Department of Electrical and Computer Engineering

2012-2013 Annual Report

In the zone: Ohio State robotics prepare for disaster relief

When responding to a natural or man-made disaster means putting human lives at grave risk – as during the Fukushima Daiichi nuclear disaster – wouldn't it be ideal to send in the first-responder robots instead?

The Ohio State University is part of a 10-school collaboration, led by Drexel University, working to advance robotics technology for disaster relief as part of the U.S. Defense Advanced Research Projects Agency Robotics Challenge. Teams from academia, industry and the private sector will attempt to design and deploy a robot capable of disaster response in radioactive or bio-contaminated areas. The robot must drive vehicles, navigate human-centered environments, use tools and manipulate equipment.

Yuan Zheng, professor of electrical and computer engineering, leads Ohio State's efforts in the challenge.

Researchers from each of the 10 partner schools are working to tackle specific aspects of the challenge, which is broken into eight events related to disaster mitigation. Robots must mount, drive and dismount a vehicle; travel across rubble; remove debris; open a door; climb a ladder; use a tool to break through a concrete wall; locate and shut off a leaky valve; and remove and replace a pump.

According to Zheng, having a robot capable of accomplishing even one of these tasks would be a giant leap forward from the current state-of-the-art in robotics technology.

"A robot can't do any of these tasks today. Just getting a robot to climb into a vehicle is very difficult, almost impossible, to perform," he said.

'We are focusing on three fundamental components of robots — the battery, the magnet in the motor and the harmonic drive — under radiation. These studies have never been performed.'

Professor Yuan Zheng

Read more on this story:
ece.osu.edu/reliefrobots/

The Ohio State team is responsible for equipping the robot to travel across rubble, which might be anything from rocks to large piles of debris. The group developed what it considers to be an innovative gait, inspired by the poles skiers use to aid in balance.

"We developed an innovative update, called a 'ski type' gait, which adds two canes to the robot to increase its support area and stability," Zheng said.

"Using this approach, if the surface becomes sloped or uneven the robot still has some margin to maintain stability. It's much better than a two-legged robot."

The removable canes increase the robot's stability without making permanent changes to its structure, which could affect its performance in other challenge events.

The renewed interest in humanoid robotics has engaged Zheng – who was one of the first U.S. researchers working in humanoid robots and developed the first humanoid in 1986 – into the real-world application of the research area. ■

Inside

Points of Pride

SmartMoney **magazine ranked Ohio State's ECE program 11th in the nation in a comparison of tuition costs to graduate earning power, with an average return on investment of 179 percent!**

Ohio State ECE boasts many areas of excellence

Robert Lee
Department Chair

Within the Department of Electrical and Computer Engineering, our focus has been on developing and implementing educational concepts that place us on the leading edge of the national dialogue of higher education teaching.

Research

We continue to do research that is making a great impact at the national and international levels. Much of the research is highly multidisciplinary and involves collaborations throughout our campus as well as with researchers at other universities.

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Educational Innovation

Over the past year, we have had a number of major accomplishments.

We employed the "flipped classroom" concept in teaching our sophomore sequence. More than 350 students went through the two-semester sequence, with half the students signing up for the traditional approach and the other half signing up for the flipped classroom approach.

Unlike the traditional lecture approach to teaching, the flipped classroom technique involves having students watch videotaped lectures outside of class as homework and then meeting in small groups of approximately 25 students to work on problems as a team, with support from the instructor.

Based on enrollment choices for 2013-14, the flipped classroom concept has been a huge success.

Faculty

Our faculty size has continued to grow, especially with the creation four years ago of clinical and research faculty tracks in the university. We have grown to 64 faculty members with 53 of them being tenured or tenure-track.

Diversity

This year, Ohio State's ECE achieved a milestone for women faculty. We have reached double digits for the percentage of women faculty for the first time in the history of the department.

We also have seen the percentage of women enrolling in the program increase during the past five years. In 2012, 10.8 percent of our ECE students were female, up from 7.4 percent in 2007. There is still room to grow to close the gender gap that is prevalent among women students and faculty in electrical and computer engineering programs nationwide.

We are becoming more diverse in other areas, too. In 2012, the number of underrepresented student minorities (African Americans, Hispanics and Native Americans) continued to increase to 8.1 percent, up from 5.9 percent in 2007.

Rankings

We have continued our seven-year ascent in the *U.S. News and World Report* rankings. We improved our position this year to 18th out of 173 programs. This is the highest rating we've achieved in 20 years.

Enrollment

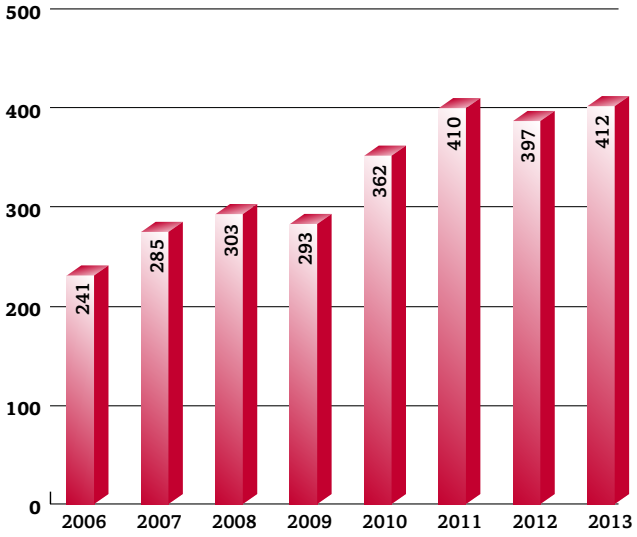
Our enrollment at the graduate level is at its highest point ever with 412 students. We also enrolled 917 undergraduates, which is approaching our record high.

We are excited about all the opportunities ahead for the department, and you can read more about our progress in this report.

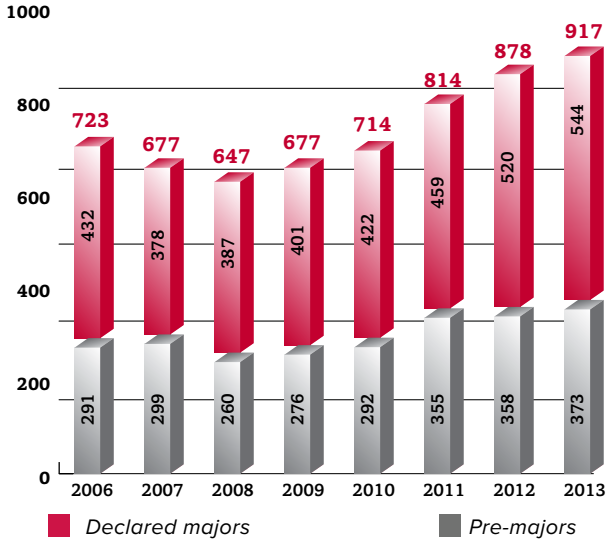
ECE's Growing Enrollment

Enrollment in Ohio State's electrical and computer engineering programs has grown significantly since the mid-2000s. In fact, in the fall of 2013 the department enrolled more graduate students than ever, with 412 Ph.D. and master's degree candidates. The department also boasts 917 undergraduate students.

Graduate Student Enrollment (2006-13)



Undergraduate Enrollment (2006-13)



Sparks of Genius

The Ohio State University College of Engineering's Buckeye Current electric motorcycle team finished third in its first-ever appearance at the world-famous Isle of Man Tourist Trophy races. The team was the only collegiate team to compete in the TT Zero. The team finished with an average speed of 90.4 mph.

Faculty Figures

The Department of Electrical and Computer Engineering currently has 53 tenure track faculty members, as well as eight research track and three clinical track faculty members.

Sparks of Genius

Ohio State's electrical engineering graduate programs have been recognized as being 18th best in the 2014 *US News and World Report* rankings.

The department's computer engineering program is ranked 19th in the nation.

Points of Pride

Students enrolled in the Department of Electrical and Computer Engineering represent 32 different countries from around the world, including China (167 students) and the United States (108 students.)

ECE Professor to lead $6.25M grant research

The Ohio State University has been awarded a five-year, $6.25 million grant through the Department of Defense's Multidisciplinary Research Initiative (MURI) Program to explore materials with spin mediated thermal properties. Funded through the Army Research Office, the initiative aims to develop new materials with extraordinary thermal properties based on an effect—known as spin—that converts heat into a quantum mechanical phenomenon.

Read more on this story:
ece.osu.edu/news/2013/09/muri

Myers

Led by Roberto Myers, associate professor of materials science and engineering, electrical and computer engineering and physics, the research could potentially lead to new materials and devices for thermal management and waste heat recovery. Since most energy is lost to heat, even small improvements in managing thermal energy would offer a dramatic increase in energy efficiency.

"The grant sends the message that the federal government realizes the importance of exploring materials science of new spin-based thermal effects where heat can push magnetic moments through material, and contrarily, waves of magnetic moments in materials can transport heat," Myers said.

The MURI program supports basic research by teams of investigators that intersect several traditional science and engineering disciplines in order to accelerate research progress. ■

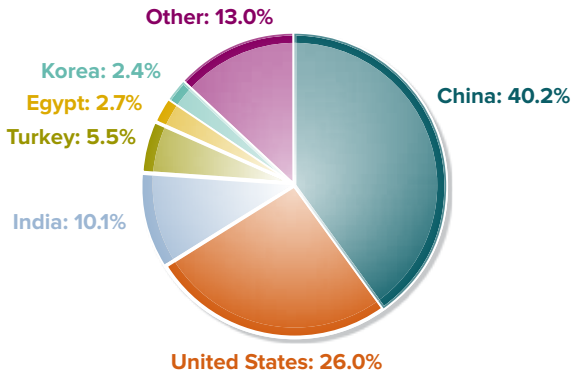
ECE Graduate Students (2012-13)

Graduate Student Overview 2012-2013

** Second score reflects new GRE rating system.*

	Master's	PhD
Total Number of Graduate Students (Aug 2012)	182	218
New Applicants	1,047	495
Number Admitted	114	93
Number Enrolled	67	40
Average GRE (quantitative)*	775/163	785/164

Graduate Student Countries of Origin



College to honor outstanding ECE alumni

Several alumni of the Department of Electrical Engineering will be among those honored this year as recipients of the 16th Annual Excellence in Engineering & Architecture Alumni Awards. The awards will be presented October 18, 2013.

Each year the College of Engineering honors alumni for extraordinary personal achievements, remarkable contributions to the field of engineering or architecture, or outstanding service to the college.

This year's top honorees and the awards they will receive will include:

Thomas L. Thomas (BS' 66, MS' 66, electrical engineering) retired chairman and CEO of EJustice Solutions, will receive the Benjamin G. Lamme Medal, the highest honor bestowed by the college for meritorious achievement in advancing engineering. The Ann Arbor, Mich., resident is the former owner and CEO of Creative Solutions, Inc., which he helped grow into the leading supplier of integrated software applications for U.S. public accounting firms before selling it to Thomson Reuters in 1998.

Tamer S. Ibrahim (BS '96, MS '98, PhD '03, electrical engineering) William Kepler Whiteford Associate Professor in bioengineering and radiology at the University of Pittsburgh, will receive the Texnikoi Outstanding Alumni Award, honoring achievements since graduation. The Sewickley, Pa., resident's work has challenged old and established theories in magnetic resonance imaging (MRI) and led to new radio frequency techniques such as RF shimming and subject-insensitive RF transmit arrays.

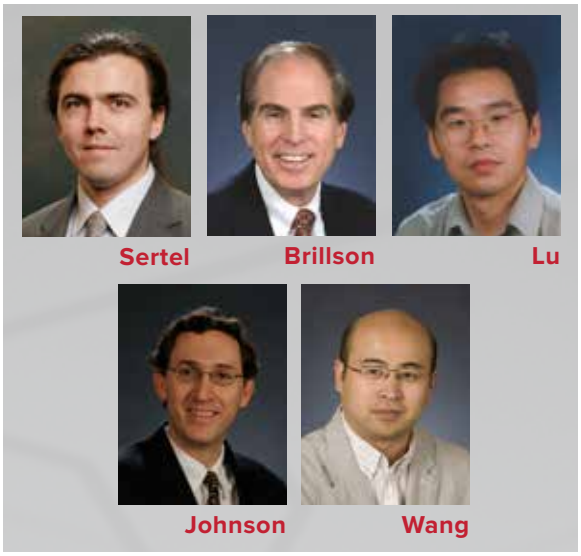
In addition to these awards, two alumni will receive Distinguished Alumni Awards in honor of their outstanding professional achievement in engineering:

Robert J. Borel (BS '65, MS '65, electrical engineering) is CEO of private engineering firm BeamAlloy Technologies, LLC, in Plain City, Ohio, and a retired Worthington Industries executive.

Songsdhit "Joe" Chongsiriwatana (BS '96, electrical engineering; MS '98, biomedical engineering) moved his family to Thailand where he applies his engineering talents to stopping child trafficking and helping rescued children through his work at ZOE International. ■

ECE faculty honored for research

Five ECE faculty received awards from The Ohio State University College of Engineering in recognition of their research achievements.



Kubilay Sertel, assistant professor of electrical and computer engineering, received the Innovators Award for developing and transitioning to a commercial product the first terahertz camera used for medical, communication and security applications. The award is presented to an individual or team of faculty and/or research scientists who best demonstrate innovation in the development of a product and/or technology originating from the Ohio State research enterprise.

Professor **Leonard Brillson** and Associate Professor **Wu Lu**, along with **Stephen C. Lee**, associate professor of biomedical engineering, received a Lumley Interdisciplinary Research Award in recognition of interdisciplinary research accomplishments of the college faculty and research staff.

Professor **Joel Johnson** and Associate Professor **Jin Wang** received Lumley Research Awards in recognition of their exceptional activity and success in pursuing new knowledge of a fundamental or applied nature. ■

Sparks of Genius

For Summer 2012 to Spring 2013, Ohio State conferred 30 PhDs, 85 master's degrees and 171 bachelor of science degrees:

PhDs conferred

Summer 2012.....4

Autumn 2012 10

Spring 2013 16

MS conferred

Summer 2012.....18

Autumn 2012 22

Spring 2013 55

BSECE conferred

Summer 2012.....10

Autumn 2012 55

Spring 2013 106

Points of Pride

The Department of Electrical and Computer Engineering received more than $21.1 million in research funding in 2012-13.

Sparks of Genius

John Volakis, Chope Chair professor of electrical and computer engineering and director of the ElectroScience Laboratory, received the 2013 IEEE Rudolf Henning Distinguished Mentoring Award in recognition of his mentoring of students and young engineers to achieve successful careers in the areas of RF/microwave and wireless engineering.

Points of Pride

A report from financial research firm NerdWallet shows starting salaries of Ohio State College of Engineering students are among the highest in the nation. For engineering and computer science programs, Ohio State ranks 10th in the nation.

Exchange program opens doors to China

Some Ohio State University ECE students have expanded their education beyond Central Ohio – and even beyond the United States borders – participating in an international exchange program through the department.

The program, which launched in 2011, is part of a cooperative degree and student exchange program with the School of Electronic, Information and Electrical Engineering at Shanghai Jiao Tong University (SJTU) in China. The program was developed by Yuan Zheng, professor of electrical engineering, in an effort to help students gain the international experience needed to stay competitive in today's global marketplace.

"I wanted to make use of the relationships that I established with the SJTU administrators and faculty to benefit the university and Ohio State students," said Zheng.

The program enables exceptional undergraduate students at both SJTU and Ohio State to study at the partner university. In 2012, Ohio State hosted 19 SJTU senior students during the fall semester. An additional 17 students came to Ohio State in the fall of 2013.

The program also enables interested Chinese students to return to Ohio after graduation to obtain a master's degree. Twelve of the original 14 participants from 2011 are currently pursuing a master's, while one student has enrolled in the ECE PhD program.

"As the number three university in China, Shanghai Jiao Tong University produces top quality undergraduates," said Zheng. "The SJTU students who study here become an excellent pool of candidates for graduate studies at Ohio State."

The student exchange program also allows Ohio State electrical and computer engineering undergraduates to study at SJTU for one semester. Three ECE students – Kevin Stewart, Zach Imm and Shivani Patel – took advantage of the opportunity earlier this year. They were the first group of ECE students to leave Ohio State to study at SJTU for an extended period of time.

For Patel, the experience was incredibly rewarding. "I benefited educationally because I was able to take ECE courses that will be transferring to OSU, which is pretty impressive for a study abroad program. I also got to take classes with very helpful and friendly Chinese professors and experience the differences between education here and in China. Professionally, I think I will benefit a lot because companies these days are no longer looking for someone who is just school, school, school all the time. They want someone with a diversified background, and this study abroad in China is going to be a key experience that I can draw from if asked by employers about my diverse experiences."

ECE students (left to right) Kevin Stewart, Zach Imm and Shivani Patel, along with Imm's father, Chuck, take a break from their studies in China to visit the Great Wall.

Stewart agreed: "I grew a lot by having to take on a completely different lifestyle and I was able to grow with my friends who were right there with me. I feel I truly had a once in a lifetime experience and cannot express how much the trip made me grow personally and professionally."

SJTU teaches a variety of courses in English each term, removing language as a barrier for engineering students who wish to study abroad in China.

In addition to coursework, Ohio State students are pursuing research projects with SJTU faculty and internships with companies in Shanghai.

Next, Zheng plans to expand the SJTU partnership to include cooperative research opportunities to allow faculty and students from both countries to work on fundamental research on problems of common interest to both the U.S. and Chinese governments, such as global warming, energy issues, and traffic issues.

Robert Lee, chair and professor of electrical engineering, said the program was a role model for a new international collaboration launched in 2013 with University of Electronic Science and Technology of China (UETSC), the largest electrical engineering university in the world. Lee said the program could serve as the basis for additional programs in the future.

In 2013, the first two students to participate in the new program are visiting Ohio State from UETSC. ■

Department Welcomes New Faculty


Fiorentini


Guo


Villarroel


Wang


Yousefi

Lisa Fiorentini
Assistant Professor of Practice

Doctoral Institution: The Ohio State University

Lisa Fiorentini has been conducting research at The Ohio State University Center for Automotive Research since 2010, most recently as a senior research associate. Her research spans the field of control and system theory with emphasis on nonlinear systems, robust and adaptive control, and applications in aerospace and automotive engineering. Fiorentini earned a PhD in electrical and computer engineering from The Ohio State University in 2010.

Liang Guo
Assistant Professor

Doctoral Institution: Georgia Institute of Technology

Liang Guo joins Ohio State with a joint role in electrical and computer engineering, and neuroscience. He conducts research in neural interfaces, neural prosthetics, biomedical microdevices, and biological circuits engineering. Guo earned a PhD in bioengineering from the Georgia Institute of Technology in May 2011. He was formerly a postdoctoral associate at the Massachusetts Institute of Technology.

Wladimiro Villarroel
Assistant Professor of Practice

Doctoral Institution: The Ohio State University

Wladimiro Villarroel joins the ECE department as an assistant professor of practice. He has more than 15 years of industry experience including 10 years at AGC Automotive Americas, where he was division manager for fundamental technologies. At AGC Villarroel managed research and development programs and innovation activities in the U.S. for the world's largest automotive glass supplier related to antenna, glass-forming simulation, acoustics, and solar technologies. He holds a PhD in electrical engineering from The Ohio State University, a JD from the Thomas M. Cooley Law School in Ann Arbor, Mich., and an MBA from Cleveland State University.

Jiankang Wang
Assistant Professor

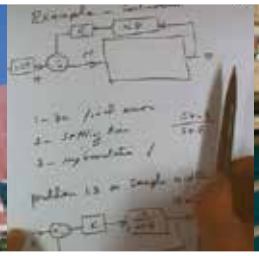
Doctoral Institution: Massachusetts Institute of Technology

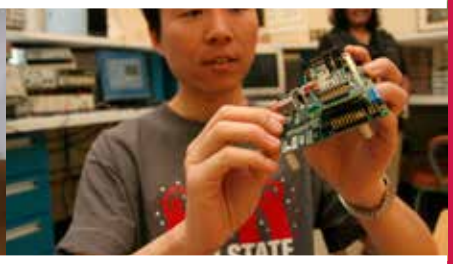
Jiankang Wang will join Ohio State in Spring 2014 with a joint role in electrical and computer engineering, and integrated systems engineering. She conducts research in power system operation and planning, electricity markets, reconfiguration, demand side management, distributed generation and renewable energy. Wang received a PhD in electrical engineering and computer science from MIT in 2013.

Mohammadmahdi Rezaei Yousefi
Research Assistant Professor

Doctoral Institution: Texas A&M University

Mohammadmahdi Rezaei Yousefi joins Ohio State as a research assistant professor. Yousefi received a PhD in electrical engineering from Texas A&M University in 2013. He conducts research in genomic signal processing, optimal control of gene regulatory networks, cancer therapy, systems biology, pattern recognition and small-sample classification.





Sparks of Genius

Prabhakar Pathak, professor emeritus of electrical and computer engineering and the ElectroScience Laboratory, received the 2013 Distinguished Achievement Award of the IEEE Antennas and Propagation Society. He was specifically recognized for "introducing and establishing the Uniform Theory of Diffraction (UTD) as a computational tool in Electromagnetics (EM) and for innovative solutions to EM antenna/scattering problems."

Points of Pride

Nearly 80 percent of Ohio State engineering students gain real-world experience outside the classroom through co-ops, internships and research projects.

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

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Editor & Designer

Selected International & National Student Awards, 2012-2013

Student	Award	Advisors
Elias Alwan	Best paper award at the 2013 Wireless Innovation Forum on Wireless Communications Technologies and Software Defined Radio	**John L. Volakis**
Tai Cheng and Forrest Obnamia	Tied for third place in engineering category at 2013 Denman Undergraduate Research Forum	**Paul Berger, Ashok Krishnamurthy**
Jonathan Doane	Second-best paper award at the 2012 Antenna Applications Symposium (co-athored by Kubilay Sertel and John L. Volakis)	**Kubilay Sertel and John L. Volakis**
Luis Herrera	Awarded three-year Ohio Space Grant Consortium Fellowship	**Jin Wang**
Sriram Krishnamoorthy	2013 Ohio State Presidential Fellowship for outstanding scholarship and research	**Siddharth Rajan**
Mustafa Kuloglu	First place student paper award at Antenna Measurement Techniques Association annual symposium (paper co-authored by Chi-Chih Chen)	**Chi-Chih Chen**
Andrew S.C. Svendsen	Third place student paper award at Antenna Measurement Techniques Association annual symposium (paper co-authored by Inder "Jiti" Gupta and Chi-Chih Chen)	**Inder "Jiti" Gupta**
Georgios Trichopoulos	Best student paper award at IEEE APS/USNC-URSI symposium on Antennas and Propagation	**Kubilay Sertel**
Grant Yang	Recipient of 2013 Graduate Research Fellowship from the National Science Foundation and first place in engineering category at 2013 Denman Undergraduate Research Forum	**Bradley Clymer**
Ruochen Yang	Second place in engineering category at 2013 Denman Undergraduate Research Forum	**Chris Baker, Graeme Smith**