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Dear Alumni and Friends:

This is the third annual ECE UConnection newsletter published by the Department of Electrical & Computer Engineering at the University of Connecticut. A chief purpose of this publication is to summarize the achievements and activities of the students and faculty of the ECE Department during the past academic year. In this issue, we report briefly on student activities, faculty accomplishments, undergraduate research, and accreditation groundwork.

As you know, our undergraduate programs are accredited every six years by the national Accreditation Board for Engineering and Technology (ABET). ABET reviewers will once again assess our programs in fall 2007—an event we are now planning for. Preparations are ongoing, with self-study reports being drafted for a mock visit by invited evaluators in spring 2006. A key factor that ABET reviewers will consider is whether we have implemented measures to ensure continuous program updates and improvements. In fact, considerable reformulation of engineering curricula and educational practices is of growing importance as the profession evolves with the changing landscape of the new century. As discussed in “The Engineer of 2020,” a publication of the National Academy of Engineering, it is necessary to proactively improve engineering education for the technological and societal challenges ahead. Multidisciplinary and interdisciplinary education and teaming will be of growing value, and practicing engineers increasingly will require leadership skills and business acumen, as well as superb command of engineering basics and exposure to emerging technologies such as nanotechnology, bioengineering, and information technology.

The engineering professions are changing at an ever-accelerating pace due to technological changes and the emergence of a global economy. As 21st century innovators, engineers will have to be more agile; greater emphasis will be placed on critical thinking, research, and life-long learning. In addition, to adequately train this agile class of engineers, educational institutions will require stronger connections to industry, including industry mentors as well as more extensive industry sponsorship of capstone design projects than currently is practiced. The rapidly changing marketplace for engineering products places greater importance on small and startup companies, which can innovate more quickly than large corporations. Therefore, engineers need to possess strong analytical skills, be inventive and professional, and have solid command of hardware and software tools of the trade. We have recently updated and enhanced our curricula to address some of these issues with the goal of providing better, more relevant education for our graduates.

Superbly trained engineers are the cornerstone of the nation’s and, indeed, Connecticut’s competitive edge in innovation, design and manufacturing. This obviously requires that we hire and retain outstanding faculty and maintain high-quality facilities and laboratories. Only prudent investment in engineering education and associated resources will ensure economic superiority.

As always, I welcome your comments. Please send me email at Robert.Magnusson@uconn.edu with your comments and suggestions. The departmental website provides additional information and I invite you to browse it at www.engr.uconn.edu/ece/.

Sincerely,

Robert Magnusson

Robert Magnusson
Professor and Head, Department of Electrical & Computer Engineering
Robert.Magnusson@uconn.edu
(860) 486-3410
Undergraduate Research Enlivens Educational Experience

As educators, we are always looking for ways to transform traditional learning methods into stimulating and deeply meaningful educational experiences. Within the ECE Department, we strive to enhance learning for our undergraduates by involving our students in cutting-edge research. Among the research areas making waves in the scientific and engineering arenas is nanotechnology, a rapidly evolving discipline expected to strongly influence our understanding of, and ability to manipulate, engineered systems in diverse areas—from medicine and sensing to military uniforms. Through a National Science Foundation (NSF) grant awarded under the Nanotechnology Undergraduate Education (NUE) program, a multidisciplinary team led by professor Faquir Jain is immersing B.S. students in the fundamentals of nanotechnology. Dr. Jain developed a new course, ECE 295 Nanoscience and Nanotechnology, to introduce nanotechnology to ECE students.

On the research side, the ECE Department is introducing undergraduates to research in ECE topics under a second NSF-funded program, Research Experiences for Undergraduates (REU), with professor Eric Donkor overseeing the program. The REU program entails two major prongs: a summer program that brings non-UConn college students to campus, and an academic-year portion that focuses on UConn engineering students. The novel program affords undergraduates an opportunity to collaborate with faculty and graduate students in cutting-edge research.

Faculty Lauded with Numerous Awards

As in previous years, during 2004-05 our ECE faculty received numerous honors for their impressive contributions to research and teaching. Yaakov Bar-Shalom was named the Marianne E. Klewin Professor in Engineering; Eric Donkor was elected a Fellow of SPIE; John Enderle was elected a Fellow of the Biomedical Engineering Society and also received the 2004 Engineering in Medicine and Biology Service Award; Bahram Javidi received the IEEE Lasers and Electro-optics Society Distinguished Lecturer Award as well as the coveted Dennis Gabor Award in Diffractive Wave Technologies from SPIE; the International Society for Optical Engineering; Peter Luh received the IEEE Robotics and Automation Society Award of Appreciation for Valued Services and Contributions as Editor-in-Chief of the IEEE Transactions on Robotics and Automation; Robert Magnusson was elected to the Connecticut Academy of Science and Engineering; Krishna Pattipati received the Walter E. Peterson Award for Best New Technology Paper at the IEEE AUTOTESTCON and the Best Technical Paper Award at the Command and Control Research and Technology Symposium; and finally, Geoff Taylor was awarded six patents for his inventions in the area of optoelectronics. The School of Engineering honored two of our faculty with awards for excellence in teaching and overall academic achievements. Krishna Pattipati was presented the 2005 Outstanding Teaching Award for the School of Engineering, in recognition of his instructional ingenuity and commitment to excellence in teaching. Additionally, Quing Zhu was presented the 2005 Outstanding Junior Faculty Award for the School of Engineering in recognition of her scholarly achievements in sustaining high quality research, teaching and service. Her area of research involves applications of ultrasound and optical tomography to enhance breast cancer diagnosis. Drs. Pattipati and Zhu each received a cash award of $2,000 and a $5,000 grant for professional development.
A Record Crop of Grads in 2004-05

During the 2004-05 academic year, the ECE Department graduated its largest undergraduate class in a decade, at 55 students. ECE students enjoy the luxury of three possible B.S. options during their undergraduate years: Electrical Engineering (EE), Computer Engineering (CompE, offered jointly with the Computer Science & Engineering Department), and Engineering Physics (offered jointly with the College of Liberal Arts & Sciences). In fall 2004, 127 students were enrolled in Electrical Engineering, 62 in Computer Engineering, and 6 in Engineering Physics. During the year, the department awarded 39 degrees in EE, 15 degrees in CompE, and 1 in Engineering Physics.
The Cyberlab was established in 1976 to provide an environment for specialized theoretical and empirical research that centers on the field of systems, in general, and on those having human components, in particular. Under the direction of professor Krishna Pattipati, the Cyberlab is home to research in the application of systems theory and optimization techniques to adaptive organizations, wireless communications, fault diagnosis and prognosis, and multi-sensor surveillance. The lab has received significant funding support from agencies and companies such as the Office of Naval Research, NASA, Toyota, DARPA and Aptima.

The Cyberlab is equipped with state-of-the-art computing facilities, including networks and high-speed computers with sophisticated software. Since 1990, the laboratory has been conducting research on 2-7 person teams using a unique distributed dynamic decision-making (DDD) simulator. The DDD simulator assists military decision-makers by visualizing and sharing information in highly uncertain battlefield environments. It employs an intelligent agent with embedded optimization-based organizational decision processes to provide decision support to commanders. The agent-based decision support system (DSS) provides mission monitoring and planning to manage information and facilitates rapid knowledge transfer among decision-makers.

Recently, the agent-based DSS was used to evaluate future technologies in a DARPA project termed "Security and Patrolling Enablers Yielding Effective SASO (SPEYES)" system. The purposes of the SPEYES system are to characterize the challenges faced by U.S. troops in performing stability and security operations (SASO) and to investigate whether a collection of emerging technologies integrated within a SPEYES system can provide a force multiplier needed to establish the desired virtual troop presence in a hostile environment. To demonstrate the SPEYES force multiplier concept, the research is focused on conducting trade-space analyses and agent-based DDD simulations that account for multiple SASO scenarios in post-conflict regions.

Cyberlab researchers also perform cutting-edge research in the area of fault detection and isolation in complex engineering systems. Representative applications include the non-toxic orbital maneuvering and reaction control system of the space shuttle, fixed-wing aircraft flight-control systems, and distributed diagnostic architecture for automobiles. The lab has developed an integrated diagnostic process that combines quantitative models of fault behavior as well as graphical dependency models for real-time fault diagnosis.

Other research carried out in the Cyberlab involves the modeling of asymmetric threats. Cyberlab researchers have developed a system known as the adaptive safety analysis and monitoring (ASAM) system, a tool for advanced counter-terrorism analysis designed to predict intent and future states of terrorist activities, and to suggest actions to prevent terrorism. Using the ASAM system, an intelligence analyst can build, test and analyze potential threat scenarios.
Students Get Involved

The UConn student branch of the Institute of Electrical & Electronics Engineers (IEEE) organized a number of professional, service, and social activities during the 2004-2005 academic year. Movie nights and two picnics were well-attended and brought together students, staff, and faculty. In addition, throughout the year, the IEEE held tutoring sessions every Wednesday night that served large numbers of students, especially those taking Electric Circuits and Signals & Systems. The IEEE student chapter also arranged plant trips to the Connecticut State Department of Transportation Research Laboratory and Hamilton Sundstrand; both trips enhanced the participants’ understanding of how classroom concepts are transformed in the commercial and public sectors. Associate professor and Associate Department Head, John Ayers, served as the IEEE faculty advisor during the year. The current IEEE advisor is Yunsi Fei.

Industrial Advisors Share Insights

Engineering education cannot—and rarely does—exist in a vacuum. At UConn, we take great pride in involving diverse groups in the educational process. Among the most important segments of our constituency is the ECE Industrial Advisory Board (IAB), a respected and accomplished team of external advisors from industry, which meets with the department to review educational goals, curricula and courses, and strategies. The IAB feedback is invaluable toward our maintenance of high-quality, relevant programs that ensure graduates possess the skills and aptitudes that employers demand. The IAB also serves another role, in helping our accreditation reviewers ascertain the quality of our B.S. programs.

As practicing engineers employed at companies throughout the region, our IAB members bring impressive expertise and experience to their advisory roles. In addition, their companies provide internship opportunities for our students and often hire them permanently. Past and current IAB members include individuals from SNET, ATMI, the Naval Undersea Warfare Center, Pratt & Whitney, United Technologies Research Center (UTRC), Pitney Bowes, Phonon Corporation, Sikorsky Aircraft Corporation, General Electric Company, JDS Uniphase, Aptima, TranSwitch, and Hamilton Sundstrand.

Electromagnetics Course Attracts Huge Enrollments

In fall semester 2004, there were 20 students enrolled in ECE 205 Electromagnetics, a course required for EE students but not for CompE students. In fall 2005, the enrollment bloomed to 45 students. An informal class survey led instructor Rajeev Bansal to state “Many roads lead to EE!” Out of 40 returned surveys, only 18 students started out as EE majors at the Storrs campus. The rest transferred from the regional campuses, other institutions, or converted to EE from other UConn engineering departments or from non-engineering programs. We welcome all these students to EE.

IEEE Officers and Advisor

Pictured from left to right, Wellicor Sorsor, Benjamin Fishman, Emily Heuer, Steven LaBarre, Yunsi Fei, student group advisor, and Christopher Ambler.
Doctoral candidate **Yiwu Ding** received his M.S. in electrical engineering from the University of Texas at Arlington, where he researched device-level packaging for high-performance computers and engaged in photoluminescence characterization of GaAs/AlGaAs quantum-well structures. As an electrical engineer in the R&D division of Alcatel Optronics, which he joined in 2001, he played a major role in the development of compact transceivers, optical add-drop modules, and subsystem modules integrating fiber Bragg gratings and arrayed waveguide gratings. He left Alcatel to pursue doctoral studies at UConn in 2002 and received a three-year fellowship as an outstanding scholar. In March 2004, Mr. Ding became a doctoral candidate and was awarded a doctoral dissertation fellowship.

His research work is in the area of nanophotonics and diffractive optics, with a focus on rigorous electromagnetic analysis and design of dielectric and metal-dielectric micro/nano structures. These structures have applications in optical filtering, optical bio- and chemical sensors, optical communications and imaging. This research, which is funded by the National Science Foundation, has resulted in more than 15 technical publications and presentations, and one patent disclosure. Mr. Ding has served as a reviewer for Applied Optics, Optical Engineering and Applied Physics Letters. He is a member of Sigma Xi, Optical Society of America and the IEEE Lasers and Electro-Optics (LEOS) Society.

**Angel Rodriguez** received his B.S. and M.S. degrees in electrical engineering from the University of Connecticut in 1998 and 2001, respectively. He is completing his doctoral studies at UConn and has accepted a position with Intel Corporation. He has conducted research on various material systems, which are used in fabricating electronic-photonic devices. In particular, he has worked on growth reactors including photo-assisted microwave plasma MOCVD (II-VI Nano-crystal growth), high vacuum organic-MOCVD, Ge VPE, and, Si-Ge MOVPE. He has conducted characterization of II-VI semiconductor materials using photoluminance, x-ray diffraction techniques, AC Hall effect; and, C-V and I-V measurements.

Mr. Rodriguez also has served as a teaching assistant in various courses, including ECE 266 Microprocessor Laboratory; ECE 268 Micro/Optic Electronics Laboratory; ECE 261 Analog Electronics Design Laboratory; and ECE 291 Senior Design. While working toward his M.S. and Ph.D. degrees, he was an NSF Graduate Student Fellow collaborating with local secondary school science, mathematics and technology teachers to develop engineering modules that parallel their current curricula and match Connecticut state frameworks. His efforts involved development of lessons that capitalized on engineering to demonstrate concepts; classroom instruction in engineering and the engineering design process; and development and execution of monthly teacher/fellow workshops. He also served as a math instructor for the summer Bridge program, a component of the Engineering Diversity Program, and as a ninth grade team leader.

Mr. Rodriguez has received scholarships from Pratt & Whitney and the National Society of Hispanic Engineers; awards from CMOC for both the Undergraduate Student Best Paper and the Graduate Student Research Prize; and on two occasions, the Electrical & Computer Engineering Research Fellow. His research has resulted in more than 15 technical publications and presentations. During his academic career, he also was an IEEE graduate advisor, member of the Martial Arts Club, president of the Ballroom Dance Club and an instructor in ballroom dancing.
Preparations for the Accreditation Board for Engineering and Technology (ABET) visit in 2007 are in full swing. The ECE faculty has worked hard to significantly enhance the curricula in both Electrical Engineering and in Computer Engineering. By streamlining the curricula, eliminating redundancies, and integrating labs and lectures as appropriate, the undergraduate programs now require 126 credit hours for graduation instead of the 134 credit hours required in previous years. It is now realistic to expect students to complete these programs in four years. Increasingly, over time it was observed that students required 4 1/2 years to graduate under the 134-hour requirement.

To achieve accreditation, programs strive to attain certain Program Educational Objectives (PEOs) as well as Program Outcomes. The meaning of these is often confused. In brief, Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to (subsequently) attain. Program Outcomes are statements that describe what students are expected to know or be able to do by the time of graduation from the program. The Program Outcomes prepare the graduates to attain the PEOs.

The proposed, updated EE/CompE Program Educational Objectives, incorporating feedback from our Industrial Advisory Board, are as follows:

1. Our alumni will make technical contributions to design, development, and manufacturing in their practice of electrical engineering/computer engineering.
2. Our alumni will demonstrate professionalism and a sense of societal and ethical responsibility in all their endeavors.
3. Our alumni will engage in professional development or post-graduate education to pursue flexible career paths amid future technological changes.

The EE/CompE Program Outcomes to be used for the 2007 visit are identical to the ABET a-k criteria:

a) an ability to apply knowledge of mathematics, science, and engineering;

b) an ability to design and construct experiments, as well as to analyze and interpret data;

c) an ability to design system, component, or process to meet desired needs;

d) an ability to function on multidisciplinary teams;

e) an ability to identify, formulate, and solve engineering problems;

f) an understanding of professional and ethical responsibility;

g) an ability to communicate effectively;

h) the broad education necessary to understand the impact of engineering solutions in a global and societal context;
i) a recognition of the need for, and an ability to engage in life-long learning;

j) a knowledge of contemporary issues;

k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Continuous assessment and improvement processes are in place to retain program quality. These include feedback from program constituents, who are the students, faculty, alumni, employers, and the Industrial Advisory Board. The assessment processes quantify the extent to which the EE/CompE graduates achieve the Program Outcomes and permit us to improve the programs based on the assessment results. For example, assessment measurements—including senior design evaluation, exit interviews with graduating students, alumni surveys, and employer surveys—demonstrate that our graduates achieve the Program Outcomes and that our programs meet the stated PEOs. The assessment processes presently applied in ECE are illustrated in the following schematic.
Our faculty members are on the technological cutting edge, conducting externally-funded research in exciting fields such as systems and manufacturing, microelectronics, biomedical engineering, optoelectronics, electromagnetics and photonics, and VLSI computer engineering. A highly visible result of our research is the department’s output of scholarly papers appearing in technical journals and presented at professional conferences. Via publications and presentations, faculty share their scholarly research with peers working in other educational institutions, research centers and businesses—thereby extending the impact of their work and enhancing the department’s scholarly reputation.

During academic year 2004-05, the ECE faculty published a combined total of 78 refereed journal articles, four books, 13 book chapters, and 117 full conference proceedings papers. We also developed nine software packages, offered numerous professional short courses, were keynote speakers at 11 international conferences, and delivered 32 invited talks. Our faculty were actively involved in nearly 100 sponsored research projects with annual expenditures approaching $4.7 million.

Another important responsibility of academicians is the training of future teachers and research professionals: acting as advisors guiding the scholarly work of their graduate students, the ECE faculty advised 124 master’s and doctoral degree students during 2004-05. Of these, seven successfully completed their Ph.D. degrees and 19 students garnered their M.S. degrees. Our faculty also contribute their time as editors of technical journals: they held nine major journal editorships during 2004-05; 34 associate editorships or conference chair posts; and 24 editorial or conference-planning appointments.

Clearly, ECE faculty members are busy individuals who are making significant contributions to research, teaching and their professions.
ECE Students Excel

The quality of UConn engineering students has steadily risen in recent years, and ECE students are among the best. The University employs various measures for judging academic excellence, including the Dean’s List. Each school or college sets the minimum GPA needed to qualify for the Dean’s List based on the academic rigor of their programs. In the School of Engineering, to earn a berth on the Dean’s List a student must earn a GPA of 3.457 or higher. In spring 2005, the ECE Department was deeply gratified to recognize 40 of 126 Electrical Engineering undergraduates who achieved the distinction of having made the Dean’s List, a very high proportion at nearly 33% of enrolled EE students.