Investing in Our Future: Student Days at the SIAM Annual Meeting

Engaging students in research in applied and computational mathematics is essential for the future vitality of the mathematical sciences, but it is only a first step. We need to make students part of our community. Student Days create opportunities for students to present to, observe, and interact with professional mathematicians.

Student Day has been a feature of SIAM annual meetings for many years. The event is designed to encourage students to participate in SIAM, to help students learn more about applied mathematics and computational science, both as fields of study and as careers, and to give emerging mathematicians a taste of the life of a professional mathematician. In 2008, Student Day became Student Days for the first time, as student activities swelled to fill two days—a reflection of SIAM's growing investment in the future of young mathematicians.

Student Days at the 2008 Annual Meeting in San Diego began early in the morning of Tuesday, July 8. Over breakfast, student representatives and faculty advisers from SIAM student chapters met and exchanged ideas with SIAM officers and staff. The students reported on activities of their chapters, on student research conferences, and on fund-raising strategies. SIAM staff left with suggestions for ways in which SIAM can support student chapters and facilitate interactions among them. The lively conversation confirmed that SIAM student chapters are alive and healthy. And it was clear that student chapters have introduced many students to SIAM at early stages of their careers.

The remainder of the first day provided an array of opportunities for showcasing student research. Six student chapter representatives presented outstanding papers in a morning session. In an afternoon session, "Undergraduate Research in Dynamical Systems," organized by Chad Topaz (Macalester College), Andrew Bernoff (Harvey Mudd College) gave a talk on promoting undergraduate research, followed by research presentations by four undergraduates and, finally, a panel discussion of strategies for mentoring undergraduate researchers. "Engaging student curiosity is key," said panel member Rich Braun (University of Delaware); "you know you have been successful when students start asking and answering their own research questions."

The day culminated with a conference-wide poster session (complete with dessert), where a highlight was the first undergraduate poster competition. Four undergraduates received prizes; among them was Amanda Traud, whose poster, "Identifying Sociological Trends in Facebook Networks," suggested metrics for identifying communities in online networking sites, demonstrating that the next generation of applied mathematicians will identify new forums for the application of mathematics. The other three winning poster presenters were Nate Bottman (University of Washington), "C–noidal Solutions of the Korteweg–de Vries Equation are Linearly Stable"; Claudia Falcon and Joyce T. Lin (University of North Carolina at Chapel Hill), "A Falling Sphere through Stratified Karo"; and Matt Hennessy (University of Ontario Institute of Technology), "Flow Transitions in a Differentially Heated Rotating Channel."

The program for the second day was devoted to predictably outstanding presentations by winners of the (undergraduate) Mathematical Contest in Modeling and by the (graduate student) winners of the SIAM Student Paper Prize, in both cases from 2007 and 2008.

The sessions were well attended by students and faculty alike. Those who heard the student talks were uniformly impressed by the maturity and professionalism of the presentations and by the quality of the research. More than one attendee remarked that some senior researchers might improve their own presentations by listening to a few student talks!

Participating students described the Annual Meeting, and Student Days in particular, as valuable experiences that they are likely to remember for many years. "The undergraduate talks were exciting and inspiring," said rising junior Vedika Khemani. "I understood all of the talks!" (Vedika is one of three Harvey Mudd College students engaged in an experimental, numerical, and theoretical study of slurry flows at UCLA's Applied Mathematics Lab under the direction of Rachel Levy of HMC.)

Brandy Benedict, recent recipient of a PhD from North Carolina State University and, as of this fall, an assistant professor at Merrimack College, attended the sessions on student research. "It was helpful to hear about undergraduate research projects in the words of the students themselves, and to ask them directly about the qualities of the mentoring that made their particular research experiences successful," she commented. "I was impressed with both the quality of research done by the undergrads, and the confidence with which they presented their results."

Talks and poster presentations at the Annual Meeting are valuable outlets for undergraduate research. Equally important are publishing opportunities, and the San Diego meeting marked the official launch of a journal created to publish outstanding undergraduate research in applied and computational mathematics: SIAM Undergraduate Research Online (SIURO; www. siam.org/students/siuro/index.php). One of SIURO's ambitious goals is to turn around undergrad-

For a dissertation titled "Multiscale and Hybrid Methods for the Solution of Oscillatory Integral Equations," Daan Huy-brechs of Katholieke Universiteit Leuven received the 2008 Richard C. DiPrima Prize at this year's SIAM Annual Meeting. The prize committee praised the work and its author, who is now a postdoctoral fellow of the National Fund for Scientific Research of Belgium in the computer science department at K.U. Leuven, for "new solution methods motivated and justified by a deep understanding of the underlying theory." SIAM president Cleve Moler, treated to a personal introduction to the work at the opening reception, was fascinated by the highly oscillatory integrals that "need fewer points than Nyquist would have thought" and methods that "improve as the frequency increases—I don't understand that, so I look forward to reading the thesis."

uate submissions in under two months, allowing students (and their prospective employers and graduate school recruiters) to see the fruits of their labors before they graduate.

SIURO editor-in-chief Peter Turner (Clarkson University), who worked diligently to publish the first two papers in time for the Annual Meeting, says that he is "excited at the opportunity for SIAM to showcase some of the best undergraduate research in a timely and modern manner through SIURO." Turner, who will succeed Bill Briggs as SIAM vice president for education in January 2009, credits undergraduate paper sessions at previous Annual Meetings and conferences on CSE for making him aware that many students can produce high-quality research. "The early papers submitted, and now published in SIURO, confirm this," he says. "One remarkable fact is that the very first submission was a highly polished paper from a high school student working largely independently. SIURO can be an important piece of SIAM's outreach to a broader student community."

Recent remarkable increases in the number of SIAM student chapters have been accompanied by a sharp increase in SIAM student membership. Student chapters, and events like Student Days, have drawn many students into SIAM activities early in their careers. The hope is that they will become life-long members of SIAM.

William Briggs, Andrew Bernoff, Rachel Levy, and Peter Turner contributed to this article.

With no annual meeting held in 2007, the program for the 2008 SIAM Annual Meeting featured an impressive array of student presentations—by recipients of the 2007 and 2008 SIAM awards in the Mathematical Contest in Modeling (see also page 1) and the SIAM Student Paper Prize.

Having spent 38 hours in the air to attend the SIAM Annual Meeting in San Diego, the SIAM winning team for the discrete problem in MCM 2007 might be expected to know something about air travel. Indeed, the problem solved by the team—left to right, Andreas Hafver, Louise Viljoen, and Chris Rohwer (not pictured is faculty adviser Jan van Vuuren), from the University of Stellenbosch, Republic of South Africa—was called The Airplane Seating Problem. In their solution paper, "Boarding—Step by Step: A Cellular Automaton Approach to Optimizing Aircraft Boarding Time," judge James Case explained in the June 2007 issue of SIAM News, the students tested, via simulation, a total of ten airplane boarding protocols before concluding that the "reverse pyramid method," with about nine seating groups, "performs as well as any." Time spent on the ground might always be an insignificant part of their own international travel, but the team's thorough analysis, if heeded by airlines, could alleviate annoying delays for travelers making shorter trips.

Amy Evans (left) and Tracy Stepien of SUNY, University at Buffalo—the winning SIAM team for the continuous problem in MCM 2008. Teams opting for that problem, Take a Bath, were asked to model the effects on land of the melting of the North Polar Ice Cap under the influence of global warming, with emphasis on metropolitan areas along the Florida coast at 10-year intervals over the next 50 years. They were also to identify appropriate responses to the expected changes. The Buffalo team (whose faculty adviser was John Ringland), titled their solution "Fighting the Waves: The Effect of North Polar Ice Cap Melt on Florida." Graduate school is in the future for both team members, in mathematical biology (Stepien) and mathematics or computer science (Evans), and they are further linked by their strong interest and talent in an unrelated area: music.

Christopher Chang represented the Harvard team, named the SIAM winner for the discrete problem in MCM 2008; Chang's teammates were Zhou Fan and Yi Sun and Clifford Taubes was their faculty adviser. The problem, Creating Sudoku Puzzles, entailed the development of an algorithm for generating Sudoku puzzles, analysis of its complexity, and illustration of its use by generating puzzles of at least four different levels of difficulty. Finally, in what judge James Case considers the trickiest part of the problem, the students were to develop a metric for measuring the level of difficulty of a given puzzle—requiring a focus on the methods used in the actual solution of Sudoku puzzles, and distinction between elementary, intermediate, and advanced techniques. The Harvard team's solution was titled "hsolve: A Difficulty Metric and Puzzle Generator for Sudoku."

SIAM Student Paper Prizes

2007 Recipients

Thomas T. Bringley, Courant Institute of Mathematical Sciences, New York University
"Validation of a Simple Method for Representing Spheres and Slender Bodies in an Immersed Boundary Method for Stokes Flow on an Unbounded Domain"
Co-Author: Charles S. Peskin, Courant Institute of Mathematical Sciences, New York University

Nir Gavish, Tel Aviv University
"Singular Ring Solutions of Critical and Supercritical Nonlinear Schrödinger Equations"
Co-Authors: Gadi Fibich, Tel Aviv University, and Xiao-Ping Wang, Hong Kong University of Science and Technology

Kristoffer G. van der Zee, Delft University of Technology, The Netherlands
"An $H^1(P^h)$-Coercive Discontinuous Galerkin Formulation for the Poisson Problem: 1-D Analysis"
Co-Authors: E.H. van Brummelen and R. de Borst, Delft University of Technology, The Netherlands

2008 Recipients

Jeremy Brandman, University of California at Los Angeles
"A Level-Set Method for Computing the Eigenvalues of Elliptic Operators Defined on Closed Surfaces"

Roland Griesmaier, Johannes Gutenberg-University Mainz, Germany
"An Asymptotic Factorization Method for Inverse Electromagnetic Scattering in Layered Media"
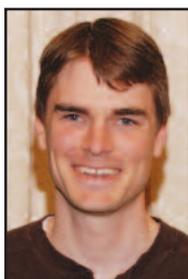
David Ketcheson, University of Washington
"Highly Efficient Strong Stability Preserving Runge–Kutta Methods with Low Storage Implementations"