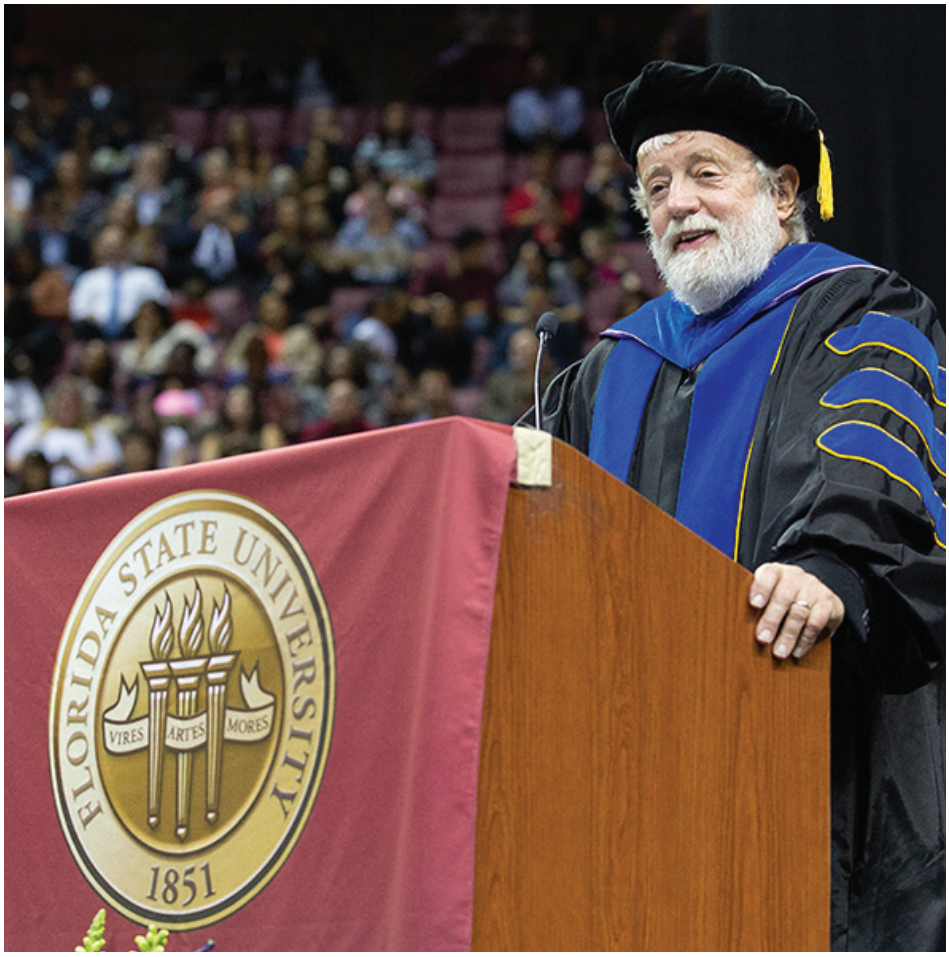
Department of Scientific Computing

Summer 2016

Max Gunzburger, department founder and chair, steps down

Max Gunzburger arrived on the FSU campus in August 2002, as a faculty member of the Mathematics Department, with an additional appointment in what was then known as SCS, the School for Computational Science. SCS had begun life as a supercomputing center, and had since gone through several changes of name, purpose, and director. When the latest director, Joseph Travis, announced he was planning to step down, he hoped that Gunzburger, as his successor, would be able to give SCS a clearly defined role in the university.



Above: Gunzburger on stage as he delivers the the Robert O. Lawton Distinguished Professor commencement speech at the Civic Center.

Gunzburger felt that the only way for SCS to survive and prosper was to become a separate department in its own right. This would mean significant negotiations with deans, other departments, and most particularly with the current SCS faculty, who at that time were only "borrowed" from other departments where their tenure was held. Over several years, Gunzburger led the effort to propose a structure for the new department, including bylaws, budgets, and a curriculum for the Masters and Ph.D. degrees. The crucial moment came when the department was approved, under the new name "Scientific Computing" or "SC", and faculty had to choose whether to stay in SC or return to their original department. Enough faculty decided to accept the risk that the department was viable, and immediately began accepting graduate students.

Since then, under Gunzburger's leadership, the department has awarded over

see Gunzburger, page 8

Tributes from Faculty, Colleagues, Students

Max on Math

"I went to a specialized high school for math and science students. After I talked to the guidance counselor and told her I like math, she said, 'Well, why don't you go to engineering school?'. I was pretty wet behind the ears, and that sounded pretty good to me, so I went to school to become an aeronautical and aerospace engineer. Somewhere around my junior year, I started to realize how much I like math and wanted to study math. It's not that I don't like engineering, and in hindsight and being an applied mathematician in the end, I think it was actually pretty beneficial that I got an engineering degree. I find I can talk to engineers much more easily than most mathematicians and collaborate. So I prepared myself for math while I was still an undergraduate engineering student by taking more math courses. The engineering department had a design course where you actually had to draw things - airplane wings and stuff like that - what they used to call mechanical drawing. I got out of that course and they let me take some math courses which was nice of them."

----Gunzburger on his time as an undergraduate at NYU.

You can hear Gunzburger talk more about the early days of his career by going to soundcloud.com/fsuscicomp.

Max is a renowned mathematician, and I am sure that his research has influenced many mathematicians. I would like to share a story about how his

research influenced me, a groundwater modeler.

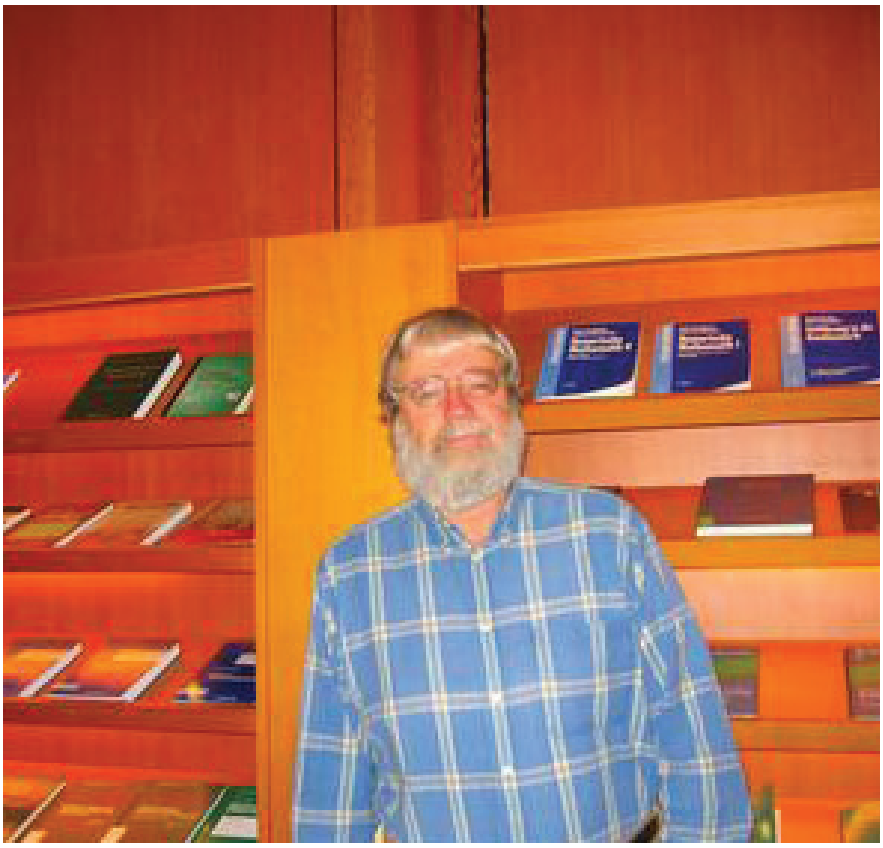
One of Max's research areas is to develop methods of sparse-grid stochastic collocation for numerical integration and building cheap-to-run surrogates for computationally expensive models. His student, Guannan Zhang, was working in this area and took my course of applied groundwater modeling. I designed a course project for him to apply their sparse grid methods to groundwater models, which are always computationally expensive because the models need to solve partial differential equations for large domains (e.g., watershed) but at small scales to account for spatial heterogeneity.

The course project showed promising results, and Max encouraged the student to continue working with me to further explore this topic, and we published a paper together in Water Resources Research, a flagship journal in the field of hydrology.

The story does not end here. When working with the student and Max and sitting in his course of stochastic partial differential equations, I realized that sparse grid methods have great potential for groundwater modeling, because the cheap-to-run sparse grid surrogates can break the barrier between models and model analysis. For example, if a single model run takes half an hour (actually for many groundwater models, a single model run can take several hours), not much model analysis (e.g., sensitivity analysis and uncertainty analysis) can be done, even when parallel computing is used. With this understanding, I included the sparse grid methods into a proposal submitted to the Early Career Program of the Department of Energy (DOE). It was funded! The panel considered that my proposed method using sparse grid could be a game-changing technique for groundwater reactive modeling.

The DOE Early Career Award is notoriously difficult to win, and I have been the only awardee from FSU. My award would not have been possible without learning the sparse grid methods from Max. He has many other research areas, and I hope to learn as much as possible from him in the future.

----MING YE



Gunzburger at the department's annual Xposition talking to Feifei Xu with Hans-Werner vanWyk in the background.

Max has had a big impact on me both professionally and personally. He has this remarkable ability to simplify complex stuff, by focusing on core issues. He does this regardless of whether he is wearing his "research hat" or his "administrative hat"; I have been constantly impressed by how he is able to disentangle a complicated issue, and break it down into a manageable set of choices or actions. He is a great leader. Personally, I am grateful to him for shielding us (assistant professors) from distractions that could easily have derailed progress towards tenure. One could think of it as another example of separating the vitally important from the less important, and then focusing on the former.

----SACHIN SHANBHAG

Max has been a recognized leader in tackling several different types of specific computational problems [physical phenomena being modeled….] This is extraordinary. Max's long and productive career has included major contributions in many areas of computational science. The physical phenomena to which Max has turned his attention include the optimal control of fluid flows, climate modeling, superconductivity, subsurface fluid flows, and image reproduction. At the same time, Max has produced methodological advances in quantifying uncertainty, computing Voronoi tessellations, solving partial differential equations numerically, refining finite element methods, and increasing the computational efficiency of multiscale modeling.

One can measure scholarly achievement by many yardsticks. The best

measure, regardless of discipline, is whether someone has changed how her or his disciplinary community thinks about an important problem. Many of us influence how our colleagues think but few of us change how they think. Only a very select few change how they think about more than one important problem. By all accounts, Max has changed how his colleagues think about several important problems. These problems include practical challenges in physical science and technical challenges in computational mathematics. Max's record is extraordinary, even among the best.

----JOE TRAVIS

Max was the driving force behind the invention of the Department of Scientific Computing, in which he served as Chair. The students graduating from this department receive broad technical training, not only in the traditional theoretical areas of mathematics, physics, biology, etc., but also in the growing pillar of computational science. Max is a visionary in the sense that he saw this transition coming, and put FSU at the forefront of such changes in academic training, which has since been copied by a variety of universities, including MIT, Harvard, Stanford, Georgia Tech, Virginia Tech, Michigan State, and many more to come in the near future.

---- CLAYTON WEBSTER

From a personal point of view, I consider Professor Gunzburger not only as my Ph.D. advisor, but also as a professional and personal mentor. Having worked with him has provided me inspiration and motivation for my own career path. His guidance and honest support have helped me to grow as an independent researcher. After graduating from the Department of Scientific Computing at FSU, I was awarded an ICES Postdoctoral Fellowship at the University of Texas at Austin, and more recently the prestigious Alston S. Householder Fellowship at Oak Ridge National Laboratory, where I am currently pursuing my own research. Not only is Professor Gunzburger a distinguished mathematician and scientist, but he also continues to innovate and to provide inspiration to both well-established and early-career researchers. I am confident that he will continue to push mathematics and science forward, and the legacy he will leave will continue to make an impact for many years.

----PABLO SELESON

Dr. Gunzburger was chosen to become the director of the School of Computational Science in 2005. During his early tenure as chair, Dr. Gunzburger promoted the transition from a research institution to a full-fledged department authorized to grant both graduate and undergraduate degrees. Because we already had initiated a graduate program in 2008, we focused on developing an undergraduate curriculum providing a state of the art of computational science education. In 2008 we became a department in the College of Arts and Sciences under the leadership of Dr. Gunzburger and by 2009 we were a standard department ready to mentor undergraduate and graduate students. Given the obstacles of developing a graduate and undergraduate program, negotiating courses with other departments, and developing the very first computational science department in the USA, Dr. Gunzburger had a clear vision and steered us unwaveringly and relentlessly toward being a unique, independent department. The Florida State University can be

> By every possible measure of a researcher's quality and influence, Professor Gunzburger is placed among the very best in the world.
>
> ---- Dominique Pelletier

> My estimation of his stature is that Max is the strongest computational mathematician in the world today.
>
> ---- William Layton

proud to have the first computational science department, now named the Department of Scientific Computing, in the country.

----PETER BEERLI

To sum up simply, there is no doubt that Professor Gunzburger has made a huge impact not only on many individuals but also on the worldwide community of applied mathematics and scientific computing.

----QIANG DU

Under Max's guidance, I completed a dissertation on Centroidal Voronoi Tessellations for mesh generation from uniform to anisotropic adaptive triangulations. Today I am still applying the knowledge to discretize surfaces in my models of microorganisms or to tessellate feasible regions for robot navigation. I owe this applied capability to Max who has shown me how a talented mathematician can use a simple but useful concept to solve many problems in the real world in an efficient and effective way. Max's vision, skill and capabilities are beyond any borders and continue to inspire many who get to know him.

----HOA NGUYEN

Professor Max Gunzburger is an exceptional researcher with a national and international reputation that is rarely obtained in the field of mathematics and computational science. This distinguished stature clearly follows from Max's seminal research contributions in critical research fields such as theoretical and numerical partial differential equations, control and optimization, uncertainty quantification, and in the theoretical and numerical aspects of finite element methods. However, Max's reputation is not limited to foundational mathematical research topics. Max's contributions also include a wide array of pioneering and field-leading sustained mathematical, numerical, and computational science contributions to critical scientific and engineering fields. These include research on superconductivity, fluid flow, fluid flow with transport, porous media flows, magnetohydrodynamics, and climate modeling to name just a few examples. My strong belief in Professor Gunzburger's profound impact on mathematics, science, and computational science, and the resulting distinguished status with which he is viewed, is certainly not unique to myself. I can personally attest that these views are shared by significant numbers of my colleagues at many top US national laboratories, my collaborators and colleagues in leading academic research institutions, and confirmed internationally by my technical and professional interactions in Europe, Asia, South and North America.

----JOHN SHADID

I truly enjoyed my time working with Max. He is a very kind and understanding person. He allowed us to do our jobs. If he didn't hear from me or anyone else, then he knew tasks were getting done.

He didn't need to be involved in the

day to day activities – he had trust in me that I could keep things going. I could make decisions based on the knowledge I gained working at the department. He knew I would go to him with any concerns or items that I was not able to get through.

----MICHELE LOCKE

I was a graduate student in Pittsburgh when I met Max, who was teaching at Carnegie-Mellon. He was an unusually friendly professor, with a taste for beer, and Chinese food, especially when it was spicy enough to make you cry. I had a chance to meet his graduate students at a combination picnic and basketball game at Max's place, a sort of A-frame lodge in the woods, complete with a deer-stand in the driveway. Max moved to Virginia Tech but we stayed in occasional contact, and he was concerned to hear that, after getting discouraged, I had let the clock run out on my PhD studies at Pitt. He urged me to consider a second try at Virginia Tech.

The saying goes that insanity is repeating an action expecting a different outcome. When I decided to give it a try, my friends were appalled, since I'd be giving up a job, a house, all the people I knew, to start all over with courses, prelims, and the dreaded thesis. As it turned out, I got a different outcome the second time, but that's because I didn't actually repeat the same action: the vital difference was Max's support and guidance. He got me through the program, on the three-year timeline he had predicted.

Getting a second chance made a complete difference in my life; while I have had many other kindnesses from Max since then, this is the first and most important that I think of.

----JOHN BURKARDT

CONTRIBUTORS

Ming Ye is Professor at the Department of Scientific Computing and recipient of the 2015 Walter L. Huber Civil Engineering Research Prize, Associate Editor of the Journal of Hydrology, winner of the Department of Energy Early Career Award, and Fellow of the Geological Society of America.

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William Layton is Professor of Mathematics at the University of Pittsburgh. He was Max Gunzburger's first doctoral student and has directed over 30 of his own doctoral students. He is the author of several textbooks in computational mathematics and served on several editorial boards for SIAM and other professional societies.

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The department's mission is to be the focal point of science and computation at Florida State University. Gordon Erlebacher is the Chair of the Department of Scientific Computing. He can be reached at 850.644.0143. Newsletters are issued three times each year. Subscriptions and single copies are available by calling 850.644.0196. This publication is available in an alternative format on request.

Gunzburger, continued from page 1

100 graduate degrees; after a long university-wide hiring freeze, new faculty have been hired, an undergraduate program has been developed, and, most recently, a new classroom was created within the department's confines for the convenience of faculty and students.

Although a departmental chair is a full time and grueling job on its own, Gunzburger simultaneously has maintained his own vigorous program of research, travel, professional service, and regular supervision and contact with his own postdocs and students. During his time as chair, he has personally supervised 26 PhD students, with several more about to finish. Although Gunzburger is stepping down from the day-to-day duties of chairing a department, we all expect to continue to rely on his insightful guidance and leadership.

Max Gunzburger pictured at right, with Richard Lehoucq and Etienne Emmrich at the Mathematical Analysis for Peridynamics workshop held in Oberwolfach, Germany, January 2011 .

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