INDUSTRIAL & SYSTEMS ENGINEERING

ISE NEWS

FALL 2010

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Research Spotlight: Energy Systems

UF | UNIVERSITY of FLORIDA

CHAIRMAN'S COLUMN

Dear Alumni and Friends,

I just passed the conference room with the smell of pizza in the air. I dropped in, expecting to see students frantically studying for midterms (it was close to 7 pm, so I figured it had to be students), but instead barged in on an ISE Ambassadors meeting. The pizza was gone, but the crew was happy to update me as they were putting the final touches on their introductory electronic newsletter to be distributed monthly to all alumni and friends. (You probably already received it!)

In this digital age of communication dominated by Twitter, Facebook and other forms of social media, the students felt that an electronic newsletter struck a nice balance for communicating without being too intrusive. The goal of the newsletter is to keep you aware of all that is happening on campus and drive you to our websites (Department and Student Clubs) when something piques your interest. All of the websites are being updated regularly, featuring Department updates, alumni updates, speaker series synopses and information relevant to our field. In September alone, we posted 15 short bulletins on the website. Many of these news briefs link to full news articles for further information. I invite you to check back with our website often -- I bet you'll find something of interest. In fact, the ISE Ambassadors are currently sprucing up our website so we can deliver more content to you in a timely manner.

The launch of this monthly communication will not impact our traditional Department newsletter, which we are now publishing three times a year. The fact is, with a growing Department and a plethora of interesting students and visitors, we have plenty of information to share with you.

As announced this past summer, Dr. Petar Momčilović, from the University of Michigan, has officially joined our faculty. You can read more about the Columbia graduate in this issue. He is eager to apply his talents in stochastic processes to a number of problems, namely health care delivery. We also continue to search for talent, in alignment with the College's strategic plan, in the areas of energy, security and/or health care.

Along with our faculty, our student population continues to grow at all levels. Official Fall undergraduate enrollment reached 434 students, the highest total in well over a decade. Masters enrollments held steady at 260 while the Ph.D. student population has grown to 57.

If you are worried that our students will struggle to find jobs in this economy, relax. I noted last issue that 86 percent of our undergraduate graduating class from spring had job offers (61 percent) or were headed to graduate school (25 percent). We only graduated nine undergraduates this summer, but seven had job offers and another was headed to graduate school. All seven of our Ph.D. graduates were gainfully employed, with three heading to academia. You can learn more about them in this issue.

Future employment is looking even better. The Fall Career Showcase was well attended by firms seeking ISE talent. I personally counted 38 companies or government entities looking specifically for ISE talent while an additional 26 were searching for unspecified engineering talent. Additionally, eight consulting firms were looking for technical consulting skills and nine were interested in logistics and operations. You can see why I am optimistic about employment options for our graduates.

A number of firms new to ISE, including BAE Systems, Cummins and Tyco, have taken additional steps to connect with the Department. If your firm is looking to establish ties with the Department (or the College) for potential hiring (or research opportunities), we have a number of ways to engage you. Just drop me an email and we can explore the opportunities.

So while the football team struggles a little (we really are spoiled!), we remain overly optimistic and excited about the future. One specific area of excitement and interest is energy. In this issue, we take a look at both the research, and research potential, for ISEs in energy. ISEs have long worked in the energy field, whether exploration (Chevron, ExxonMobil, Schlumberger and Shell with suppliers such as Cameron) or generation and distribution (FP&L, Entergy, GRU, JEU and Progress Energy). With deregulation, the process of generating and distributing energy has become much more complicated -- both for the consumer and producer/distributor. This has opened the door to Industrial and Systems Engineers to not only redesign these processes, but operate them more efficiently than previously. Read on for some of our work on this area.

Finally, it was a pleasure to see so many of you at the College of Engineering 100th Anniversary tailgate before the Kentucky game. In addition to the football game, the Dean hosted a Leadership Symposium to discuss how to better teach our students to become leaders in industry. As ISE students must routinely work in teams to complete classroom projects, often motivated by industry, and we have very active student clubs, we feel that every student has the opportunity to develop their leadership skills. But there is always room for improvement." We will hear more about the Dean's plans concerning a Leadership Institute in the future.

I hope my closings to these letters have not become too predictable -- it is hard to believe that I am in my fourth year here at UF! But I am sincere when I say that we want to hear from you. We have numerous opportunities for you to engage with the Department, so reach out and tell us your story. We're listening (352-392-1464, hartman@ise.ufl.edu)!

GO GATORS!

Sincerely,

Joseph C. Hartman
Professor and Chair

Momčilović Joins Faculty

Don't let his laid back attitude fool you – new hire Dr. Petar Momčilović is a serious scholar – happy to work out the mathematics of the behavior of a stochastic system as well as an enjoy a coffee at an outdoor café. Momčilović joined the Department of Industrial and Systems Engineering this past summer as an Associate Professor.

An expert on stochastic systems, Momčilović has generally focused on studying the behavior of queues of different designs (i.e., numbers of servers) and assignment protocols. His applications have focused on the performance and scalability of wireless networks, work that began when he was working at IBM. The National Science Foundation recognized this research with a CAREER award in 2007 while he was also won an IBM Faculty Award in the same year. His work has appeared in leading technical journals, including *Mathematics of Operations Research, Queueing Systems, Journal of Applied Probability* and *Advances in Applied Probability*. His paper "Buffer Scalability of Wireless Networks," published in the 2006 *Proceedings of IEEE Infocom* won the Pat Goldberg Memorial Best Paper Award from IBM Research.

Born in Novi Sad, Serbia, Momčilović grew up enjoying mathematics and science. So he followed some friends to Moscow and enrolled at the Moscow Power Engineering Institute, graduating with honors in 1997. He then headed to the states to pursue graduate school at Columbia. Purely for the academics, right? "Living in New York City sounded exciting," said Momčilović with a smile, and "a cousin of mine lived a block away from campus."

Momčilović excelled at Columbia, winning the Edwin H. Armstrong Award for an outstanding academic record and the Elaihu I. Jury award for best doctoral thesis in signal processing, communications and systems from the Department of Electrical Engineering. He was also awarded an IBM Fellowship while a student. Upon graduation, he was awarded the Herman Goldstine Postdoctoral Fellowship in the Department of Mathematical Sciences at the IBM T.J. Watson Research Center in Yorktown Heights, New York. In the fall of 2004, he joined the faculty in Electrical Engineering at the University of Michigan.

"I always liked the 'independence aspect' of being a professor," said Momčilović on his choice of an academic career. "The ability to work on problems that interest you is hard to find in other professions. Also, educating and interacting with students is rewarding."

"We have been fortunate to hire a number of talented faculty over the past few years," said Department Chair Joseph Hartman, "and Petar fits right in with that cohort. His work in stochastic systems is world class and he is fantastic in the classroom. At Florida, he will have an excellent opportunity to apply his talents in the healthcare field."

Currently, Momčilović is examining patient routing processes in hospitals. "I am looking into algorithms that require a minimal amount of information for their operation," he said. In addition to improving efficiency, he is also interest in studying the fairness of policies towards medical staff.

Last year, he was intrigued by the opening in ISE at Florida, given the Department's research strengths in operations research and the focus of the search on stochastic systems. "The environment in the department is excellent," said Momčilović about the move. "And I like the faculty in the department a lot." Of course, the change in weather didn't hurt. "Replacing winter coats with t-shirts sounded like a great idea," he said with a laugh.


Randy Bush and Kyle Kirwan

In The Spotlight

IT MAY BE GAMING, BUT ITS SERIOUS BUSINESS TO THESE ISE STUDENTS

THE UNIVERSITY OF FLORIDA is huge. You can major in just about anything and odds are, there is a club for just about any hobby or sport. That is why ISE students Randall Bush and Kyle Kirwan were surprised that there was no "Gaming Club". "Gaming" is when people get together and connect with computers on a Local Area Network (LAN) to play games with multiple players. "We discussed the idea of starting our own gaming club, but we had no idea where to begin," said Bush.

And like good ISEs, they benchmarked, studying the LANknights club at the University of Central Florida, before starting "Gator Gaming". They hosted their first event, GatorLAN, in the Fall of 2009 with 50 participants. The event had some hitches – IT shut down the event briefly as they thought the UF network was under attack – but Bush officially declared it a "non-failure". "The event was messy, but everyone who came out had a ton of fun," he said.

The event has been held each successive semester and is growing rapidly in popularity. The Spring 2010 event doubled attendance and ran smoothly. The Fall 2010 event hosted over 450 people in the Reitz Grand Ballroom and was sponsored by EA Sports, Best Buy and 352 Media. Games including League of Legends, Halo 3, Call of Duty: Modern Warfare, and Madden 11 were all being played.

The club is growing too, with over 600 members. As President, Kirwan tracks external relations with local businesses and other on-campus organizations while managing the internal operations. "The club has been a lesson in personal time management -- one that I'm still learning," he confessed. Bush is in charge of Business Development. "Our goal is to continue to grow and unite the gaming community of Gainesville," explained Bush. They hope to someday fill the O-Dome with a gaming night and establish intercollegiate gaming rivalries with other universities.

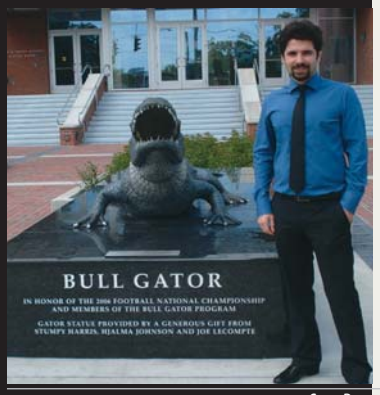
With Gator Gaming growing, it was time for Bush to get his schooling in order. After being undecided upon entering the College, he chose to pursue a degree in Mechanical Engineering. "But as I learned more about my chosen path, I became disenchanted," said Bush.

Enter Gator Gaming and the need to, essentially, run a business – raise funds, buy equipment and do a lot of logistical planning. Throw in a few ISE courses (Engineering Economy and Sales Engineering) and pressure from Kirwan and it was only a matter of time before Bush changed majors. "Given that I was already caught between business and engineering, all I had to do was make the connection and pursue a degree in ISE," said Bush. "A problem existed and I set about finding a solution and I knew where to go."

Kirwan had originally considered a degree in Economics, but wanted a bigger challenge. Friends from UF and other universities guided him over to ISE when he was a freshman. "My understanding of ISE was that it would allow me to focus on a primarily management and business strategy role in my career, while having a stronger skill set afforded by a real engineering program," said Kirwan. In addition to Gator Gaming, Kirwan is Vice President of Phi Beta Lambda, the college version of Future Business Leaders of America – an organization he has been active with since high school (where he won the national Computer Network Design competition).

PH.D. GRADUATES

This summer, ISE graduated seven Ph.D. students, bringing the program's total to 152 graduates since its inception in 1967 (and first graduate in 1969)! Here are a few facts about our latest Ph.D. graduates:



Suat Bog

Suat Bog

Hometown: *Samsun, Turkey*
Schooling: *B.S. in Industrial Engineering from Bogazici University, Istanbul, Turkey and M.S. in Industrial Engineering, Koc University, Istanbul, Turkey.*
Dissertation: *"Optimization Models and Algorithms for Solving Large-Scale Network Design, Routing and Scheduling Problems." (Advisor: Ravi Ahuja)*
Current Position: *Senior Operations Research Specialist, Cheetah Software Systems Inc., Westlake Village, CA.*


Nikita Boyko

Nikita Boyko

Hometown: *Dnipropetrovsk, Ukraine (city where Sputnik was assembled)*
Schooling: *B.S. and M.S. in Applied Mathematics from the Faculty of Applied Mathematics, Department of Mathematical Foundation of Computing, Dnipropetrovsk National University in Dnipropetrovsk, Ukraine.*
Dissertation: *"New Approaches to Robust Optimization with Applications." (Advisor: Panos Pardalos)*
Current Position: *Senior software developer for a financial company in Manhattan, New York.*
Personal: *"My son is already almost 6 months and he makes my wife's and my life fun!"*

Kwanghun Chung

Hometown: *Seoul, South Korea*
Schooling: *B.S. and M.S. in Industrial Engineering, Seoul National University, Seoul, Korea and M.S. in Industrial Engineering, Purdue University, West Lafayette, Indiana.*
Dissertation: *"Strong Valid Inequalities for Mixed-Integer Nonlinear Programs via Disjunctive Programming and Lifting." (Advisor: J.P. Richard)*
Current Position: *Post-doctoral Fellow, Center for Operations Research and Econometrics(CORE), Université Catholique de Louvain (UCL), Louvain-la-Neuve, Belgium.*
Personal: *Transferred from Purdue University to complete his Ph.D.*

Gudbort Gyfadottir

Gudbjort Gylfadottir

Hometown: *Laugaras, Iceland (population of 100).*
Schooling: *B.S. in Mathematics from the University of Iceland in 2006 and M.S. in Finance from the Warrington School of Business, Department of Finance, University of Florida.*
Dissertation: *"Path-Dependent Option Pricing: Efficient Methods for Levy Models." (Advisor: Farid AitSahlia).*
Current Position: *Research and Development at Bloomberg L.P. in Manhattan, New York.*
Personal: *"My husband Arni and I really loved living in Gainesville and becoming part of the Gator Nation. It was an amazing experience. Go Gators!"*


Steffen Rebennack

Steffen Rebennack

Hometown: *Mannheim, Germany*
Schooling: Vordiplom (mathematics & computer science), Universitaet Mannheim, Mannheim, Germany; Diplom (mathematics), Karls-Ruprecht Universitaet Heidelberg, Heidelberg, Germany; M.S. in Industrial and Systems Engineering, University of Florida, M.S. in Management, University of Florida.
Dissertation: *"A Unified State-Space and Scenario Tree Framework for Multi-Stage Stochastic Optimization: An Application to Emission-Constrained Hydro-Thermal Scheduling." (Advisor: Panos Pardalos)*
Current Position: *Assistant Professor, Division of Economics & Business, Colorado School of Mines in Golden, Colorado.*
Personal: *Interested in applying operations research to a variety of problems dealing with the energy industry.*

Zhili Zhou

Hometown: *Nanjing, China*
Schooling: *B.S. in Mathematics from Nanjing University in Nanjing, China*
Dissertation: *"Multi-Stage Discrete Optimization Under Uncertainty and Lot-Sizing." (Advisor: Yongpei Guan)*
Current Position: *Postdoctoral Researcher at IBM, T.J. Watson Research Center in Yorktown Heights, New York.*
Personal: *Transferred from the University of Oklahoma to complete Ph.D.*

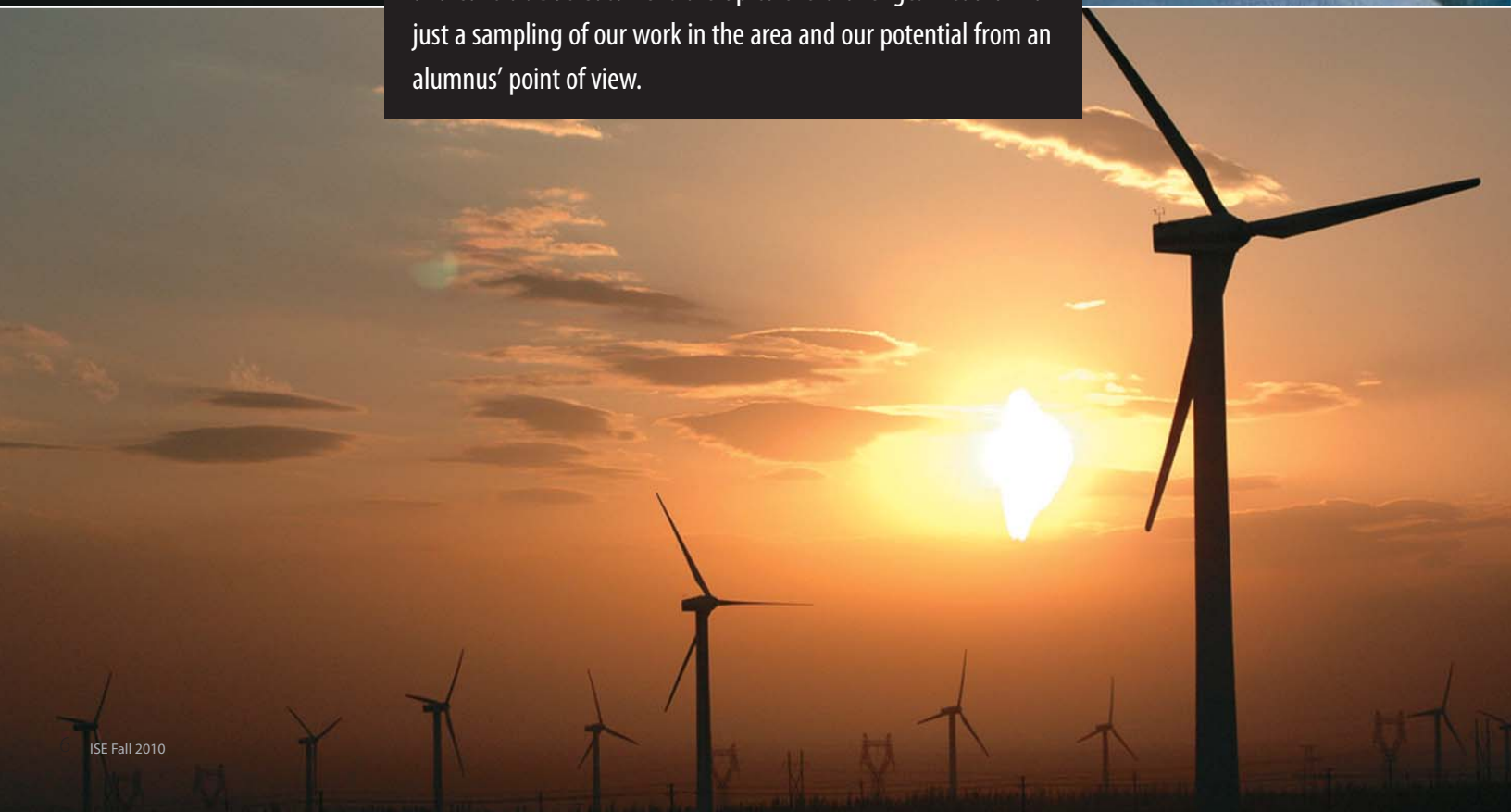

Qipeng "Phil" Zheng

Qipeng "Phil" Zheng

Hometown: *Zibo, Shandong Province, China.*
Schooling: *B.S. in Automation, North China University of Technology in Beijing China and M.S. in Automation from Tshinghua University, Beijing China.*
Dissertation: *"Stochastic Integer Optimization and Applications in Energy Systems" (Advisor: Panos Pardalos).*
Current Position: *Assistant Professor, Department of Industrial and Management Systems Engineering at West Virginia University in Morgantown, West Virginia.*
Personal: *Enjoys fishing and traveling.*

RESEARCH FOCUS

ENERGY SYSTEMS are becoming much more complex to design and control. But Gator ISEs are up to the challenge. Read on for just a sampling of our work in the area and our potential from an alumnus' point of view.




Panos M. Pardalos


Steffn Rebennack

Energy Deregulation Driving Center for Applied Optimization Activities

By Panos M. Pardalos and Steffen Rebennack
Distinguished Professor of ISE and Recent Ph.D. Graduate

The energy industry has been through a revolution in the last two decades, being deregulated around the world. Previously, electricity was sold by public utilities in order to meet customer demand in a cost minimal way. In this environment, the utility generated power through its own power plants and contracts with other power suppliers while the price of the electricity was set (fixed) by the utility or government. This started to change significantly in 1990 with the first deregulated electricity market appearing in Chile. The result was that electricity was traded as a commodity: it could be sold and bought at a price determined by the market; i.e., the price of electricity varied according to supply and demand.

In the late 1990s and the beginning of this century, deregulation of electric power systems took place around the world. NordPool was established in 1996, serving as an electricity market for the Scandinavian countries of Norway, Denmark, Sweden and Finland. The European Energy Exchange (EEX), established in 2002 as a the result of a merger of the Power Exchange and the European Energy Exchange, is located in Leipzig and serves as Germany's energy exchange. The USA has several wholesale electricity markets including the ERCOT Market, New York Market, Midwest Market, California ISO, and the PJM Interconnection, located in Valley Forge, Pennsylvania, is the world's largest competitive wholesale electricity market (deregulated since 2002).

The deregulation of energy markets has made it more difficult for power producers to operate their assets optimally. The main reason is that another source of uncertainty has been introduced: electricity prices. To serve the electricity demand of its customers, a company can now choose to use its own physical assets (generating decision) or buy electricity on the market (buying decision). In this market, the company's' objective is no longer the minimization of its operating costs but the maximization of its profits – under a determined risk profile. Hence, along with the opening of the electricity market, another complication has been added: risk control.

A further challenge facing electric power producers is the controversial topic of climate change. The Kyoto Protocol, signed in 1997, aims to reduce emissions of six greenhouse gases: CO2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. The main question, however, is only answered partly by the Kyoto Protocol: How to achieve these reduction targets for emissions economically and ecologically while meeting our power consumption needs?

One potential answer lies in so-called emissions trading schemes - such as the European Union emissions trading scheme – or emission taxes. Emission trading schemes have been developed, giving greenhouse gases a 'price' – making it a tradable good. The main motivation comes from the fact that climate change is recognized as a global problem and can only be solved globally. Hence, it is not important at which exact location the greenhouse gas emissions reduction is achieved, but more importantly, that the reduction is done in a cost efficient way. Electricity generation companies within an emissions trading scheme for CO2 allowances face new challenges of managing their portfolio.

A number of past and present students in the Center for Applied Optimization are working on these challenging and important problems.

• Summer 2010 Ph.D. graduate **Steffen Rebennack** is developing mathematical programming models that maximize the expected net profit of a hydro-thermal power subsystem over a mid- or long-term horizon, operating in an open electricity market within a CO2 trading scheme. In particular, the models take into account stochastic electricity prices, fuel prices, water inflows and CO2 prices. In order to cope with these different uncertainties and in order to account for their correlations, a state-of-the-art multistage stochastic programming decomposition algorithm called 'stochastic dual dynamic programming' is used and extended to cope with these elements of uncertainty.

• With the surge in global energy demand and concerns about green house gas emissions, natural gas plays an increasingly important role in the global energy market, since

natural gas is abundant in many places, produces a great amount of energy and releases less green house gases than coal and oil. Modeling and optimization techniques for various problems in the natural gas industry are being developed by summer 2010 Ph.D. graduate **Qipeng Zheng**. He models the gas contract optimization problem for a gas power plant, while taking into account the maintenance scheduling of the plant, as a multistage stochastic mixed integer programming problem (MSMIP) which is challenging to solve when the number of stages increases. To solve this problem, an embedded Benders' decomposition approach is used to render the stochastic dual dynamic programming in order to handle nonconvex, discrete subproblems and solve the MSMIP. Another model considering risk due to price volatility from the gas and electricity spot market is formulated, and a new method is proposed to solve the problem accordingly.

• Current Ph.D. student **Alexey Sorokin** is examining capacity planning and expansion for natural gas in North America. The US power system, one of the largest interconnected systems in the world, is slated to grow larger as connections are made from Canada to Guatemala. But the age of the US system poses a challenge to expansion and stability. As noted in Zheng's work, natural gas plays a strong role in electricity generation due to its supply and environmental benefits. Thus, any expansion of the US system must consider the location and size of natural gas-fired power plants, power grid requirements, the natural gas transmission network, and the location of liquified natural gas terminals. Current research is focusing on a decomposition technique and an algorithm to solve the large-scale expansion problem.

TO LEARN MORE, CONSULT THE FOLLOWING PAPERS.

"Optimization in the Energy Industry," edited by Josef Kallrath, Panos M. Pardalos, Steffen Rebennack and Max Scheidt; in series "Energy Systems," vol. 1, Springer, 533 p., 2009.

Kyoto Protocol, MEM/03/154. Brussels, 23 July 2003.

M.V.F. Pereira and L.M.V.G. Pinto. Multi-stage stochastic optimization applied to energy planning. Mathematical programming, 52:359–375, 1991. Steffen Rebennack, Niko A. Iliadis, Mario V.F. Pereira, and Panos M. Pardalos. Electricity and CO2 emissions system prices modeling and optimization. In proceedings of IEEE PowerTech, Bucharest, 2009.

The Smart Grid — an Industry Insider's Perspective

By Josh Bass (BS ISE 1999)
Director, Strategy and Product Development
OpenPeak Inc.

If I were to poll you, my fellow ISE's, why utilities are investing billions of dollars in smart grid technologies, what value the smart grid brings to you, and how you can lever the smart grid to better manage your energy costs, I am positive that I would receive more questions than answers. I am sure each of you would have a different perspective. You are not alone, as there are many questions and answers on this subject. While I do not have all the answers, as a former utility and current technology "insider" in this space, hopefully I can shed a bit of light.

Utility customers have historically had limited involvement with their utility. They received a bill monthly, and unless they perceived a billing error or a confusingly high bill, they did not spend too much time thinking about energy. With increased economic pressures impacting residential customers and commercial businesses, coupled with rising energy costs, suddenly, customers have become more engaged. They want answers, a better understanding and breakdown of their bills, and cost-effective solutions to reduce their energy use. They want granular bill information throughout the month, not just a surprise total at the end.

At the same time, there are increased regulatory and economic pressures on utilities to decrease customer bills, to lower system peak demand, to improve system reliability, and to implement energy efficiency measures such as building insulation or compact florescent lights. When peak demand spikes, utilities are forced to either run more costly, less efficient plants or purchase enough capacity at high-cost spot prices on the open market. As a result, utilities are increasingly offering rate-based incentives such as Peak Time Rebates (PTR) or dynamic rates with high-peak pricing periods, such as CPP, RTP, VPP, TOU, etc. That's a lot of acronyms, and we could easily spend the rest of this article discussing rate strategy. The bottom line is that utilities are offering price-based incentives for customers to reduce their consumption during strategic periods of the day when peak loads spike, aiming to smooth out their 24-hour load curve.

System reliability remains one of the top elements that utility customers value. No one likes to have to reset their clocks when there are system momentaries, and longer outages that extend into hours and days are not fun. Anyone who has been without power for any duration, particularly during a hot Florida summer, isn't ecstatic with their utility provider. Utilities want to take their grid infrastructure and make it smarter. They are installing sensors and switches from generation down to the house or business and are replacing legacy meters with automated meters that provide remote-monitored, periodic meter reads. Utilities will now have the tools and intelligence both to better identify outages when they occur and to predict and forecast outages before they occur. Grids can become self-healing, fixing problems before they result in customer disruption or costly technology damage.

Utility commissions, state legislatures, and the federal government are giving the subject more attention. For example, the Department of Energy last year awarded over $3.5 billion dollars of stimulus funding to projects emphasizing increased grid reliability and security, as well as enabling customer technologies such as automated meters and in-home controllers and displays.

So, there you have it on the smart grid, right? Not so fast. Lets come back to the customer again and the last thing I mentioned…. in-home technologies. It is hard for customers to see the smart grid. They do not see the new sensors in a substation. They do not see the improvements in the feeders and laterals. An automated meter looks pretty similar to the digital meter they may have had before.

If a customer is now on a dynamic rate such as Critical Peak Pricing, what do they do if they are at work or on vacation during a high-price period or a demand response event? It is hard to shut off the lights, turn off the water heater or pool pump, or change HVAC settings when one is away from home. Customers need smart technologies both to better understand their usage and to be enabled to take control of their consumption.

In-home technologies such as OpenPeak's home energy controller give consumers the ability to see their energy usage real time and to control their appliances and energy loads via a countertop device technology. By linking with an automated meter or a utilities' back-end, they can see their historical energy usage on a real-time, hourly, monthly, and yearly basis. For example, they can see that on the third Saturday of the month, their usage spiked irregularly. However, they know that was the weekend when the in-laws were staying with them. That granularity would not be apparent in a monthly bill total.

Customers can manage their home and energy profiles for when they are home, away, asleep, on vacation, or during a high-price period. They can seamlessly connect, control, and automate their thermostats, smart appliances, and loads such as heat pumps and hot water heaters. For instance, one can automatically turn off a hot water heater when on vacation or during a savings period, without having to be home.

Appliance manufacturers are getting involved too. They want smarter intelligence and controls in their dishwashers, dryers, fridges, etc. so that during high price periods, they can cycle down appliances or delay start times. Emerging technologies such as Plug-in Hybrid Electric Vehicles (PHEVs) and solar PVs will ultimately be integrated into the smart grid, and increased grid intelligence to manage these loads will be critical.

So where do ISEs fit in this evolving industry? Two words…. perfectly and everywhere. Our capabilities with simulation, OR, and Quality and Six Sigma are critical to be able to design, forecast, and troubleshoot grid faults and improvements. Advanced Metering Infrastructure projects require leaders who can manage and balance technical and customer requirements, as well as significant complexity and uncertainty. Understanding customer behavior, supply, demand, and pricing strategy are necessary for both rate development and demand response projects. Designing and developing in-home and commercial technologies relies on human engineering and the understanding of interactions between people and technology. Of course, one must be able to effectively communicate these new ideas and recommendations to industry leaders, regulators, legislators, investors, fellow engineers, employees, etc. These are all unique skill-sets that we as ISEs possess.

The role of an ISE "smartly" aligns. I am excited for our current and future prospects in this industry!


Tim Middlekoop


Yongpei Guan

Clean Emergy Optimization, Control, and Intergration

By Tim Middelkoop
Assistant Director, Industrial Assessment Center

The severe economic downturn and the spike in oil and other energy prices has put a renewed focus on using alternative energy sources in more efficient ways. This focus on renewable and clean energy systems has been intensified by the stimulus package and a push for a carbon cap and trade system making clean and sustainable energy independence a priority. One key to achieving this is to develop and re-engineer energy systems to optimally use clean technologies. There are two different, but related, problems to solve. The first is to develop algorithms and technologies to operate systems efficiently. The other is to use the same performance and optimization models to design and re-engineer entire systems from the ground up. Here the objective is to select the best combination of components such that they meet the unique performance needs of the client leveraging resources locally available in clean, sustainable ways.

What makes clean energy optimization an interesting problem, from an operations research perspective, is the use of storage technologies to differ the production of cold or hot medium that is used to condition the space. The decoupling of consumption from production allows production to occur at times when it is most efficient. For cooling, this occurs at night when the outside air is cooler (air conditioners work more efficiently when outside air is cooler) and energy is cheaper (base load demand is typically cheaper and cleaner to produce at night than during peak demand, during the day). The cooling is often shifted in the form of ice, which is frozen at night and used to cool during the day. From an "operational" optimization perspective, the question is when to produce ice, how much to produce, and when to use it during the day. From a "design" optimization perspective, the question is what combination of cooling technologies to use and how large to make the storage devices. Similar questions arise when using solar energy to produce hot water for heating and cooling (solar collectors cool using an absorption chiller).

Research and development in this area requires industry collaboration and a true multi-disciplinary approach. For example, the performance of the mechanical systems must be properly characterized before they are optimized (this is very different from designing HVAC systems), new optimization models must be developed to solve the problem in a tractable way, and the results must be deployed into the field. Industry requires that these models be built efficiently, which is challenging when each customer's site and needs are unique. This requires that the modeling, optimization, and control be represented in a way that it can be managed by design tools and deployed directly into the field.

We have been employing an interdisciplinary team and working closely with an industry partner to build, test, and validate such a system. This team is made up of a number of students and faculty, including Dr. Herbert Ingley from Mechanical Engineering who is responsible for developing and validating performance models of the HVAC system. The quality of the performance models is important for optimization with constraints being of particular importance for the safety of people and equipment. The complexity and non-linear nature of the optimization model requires that it be formulated in a tractable manner and this effort is being lead by Dr. Elif Akçalı from the ISE department. The validation of the model requires extensive on-site data collection and analysis, which has been led by Dr. Cristián Cárdenas also from ISE and Industrial Assessment Center. All this is tied together by the information integration and computational engine effort, led by myself. The last two parts are what makes it possible to deploy the research on a real system.

Currently the team is developing an optimization model to intelligently schedule the production, storage and the subsequent use of energy to maximize efficiency and cost savings for three pilot sites. In this problem, the time at which consumption and production occurs has a large impact on cost and efficiency. The hope is to demonstrate that an intelligent control system can significantly outperform a traditional control policy. This is part of the larger integration environment being developed that is taking a systems approach to managing energy usage. Not only will this system be able to integrate, monitor and control complex energy systems, but will optimize the many trade-offs that can be made. The hope is that optimizing these small trade-offs can add up to significant savings. If successful, this project will demonstrate the value of a systems approach to energy management as well as providing infrastructure to explore the impact of other energy savings technologies.



The close working relationship with industry allows the UF team to test new research in the field in a timely manner and use the results to constantly improve the optimization system. Optimizing the operation of a given system can only save so much energy. The direction in which this research effort is heading is to use the tools, experience, and knowledge gained from the current project to develop optimization models for the design of new systems. In addition, the information environment will also provide an infrastructure for which to interface future smart-grid technologies. With these technologies energy producers will be able to interact with consumers to optimize energy usage across the entire system (a very interesting optimization problem to solve!). Intelligent energy systems, such as what we describe here, are what will be needed if our society is going to meet the environmental and energy challenges of the future.

Difficulities in Harvesting the Wind

By Yongpei Guan
Assistant Professor of ISE

A power grid system is a large-scale electricity network that supports electricity generation, power transmission, and electricity distribution operations. As energy markets are transforming from regulated to deregulated markets, it is more challenging to design and analyze power grid systems, due to increased problem size and uncertainty. The uncertainty comes from all three types of operations. For instance, electricity generation operations have uncertainty from forced outages due to maintenance, de-rating of equipment, and uncertain renewable energy output (e.g, solar power is at the mercy of the sun while wind power is at the mercy of the wind); for power transmission operations, uncertainty comes from transmission line breakdowns; for electricity distribution operations, uncertainty comes from inaccurate demand forecasting.

Among other problems, we are focusing on dealing with the uncertainty of generating power from wind farms. In addition to complications from deregulation, there are increased efforts to generate power from renewable sources, such the sun, wind and waves. Many states and countries have mandated that a certain percentage of power must be generated from these sources. But there is tremendous risk in using these technologies, as power output is dependent on uncontrollable factors. That is, a wind farm cannot produce energy unless the wind is blowing and the amount of power to be generated is dependent on the strength of the wind. This is in direct contrast to traditional coal or natural gas burning power plants that generate a predictable power supply.

The Unit Commitment problem is a traditional problem faced by the utilities. The problem is straightforward: given a forecasted demand for power over some horizon, determine which power sources will be utilized (committed) over the horizon to meet that demand. Phrased another way, the question is how do you schedule your plants (switch them on or off) over the next few periods in order to meet the requested power needs? If the power sources are predictable in terms of output and demand is known, then this is a deterministic scheduling problem. But with wind power, the power output is not longer certain. Note that traditional power sources require significant start-up time if they are switched off, so if there is a significant drop in wind, it may not be possible to quickly switch to other power sources. Thus, if a regional utility must increase its use of renewable energy sourcing, it must plan accordingly for potential drops in power output.

We examine the short-term scheduling of power sourcing (unit commitment) while taking into account wind power forecasting errors. The system operator must define their preference of dealing with uncertainties – that is whether they are prone to accept less wind power in favor of stability or will curtail excess wind power to prevent transmission congestion. We model the wind power uncertainty with scenarios in a two-stage stochastic program and capture the operators' preferences using chance constraints. With the model, we can examine different operator policies and determine which is the best course of action.

This is one of the problems in energy that we in the Computational and Stochastic Optimization Lab are examining. We are currently working with students and colleagues, at UF and other universities, ISOs (system operators), and national labs to develop efficient algorithms to solve a variety of large-scale power grid system design and analysis problems under uncertainty.

Dasburg Discusses Leadership with Students

John Dasburg, holder of BSIE, MBA, and JD degrees from the University of Florida returned to campus on September 7, 2010 to speak in the Weil Lecture Series. He addressed students, faculty and staff on the topic of Leadership in his talk entitled, "Setting Goals and Some Keys to Achieving Them." Before addressing the issue, he suggested that those interested in leadership should read about it -- not through New York Times' bestseller lists -- but rather by reading biographies of great leaders, such as Washington, Adams, Reagan and Clinton and texts that might not immediately come to mind, such as Machiavelli's "The Prince" and Shakespeare's "Henry IV". "There is nothing better than reading what other leaders did," said Dasburg. "You can learn from history." (See the attached complete list.)

Dasburg, a former Lt. Commander in the U.S. Navy Reserves, partner at KPMG, CFO at Marriott, CEO at Northwest Airlines, CEO at Burger King and current CEO and co-owner at ASTAR Air Cargo, compiled a list of attributes or capabilities of great leaders:

(1) **Decision making with incomplete information:** Dasburg noted that in school, students generally make decisions, or compute answers, with complete information. In reality, "you don't have that luxury," he said. "And you will have to make a decision or you are not providing leadership."
(2) **Decisiveness:** Dasburg noted that it is important to make decisions, as people generally do not want to follow those that are indecisive.
(3) **Self Confidence:** Dasburg recalled that leaders he has been around are confident, but they also posses opposing traits in that they are insecure, and even paranoid, of someone taking their position or share.
(4) **Fact Finding:** According to Dasburg, listening is often listed as a key attribute, but "fact finding is what we after here," he said. One should not be listening for the sake of listening.
(5) **Good Health:** The fact is, leaders work enormous hours and it is important that they are of sound mental health (and physical health helps with that).
(6) **Work Ethic:** See the previous point.
(7) **Competitive:** According to Dasburg, most leaders are a bit insecure because they are so competitive. But this goes beyond the self - everyone wants an organization full of winners. "You want your newest hire to win, and win quickly," he noted.

Being in an organization of winners was a point of emphasis for Dasburg. "It is easier to join an organization that is going to succeed," noting that if one rises to the top of a company that fails will only align you with failure. "You have to do an analysis of the industry and choose the right place." Of course, he conceded that you may have to make compromises when you are building your resume, but if it is not the right place, "you have to get out as soon as you can."

Dasburg's Reading List

-The Plays
by Aeschylus
-Plutarch's Lives, Volume II
by Plutarch
-The Civil War
by Julius Caesar
-The Prince
by Machiavelli
-Matthew, Chapter 5 verses 1-11
(King James' version)
-Henry IV
by Shakespeare
-Maslow's Hierarchy
by Abraham Maslow
-Man's Search for Meaning
by Victor Frankl
-Nixon, Agonistes
by Garry Wills

Along with biographies of George Washington, John Adams, Thomas Jefferson, Alexander Hamilton, Aaron Burr, Thomas Paine, Ronald Reagan and Bill Clinton.

Once in the right organization, the key is not to get stuck in the back room. "You have to be visible," Dasburg pleaded. "Or other people will take your numbers and get all the credit." He continued that it is "more important to be in the right place where you can be seen so you can move up in the institution."

This is often a fault with engineers, but Dasburg noted the strength of an undergraduate degree in Engineering. "Four or five years of deductive reasoning is marvelous training for the rest of your life," he said. Furthermore, "mathematics is everywhere," he continued. "It is impossible to escape math if you are a leader or in management."

He also cautioned that one must learn inductive reasoning -- something he learned in Law School. (He pursued the law degree instead of a PhD in Economics at Penn as the result of a coin flip.). "You have to learn to ask questions," he said, "and note that the best answer may not be the correct answer."

Dasburg also stressed the importance of setting goals and working towards them "You have to have a definition of success and go for it," he said. "If you don't know where you are going, you're unlikely to get there," he summarized. He also warned the students to be prepared to deal with failures, as they "are a part of success."

He concluded with one final thought: "Keep your options open." Whether pursuing advanced degrees, especially in different fields (such as he did with law), or taking new assignments or positions, he stressed broadening horizons and, thus, options. After all, this is a global world requiring "tolerance and perspective" while understanding the politics.

The students in attendance absorbed a lot of information. "Overall, this has been the single most useful lecture on leadership that I have ever sat through," noted Scott Powers, senior in Industrial and Systems Engineering. Junior Allison Dreyer was inspired to become more active. "He made me realize that I must start stepping up for leadership roles and not shy away from them," she noted. "I will now make a conscious effort to try to volunteer more for leadership roles."

Mitchell Opens Possibilities to Students

"Work hard. And don't be a jerk." It seems like a simple statement, and maybe a bit off key, but it sums up Rick Mitchell (BS ISE 1992) and what he told the undergraduate ISE students as he addressed them in the "Introduction to ISE" class on campus this past September. He told the students to show up early and expect to work late as they start their careers. "If you are not passionate," he implored, "do something else."

It is hard to label Mitchell as a typical ISE. After working for three years as an Industrial Engineer for the Walt Disney World Company, he returned to UF to earn a law degree. Upon completion of his J.D. (1998), he clerked for two federal judges and witnessed hundreds of hearings and trials. "It gave me a sense of confidence that I could do this," he reflected with the students.

"Mitchell helped solidify my certainty about majoring in Industrial Engineering," noted ISE undergraduate Kaitlin Harding. "He reassured us that there are innumerable ways to use an ISE degree." Junior Oscar Oropeza went further, "After hearing Richard talk about his life and experience working, I have confirmed that there are no limits to what an Industrial and Systems Engineer can do."

Mitchell then returned to Orlando to work for the GrayRobinson law firm, which was founded in 1970 by UF alumni Charlie Gray and Robbie Robinson and had 48 partners in three locations at the time. GrayRobinson has since grown into a full-service law firm with 245 attorneys throughout 10 offices across Florida, and provides legal services for Fortune 500 companies, emerging businesses, lending institutions, local and state governments, developers, entrepreneurs and individuals across Florida, the nation and the world.

Looking back, Mitchell refuses to believe that he would be as successful of a lawyer if he had not first earned an ISE degree. It gives you "the broadest knowledge" he argued; but more importantly, when he is meeting with presidents and CEOs, "I can talk the talk and walk the walk," he said. That is, he has no problem talking processes and throughput with his clients, putting them at ease.

Mitchell has the honor of working closely with some of his firm's most important clients, including educational clients UCF, FAMU, UNF and Valencia Community College, and business clients such as Siemens Energy, NASCAR, ExxonMobil and Coca Cola Enterprises. His firm also represents Shands UF.

This from a man with humble beginnings. The son of a law enforcement officer and church secretary, Mitchell was the first in his family to complete a four-year degree. These beginnings developed his work ethic and his desire for all to succeed. "Show up on time and stay late," he told the students. "And don't be a blue crab," he said in reference to the fact that you do not need to put a lid on blue crabs, because if one tries to crawl out of the pot, another one will pull it back down. "Treat everyone with respect and be a part of the team," he said. "At some point in your career, they will pick you up." In addition to helping the team, he urged the students to be well rounded and volunteer.

In all, Mitchell doesn't think Law and Engineering are all that different. "When I got my (law) diploma, it said 'Attorney and Counselor at Law'," he recalled. "Focusing on the Counselor part, an attorney must fully answer critical client questions such as, 'Am I at fault? What course of action should I take?' How much will this cost us and what is our probability of success?'"

"In IE," Mitchell explained, "we are Counselors at Business." In this context, the questions refer to whether a process should change or a capital investment should be made.

He closed by emphasizing that all should plan for the future, including writing out by hand their five-year and ten-year plans which should revisited and updated each year. "Plan your work," he said "and work your plan" and all will work out. For students, the first plan was clear: get an internship, graduate with honors and land that great first job. For the longer term plan, the sky is the limit; after all, "the nicer you are and the harder you work, the more options you will have, and always remember not to be a blue crab."

WHY I STARTED GIVING BACK....

This past August, I (Joseph Hartman) walked into the ISE office in Weil Hall only to find a (very) recent graduate waiting outside my door. I invited Arun Narayanan in and asked what he needed. "I just wanted to say thank you," he told me, as he was stopping in Gainesville to say hello to a few professors while moving from an internship in South Florida to his new job (starting in three days) in North Carolina. In fact, he had stayed an extra night in Gainesville to see me, as I was off campus the previous day.

We chatted about his internship and his three job offers. Given his excellent academic record and engaging personality, I was not surprised at all by his job prospects – even in these difficult times. He thanked me again and said he wanted to "start giving back." I was delighted and told him to get settled and then someday, he could come back to campus and talk to students about getting a job and working in manufacturing while also helping increase our network of employers. He said that was fine, but that he also wanted to make a donation. Again, I was delighted, and a bit surprised, as he had not even started his job yet, and directed him to get online and make a donation when it was convenient. But he insisted on pulling out his checkbook and making he donation right then and there.

Again, as you might imagine, this caught me by surprise. He went on to explain that he wanted to start giving back now because he had gotten so much from UF and ISE. I asked if he would mind telling his story to his fellow Gator ISE Alumni, and he did…

ALUMNI ROLL CALL, FALL 2010 GUEST SPEAKERS

Sandra Abdalian (BS ISE 2004)
Aloiye Abu (BS ISE 2002)
Dan Boccabella (BS ISE 1993)
John Dasburg (BS IE 1966)
Donald Dunlap (BS ISE 1984)
Scott Figura (BS ISE 1983)
Linda Hudson (BS SE 1972)
Robert Jeyaseelan (BS ISE 1998)
Trey Lauderdale (BS ISE 2004)
Rick Mitchell (BS ISE 1992)
Jim Neff (BS IE 1969)
Ron Quinn (MS ISE 2006)
Thomas Roberts (BS SE 1968)
Jose Smith (BS ISE 1989)
Jim Williams (BS ISE 1993)

UF UNIVERSITY of FLORIDA

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Summer, 2010 Graduates

THE DEPARTMENT conferred 9 undergraduate and 31 graduate degrees this summer. The graduate degrees included 24 at the Master's level and seven at the Ph.D. level. You can read about the Ph.D. graduates. Employers this summer included, among others, Accenture, Citrix. General Electric and RTI Biologics.

B.S. in Industrial and Systems Engineering

Jose Calvo
Damiem Chamness
Christopher Jess
Paul Ltaif
Bernardo Lopez
Peter Cory Myers
Javier Rosales
James Sindija
Andre Thomas

M.S./M.E. in Industrial and Systems Engineering

Behdani Behnam
Ergun Bektur
Akshay Bhardwaj
Srikanth Chada
Gary Coquillo
Yang Dong
Nicholas Dupre
Christopher James
Latha Jayaraman
Mohammad Khalil
Matthew Kowalski
Arun Lakshminarayanan
Zhenyu Liu
Jaimin Parikh
Robert Percy
Mayur Phadtare
Ingrida Radziukyniene
Joseph Richardson
Cole Russell
Catherine Snow
Alexey Sorokin
Sathyanara Sundaresan
Jonathan Wing
Cheng Xu

Ph.D.

Suat Bog
Mykyta Boyko
Kwanghun Chung
Gudbjort Glyfadottir
Steffen Rebennack
Qipeng Zheng
Zhili Zhou