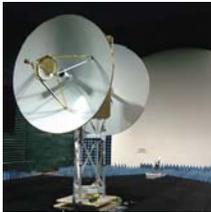


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ECE ANNUAL REPORT



Inside:

2. Research Highlights
5. New Faculty
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MESSAGE FROM THE CHAIR



This report provides a brief review of our department, which is in its 113th year. A more expanded version of the report will be added to our website at <http://www.ece.osu.edu>. This year has seen significant changes within our department. Our undergraduate student population of approximately 710 students has continued to follow the downward national trend. On the other hand, the graduate student population has increased by a dramatic 25% this past year, and at the start of Autumn 2007, we had approximately 310 students compared to 248 the previous year. The faculty size has held relatively steady at 43.25 FTE with 23 IEEE Fellows within the department.

Our faculty members have been very productive the past several years. Our average faculty publication rate the past three years is 3.1 peer-reviewed journal papers per year. Over the past two years, we have awarded a total of 76 Ph.D. degrees, and several faculty members were recipients of prestigious awards.

The graduate program has gone through major changes this past year. The direct B.S. to Ph.D. program was established. This program emphasizes research and de-emphasizes classroom work; a student does not directly pursue a M.S. degree but will obtain the degree after passing the candidacy exam. Most of the students interested

in research have chosen to proceed along this path.

Four new faculty members have joined us this past year (see page 5). We have also had three successful searches this past year, and we will be bringing three new faculty members in the areas of photovoltaics, electronic materials, and RF integrated circuits.

In terms of research, it has been an exciting year. The state of Ohio has provided significant funding for infrastructure as well as direct research support. The state funded two proposals for Wright Centers for Innovation. The first was for the Institute for Development Commercialization of Advanced Sensor Technology (IDCAST) in which our department received approximately \$3.5 million. The second was for the Center for Photovoltaics Innovation and Commercialization (PVIC) in which ECE benefits to a great degree from the \$6.8 million provided to OSU. The state has also funded a proposal for an Ohio Research Scholar in Sensing from which our department received \$8.5 million (\$2.5 million for an endowment). We have had great success in obtaining funding from national agencies. There are currently six active MURI's in the department with three of them being led by OSU professors (Randy Moses, Ness Shroff, and John Volakis) and the other three having significant OSU involvement. Prof. Moses also won an AFRL center for Automatic Target Recognition, and Prof. Volakis won a large multi-university AFOSR grant for studying load-bearing antennas in unmanned aerial vehicles. Our total research expenditure (from both external and internal funds) for the past year is \$18,957,580.

I hope you will enjoy reading about the variety of activities going on in the department. We feel strongly that our education and research accomplishments will make an impact on the University, the state of Ohio, and the nation.


Robert Lee, Chair

DIGITAL FACE RECOGNITION

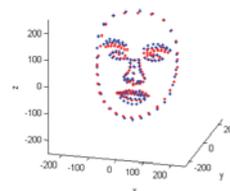
Aleix Martinez, assistant professor of electrical and computer engineering, is studying ways to model American Sign Language to improve teaching methods and possibly build human interaction computers — the sort that one day might translate someone's sign language through a computer into voice or text. Applications of the research, he points out, could overcome many communication obstacles. For example, doctors would not have to wait for translators to start diagnosis or care, and hotel workers could easily help visitors.

Martinez received a boost toward his goal with a National Science Foundation grant to create computer vision algorithms for the study of facial expressions in the motions of sign language. The work coincides with a National Institutes of Health grant he had already received to study facial detection in video via computers.

In his Computational Biology and Cognitive Science Lab, Martinez and his graduate students are reconstructing video into complex 3-D models to sort out the components of various facial expressions. For example, when people sign “wh” questions, such as those that begin with “who” or “why,” they lower their eyebrows so that the person they're talking to can distinguish between a question and a statement. For questions that would require a “yes” or “no” answer, they raise their eyebrows.

Martinez, who collaborates with a linguist from Purdue University on the projects, and his team will design computer algorithms that extract the facial expressions from the videos and then, using pattern recognition, devise hypotheses regarding their meaning. “Once you create the hypotheses and see that they hold true, you know how individual types of grammar rules are encoded on the face, and you can build a computer vision algorithm to recognize American Sign Language and develop teaching courses.”

Contact: Aleix Martinez, 614.688.8225, martinez@ece.osu.edu



Videos of the facial expressions made during American Sign Language enable Prof. Martinez and his students to study ways to translate details into computer algorithms to determine how grammar is encoded on the face.

Excerpt from OSU News in Engineering, Vol. 80, No. 1, 2008.

COLLABORATION WITH NILE UNIVERSITY (NU), EGYPT

During the past year, Nile University (NU), Egypt, started its M.Sc. program in Wireless Technology to support its newly founded Wireless Intelligent Networks Center (WINC). Currently WINC has twenty research assistants and four research faculty working on cutting-edge projects in Cognitive Radios, Wireless Sensor Networks, and Wireless Security.



Prof. El Gamal (center) with Research Assistants at WINC.

The agreement between OSU and NU allows OSU professors to teach courses in the Wireless MSC Program and interact with the local talent.

Professor Hesham El Gamal spent his 2007/08 sabbatical year at NU launching their research and academic activities in the area of wireless communication. A native of Cairo, Prof. El Gamal found it an invaluable opportunity to contribute to the national efforts to build a research and education infrastructure in Information and Communication Technology.

(Continued on page 3)

SOLAR CELLS ABOARD SPACE STATION

Among the cargo items returned to Earth by the space shuttle Atlantis recently was a solar energy conversion device. Steven Ringel, the Neal A. Smith Professor of Electrical Engineering and Director of The Ohio State University Institute for Materials Research, and his team designed special materials for the project, in collaboration with scientists at



the Massachusetts Institute of Technology and NASA Glenn Research Center.

The solar cell -- a device that converts sunlight to electricity -- behaved flawlessly as it was tested by NASA aboard the International Space Station over a 16-month period. The devices were used to do accelerated testing of the team's new technology for space power applications. NASA is interested in Ringel's solar cell technology for the next generation of space vehicles, but the long-term payoff here on Earth could be efficient, affordable solar energy.

Intense research is ongoing to continue the group's pioneering activities to develop so-called third generation III-V/Si solar cell technologies for both space and terrestrial solar energy conversion applications based on concentrating photovoltaics, or CPV. Work on multi-junction III-V/SiGe solar cells and advanced methods to integrate super efficient thin crystalline films with cheap substrates that may maximize PV cell performance and minimize future consumer costs are being explored based on engineering of electronic materials at the nanoscale. The work is being carried out in Ringel's research labs and also through his efforts within the Wright Center for Photovoltaics Innovation and Commercialization that is located at the Nanotechnology West Laboratory on the West Campus of OSU.

Contact: Steven Ringel, 614.292.6904, ringel@ece.osu.edu

(Collaboration with Egypt, continued)

What attracted Prof. El Gamal to Nile University in particular was its commitment to becoming a world-class technological institute. "Its standing as the first private, non-profit university, heavily supported by the government and local community made it an easy decision."

OSU professors who have visited NU were very impressed with the quality of NU students and faculty. This collaboration is expected to enhance OSU's efforts aiming to tap into Egypt's talent pool. Prof. El Gamal added, "The ongoing activities are synergetic with our own research at OSU which should encourage continued collaboration."

Contact: Hesham El Gamal, 614.292.4374, helgamal@ece.osu.edu

Professor Len Brillson:
2006 Gaede-Langmuir Award from
the AVS Science & Technology
Society

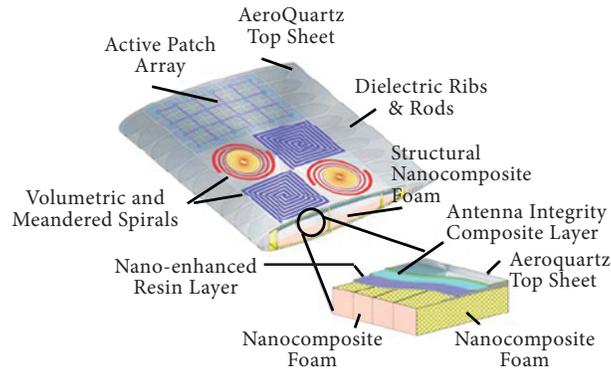
Professor Hesham El Gamal:
Harrison Award - the top award in the
College of Engineering for a
mid-career professor

AFRL INVESTING IN PH.D. STUDENTS FOR THE FUTURE

A major concern to the nation is the aging of the technical work force within the government. It has already been well publicized that a high percentage of the technical personnel in DoD will be eligible for retirement in 10 years. The Air Force Research Laboratory (AFRL) Sensors Directorate is proactively trying to address this problem by funding fellowships for Ph.D. students in the critically important areas of sensors and sensor systems. In 2007, AFRL provided \$700,000 to support 10 fellowships in the Department of Electrical and Computer Engineering at Ohio State. The only requirement for the students is that they must be a U.S. citizen pursuing a Ph.D. in a research area related to sensors or sensor systems. As part of the program, these fellowship students spend part of their summer working at Wright-Patterson Air Force Base collaborating with researchers in the Sensors Directorate.

The initial start of the fellowship program has been a great success. The department was able to recruit ten high-caliber students for the program. Seven of the students are working with faculty members affiliated with the ElectroScience Laboratory. The other three students are working with faculty members in the Institute for Sensing Systems.

Professor Steve Yurkovich:
2008 John R. Ragazzini Award in
Control Education from the American
Automatic Control Council (AACC)



ESL researchers are developing new load bearing antenna technologies for next generation Unmanned Aerial Vehicles (UAVs).

Project highlights include:

- *E-textile (carbon nanotube and Au/Ag coated textiles) printing on polymer substrates*
- *E-fiber weaving in polymer substrates*
- *conformal, load bearing conductors and substrate development for load bearing applications*

\$8.5 MILLION FOR RESEARCH INITIATIVE IN LAYERED SENSING

The Ohio Department of Development and the Chancellor of the Ohio Board of Regents provided \$143 million in grants to strengthen and increase the number of clusters of research excellence in Ohio under the Ohio Research Scholars Program (ORSP). The ECE department was awarded \$8.5 million as part of a multi-University research cluster in layered sensing. Approximately \$4 million (including \$2.5 million for an endowment) will be used to support the hire of a senior faculty member in layered sensing. The remainder will be used to improve the research infrastructure in ECE. The ORSP funding will greatly increase our research capability and allow for greater collaborations between the already strong ECE research groups in wireless/RF, radar, signal processing, and networking.

NEW FACULTY



Ness Shroff

Ness Shroff accepted an appointment as an Ohio Eminent Scholar (OES) in Networking, which is a joint position between ECE and Computer Science and Engineering (CSE). The OES position is considered the top endowed professorship at OSU, and he is the only person in both departments with this designation. His research interests span the areas of wireless and wireline communication networks. He received his Ph.D. degree from Columbia University, NY in 1994. Prior to arriving at Ohio State, he was professor of Electrical & Computer Engineering at Purdue University, and director of CWSA, a university-wide center on wireless systems and applications. Recently, Professor Shroff and his colleagues' research resulted in discovering a new way to combat the most virulent kind of worm: a computer virus that scans the Internet randomly, looking for vulnerable hosts to infect.

Contact: Ness Shroff, 614.247.6554, shroff@ece.osu.edu



Atilla Eryilmaz

Atilla Eryilmaz joins the ECE faculty as an assistant professor. He is an expert in communications networks and comes to OSU after working in the Laboratory for Information and Decision Systems (LIDS) at the Massachusetts Institute of Technology as a postdoctoral associate. His research interests lie in the general area of communication networks with emphasis on sensor and wireless networks; distributed and randomized algorithms; network coding; and the application of optimization theory to network design and analysis. He is particularly interested in the principled development of practical and high-performance network systems based on rigorous mathematical analysis.

Contact: Atilla Eryilmaz, 614.292.7464, eryilmaz@ece.osu.edu



Can Emre Koksalsal

Can Emre Koksalsal, assistant professor, received his Ph.D. from the Massachusetts Institute of Technology and comes to us from the School of Computer and Communication Sciences in Switzerland where he worked as a Senior Researcher. Some of his research interests include wireless communication networking, high speed electronic and optical switches, performance analysis, and financial systems.

Contact: Emre Koksalsal, 614.688.4369, koksals@ece.osu.edu

Emeritus Professor Ben Munk:
2007 John Kraus Antenna Award
from the IEEE Antennas and
Propagation Society

Dr. Jiti Gupta:
2007 Distinguished Achievement
Award given by the Antenna
Measurement Techniques Association

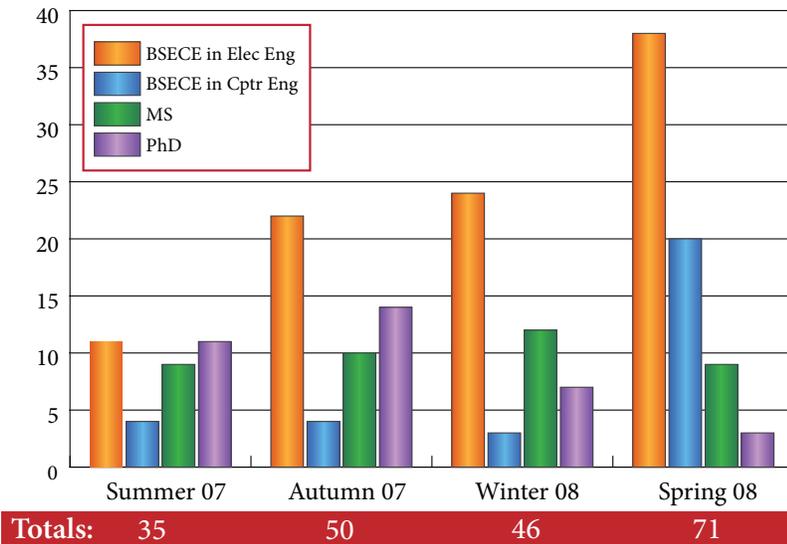


Jin Wang

Jin Wang's current position at OSU as an assistant professor is co-sponsored by American Electric Power, Duke/Cinergy, First Energy, as well as Ohio State. He received his Ph.D. degree from Michigan State University in 2005. Dr. Wang joined Ford Motor Company where he worked as core power electronics engineer in the hybrid electric vehicles (HEV) group and established a state-of-the-art power electronics laboratory for HEV development. His research interests span the areas of power electronics circuits and control, power electronics in hybrid and fuel cell vehicles, and applications of power electronics in power and high voltage systems.

Contact: Jin Wang, 614.688.4041, wang@ece.osu.edu

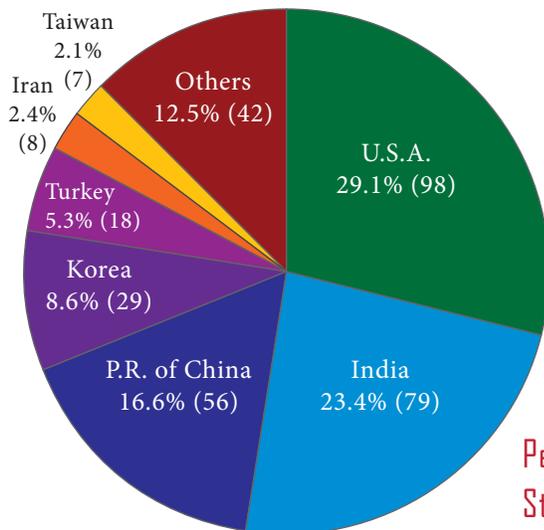
STUDENT STATISTICS



Degrees Conferred
2007-2008

Supported Graduate Students for 2007-2008

University and Industry & ECE Supported Students	
Graduate Teaching Associate	24
Graduate Research Associate	112
Graduate Administrative Associate	2
Presidential Fellowship	2
University Fellowship	9
Industry & ECE Fellowships	20
Total:	169



Percentage of Graduate Students Enrolled by Country

Graduate Student Overview 2007-2008

Number of Applicants	787
Number Admitted	201
Enrolled Students	337
Average GPA Admitted	3.70
Average GRE (verbal)	505
Average GRE (quantitative)	764

DISTINGUISHED ALUMS

Robert S. Chau is an Intel Senior Fellow, the company's highest and most prestigious technical position, and the Director of Transistor Research and Nanotechnology at Intel Corporation. He is responsible for directing research and development in advanced transistors and gate dielectrics, process modules and technologies, and integrated processes for microprocessor applications. He is also responsible for leading research efforts in novel electronic materials and emerging nanotechnologies for future nanoelectronics applications.

Dr. Chau holds more than 120 issued United States patents, has received six Intel Achievement Awards and 13 Intel Logic Technology Development Division Recognition Awards, was recognized by IndustryWeek in 2003 as one of the 16 "R&D Stars" in the United States who "continue to push the boundaries of technical and scientific achievement", and is currently a member of the Board of Directors of the Oregon Nanoscience and Microtechnologies Institute (ONAMI) in the U.S. and a member of the Scientific Advisory Board of the Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN) in Ireland.

He received his B.S., M.S. and Ph.D. degrees, all in electrical engineering, from Ohio State. Dr. Chau has been elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). He was the recipient of the 2003 Alumni Professional Achievement Award from The Ohio State University.

Vyomesh (VJ) Joshi is executive vice president of HP's Imaging and Printing Group (IPG), a \$28 billion annual business that encompasses Inkjet, LaserJet and commercial printing, printing supplies, digital photography, entertainment, web and software services, graphics and managed services.

In the last five years under VJ's leadership, IPG has grown revenue from \$19 billion to \$28 billion and doubled the operating profit to \$4 billion. VJ, a



Robert Chau



Vyomesh Joshi

Chau and Joshi each received a Distinguished Alum Award in 2007 and 2008, respectively. The award recognizes distinguished achievement on the part of alumni in the field of engineering or architecture by reason of significant inventions, important research or design, administrative leadership, or genius in production.



Vineet Arya

Arya received the Texnikoi Award in 2008 - given to an alum who has risen rapidly in the field of engineering, who has made outstanding contributions through civic and social activities, and is approximately 40 years of age or under.

passionate and respected industry leader, spearheads HP's drive to become not merely the world's premier printer company, but the world's premier printing company.

VJ joined HP in 1980 as an R&D engineer, and has held various leadership positions. He holds a master's degree in electrical engineering from Ohio State university. He has been a member of the Yahoo board of directors since 2005.

HP has been the worldwide market leader in printing since introducing its first inkjet and LaserJet printer. HP leads the imaging and printing intellectual property portfolio with more than 12,500 patents worldwide.

Vineet Arya is a two-time graduate of OSU, with a bachelor's degree in Electrical Engineering in 1993 and a master's degree in business administration from the Fisher College of Business in 2000. Vineet is the founder and Chief Executive Officer of Everest Technologies, an IT consulting company that provides software design, architecture, development, testing and implementation services, based in Worthington, OH.

Vineet leads the overall strategic business direction and lends oversight to Everest's daily operations. His devotion to building strong, long-lasting customer relationships is the foundation of Everest's business philosophy. His extensive experience as an IT consultant, IT manager and IT executive is a key factor in the success of Everest Technologies.

For over a decade, Vineet has been responsible for supporting technology initiatives in the areas of E-Commerce, Supply Chain Management, Logistics and Distribution. His work includes the design, development and implementation of several mission critical systems for clients such as Gap, Limited Brands and J.Crew. He has served in many technical and management roles for leading retail industry clients including serving as CIO of J.Crew, leading the turnaround of its IT department.

STUDENTS EXCEL IN DESIGN COMPETITION

The Texas Instrument (TI) Analog Design contest was initiated in the 2006-2007 school year among 10 universities that were chosen by TI to launch the contest. The OSU ECE department was one of the first year schools. In that year, ECE had 10 teams enter the competition, the most of any university. A first place prize of \$3000 was given to each university, judged by TI engineers and their contractors. At OSU, the prize was awarded to team Accel3D – whose project demonstrated a wireless sensor network node that used a 3D-axis accelerometer. Andrew Milley was the lead designer for the Accel3D team, and was also offered an internship at TI. He returned from TI to become a graduate student in ECE and a teaching assistant for the senior project course for next year's contest.

In the second year of the TI Analog Design Contest, the number of schools doubled and the North American schools also competed against each other for first, second, and third place prizes of \$10,000, \$7500, and \$5000, respectively.

In addition, at each school there was a first and second place prize of \$1500 and \$500, respectively. The first place OSU prize went to team Golden Icarus, which developed a wireless and

Learning the Basics Hands-on



ECE has been developing hands-on projects that can be done by high school students in a reasonable amount of time. Here, one student is completing an LED circuit that lights up her initials. The students consider engineering tradeoffs such as high brightness v. battery life. The circuit is very easy to debug, making it a satisfying experience.

solar powered airplane runway lighting system that could be set up in any remote area large enough to land planes.

Team Golden Icarus later received third place when they competed at TI Dallas against all the other first place teams from the North American competition - now called the Engibous Prize. The lead designer for Team Golden Icarus, Matt Anker, now works for Cessna Aircraft Company.

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