is Stacy Wohead. Stacy hails from Mesquite, Texas, and she has been a Mouzon Scholar since arriving at SMU. Stacy is one our undergraduate graders. Our graders are essential to our teaching efforts as they allow faculty to focus on meeting with students and preparing classes. Graders must have earned at least a B+ in

the course they are grading. Stacy grades for two advanced courses, Calculus 3 and Advanced Mathematics for Science and Engineering and has been grading for four semesters. She is graduating this spring with minors in economics and women's studies and is planning on attending graduate school in Finance or Financial Mathematics.

Markos Mulugeta will be finishing his Ph.D. this spring. Markos is from Ethiopia. He arrived with Masters degrees from Ethiopia and the University of Texas at Dallas. Markos is working with Professor Ajaev on fluid flow in micro heat pipes (see below) and is currently our SMU Dissertation Fellow. He has also served as a teaching assistant in our Business Calculus class. He hopes to find a job as a professor in a university in the United States.

Research Highlights

The excellence of our faculty research is evidenced in various ways. Four of our faculty (Chen, Gladwell, Haberman, Moore) serve as editors for scientific journals or book series. Service as an editor is critical to the peer-review process that underlies scientific progress. In the coming year four of our faculty (Ajaev, Ayati, Chen, Chung) will have traditional grants from the National Science Foundation (NSF) totaling \$322,284. Over the last academic year our faculty have published 32 papers in journals and conference proceedings and have delivered 44 conference or colloquium lectures. Fourteen researchers gave talks in our colloquium series during the year.

Research in the department focuses on the study of differential equations, their solution and their application. Differential equations arise in every area of science and engineering and increasingly in business applications. These equations can be used to model the behavior of physical, biological and sociological phenomena. Analysis of these equations often requires the use of sophisticated computer software. Several of our faculty are engaged in the development of general purpose codes for use by other scientists and engineers. This year's report highlights the research efforts of two of our four faculty members with NSF grants: Yeo-jin Chung and Vladimir Ajaev.

Yeo-jin Chung is working in three key areas related to optical communication: the propagation of light in photonic crystals; error correction in communication networks; and pulse evolution in optical fibers. In the first application she is studying the effects of nonlinearity on the optical properties of these crystals to identify the practical potential for developing new optical devices via nanotechnology. With ever increasing data transmission in communication networks, it is essential to ensure error free information propagation. Error correction aims at decreasing the probability of transmission error and is attained via coding and decoding schemes. Yeo-jin is developing computational tools for comparing the effectiveness of these schemes. Finally, she is studying the effect of randomness, caused for example, by imperfections in the geometric structure of fibers on the evolution of ultrashort pulses in those fibers. Applications include medicine, imaging and broadband communication.

Vladimir Ajaev works on applications of bubbles in fluids, especially when the shape of the device (container) plays a critical role. If a gas results from the boiling of a liquid then the resulting bubbles are referred to as “vapor bubbles”. For example, in thermal ink-jet printers an expanding vapor bubble pushes the ink out of a nozzle resulting in a single droplet. These droplets deposited on a print surface give rise to a high-quality image. The success of this process has led to other applications. For example, an expanding bubble in a blood vessel can be used to block the flow of blood to tumors in a recently proposed cancer treatment. In other situations, the formation of bubbles must be suppressed such as in micro heat pipes that remove heat generated by electronic devices inside laptop computers. Vladimir uses a variety of methods to address these problems including analytic and computational approaches. Better understanding of the formation and subsequent behavior of these bubbles should lead to more effective products.

Initiatives and Opportunities

The department has started several new classes including a new mathematical biology courses for undergraduates and graduates, respectively. We have expanded our double major program to include Civil Engineering and Environmental Engineering. We are beginning to create a math library in the department for our majors and graduate students.

The success of our program depends on our faculty and students and alumni support. Our reputation is enhanced through the increased visibility that comes with travel to major conferences and a stronger colloquium series. Increased faculty recognition will lead to recruiting better undergraduate majors and graduate students. We are looking to provide additional funding for our colloquium series, increase our funding for faculty and graduate students to travel to conferences and fund an endowed graduate student fellowship. If you have an interest in directing your charitable giving funds to the Mathematics Department, contact: Dr. Peter Moore, 214-768-1779, pmoore@smu.edu or the Dedman College Office of Development, Julie Diaz , 214-768-4714, diazj@smu.edu Thank you for your continued interest and support. If you have any news please pass it on to Dr. Peter Moore. If you wish to be taken off our mailing list please let Liz Berry know, lberry@smu.edu.