

SIAM Marks 60th Anniversary at Minneapolis Meeting

With an AWM–SIAM Sonia Kovalevsky Lecture titled “The Role of Characteristics in Conservation Laws,” Barbara Keyfitz emphasized her direct connection to the work of Sonia Kovalevsky (1850–1891), whose Cauchy–Kovalevsky theorem makes clear the importance of characteristics in PDEs. (At the Joint Math Meetings early this year, by contrast, Keyfitz titled her Noether Lecture “Conservation Laws—Not Exactly à la Noether,” pointing to the more distant relation between current research in conservation laws and the celebrated theorem of that name by Emmy Noether (1882–1935). In fact, Keyfitz says, it is well known that weak solutions to conservation laws do not preserve the symmetries described by Noether’s theorem; Noether herself moved away from her early work on invariant theory and went on to a career as a founder of modern algebra.)

The contributions in hyperbolic conservation laws for which the Kovalevsky committee cited Keyfitz include work with Herbert Kranzer on the “novel and important notion of singular (also called delta) shocks” and their properties. She and her collaborators also “spearheaded the revival of the rigorous treatment of transonic gas flow.” Her work has applications in aerodynamics and in models of multiphase flow in porous media.

In the lecture, Keyfitz followed an overview of progress in the field with a gratifying recent update: After “languishing for 25 years,” she said, one of her and Kranzer’s results was resuscitated recently by Marco Mazzotti of ETH Zurich. Mazzotti explored a variation on the familiar equations of two-component chromatography, which he terms “Langmuir/anti-Langmuir adsorption isotherm,” and discovered solutions that appeared in numerical simulations to exhibit singular shocks. In a real tour de force, Keyfitz said, Mazzotti and co-workers were able to design an experiment that demonstrated an example of these elusive objects.

“When I discovered numerically the singular solution in nonlinear binary chromatography,” Mazzotti wrote to *SIAM News*, “I had never heard of the existence of that type of solution to hyperbolic equations. Keyfitz’s papers allowed me to put my results into context. Particularly her 1995 paper with Kranzer (*Journal of Differential Equations*) was decisive in providing me with the conceptual and mathematical tools needed to find an explicit expression for the rate of propagation of the singular solution that matches nicely the experimental measurement. After learning of my first results and efforts, and despite my being a clear outsider, Barbara Keyfitz took the time to look into what I was doing and then encouraged me enthusiastically, thus providing very valuable support and motivation.”

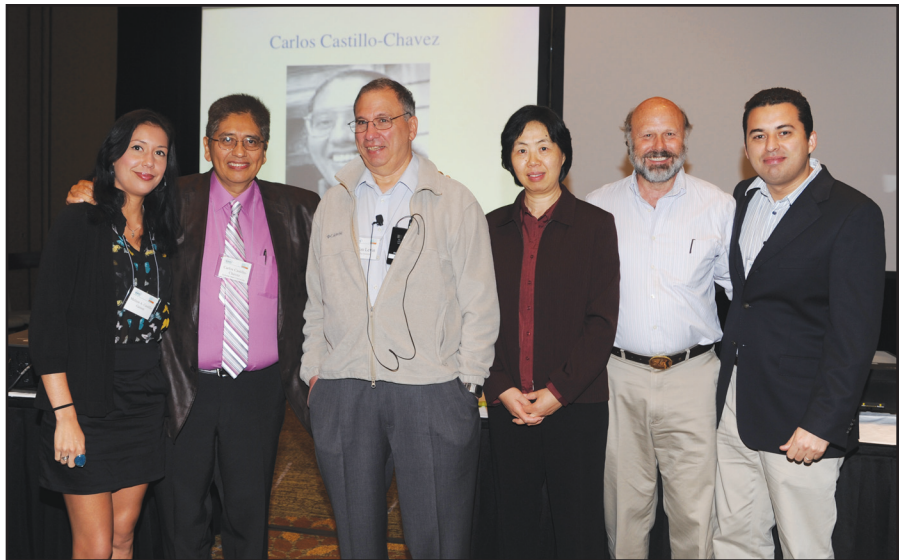
One of Keyfitz’s points in the lecture was that characteristic surfaces give information on analytical as well as geometric properties of solutions of hyperbolic equations, via, for example, the symbol of the operator and the mechanism of Fourier transformation. This analysis is the basis of Rauch’s proof, following work of Brenner, that multidimensional conservation laws are unlikely to be well-posed in L_p unless $p = 2$. The power of analysis of this type, she suggested, has not yet been fully exploited.

Partly as an illustration of related open questions, Keyfitz concluded with a computational result of which she was clearly very proud: an extension to the full Euler equations of ideal gas dynamics that exhibits (again numerically) a cascade of rarefaction waves, called “Guderley Mach reflection” by Keyfitz and collaborators Allen Tesdall and Richard Sanders (who built on pioneering work by Tesdall and John Hunter). This phenomenon has also been verified experimentally, she says, by Beric Skews and colleagues.

Chosen to give this year’s AWM–SIAM Sonia Kovalevsky Lecture, Barbara Keyfitz (left) of Ohio State University accepted the prize from AWM president Jill Pipher at the 2012 SIAM Annual Meeting in Minneapolis. Citing Keyfitz for “pioneering and seminal contributions to the field of hyperbolic conservation laws” (see accompanying article), the prize committee also commended her for “an outstanding record of professional service.” SIAM had the same idea in the latter case: Keyfitz also received the SIAM Prize for Distinguished Service to the Profession in Minneapolis.



2012 John von Neumann lecturer Sir John Ball of the University of Oxford (right), pictured with SIAM president Nick Trefethen, was honored for “his deep contributions to our understanding of the mechanics of materials via the calculus of variations and other branches of mathematical analysis, especially his pioneering work on existence theorems and constitutive models for nonlinear elasticity, cavitation in solids, irregular minimizers and material microstructure, and, more recently, defects in liquid crystals.”



Also celebrating a 60th birthday this year is Carlos Castillo-Chavez (second from left), whose contributions to mathematical epidemiology were recognized in Minneapolis at a session organized by admiring and grateful students and colleagues as part of the Workshop Celebrating Diversity. Speaking at the session were, from left: Castillo-Chavez's daughter Melissa Castillo-Garsow of Yale University, a journalist and writer; early mentor Simon Levin of Princeton University; first postdoc Zhilan Feng of Purdue University; long-time colleague Mac Hyman of Tulane University; and former graduate student Gerardo Chowell of Los Alamos National Laboratory.

Together, the speakers told the story of a remarkable career in which early twists and detours—a thwarted ambition to become an actor, an aversion to working on infectious diseases, announced to Levin by Castillo-Chavez on his arrival in Princeton—led with seeming inevitability to an emphasis on mentoring, over research (path-breaking research in infectious diseases, in fact) and just about everything else. The founding of the Mathematical and Theoretical Biology Institute, and its eventual relocation from Cornell to Arizona State University, gave Castillo-Chavez a platform from which he could influence hundreds of students to consider careers in mathematical modeling and analysis. The ASUs of the world, Castillo-Chavez said at the conclusion of the session, can reach far more students than an elite institution ever could. The many MTBI alumni in attendance provided strong confirmation of his vision and impact.



"Tony Chan is not your average university president." Sparked by Chan's remarkable invited talk on big themes in image processing, SIAM president Nick Trefethen devotes his column in this issue to advances and algorithms discussed in the talk, and to the equally remarkable career leading up to Chan's appointment

in 2009 as president of Hong Kong University of Science and Technology.



Hans Kaper of Georgetown University is co-director of the NSF-funded Mathematics and Climate Research Network and, as of very recently, editor-in-chief of SIAM News. In Minneapolis, as in Vancouver at ICIAM 11, he was on the lookout for interesting topics for SIAM News coverage; he is now in the process of forming an editorial board.

Annual meeting photos by John Markovich unless otherwise noted.



Michele Benzi (left) and Tasso Kaper, co-chairs of the organizing committee for the 2012 SIAM Annual Meeting. One innovation introduced at the meeting, in which both took active roles, was a minisymposium during which a group of invited speakers made themselves available to students at all levels, who were free to ask questions about anything to do with careers in the math sciences. See page 5. Photo by Susan Whitehouse.