



BuckISE

News from The Department of Integrated Systems Engineering at The Ohio State University

Spring 2014

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Data Analytics and Optimization Track Arms ISE Students with 'Powerful Combination' of Skills

To maintain their competitive edge, businesses are increasingly turning to big data analytics to predict trends and inform business decisions. The demand for the skill set prompted The Ohio State University Department of Integrated Systems Engineering to introduce an undergraduate Data Analytics and Optimization Track and a master's degree concentration

"There is an imperative need for data analytics – means and methods for using large data sets and computer models – to drive business value, understand human relationships and improve decision-making," according to Integrated Systems Engineering Department Chair Dr. Philip Smith.

Judging by the response to the new program, students understand that the critical tools necessary for managing, visualizing and extracting useful information from big data will make them more marketable in their careers.

"We've received really great feedback from the students when they find out it's being offered," says Kristen Arra, coordinator of academic advising for ISE. "We're giving them an opportunity to gain expertise in an area that's really hot right now and they appreciate that."

Student Jennifer Shal used the opportunity to open doors for her at the 2013 Engineering Expo. "I ap-



Photo courtesy of Josh Robison

OSU Integrated Systems Engineering students Logan Johnson, left, and Josh Robison, right, are serving internships this summer at IBM's Advanced Analytics Division in Columbus.

proached several companies at the career fair that were not listed as hiring ISE majors, but that I knew were doing exciting things in the analytics space," she says. "Many of the recruiters grew visibly excited when I told them about our new program and took note of it to take back to their companies. I got interviews and job offers from many of them, and am confident that my classmates will as well."

The department can accommodate 10 students in the track each semester and received twice as many applications. Previously, students

interested in data analytics signed up for computer science courses to gain experience. "Now, they have a formalized plan and course list to ensure competence in data analytics," Arra says.

For student Tim Rettig, it's the perfect combination to suit his interests. "When I found out about the data analytics program, I was ecstatic at the thought of being able to blend my passions in [Computer Science and Engineering] and ISE into one structured program. Now that I am in this track, I am taking the classes I really want to take, rather than just the ones I have to take."

Big Data Analytics and Optimization focuses on using large data sets, computer models and optimization methods to support data-driven decision-making. The skills have been successfully demonstrated and are becoming increasingly necessary in the management of:

- Healthcare and transportation networks,
- Retail and financial decision-making,
- Supply chain and logistics systems,
- Large-scale information systems,
- Manufacturing operations,
- Energy and smart grids, and
- Social networks.

(continued on page 2)

From the Chair

Spring 2014

Photo: Cedric Sze/ISE



The 2013-2014 academic year has been a good one and our program in industrial engineering continues to thrive. Last year 83 percent of our undergraduates had a job within three months of graduation – the second year in a row that ISE has broken the College of Engineering record – and things look

equally good for students as they graduate this year. I would like to share with you a few of the highlights from the past academic year:

■ **Student Activities.** Our student Institute of Industrial Engineering (IIE) Chapter continued to live up to its reputation for exceptional involvement and achievement. This included the efforts by more than 30 of our students to organize the second annual Leadership Summit, which attracted 380 students from business and engineering who wanted to learn more about the secrets of effective leadership. IIE also sent 35 students to Western Michigan University to represent the Department at the 2014 IIE Great Lakes Regional Conference. One of our students, Mike Newbern, won first place in the Technical Paper Competition. Mike will continue to represent OSU at the 2014 IIE Annual Conference in Montreal along with 16 other students from Ohio State.

■ **Healthcare.** Under the leadership of one of our faculty members, Professor Bill Marras, a member of the National Academy of Engineering, a new Spine Research Institute (SRI) has been created, which is a collaborative effort of the College of Engineering, the College of Medicine and the College of Veterinary Medicine at Ohio State. The SRI will continue OSU's tradition of leading the world in research focusing on the prevention and treatment of back disorders. It also will provide indus-

try with technical assistance for the prevention of back problems, and will create a major new program to provide a unique set of clinical services to patients with back problems. These clinical services build upon the advances that Dr. Marras has developed at OSU since 1982, providing personalized medicine for the more effective evaluation and treatment of spine disorders, demonstrating how advances in research at OSU can have an impact on the health of millions of people (and, in the future, their pets as well!)

■ **Manufacturing.** Manufacturing is of vital importance to the State of Ohio, as well as to the entire nation. Manufacturing represents 17 percent of the gross domestic product in Ohio, providing 639,000 jobs. Equally important, new investments in research, development and training in advanced manufacturing offer an opportunity for Ohio to establish world leadership. With its long history of research in manufacturing, the ISE Department is playing a central role in making this happen. This includes participation in a newly created Center for Design and Manufacturing Excellence reflecting partnerships with key industry partners like Honda, and key research partners such as the Edison Welding Institute (EWI). The ISE Department also is an important participant in the newly funded federal initiative creating the American Lightweight Materials Manufacturing Innovation Institute, with Ohio State serving as a co-leader along with EWI and the University of Michigan.

To put it simply, our goal has been to identify major thrust areas where the ISE Department can provide international leadership in research, education and practice, and to develop and staff the programs necessary to accomplish this. We expect efforts and activities like those described above to make this possible.

Dr. Philip Smith
Chair

Data Analytics and Optimization Track Arms ISE Students with 'Powerful Combination' of Skills (continued from page 1)

The ISE Data Analytics and Optimization track is an undergraduate elective program designed with a comprehensive and applied curriculum providing students with a strong background in data science, computer science and optimization methods. The track requires a sequence of courses in computer science, operations research, cognitive

engineering, and probability and statistics.

"This program gives us a unique advantage in that we will have a powerful combination of technical and analytical skills, business insight, presentation and communication skills, collaboration and leadership experience." Shal says.

Paying Forward

The College of Engineering and the ISE department have absorbed significant growth over the past two years. ISE enrollment increased to 75 students admitted each semester. Coupled with the switch from quarters to semesters, class sizes have doubled. Even with these challenges, the “product” your ISE department continues to produce is impressive. Current ISE department job placement rates are more than 80 percent – the highest in the College of Engineering – with an average starting salary of \$62,000, which is excellent.

With this increased enrollment, the university has provided the ISE department with a temporary increase in funding. These funds are used for ongoing institutional instructional support such as the hiring of faculty teaching assistants. But what happens if these funds are no longer available? And, what about the other pressing needs of the department?

On a recent visit, I noticed that the lobby of Baker Systems looks exactly like it did in the mid ‘70s when I attended OSU. There is a plan to modernize and make better use of this space, but funding is needed. Likewise, the ISE Manufacturing Lab is in desperate need of supplies. Last, but certainly not least, students need our help to meet the challenge of ever-rising tuition and fees.

There are 5,100 alumni from the ISE department (representing 9 percent of total College of Engineering alumni). Over the past three years, 1.5 percent of overall gifts to the College of Engineering came from ISE alumni. Quite frankly, the ISE department needs our help.

My wife Sharon (also a graduate of the ISE department) and I established an annual scholarship to provide an opportunity for a student from Columbus to major in ISE. Won’t you join us in supporting this great department – our department – ***Integrated Systems Engineering at The Ohio State University!***

Go BuckISE!

Chuck Elgin (BS, ISE ’78)
Chair, ISE Alumni Advisory Board



What does Ohio State mean to you?

I would like to give \$_____ to the Department of Integrated Systems Engineering

☐ Use my gift where it is needed most.

☐ I would like to designate my gift to be used for: _____

☐ My employer will match my gift. I have enclosed my employer’s matching gift form.

Name: _____ Degree/Year: _____

Address: _____ City: _____ State: _____ Zip: _____

Daytime phone: _____ Evening phone: _____ E-mail address: _____

Employer: _____ Title: _____

I have enclosed a check made payable to ISE-OSU. ☐ Please charge my gift to my credit card.

☐ Visa ☐ MasterCard Card #: _____ Expiration Date: _____

Signature: _____

Mail to ISE, 224 Baker Systems, 1971 Neil Ave., Columbus, OH, 43210-1275, Attn.: Julie Sills-Molock



If you would like more information on ISE, or would like to discuss other opportunities to assist the Department, please contact Director of Development Julie Sills-Molock, at sills-molock.1@osu.edu or 614-292-0096.

BuckISE Making News

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New Computer Lab Designed to Meet Needs for Group Projects, Individual Students

For most ISE students, the Department's student lounge and computer lab are their homes away from home as they spend increasingly more time at Baker Systems.

Fortunately, the lounge underwent a much-needed renovation in 2012, while the computer lab awaited its turn. Last fall, ISE Department Chair Phil Smith tasked the OSU student chapter of the Institute of Industrial Engineers to develop a plan to re-create the lab space.

Led by IIE Director of Recruitment Rehgan Avon, a team of students, including Philip Wilson, Bret Mayer, Matt Foster, Joseph Francis and Jack Shroder, tailored a plan designed to achieve the following goals:

- Split the lab into group and individual rooms,
- Modernize the space,
- Increase seating and study areas,
- Increase natural lighting and control temperatures, and
- Add color and eye appeal to a currently utilitarian room.

Avon says they received about 90 responses to an email sent to the ISE student body requesting suggestions. The lab is currently divided into separate rooms and rather than knock down a wall, the students decided that having two rooms could work in their favor. ISE majors tend to collaborate on group projects, she says, so it was decided that one room

should be tailored to their needs while a separate "quiet" room could accommodate students working on individual projects.

"We also decided we wanted to open up the lab a little bit," she says, by installing windows to the hallway to encourage people walking by to use the lab.

The walls will include photos from IIE events and computer stations will feature ergonomically friendly chairs. A supply cabinet will provide office supplies, such as hole punches, staplers and printer needs.

The plan is to incorporate scarlet and gray on the walls, while including a band of orange frequently used as an identifying color for the College of Engineering.

The next phase is to determine a budget for the updates with plans to renovate the space over the next year.

"We want to make sure every student feels comfortable in our building; Baker is our building," Avon says. She says she appreciates the opportunity to utilize the project management skills she has learned at Ohio State, as well as the opportunity to leave an imprint on the university.

"I know the lounge is important to me and I had nothing to do with it," she says. "The lounge brought our department closer together and I think this lab will continue to do that."



Illustration shows the suggested redesign of the ISE computer lab space. A group study lab is on the left, while individual stations are located in the "quiet" lab room at right.

Castro's Process Offers More Conductivity, Greener Approach

Integrated Systems Engineering Professor Jose M. Castro's research centers on using nanoparticles to improve materials performance, while maintaining processability.

Castro, who also directs the Center for Advanced Polymers and Composites Engineering at OSU, says that by using carbon nanofibers, his team has found that mechanical properties can be improved by about 30 percent, while keeping the manufacturability at an acceptable level.

"Due to the difficulty of adding more than a few percent nanoparticles, in order to keep the manufacturability acceptable," he says, "we have concluded that a better use of nanoparticles is for surface protection and providing a conductive surface on the composites for among other things de-icing and EMI shielding."

Electromagnetic interference (EMI) is a disturbance that affects an electrical circuit due to electromagnetic radiation emitted from an external source. EMI may induce malfunction of equipment, interference with telecommunications and degradation up to total loss of data. EMI shielding refers to the reflection and/or adsorption of electromagnetic radiation by a highly electrically conductive material, usually metal, or polymer composites filled with conductive fillers. However, metal coatings tend to corrode and acceptable EMI shielding levels are difficult to achieve using conductive fillers in a thermoplastic matrix. Castro's group is developing a new approach to EMI shielding of plastic parts using in-mold coated nanoparticle thin films or nanopapers to create a highly conductive top layer.

"Critical to the new approach is the strength of the nanopaper as it has to survive the wall shear stress during injection molding," Castro says. "Our research has found that if the tensile strength of the

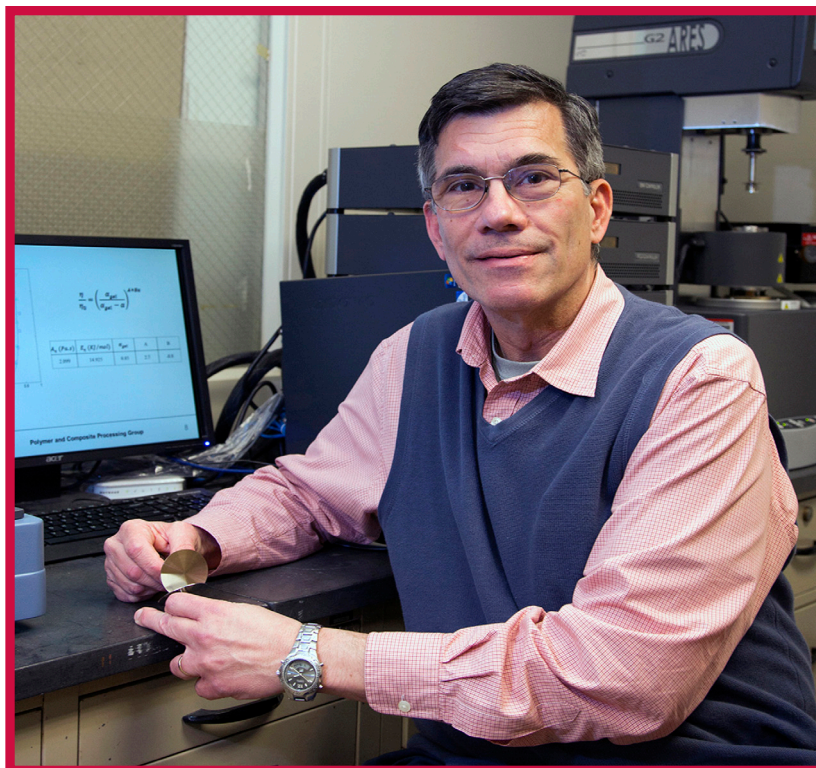


Photo: Cedric Sze/ISE

Integrated Systems Engineering Professor Jose M. Castro directs the Center for Advanced Polymers and Composites Engineering at The Ohio State University.

nanopaper is larger than the maximum wall shear strength during injection molding, the nanopaper will survive the process."

To improve the strength of the nanopaper, several nanoparticle functionalization approaches are evaluated. According to the team's research, in-mold coating, or IMC, is an environmentally friendly alternative to painting for composites and plastic parts. The process injects a liquid reactive coating material onto the molded part, while still in the mold. When the paint quality is critical, the IMC can be used instead of primer and still greatly decreases the volatile organic compound.

Castro is collaborating with Chemical Engineering Professor L. James Lee, post-doctoral student Rachmat Mulyana and three PhD candidates, Seunghyun Ko, Eusebio Cabrera and Ziwei Zhao on the research.

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Conejo Brings International Perspective

Antonio J. Conejo joined the Integrated Systems Engineering faculty spring semester. Professor Conejo specializes in operations research and electric energy systems. He previously was a professor at the University of Castilla-La Mancha in central Spain where he created a PhD program focused on operations research and electric energy systems.

"Electric energy systems are managed somewhat differently in the U.S. and Europe," Conejo says. "My familiarity with both management views will allow me to provide my students with a worldwide understanding of such systems and with a diversity of tools to operate, plan and regulate them. I am also familiar with higher education systems in the U.S. and Europe, and this should be useful to help my students to make the best career choices."

He received his master of science degree from the Massachusetts Institute of Technology and a PhD from the Royal Institute of Technology in Sweden. Conejo is an Institute of Electrical and Electronics Engineers Fellow.

At Ohio State, he will teach courses in optimization, stochastic optimization, electric energy system analysis and electric energy systems economics. He says he is looking forward to contributing "to the education of our undergraduate and graduate students with an interest in energy systems and decision-making tools, and helping to find better solutions to the challenging problems



Photo: Cedric Sze/ISE

Antonio J. Conejo

regarding a sustainable and clean supply of electric energy in Ohio and elsewhere.

"I am most excited for the opportunity that Ohio State has provided me, and am eager to contribute to the best of my ability through research and teaching on energy systems and decision-making tools," he says. "Ohio State is an excellent and comprehensive university with a current focus on energy and

excellent industrial and electrical engineering departments."

Department Chair Dr. Phil Smith says Conejo has made major contributions to the design of electricity markets and the development of methods and policies for their efficient operation. "He is particularly interested in devising ways to enable a large-scale integration of renewable sources in electric energy systems," Smith says. "Dr. Conejo will help us to achieve our goal of becoming one of the major research centers for energy systems modeling in the world."

Conejo is the editor-in-chief of the Institute of Electrical and Electronics Engineers Transactions on Power Systems, an IEEE Fellow and chair of the IEEE Power & Energy Society Power System Operations Committee.

ISE Student Participates in President Clinton's Hult Prize Challenge

Integrated Systems Engineering student Kartik Malhotra, along with teammates from the Fisher College of Business – Burouj Aljouni, Danielle Latman and Aiswarya Ramamurthi – represented The Ohio State University in the prestigious Hult Prize regional finals, which took place in March. "The goal was to develop a viable business that would help address chronic diseases in slums around the world," Malhotra said. "My team developed an idea that was specifically designed to address the challenge of chronic diseases and provide gainful employment with a stable income to participants."

The OSU team pitched its start-up idea in San Francisco, while other teams met in Boston, London, Dubai, Shanghai and Sao Paulo. Malhotra said even

though his team was not among the three that made it to the final round, he was inspired by the opportunity. "We met and networked with kids from all over the world, many of which, I am still in contact with," he said. "All in all, the experience was amazing and really gave me a positive perspective about how my generation will fare in the future."

This year's competition received a record number of more than 10,000 first-round applicants. The Hult Prize awards \$1 million to the winning team, while each regional champion spends the summer at the Hult Prize Accelerator and receives a one-year membership into the Clinton Global Initiative, started by former President Bill Clinton, who issued this year's call to action.

Yue Tan

Yue Tan is studying for her PhD and expects to graduate spring 2015. She earned a bachelor of science degree in information and computational science from University of Science and Technology of China in 2008. She also holds a master of science degree in mathematics of finance from Columbia University ('09).

Area of ISE specialization: I am studying in the operations research group of ISE. My research interests include stochastic modeling, queuing networks, statistical learning, revenue management and business analytics. Together with my adviser, Dr. Cathy Xia, we are now working on solving revenue management problems using nonparametric data-driven decision-making algorithms. Eventually, we hope our research could help companies and businesses to make transitions from being data rich to data smart.

Career plans: I plan to find a job as a data scientist or business analyst in industry that is closely related to what I have been working on for my PhD. Data scientist is what is now called "the sexiest job of the 21st century." It requires a solid foundation in statistics, analytics, math and computer science. To me, it is both appealing and exciting.

Best thing about OSU: I love OSU for many reasons: talented faculty and students; beautiful and vibrant campus; and top-notch facilities. Among all of them, I love the student life here the most. During my first year here at OSU, I joined the OSU student chapter of Institute for Operations Research and the Management Sciences (INFORMS) and was elected president in 2013. It has become part of my life here. It's a nice way to be involved with other ISE students.

Awards and achievements: Received the Sigmetrics/Performance 2012 Student Travel Award and the 2012 OSU Complexity Innovation Group Travel Award. I have published two peer-reviewed research articles and also have given several presentations at various conferences including: INFORMS annual meetings, Applied Probability Society Conference, Mathematical performance Modeling and Analysis (MAMA) workshop, and INFORMS Midwest.

When did you know that you wanted a career in ISE? I came to know operations research during my junior year and I was determined to further my study in this area during my master's study. After taking several advanced courses in operations research, I found that ISE is the discipline where mathematical models and analytical methods are applied to solve real-life problems and help make better decisions. Visioning myself as a business analyst and a problem-solver, I decided to join a reputable PhD program, and pursue a career in ISE.

What is the best advice anyone has ever given you? "Never consider what lies in front of you as the toughest, because they wouldn't be when you looked back from the future." This is what my parents told me when I was depressed by what I thought to be the toughest time in my life. Keeping their advice in mind, instead of being depressed or resentful, I felt confident to face any challenges.



Photo: Cedric Sze/ISE

Jaejin Hwang

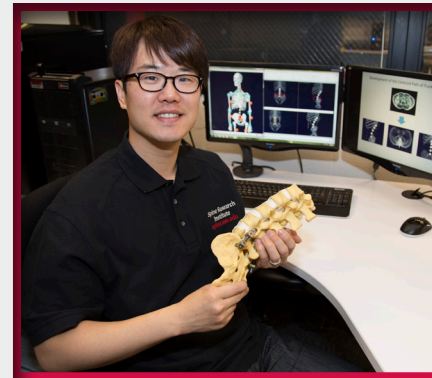


Photo: Cedric Sze/ISE

Jaejin Hwang intends to graduate from The Ohio State University College of Engineering in 2016 with a PhD, specializing in human factors, and is being advised by Dr. William Marras.

Undergraduate degree: I have the same ISE degree in my undergrad and I studied at Ajou University, South Korea, graduating in 2009.

Career Plans: After graduation, I want to pursue my career in academia.

Best thing about OSU: OSU has so many different programs and events, so there is always something to do.

What is the best advice anyone has ever given you? "If I had only one hour to save the world, I would spend fifty-five minutes defining the problem, and only five minutes finding the solution." – Albert Einstein

Awards and achievements: In 2013, my master's thesis was accepted by the Applied Ergonomics journal. The title is "Joint Motion Pattern Classification by Cluster Analysis of Kinematic, Demographic and Subjective Variables."

Professional experience: I am a graduate research associate in the Spine Research Institute, and I am currently developing a biomechanical model of the spine.

When did you know that you wanted a career in ISE? As an undergrad, I became interested in human factors, so I worked as an intern in the laboratory, then I wanted a career in ISE.



THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING

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Photo: Cedric Sze/ISE

Celebrating Global Engineers

The Ohio State University hosted the 2014 Society of Women Engineers Region G Annual Conference Feb. 21-23. Representing Integrated Systems Engineering are, left to right, Natalie Ducharme, Lauren George, Chynna Hartman, Abby Riley, Judy Chen, Veronica Irizarry and Julia Burrowbridge. The conference, with the theme Engineering Around the World, brought together students, faculty and professional engineers from Ohio, Pennsylvania, Kentucky and West Virginia. George served as one of the conference co-chairs, along with Nora Wisor, a civil engineering major at Ohio State.