

TRANSMISSIONS

Electrical **and/or** Computer Engineering



In the last newsletter I suggested that much of the future for electrical and computer engineering lies in the “information engineering” area. Regardless of whether this term ever comes to identify a new academic discipline, I would like to suggest

that a somewhat older term, “computer engineering,” occupies an important place in this transition period. It seems that the traditional term “electrical engineer” is often misunderstood, and that this misunderstanding is becoming broader and more significant than it was in the past. In part, this is true because there are more alternatives to electrical engineering, including computer engineering, computer science, and (at least, popularly) information technology. In the past the term “electrical engineer” may not have been well understood, but it was clear by elimination that a person with this title was the one to do something such as “design a high-speed communications system.” If we now ask, “Who designs and oversees the implementation of the physical infrastructure of the Internet?” I think we would receive a very wide range of answers, including electrical engineers, computer engineers, computer scientists, “IT people,” and quite a few “I don’t know” responses.

For the past decade, we have been the Electrical and Computer Engineering department, delivering the bachelor’s degree of Electrical Engineering. The ECE faculty have now concluded that we should change the title of our B.S. program to Electrical and Computer Engineering (with some appropriate content changes). This seems to be the best term to represent the profession today. It is a very broad term, but we believe

that at the undergraduate level, a broad program that spans from electromagnetics to microprocessors, and from signal theory (both continuous and discrete-time) to physical electronics is appropriate.

A search of the ABET Web site indicated that only four accredited ECE programs exist in the United States. Why so few? My guess is that a major reason is that under past accreditation criteria, separate requirements existed for electrical engineering and for computer engineering, so that in a combined program students were required to satisfy both sets of requirements. Recently ABET, the accrediting agency for all of engineering (and now for Computer Science also) adopted “Engineering Criteria 2000,” which addresses outcomes rather than specifying curricular components. The new criteria for “Electrical, Computer, and Similarly-named Engineering Programs” allow considerable flexibility in designing an ECE major. An ECE program must include breadth across both hardware and software issues, and advanced mathematics, including discrete math.

What about the depth vs. breadth question? We believe that it is appropriate for an undergraduate engineering program to be quite broad, and that the M.S. level is the place for specialization. Perhaps more important, we believe that a high-quality electrical engineering program must include a significant amount of computer engineering, and that a high-quality computer engineering program must include significant electrical engineering outside the computer engineering area. Computer engineering is simply integral to the rest of EE. For example, we no longer accomplish signal processing by designing analog circuits; we do it by designing highly specialized code that runs on specialized computers (DSP chips). Similarly,

Four New **Colleagues**

Donald R. (Rick) Brown, assistant professor of ECE, brings important strengths to our communications and computer networks area, with interests and accomplishments in wireless multiuser systems and channel equalization. He has published extensively in these areas. Rick received his B.S. and M.S. degrees in EE from the University of Connecticut in 1992 and 1996, respectively, and his Ph.D. in EE from Cornell University in 2000. He has substantial engineering experience with several divisions of General Electric, as well as with Applied Signal Technology in Sunnyvale, Calif. While at Cornell, Rick received the IEEE Teaching Assistant of the Year award.

Edward (Ted) Clancy joins us as assistant professor of ECE after experience in industry. Following graduation from WPI (BSEE '83), Ted completed his M.S. ('87) and Ph.D. ('91) at MIT in the interdisciplinary area of electromyography. His doctoral thesis is titled "Stochastic Modeling of the Relationship Between the Surface Electromyogram and Muscle Torque." Since 1991 he has been performing research and publishing in this and related areas at Colin Research America, Aspect Medical Systems and Liberty Mutual Research Center. Back at WPI, Ted will combine these research interests with teaching in the computer engineering and signal processing areas.

Sergey Makarov, associate professor of ECE, has a distinguished set of accomplishments in his

career to date, including a full professorship at St. Petersburg State University (the youngest full professor on the faculty). Prior to his tenure-track appointment at WPI, Sergey worked closely as a visiting scientist with Reinhold Ludwig and Diran Apelian in the application of electromagnetic fields to materials processing and testing. Sergey's rich experience at the interface of mechanical and electrical engineering and mathematics has already produced substantial accomplishments. His education includes M.S. and Ph.D. degrees in applied math, in 1982 and 1986, and the Dr. Sc. in mathematics and mechanics in 1995, all from St. Petersburg State University, Russia.

Berk Sunar, assistant professor of ECE, joins us from Secured Information Technologies Inc., where he has been designing secure e-commerce solutions and electronic payment systems since receiving his Ph.D. degree. His interests range from cryptography to network security to high-performance computing. Particular expertise involves algorithms and hardware implementations for fast and efficient encryption/decryption on commercial microprocessors. Berk's doctoral dissertation is titled "Fast Galois Field Arithmetic for Elliptic Curve Cryptography and Error Control Codes." His education includes a B.S. degree in EE from Middle East Technical University, Ankara, Turkey, in 1995 and a Ph.D. degree in EE from Oregon State University in 1998.

(Continued from page 1)

computers are nothing more than sophisticated, high-frequency, high-performance electric (actually electromagnetic) circuits, with all that is implied about the underlying electrical engineering knowledge required for their design.

This new ECE major has been approved by the ECE faculty, and is awaiting WPI faculty approval. When the new program is in place and accredited,

we plan to eliminate the EE major. The ECE faculty believe that this new major will serve our students well as our profession moves further into the "Information Engineering" age. I would really like to hear your thoughts. Please email me at orr@wpi.edu.



John A. Orr, Department Head



Brown

Clancy

Markarov

Sunar

Whitmal

Satin Fellow

The Joseph Samuel Satin Faculty Fellowship for 2000-01 was presented to Professor **Nathaniel Whitmal III** at the annual ECE faculty dinner last May. Nate came to WPI in the fall of 1999 from DePaul University. He earned his PhD in electrical engineering and computer science at Northwestern University where he also received the M.S. degree. Previously, he earned a master's degree in engineering management at the Gordon Institute of Tufts University and a bachelor's degree in electrical engineering and computer science at MIT. Nate began his career at Bose Corporation. His research interests are in digital signal processing, specifically in speech intelligibility enhancement.

This year Nate has introduced a new undergraduate course in real-time digital signal processing, which has proven to be extremely popular with students. It is taught in the studio format, where lecture and laboratory work are fully integrated, providing close coupling between signal processing theory and its implementation on DSP chips.

The Satin Award was established in 1982 to recognize faculty for both early success and future promise in teaching and scholarship. Endowed by an ECE alumnus, it includes significant funding to support the teaching and scholarly work of the recipient. It has played a major role in the success of many of the department's current faculty.

Newell Award

The 1999-2000 Hobart Newell Award for Outstanding Contributions by an ECE graduate was awarded to **John Petrillo '71**, executive vice president for corporate strategy and business development at AT&T. John joined AT&T in 1971, received his J.D. from Brooklyn Law School in 1976, and has held a variety of management positions within the company; he was appointed to his current senior management position in 1997.

The award is named for the late Hobart H. Newell, who joined the WPI EE faculty in 1921 and introduced modern electronics to the electrical engineering curriculum during his 44 years as a professor of electrical engineering. Previous recipients include William R. Grogan '46, Paul A. Allaire '60, Ronald L. Zarrella '71, Robert E. McIntosh Jr. '62, John Lott Brown '46, Donald H. Foley '66, Richard Freeman, Peter B. Myers '46 and Alfred A. Molinari Jr. '63.

Faculty Notes

Professor **Kaveh Pahlavan** was named a Nokia Fellow for 1999 and continues as editor in chief of the *Journal of Wireless Information Networks*.

Professor **Alex Emanuel** received the John Mungenast International Power Quality Award for 1999.

Professor **James Demetry** retired to professor emeritus status, effective January 1, 2000.

Professor **Len Polizzotto** was appointed (half time) to the newly created position of director of the Center for the Globalization of Technology.

Professors **Len Polizzotto** and **Nate Whitmal** were selected for the New Century Scholars program at Stanford University, a weeklong series of workshops in the summer of 2000.

Professor **David Cyganski** was selected as the Weston Hadden Professor of ECE.

Professor **John McNeill** was chosen by the ECE students as the Eta Kappa Nu Outstanding Professor of the year.

Major IEEE Award

WPI President (and ECE professor) **Edward Alton Parrish** was chosen to receive the Institute of Electrical and Electronics Engineers (IEEE) Educational Activities Board's Meritorious Achievement Award in Accreditation Activities. The award was presented at the IEEE Meeting Series in Tampa, Fla., Nov. 17, 2000.

Last July marked the fourth year for Camp REACH, founded in 1997 by ECE Professor Denise Nicoletti for Massachusetts girls who have completed sixth grade and who are interested in learning about engineering and technology. Camp REACH (Reinventing Engineering And Creating new Horizons) was created with a grant from the National Science Foundation and is now assisted by corporate supporters. The two-week residential program, which has received nationwide recognition and press coverage, involves campers in using science and technology to accomplish real-world projects. Thirty campers participated in Camp REACH last summer.

Theory and Practice of **Design**

A new course, Electrical and Computer Engineering Design, has just been added to the curriculum. The goal of this course is to teach our students the process steps associated with designing new products, as well as the business implications of the decisions they make. The course is typically taken at the end of the sophomore year or beginning of the junior year, so that students will be better prepared to apply the principles of engineering design in their MQPs. At the first course meeting the instructor tell the students, "You now work for my company; I will be your supervisor."

Groups, consisting of three students each, are selected by the supervisor, and are assigned a project. Each group must design and build their specified device following the design process steps. Example devices include digital scale, electronic torque wrench, jump height indicator and altimeter. Students learn how to complete the following steps: 1) performance of market research to determine what customers want; 2) development of customer requirements; 3) development of product requirements; 4) determination of detailed product specifications; 5) analysis of competitive products; 6) design for manufacturing; and 6) analyzing return on investment. At the end of the term, the groups must formally present and demonstrate their projects to the CEOs (outside guests) and convince them to 'fund' their projects.

Class lectures focus on the design process steps; lab time concentrates on individual designs, ordering parts, and building working units. Each project contains electrical engineering components, including a sensor, A to D conversion, micro-processor control and display readout, as well as a mechanical aspect. The course is team-taught by two or three faculty, who provide a range of expertise and sufficient student-faculty contact to accomplish ambitious goals. After the first offering of the course, both faculty and students were exhilarated and a little exhausted. Everyone agreed that ECE Design merits a permanent and central place in the ECE curriculum.



Camp REACH participants make use of chemistry lab facilities in Goddard Hall.



Students test launch rockets designed from a kit of simple parts, including soda bottles.

Alumni Notes

Three receive awards

The WPI Alumni Association recognized three ECE alumni at Reunion 2000 with major awards.

David Cyganski, BSEE '75, MSEE '76, Ph.D. '81, received the Robert H. Goddard Award for Outstanding Professional Achievement. Dave is a professor in this department. A portion of the citation reads, "As a teacher, you are renowned for your enthusiasm and your dedication to helping students develop a passion for learning. As a researcher, you are known for your wide-ranging interests and for the elegance of your methods."

Paul V. Bergantino, BSEE '85, vice president of technology and architecture at Conexant Broadband Internetworking Systems received the Ichabod Washburn Young Alumni Award for Professional Achievement. Paul's citation reads in part, "Your innovative microchip architecture has set a new benchmark for success in the field of network communications."

Jonathan L. Bird, BSEE '90, founder and president of Oceanic Research Group Inc., received the Ichabod Washburn Young Alumni Award for Professional Achievement. He has received two Emmy awards for television and film work and a host of other prestigious awards. Jonathan's citation includes the statement, "Your spectacular photography has touched millions of viewers and readers and taught them to treasure the beauty that lurks beneath the sea."

Advisory Board adds new member

The ECE Advisory Board meets twice yearly to provide an external perspective from both the corporate and academic worlds. The board and provided invaluable advice throughout the recent ECE strategic planning process. The newest board member is **Jeffrey W. Gwynne**, MSEE '84, vice president for marketing at Quantum Bridge Corp. Jeff received his B.S. in physics from Bowdoin College. After graduating from WPI, he spent 12 years at AT&T in the broadband area, and later co-founded IPA Technologies.

Jeff was one of the founders of Quantum Bridge, a recent startup company in the optical networking area, specifically targeting the "last mile" for high-speed business connectivity. His experience in entrepreneurship, high-tech startups and optical networking all represent important additions to the breadth of expertise represented on the ECE board.

Campaign Update

At the end of 2000, *The Campaign for WPI* had generated nearly \$100 million in cash and pledges, or two-thirds of the \$150 million it hopes to raise by June 30, 2003.

While WPI has traditionally relied on many people who have "always been there," a new generation is now stepping forward to take its turn. This includes many recent graduates who have achieved success in the new economy.

A very visible sign of the campaign is the campus center, which is nearing completion. Scheduled for opening in the spring, it represents a dream come true for generations of students. The center will also provide some help in alleviating the major space crunch on campus, with substantial multipurpose meeting room space.

Students will benefit directly from the large amount of scholarship support that has been received, and many other opportunities exist to support ECE via the campaign. As an example of past philanthropy, the Satin Faculty Fellowship (see page 3) provides an example of endowed alumni support that has major continuing impact on the department. For more information about ECE-specific campaign opportunities, contact John Orr at 508-831-5273 or orr@wpi.edu. For general information about *The Campaign for WPI*, call 508-831-5611, visit www.wpi.edu/Campaign/, or e-mail campaign@wpi.edu.

The second annual Workshop on Cryptographic Hardware and Embedded Systems (CHES), organized by Professor Christof Paar, was held on campus last August. The 1999 workshop, also at WPI, attracted more than 170 computer-security experts, half from outside the United States; in 2000, more than 200 attended. The specific focus of this conference is of growing importance, with the rapidly increasing use of wireless data transmission to and from small devices. This situation creates the need for rapid encryption and decryption algorithms running on small, low-powered devices. Security experts gathered from around the world to learn about and discuss real-world system and design issues. In 2001 the conference moves to Paris, with the continued involvement of Professor Paar.

Where's the **Button**?

Many cities have added audible signals to walk lights to assist the vision-impaired in crossing streets. However, there has been one remaining problem: how do the blind find the buttons that are often used to activate the walk signals?

This simple question led Professor **Len Polizzotto** and four students to explore the intersection of technology and social needs that defines our Interactive Qualifying Project program. The project team includes three electrical engineering students, **Matthew Geiger '02**, **Brian Laplume '03**, and **Jeremy Lynch '01**, and one physics student, **Rabin Tamang '02**.

While the technology (a small radio transmitter and pole-mounted receiver and audible alerter) is important, it is the work with the sight-impaired community and the relevant city agencies that made this IQP a valuable educational experience. The students demonstrated their system at a downtown Worcester street corner to Worcester City Manager Thomas Hoover, with testing performed by Lawrence Raymond, Worcester's assistant director of human resources, who is blind.

The demonstration was successful, and funding for the production and installation of a set of prototype systems is now being sought. The project advisor is Len Polizzotto professor of the practice of ECE, and director of the Center for the Globalization of Technology.



From left, Cetin Koc (Oregon State University) and Christof Paar (WPI) with Alfred Menezes (University of Waterloo, Canada), presenter at one of the invited talks at the CHES 2000 Workshop.



From left, Larry Raymond, assistant director of human resources for the city of Worcester, project advisor Len Polizzotto, Matthew Geiger, Jeremy Lynch, Brian Laplume and Rabin Tamang.

Recent Grants

The following new grants, or additional awards on previous grants, were received by ECE faculty in academic year 1999-2000:

Cyganski, D. "Advanced Machine Vision Toolset," Data Translation Inc., \$122,809, February 2000.

Cyganski, D. "Tool Condition Monitor Phase," Textron Systems Inc., \$114,902, January, June 2000.

Loft, F.J. "Student Projects at the Goddard Space Flight Center," NASA, \$15,000, June 1999.

Ludwig, R. "Development of Electromagnetic Nondestructive Testing Techniques," Gillette Company (continuation), \$7,760, September 1999.

Ludwig, R. "Design and Development of a DC-Coupled Ultrawideband RF Amplifier," Teradyne Inc., \$35,587, May 2000.

Ludwig, R. "Feasibility Study to Develop RF Coils for High-Field MRI," University of Massachusetts-Worcester (renewed), \$27,693, November 1999.

Ludwig, R. "Establishing and Funding for the New England Center for Analog and Mixed Signal IC Design (NECAMSID)," \$30,000 each from Analog Devices, Unitrode, Allegro, EG&G Reticon, Teradyne, August 1999.

McNeill, J.A. "High-Speed Digital Output Camera-on-a-Chip," EG&G Reticon (supplement), \$5,000, January 2000.

Michalson, W. "An Auto-Calibrating Surround Sound System," Keyhold Engineering Inc. (continuation), \$11,242, April 2000.

Nicoletti, D. "Camp REACH: An Engineering Summer Camp for Middle School Girls and Teachers," funds received from United Technologies (\$5,000), Intellution (\$5,000), Quantum (\$5,000), PaineWebber (\$250), Mercury Computer (\$2,000), ABB (\$250), Mass Academy (\$10,000).

Paar, C. GTE fellowship, for research in the area of cryptography, GTE, \$15,000, July 1999.

Paar, C. "General Dynamics Trusted Network Systems Center," General Dynamics, \$40,000, July 1999.

Pahlavan, K. "Hardware Platform for Real-Time Wireless Channel Simulation for Modern Telecommunication and Geolocation Military Applications," DOD/Army, \$195,000, April 2000.

Pahlavan, K. "Wireless LANs for UMTS," University of Oulu, Finland (renewal), \$166,190, September, 1999.

Pahlavan, K. "Indoor Geolocation Science for 4G Wireless Networks," NSF, \$270,000, June 2000.

Pahlavan, K. "Wireless Indoor Geolocation Using IP Networks," Nokia, Finnish Air Force, TEKES, \$169,000, May 1999-April 2000.

Pahlavan, K. "Interference in Local Wireless Networks," Fidelity Investments, \$20,000, June 2000.

Pedersen, P.C. (co-PI), "Stability and Heat Transfer Characteristics of Condensation Fluid Layers in Reduced Gravity," NASA, \$43,086, April 2000.

Whitmal, N.A. Equipment donation for an interactive course in real-time digital signal processing, Texas Instruments, \$16,319, July 2000.

Visit Our **Web Site**

It's easy to stay up to date on ECE department activities by visiting us on the Web. You can get there directly at www.ece.wpi.edu, or from WPI's home page, www.wpi.edu. We enjoy hearing comments from our alumni and other readers via the "Alumni Corner" of the ECE Web pages.

The **Student** Body

Emrah Diril and Brian Greenlaw, members of the ECE class of 2000, were among 12 recipients of the Salisbury Prize for 2000. Every spring the award is presented to the most meritorious members of the senior class.

Nicholas Arcolano, ECE '01, was chosen for the Two Towers Prize. This award is presented to a single student in each year's junior class, in recognition of "combined proficiency in the theoretical and practical, which is at the heart of the WPI educational tradition." Nick is the first ECE recipient of this award in several years.

Winners of the Provost's MQP Awards and the ECE Alumni MQP Awards for 1999-2000 are (first place) **Melinda M. Lawler '00, Gregory J. Levesque '00, Jacob F. Ruiter '00**, for "Programmable 50 Ampere Load," advised by Professor John A. McNeill;

(second place) **Gino Cerro '01, Sean M. Cooper '00, Andrew L. Meier '00**, for "Digital Printer Adapter," advised by Professors Leonard Polizzotto and Fred Looft; (third place) **Mankong Chowkwanyun '00, Bernard M. Tan '00 and Govind S. Samant '00**, for "Advanced Encryption Standard (AES) Algorithm Library," advised by Professor Christof Paar. Eta Kappa Nu, the ECE student honor society, presented its Outstanding Senior Award to **Jeffrey J. Mackin '00**.

The Eta Kappa Nu Outstanding ECE Teaching Assistant Award for 1999-2000 was presented to **Frank K. Gurkaynak**.

The Sigma XI Research Award for M.S. thesis work was presented to **Daniel V. Bailey**. Dan is a CS student who has performed all of his research work (in cryptography) with Professor Christof Paar.

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