Department of Scientific Computing

Summer 2014

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Retirement approaches, Navon reflects

After five decades in science and mathematics, Professor Ionel Michael Navon is retiring. Navon has always been a scholar, a researcher, an investigator and has spent his life and career in learning and scholarship. Along the way, he has worked for universities, meteorological institutes, and science and space powerhouses around the world. He has collaborated and created global alliances, finding new and more refined mathematical problem solving methodologies.

Navon is a native of Romania, and lived there with his family until 1950. Following World War II, the political climate changed and became unfavorable for them, as Russian influence gave rise to imposed Communism. "I grew up as a child in Romania until the age of ten -- I'm 74 now -- and then the Communists came to power and so my parents moved to Israel in 1950. The political situation was that for most of the war, Romania was an ally of the Nazis. In 1944, Russia occupied Romania." When the war ended, the soviets continued to occupy Romania; in time, Russia's domination increased. Concerned for their security, Navon's father moved the family to Israel.

"The rule in Israel is that if you're of Jewish origin, you're automatically a citizen. So between the ages of 10 and 14 I had to learn Hebrew. I didn't know a word of Hebrew, but I learned it in a few months. I finished elementary school, and I went to high school at the age of 14. Then my family sent me to Paris, France where my father's sister lived, because they believed I would get a better education there. I was put in a boarding school, and I finished high school in France. So I had to learn French within few a months.

"After high school, I passed all the competitive exams to go to university, but I couldn't pursue my studies since being an Israeli citizen I was called to serve 2½ years in the army. I did my basic training and then did my service in army intelligence, since I was fluent in several languages. This was between 1960 and 1963.

"When I finished my 2½ years compulsory service, I wanted to go to the Hebrew University of Jerusalem to study mathematics and physics. At that time, one of the generals tried to persuade me to adopt a military career. When I told him I didn't want to make the army my career, he arranged to extend my time in the service for a few more months." Once Navon was discharged from the army, he studied for and received the Bachelor of Science degree in Mathematics and Physics from the Hebrew University. Soon after graduation, Navon married, and began and completed graduate studies in atmospheric science. After the birth of his first child, he accepted a full time position in Israel. "My first daughter was born in 1972, so I competed for a position as an applied mathematician with the Israeli Aircraft Industry related to missiles. There were a lot of competitors for the position and I did undergo a very extensive background check prior to being hired. I worked with them for 3 years, and then I left there to pursue completion of my Ph.D.

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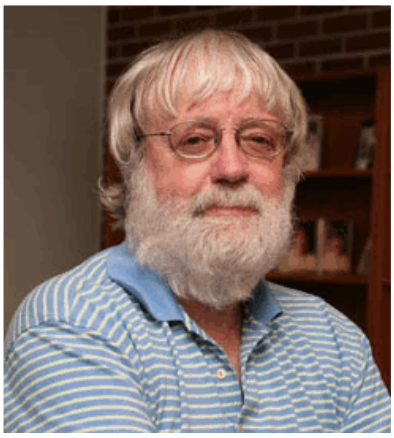
Message from the Chair



DSC CHAIR MAX GUNZBURGER

"Throughout all those years, Michael's stellar research brought great visibility and honor to FSU, so his contributions will be sorely missed."

The start of the new academic year comes with some sadness. With Michael Navon retiring and Jim Wilgenbusch moving to another university, we have lost two stalwarts that contributed in so many ways to the success of our department. Among our faculty, Michael has been with us through all the incarnations (SCRI - the Supercomputer Computations Research Institute, CSIT - the School of Computational Science and Information Technology, and SCS - the School of Computational Science) that preceded the Department of Scientific Computing. Throughout all those years, Michael's stellar research brought great visibility and honor to FSU, so his contributions will be sorely missed. Jim contributed to CSIT, SCS, our department, and FSU through his research, and more so through his leadership of our technical staff, and especially in the design, implementation, and management of the high-performance computing facility. We wish both Michael in his retirement and Jim at the University of Minnesota, as well as their families, good health and good times.

The new year does bring some very good news as well. We are very pleased to have Huang Chen join our faculty. Huang received a Ph.D. in physics from Princeton and then was a postdoc at Los Alamos. Huang joins us as part of FSU's initiative in energy and materials. So, we warmly welcome Huang and wish him every success in the department and as part of the faculty spread out over FSU associated with the initiative.

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"At the time, a friend of mine told me that South Africa had a position at an institute in Pretoria which is the Council of Scientific and Industrial Research. I applied there, and they offered me the position, along with a programmer, and helped me buy a house. My wife, who finished her engineering studies at the Technion, Haifa, found work as a structural and bridge engineer, in South Africa, and I finished my Ph.D. towards the end of 1978 at the University of the Witwatersrand."

Once he completed his doctoral work, Navon continued his position at the National Research Institute for Mathematical Sciences (NRIMS) in Pretoria, advancing through the ranks until he was named Chief Research Officer. He also taught meteorology courses at Pretoria University. While employed at NRIMS, Navon spent a year during 1980-1981 working as sabbatical visitor at NASA Goddard Space Flight Center in their modeling and simulation unit. He was the recipient of a NASA grant while in South Africa.

Navon arrived at FSU in 1985, after meteorologist James O'Brien contacted him and asked him to come to Florida State. "At that time, Jim O'Brien knew about me through some professional networks. He contacted me and made me an offer. But since my Ph.D. was in applied mathematics, I ended up in the Department of Mathematics in 1987." During that time, Navon also held a position that was created at SCRI, the Supercomputer Computations Research Institute. Later, he came to the then new Department of Scientific Computing and has happily remained for many years. "I had other offers over the years, but I like being in Florida, so

I turned them down. I was doing interesting work here, and I had my family here. Plus, I have been able to do research with people who are located anywhere. I am still able to collaborate with colleagues all over the world."

One of Navon's many alliances is an ongoing relation with Imperial College of London. Imperial College is one of the most highly regarded and well-respected institutions in the world. Years ago, scholars there knew of his extensive work in mathematics, and sought his expertise on a research project. "In about 2002, Imperial College needed an expert in data assimilation because they had a big funded project on ocean and atmosphere, and that was the start. After that, we wrote proposals and started a long term collaboration. Just recently I had a month-long visit with Imperial College. We are now discussing a book project on model reduction." Another fruitful collaboration was with the Institute of Atmospheric Physics (IAP), Academia Sinica, Beijing, China that continues up to this day.

In looking back, Navon can recall many pivotal changes in the field since he began his career. In the last thirty years, there have been sweeping changes in technology and computing, manufacturing, infrastructure and healthcare. The changes in computing and healthcare are two of the most crucial in Navon's opinion.

"In the last 30 years, there have been many big changes due to the increasing power of computers. We now have a clear and fast understanding of the human genome and have elucidated the molecular mechanism underlying the progression of Parkinson's disease. There have been applications of inverse problems to blood circulation for example. In the past, these types of very complex problems have been prohibitively computationally expensive. Major developments in memory and advances in efficient computer architectures led to advances in mathematical techniques such as reduced-order modeling, uncertainty quantification, PDE constrained optimization – these advances have helped solve fundamental problems in all the spectrum of sciences using computational approaches. These are the type of topics that computational scientists use to advance their respective field frontiers. This kind of contribution simply cannot be overestimated."

To see Mike Navon's extensive list of publications, articles, and books, go to http://people.sc.fsu.edu/~inavon/navon2.pdf

I. Michael Navon

Q. How are you planning to spend your retirement?

A. I will probably work part time in research. I have been invited to participate in research with my colleagues at Imperial College and at the University of South Carolina. We published a book last year (2013), and there are other research questions to answer and document.

Two other things I want to do are volunteer for experimental treatments of my Parkinson's disease, and write a novel. I want to write a novel based on my experience of living in Romania, Israel, France, South Africa and the United States.

Young Scholars spend summer on research

From left: A.J. Sacks, John Ameen, Peter Lin, Kelly Lampotang, Julia Gu, and Samantha Morris.

Scientific computing was the research training ground for six high school

students this summer. John Ameen (Tallahassee), Julia Gu (Boca Raton), Kelly Lampotang (Gainesville), Samantha Morris (Orlando), and A.J. Sacks (Boca Raton) worked on research projects with Professors Peter Beerli, Gordon Erlebacher, and Tomasz Plewa; Postdoc Tim Handy; and graduate students Haleh Ashki, Justin Bricker, Dan Smith, and Nathan Crock.

The FSU Young Scholars program is a six-week summer residential research program designed to expose high achieving high schoolers to original research in science and mathematics. Florida high school seniors compete for forty placements in the program. Admission to FSU YSP generally requires a score of at least 90% on a national standardized exam such as the SAT, PSAT, ACT, or PLAN, a handwritten student essay, an evaluation from a high school counselor, transcripts, and letters of recommendation.

On arriving, each of the SC Young Scholars enrolled in math, programming and science courses, and was assigned a professor and an Independent Research Project as follows:

CASAnova / PETER LIN

CASAnova (Computational Astrophysics Simulation Archive) is a data repository whose goal is to store and provide access to simulation results produced during the course of computational astrophysics research. The development of CASAnova accomplishes two tasks: 1) Internally compare and contrast simulation results to guide future research directions; 2) Disseminate the data to external users for comparison, verification, and further analysis. This second point is particularly important in the field of computational astrophysics, where the results of different research groups can be conflicting and irreproducible due to differing simulation codes, initial conditions, runtime parameters, and other simulation components.

Lin's work focused on preparing CASAnova for use by both internal and external users. Primarily, this involved redesigning the web interface to provide users with a clean and logical workspace for investigating simulation data. Additionally, Lin helped rollout new features including saving recent and favorite database queries, as well as user account control. This project touched on all aspects of web development, including HTML/CSS design, databases such as MongoDB and MySQL, and server-side programming using Python.

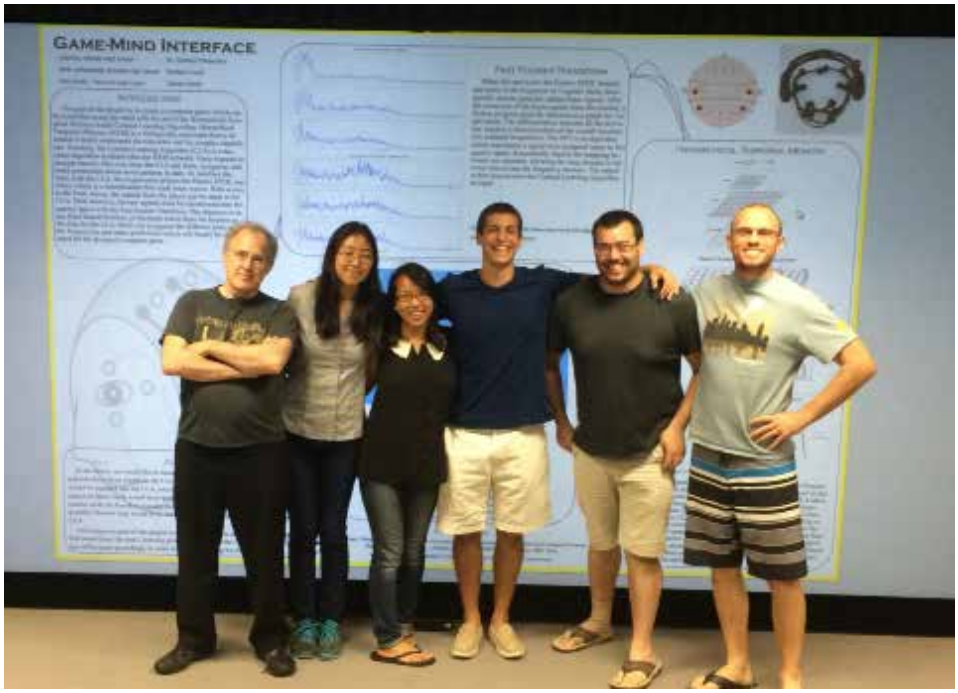
IDENTIFYING SINGLE NUCLEOTIDE POLYMORPHISMS / JOHN AMEEN & SAMANTHA MORRIS

Beerli's students, John Ameen and Samantha Morris, worked to identify single nucleotide polymorphisms (SNPs) in the transcriptomes of three European water frogs whose genomes have not been completely sequenced. Because there is no reference genome for these organisms, the students had to identify alternative methods of aligning the RNA sampled from the tissues of these frogs and use existing software to treat and analyze these alignments for the presence of SNPs. The Beerli lab hopes to use the information obtained from the analysis of these SNPs to explore the evolutionary relationship between these three frogs.

BRAIN PREDICTION RESEARCH / JULIA GU, KELLY LAMPOTANG, A.J. SACKS

Gu, Lampotang and Sacks experimented with making a game that the user controls with their mind. Based on a theory of the neocortex, the students used a device called the Emotive EPOC to collect brain waves from the neocortex. The signals from the headset are fed into the Cortical Learning Algorithm which recognizes patterns in the data and classifies those patterns as different thoughts. The game portion of the research tests the user's ability to control their thoughts in order to complete the game.

Facebook Extra! Visit our Facebook page to see the Young Scholars participants having fun and presenting their final posters at www.facebook.com/FSUSciComp/.



Erlebacher crew after the final practice session.

New postdocs

New Scientific Computing postdoctoral research associate AHMED ELSHALL was born in Cairo, the capital of Egypt, the largest city in the Middle East and the second largest in Africa. After earning his bachelor of science degree in Construction Engineering from the American University in Cairo in March 2003, Elshall worked in construction engineering and environmental management in several cities in Egypt.

In September 2007, he moved to Germany to study Applied Environmental Geoscience at the Center for Applied Geoscience at the University of Tübingen. Upon completing his master's degree in Applied Environmental Geoscience (September 2009), Elshall continued to live in Germany and work at the University as a research assistant where he researched optimal design of groundwater remediation.

Elshall moved to Baton Rouge in 2010 to begin his doctoral work in civil engineering at Louisiana State University, where he studied water resources engineering and did extensive research in modeling complex groundwater systems. Elshall completed his Ph.D. in December 2013.

Elshall is studying groundwater flow and contaminant, with a focus on development of numerical methods for uncertainty quantification of groundwater solute reactive transport models. He works under the supervision of Ming Ye.

MOHAMMAD SAYEMUZZAMAN arrived in Tallahassee in June to work as a postdoc with SC Associate Professor Ming Ye. Sayemuzzaman is originally from Dhaka, the largest city and capital of Bangladesh, where he attended Bangladesh University of Engineering and Technology and received his B.Sc. in civil and environmental engineering. In 2010 and 2014, Sayemuzzaman received his M.Sc. and Ph.D. degrees in environmental engineering from North Carolina A&T State University in Greensboro.

Sayemuzzaman's past research involved the analysis of climate variability and groundwater contaminant transport modeling. In summer 2011, he was selected as the Environmental Defense Fund's Climate Corps Public Sector Fellow in Elizabeth City. In this role, Sayemuzzaman studied mechanical processes at three local waste water treatment facilities, using the research to decrease energy costs by $195,000 over a five year period. During his postdoctoral research, he will be working in groundwater nitrogen transport modeling.

Sayemuzzaman enjoys spending time with Yafi, his one-year-old son, playing soccer, watching movies, and travel. You can find a listing of his previous research at scholar.google.com.

Ahmed Elshall

Mohammad Sayemuzzaman

Fenn lands prestigious fellowship

Scientific Computing doctoral student Daniel Fenn is one of an exclusive group of students selected for the Science, Mathematics & Research for Transformation (SMART) Scholarship sponsored by the Department of Defense (DoD). Not only will the award fund Fenn's doctoral research, the award provides summer and post-graduation employment with the DoD. Fenn will be sponsored by the Air Force division A9, located at the Pentagon.

Past acceptance statistics have been very low for the award (between 6-10%), and the application process is extremely rigorous. "I had to write several essays detailing my research experience, and how my skills could benefit the DoD. I worked extensively with Keisha John at the Office of Graduate Fellowships and Awards. She was very helpful in providing the viewpoint of someone unfamiliar with the work. She provided a lot of constructive criticism and had me re-write each of the essays several times.

"I also had to provide information about extracurricular activities such as clubs, community service, leadership experience, etc., as well as transcripts, GRE scores, and letters of recommendation. They gave me the opportunity to list which DoD facilities I would prefer to work for.

"I submitted the application in mid-December of last year. I didn't hear anything at all from them for several months. In February or March, they sent out an email saying that I had made it past the first cut, and then I didn't hear anything again for quite a while. In early May, I was contacted by A9 to set up a phone interview. During the interview they let me know that my application caught their attention because of the computational background, which was a nice fit for their work in constrained optimization. One of the interviewers was Brazilian and without warning started speaking to me in Portuguese. I had indicated in my application that I am fluent in Portuguese, and I think that was some sort of test."

Fenn's award will begin on August 1 of this year. He will work with the Air Force division A9 each summer until graduation, and after he graduates for 2.5 years.

SMART scholarships can be used at select colleges and universities to support undergraduate and graduate students pursuing degrees in Science, Technology, Engineering and Mathematics (STEM) disciplines. The program aims to increase the number of civilian scientists and engineers working at DoD laboratories.

> "I had to write several essays detailing my research experience, and how my skills could benefit the DoD."

You can find additional information on the SMART scholarship program by going to the Depratment of Defense website, at http://smart.asee.org/. There you'll find sponsoring facilities, program stats, application materials, and other award details.

Dr. Keisha John and FSU's Office of Graduate Fellowships and Awards are dedicated to assisting graduate students obtain scholarships, fellowships, internships, and other awards. Find out more by going to http://ogfa.fsu.edu/.

For more on the Department of Scientific Computing, go to sc.fsu.edu.

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The department's mission is to be the focal point of science and computation at Florida State University. Max Gunzburger is the Chair of the Department of Scientific Computing. He can be reached at 850.644.7024. 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.

Humpback whale research recently published

Beerli helps uncover migratory patterns in humpback whale populations

Associate Professor Peter Beerli's collaborative research entitled, Global diversity and oceanic divergence of humpback whales (Megaptera novaeangliae), was published recently in the Proceedings of the Royal Society B. This new genetic study revealed that populations of humpback whales in the oceans of the North Pacific, North Atlantic and Southern Hemisphere are much more distinct from each other than previously thought, and should be recognized as separate subspecies. The findings show that humpback whales of the North Pacific, North Atlantic and Southern Hemisphere are on independent evolutionary trajectories.

Along with Beerli, this research project brought together scholars from the British Antarctic Survey, Oregon State University, James Cook University, University of Auckland, Fundacion CEQUA, Wildlife Conservation Society, the American Museum of Natural History and the South Pacific Whale Research Consortium, with funding from the New Zealand Royal Society Marsden Fund and the Lenfest Ocean Program.

Humpback whales annually undertake the longest migration of any mammal between their winter breeding grounds and summer feeding grounds. Although they travel vast distances, it appears their populations do not cross paths. Understanding how connected these populations are has important implications for the whales' recovery.

Proceedings B is the Royal Society's flagship biology research journal. It gives precedence to research that presents significant advances of broad interest.

For more information, go to the British Antarctic Survey at http://www.antarctica.ac.uk.
For more on Peter Beerli and his research, go to http://people.sc.fsu.edu/~pbeerli/Beerli_Lab/Peter.html

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