TRANSMISSIONS

We put the e in **e-commerce**

A few weeks ago, President Parrish convened a meeting of the ECE, CS and Management departments to review WPI's activities in information technology, and to consider whether we should be doing more in this area. I won't speak for Ed, but my guess is that one reason for the meeting was to be sure that we stay at the forefront of the tidal wave of interest in all things associated with IT and e-commerce. We quickly came to two conclusions: 1) we are doing a lot already, and 2) almost everything in ECE and CS can be considered to be some form of IT. We questioned whether we should create a major in information technology to give those activities some focus and identity.

IT is not a discipline, it's an umbrella name for a set of technologies.

The conclusion at present is "no"—for several reasons. The primary one is that IT is not a discipline, it's an umbrella name for a set of technologies that incorporate hardware, software and management components. These technologies are the output of academic and professional disciplines. However, I personally believe that it may be possible to make the case that information *engineering* is an emerging academic discipline. One could argue that electrical engineering consists of only two fundamental pieces, power engineering and information engineering, and all that we do that is not power-related is directed at acquiring, processing, storing or outputting information in one form or another. In the past these latter operations were performed directly by physical devices (circuits!), and now they are generally performed by software running on physical devices.

While it might be possible to distinguish the information analysis and synthesis aspects of our profession (and our curricula) from the physical electronics analysis and synthesis aspects, excessive compartmentalization often leads to poor engineering design. The possible advantage is that we could more easily relate and integrate the information engineering aspects into disciplines outside EE.

For the time being, the ECE faculty have agreed to continue with a broad electrical and computer engineering curriculum that integrates information engineering principles with physical electronics and computer engineering while increasing our emphasis on applications in the IT area. It is an understatement to say that the next decade in ECE education will be a time of great changes!

Please let me know your thoughts by contacting me directly at orr@wpi.edu, or via the alumni feedback section of the ECE Web site, www.ece.wpi.edu.

John A. Orr, Department Head

Three New **Colleagues**

Leonard Polizzotto is WPI's newest professor of practice. Len comes to WPI from Polaroid Corp., where he was vice president of new business development. His substantial industry experience began with AT&T Long Lines and includes positions with Briox Technologies and Loctite Corp. Much of his career has been with Polaroid, including such positions as assistant director of corporate research and senior director of product strategy, electronic imaging. He brings interest and expertise in imaging to WPI, along with a wealth of engineering experience and a great enthusiasm for teaching. Interested in pursuing all aspects of the faculty role, he is pursuing research in sensory- and image-related topics and teaches in the undergraduate and graduate programs. Len received his B.S. (1970) and M.S. (1972) in electrical engineering from WPI, and his Ph.D. in visual sciences from Tufts University in 1982.

Nathaniel A. Whitmal III has joined the faculty as assistant professor of ECE. Before coming to WPI, Nate gained faculty experience at De Paul University and substantial industrial experience at Bose Corp. His interests include audio and acoustics and digital signal processing—particularly as applied to audio signals—including time-frequency and wavelet analysis. Specific research topics include speech intelligibility enhancements for the hearing-impaired. His Ph.D. dissertation is titled "A Wavelet-based Noise-reduction Method for Speech Enhancement." Nate received his B.S. in electrical engineering and computer science from MIT in 1986, his M.S. in engineering management from Tufts University's Gordon Institute in 1990, and his Ph.D. in electrical engineering and computer science from Northwestern University in 1997.

Matthew C. Bromberg joined WPI as assistant professor of ECE at the beginning of the current spring semester. He arrived with substantial experience in the communications industry, where he has been actively involved in developing state-of-the-art research results and applying them to products for the commercial and defense sectors. His current work focuses on the important area of wireless communications, specifically in developing techniques for increasing channel capacity and enhancing communications reliability. Matthew comes to WPI from Radix Technologies in Mountain View, Calif. He received his B.S. in engineering mathematics from the University of California, Berkeley, in 1983, his M.A. in mathematics from UC-Berkeley in 1986, his M.S. in electrical engineering from UC-Davis in 1988, and his Ph.D. in electrical engineering from UC-Davis in 1990.

Emeriti

Professors **Wilhelm Eggimann** and **Peter Lanyon** announced their retirements at the end of the 1998-99 academic year. Both Willy and Peter made major contributions to ECE and to WPI during their long careers, and the department is fortunate that they are continuing their part-time involvement with ECE as professors emeriti. Both of these professors presaged WPI's Global Perspective Program—Peter coming to us from England, Willy from Switzerland.

Willy joined the WPI faculty in 1964 after serving on the faculty at Case Institute of Technology for three years. He earned his B.S. at the Swiss Federal Institute of Technology in Zurich in 1954 and his M.S. and Ph.D. at Case in 1959 and 1961, respectively. Willy's original area of specialization was electromagnetics, where he established a substantial record of scholarly contributions. He twice reinvented himself on the technical side—first immersing himself in the principles of logic design and computer

Polizzotto Whitmal Bromberg Eggimann Lanyon Leblebici

engineering in the 1970s, and then in integrated circuit (VLSI) design in the 1980s. It was he who was responsible for bringing VLSI design to WPI, along with the computer power (a room-filling VAX 780) that it required; he founded and chaired the Massachusetts VLSI Faculty Association of the Massachusetts Microelectronics Center.

Willy played a major role in the development of the WPI Plan, founded the very successful Zurich exchange program, and served as faculty advisor at the Washington, D.C., and Puerto Rico project centers. He originated the MQP awards program in EE, substantially predating the University-wide awards program. He is a member of Skull and was one of the longest-serving members of IHEE (ask Willy or an alum of the '60s or '70s what those initials stand for).

Peter joined the WPI faculty as associate professor in 1967 after faculty experience at the Carnegie Institute of Technology, research experience at the University of Illinois, and industrial experience at RCA Labs. He received his B.A. in physics from Christ's College, University of Cambridge, England, in 1958, his M.A. from Cambridge in 1962, and his Ph.D. from the University of Leicester, England, in 1961.

Throughout his career, he pursued research in solid-state device theory, particularly in the area of heavy doping effects. While on sabbatical in 1995, he presented several lectures at the University of Leuven, Belgium, and was an invited speaker at the Conference on Semiconductor Devices in New Delhi, India, that year.

While Willy was implementing the integrated circuit design curriculum, Peter was busy working on the complementary discipline of IC fabrication. His upper-level and graduate course teaching have emphasized analog IC design, device characterization and modeling. Recently, he has been assisting in the organization and operation of the New England Center for Analog and Mixed Signal IC Design (directed by Professor John McNeill), providing particular expertise in the solid-state device physics area. Peter's current solid-state research work is challenging some old ideas, and we look forward to his association with WPI as he continues this work.

Faculty **Notes**

The Joseph Samuel Satin Award for 1999-2000 was presented to Associate Professor **Yusuf Leblebici.** Leblebici came to WPI in D-Term 1998 with substantial experience acquired in Turkey (his native country) in his doctoral studies and a subsequent visiting faculty appointment at the University of Illinois, and as an invited professor at The Swiss Federal Institute of Technology. His area of expertise is high-performance VLSI systems. He has redeveloped our VLSI program at the undergraduate and graduate levels and has just published (with S. Kang of the University of Illinois) the second edition of his popular text on CMOS design.

John Rulnick received a prestigious NSF CAREER Award.

David Cyganski was chosen by the ECE students as the Eta Kappa Nu Outstanding Professor of the Year.

Denise Nicoletti, a founder of WPI's Camp REACH program, received an Unsung Hero Award from Gov. Paul Cellucci for her contributions to the youth of Massachusetts.

Hossein Hakim returned full time to the ECE department after overseeing a dramatic increase in all aspects of WPI's Global Perspective Program as chair of the Interdisciplinary and Global Studies Division.

Richard Vaz served as resident advisor at the Bangkok Project Center in C-Term last year. He was recently appointed associate dean for projects and interdisciplinary affairs.

Alex Emanuel continues to receive professional and popular recognition for his work in power quality, including the identification of fraudulent energy-saving devices.These results were noted in the November 1998 and January 1999 issues of *Electrical Apparatus*.

Department **Highlights**

By the Numbers

The ECE Department awarded 100 B.S., 30 M.S. and 3 Ph.D. degrees in 1998-99.

Undergraduate enrollment continues on an upward trend, with 124 entering EE students in the fall of 1999 (Class of 2003).

Busy Summer

Summer activities in Camp REACH, Strive and Frontiers demonstrated a high level of involvement and enthusiasm. Directed by Professor **Denise Nicoletti,** Camp REACH immerses rising 7th grade girls in a two-week residential program that focuses on science, engineering and math. This year it hosted 27 girls from Massachusetts and Connecticut.

Visiting Faculty

Over the past year ECE has hosted international visiting faculty representing a broad range of discipines and home countries. Included among them were Professor Sergey Makarov, State University of St. Petersburg, Russia; Professor Abdul K. Yesufu, Edo State, Nigeria; Dr. Hasem Oraee-Mirzamani, Sharif University of Technology, Tehran, Iran; Dr. José Policarpo de. Abreu, Federal School of Engineering, Itajuba, Brazil; and Dr. Dalgerti Lelis Milanez, State University Julio de Mesquita Filho, Brazil.

Visit Our Web Site

It's easy to stay up-to-date on ECE Department activities by visiting our Web page. You may get there directly at **www.ece.wpi.edu,** or from WPI's home page. **www.wpi.edu.**

Curriculum **Innovations**

In 1992-93 the revolutionary idea of studying ECE in the freshman year brought four new courses into the curriculum, two of which (recent alumni will recall them as EE 2011 and 2022) were available in C and D terms of the student's first year. These courses also marked a milestone in the evolution of the ECE profession and curriculum as they were not fundamentally "circuits" courses, although circuits still held a prominent place in these and following courses.

The first-year courses have been extremely successful and a review of the overall core ECE curriculum led by Professor **John McNeill** has confirmed their value but recommended some innovations following the introductory courses, including the following:

- Addition of a course at the sophomore level in embedded microprocessor systems, integrated with the computer engineering specialization.
- Addition of a course in the principles and practice of electrical and computer engineering design—to be taken by all students prior to the MQP (senior project).
- Revamping of ECE core courses that would include deleting EE 2013 and 2014 (Fundamentals of ECE I and II), and EE 3111 (Electromagnetics Fields), and addition of two new courses—one emphasizing circuits and one emphasizing electromagnetic fields.

Experimental versions of the new embedded microprocessor and design courses are being offered in 1999-2000. Both of these course offerings "sold out" within days of appearing on the WPI Web site for student registration. The design course is team-taught to provide substantial student-faculty contact and to bring more than one area of faculty expertise to the design process. Students will learn the engineering design process and carry out a complete design, from specifications through prototype construction and test.

As most readers of this newsletter understand, there are no required courses in WPI's EE curriculum. However, faculty do advise students to become knowledgeable by taking a "core" of ECE courses. With the revisions described above, this core curriculum now includes five courses: EE2011, Introduction to Electrical and Computer Engineering; EE2022, Introduction to Digital Circuits and Computer Engineering; EE2111, Fundamentals of Electrical Engineering; EE2311, Continuous Time Signal and System Analysis; and EE2799, Electrical and Computer Engineering Design.

Campaign supports **ECE**

The Campaign for WPI is, in effect, a campaign for ECE. Last April 22, WPI launched a drive to raise $150 million by June 30, 2003. The campaign will provide the resources for WPI to embrace the extraordinary opportunities represented by its expanding national and international reputation and by the evolution of a new direction for technological higher education that closely parallels the blueprint the University drafted over a quarter century ago.

For ECE, the unprecedented explosion of interest in communications and computation provides special opportunities for us to strengthen current programs and embark upon exciting new academic initiatives. Since the essence of innovation and leadership is continual growth and improvement, a major focus of the campaign is to build upon the University's academic strengths and to ensure that the students who benefit from these strengths can afford a WPI education.

The Campaign for WPI was launched in April 1999 with a gala event in historic Mechanics Hall.

Available funding opportunities include undergraduate scholarships, graduate fellowships, endowed professorships, and special funds to support faculty development and WPI's unique Global Program, as well as capital projects to enhance and renovate the physical plant. Most ECE alumni will be asked to participate through their Reunion Gift campaigns, and will also be asked to consider increasing their commitments to the Alumni Fund. Broadening participation in the fund will ensure that WPI always has funds at hand to respond immediately to new challenges and opportunities.

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 or write to campaign@wpi.edu, or visit www.wpi.edu/Campaign.

Newell Award

The 1998-99 Hobart Newell Award for Outstanding Contributions by an ECE graduate was presented to **Alfred A. Molinari Jr. '63,**

founder of Data Translation Corp., at the annual ECE faculty dinner on May 8, 1999.

Fred follows in the footsteps of other great engineers and entrepreneurs. In addition to his B.S. degree in electrical engineering from WPI, he received an M.S.E.E. from Northeastern University and an M.B.A. from Harvard Business School.

Founded in 1973 and headquartered in Marlborough, Mass., Data Translation is a world leader in the design, manufacture and marketing of high-performance hardware and software for PC-based data acquisition, imaging, machine vision and multimedia. The company's first products were analog-digital converter interface boards for minicomputers and early PCs. More recently, it expanded into the important area of computer video, including video acquisition and editing.

The Newell Award is named for the late Hobart H. Newell, who joined the 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 John Lott Brown '46, William R. Grogan '46, Peter Myers '46, Paul Allaire '60, Robert McIntosh '62, Donald Foley '66, Ronald Zarrella '71 and Richard Freeman.

CHES **Highlights**

Two new suggestions to tackle the difficult problem of generation of random numbers came out of CHES. Scientists from Italy's Ugo Bordoni Foundation offered a cost-effective idea based on sampling noisy semiconductor junctions, and researchers from Bell Labs Innovations provided a variety of practical new techniques—including one based on chaos theory, which appears to be particularly cost-efficient.

Sandia National Labs researchers presented a design for a new computer chip that can encrypt up to 10 gigabits of data per second. In addition, one can use three of the chips together to handle Triple-DES

encryption with no loss of performance. The DES algorithm is the most widely used bulk encryption method, having been a U.S. government standard since 1977.

Another highlight of the workshop was a talk by Brian Snow, a senior person in the National Security Agency. Snow discussed the importance of providing security in modern communication systems and stressed the central role of the CHES workshop for addressing the security problems in future computer and communication applications.

Crypto Conference

Computer security experts from around the globe converged on WPI for the Workshop on Cryptographic Hardware and Embedded Systems (CHES), Aug. 12-13. The workshop, which provided a forum for real-world system and design issues, attracted 170 participants, more of half of whom came from outside the United States. Adi Shamir of Israel's Weizmann Institute of Science, a world-renowned cryptographer and co-inventor of the RSA code, called the security of the world's leading Web browsers into question with a new fast-factoring attack. Conference organizers **Christof Paar** of WPI and Cetin Koc of Oregon State University pointed out that many consumer products are gaining computer-like capabilities. E-commerce and other electronic communications demand that sensitive data, such as credit card numbers, must be protected from prying eyes. The tool for protecting information, called cryptography, will be required in these products, using embedded systems that offer relatively little computational power.

...not a fast way to make a code, but a speedy way to break one.

The challenge of adding cryptography to hardware devices and embedded systems led to the development of the WPI workshop. In its inaugural year, international experts presented new results on efficient implementation of cryptographic algorithms and attacks, as well as other practical issues in system design such as random number generation.

The most eagerly awaited contribution to CHES involved not a fast way to make a code, but a speedy way to break one. The RSA public-key cryptosystem, widely used in such Web browsers as Netscape Communicator and Microsoft Internet Explorer, is based on the problem of factoring large numbers. Fortunately for consumers and businesses, up until now factoring algorithms have been slow and memory-intensive processes. But at the workshop, Shamir shed light on an ingenious way to speed up part of a factoring computation known as sieving by a factor of 500-1000 times.

CHES provides a vital and novel forum for scientists and engineers working in practical cryptography to meet and share ideas. As time passes, more and more consumer products will handle sensitive data, making the need for practical cryptography even more critical. CHES will become an annual event, and will return to WPI in August 2000. More on CHES 2000 can be found at http://www.ece.wpi.edu/Research/crypt/ches. The CHES '99 proceedings are published in Springer-Verlag's Lecture Notes in Computer Science Series, volume 1717.

Recent **Grants**

The following new grants or additional awards on previous grants were received by ECE faculty in the 1998-99 academic year. Awards received through the Research Administration and Development and University Relations offices are included on this list.

Clements, K.A., "Contingency Constrained Optimal Power Flow for Deregulated Electricity Markets," NSF, $98,868, August 1998; $22,918, March 1999 (supplement).

Cyganski, D., "Advanced Machine Vision Toolset," Data Translation Inc., $239,009, May 1, 1998; $12,567, extended May 1999.

Lee, J.F., "Geophysical Earthquake Modeling (GEM)," NASA, $171,000 (three years).

Lee, J.F., two graduate student fellowships, Ansoft Corporation, $60,000, 1998.

Looft, F.J., "Mechanosensitivity of Tactile Receptors," NSF, $73,524 September 1998; $5,000, March 1999 (supplement); $65,024, June 1999 (continued).

Ludwig, R., "Development of Electromagnetic Nondestructive Testing Techniques to Measure Retained Austenite in Moving Steel Blades (Phase II)," Gillette Company, Boston, Mass., $35,000, September 1998 (renewed); $44,300, April 1999 (continued).

Ludwig, R., "Development of a Novel Inclusion Sensor for Molten Aluminum," G. Koenig et al., Heraeus Electro-Nite International NV, Philadelphia, Pa., $98,647, Feb. 4, 1999.

Ludwig, R., "Feasibility Study to Develop RF-Coils for High-field MRI," UMass Medical Center, Dr. J. King, $16,613, April 1999.

Ludwig, R., (co-PI), "Imaging Cocaine Reinstatement in Awake Monkey at 9.4T," NIH, $752,270, March 25, 1999.

McNeill, J., Y. Leblebici, "Establishing and Funding for the New England Center for Analog and Mixed Signal IC Design (NECAMSID)," $30,000 each from Analog Devices, Allegro, Unitrode, Teradyne, EG&G Reticon, $150,000 (total), October 1998.

Michalson, W., "GPS-based Attitude Determination System," Mayflower Communications Inc., Billerica, Mass., $10,350, July 1998.

Michalson, W., "An Auto-calibrating Surround Sound System," Keyhold Engineering Inc., $54,483, June 1999.

Michalson, W., "A GPS Simulator for Assessing System Accuracy and Integrity," National Research Council Transportation Research Board, $61,483, March 1999.

Nicoletti, D., "Wavelet Decomposition of Inrush and Arc Currents," NSF, $72,673, August 1998.

Paar, C., graduate student fellowship, GTE, $15,000 (continued), 1998.

Paar, C., "CISE Research Instrumentation," NSF, $47,990, December 1998.

Paar, C., "Development and Implementation of a Key Management System," Technical Communications Corp., $21,366, January 1998; $57,184, September 1998 (continued); $13,430., March 1999 (continued).

Paar, C., "Cryptographic Library for TI DSPS," Texas Instruments, $149,994, September 1998.

Pedersen, P.C. (co-PI), "GAANN Support in Biomedical Engineering at WPI," submitted to Department of Education, $126,110, June 1998 (continued); $126,875, June 1999 (continued).

Pedersen, P.C., "Fluid Dynamic & Heat Transfer Characteristics of Condensed Films in Simulated Reduced Gravity," Universities Space Research Association, $47,273, August 1998.

Rulnick, J., "Efficient Distributed Resource Allocation Algorithms, with Application to Wireless Communications," NSF CAREER Program, $60,000, February 1999.

Rulnick, J., "Firewall Security Research Project-Intrusion Detection," Fidelity Investments Corp., $102,607, December 1998.

Rulnick, J., "Performance Benchmarks Project," USENIX Association, $9,860, November 1998.

The **Student** Body

ECE majors **Harish Chawla** and **John Markow** were among 14 members of the Class of 1999 who received the Salisbury Prize, the award presented to the most meritorious members of the senior class.

Winners of ECE Alumni MQP Awards and Provost's MQP Awards for 1998-99 are (1st place) **Thomas Connor, Sheng Deng** and **Stephen Marchant** for "Cryptographic Coprocessor With Algorithm Agility," advisor Christof Paar; (2nd) **Daniel Nashold, John Markow** and **Michael Garrett** for "The AD73422 DSP Converter Evaluation Kit," advisors John McNeill, Richard Vaz; and (3rd) **Jeffrey Hanscom, Harish Chawla** and **Jeffrey Bartlett** for "Hydranet, the DODB-based Local Area Network," advisor David Cyganski.

The WPI Outstanding Teaching Assistant Award was presented to ECE graduate students **Siddharth Gahlaut** and **Oluwafemi Badeji.** Eta Kappa Nu gave its Outstanding Senior Award to **Harish Chawla.**

Throughout high school, **Timothy Dresser '01** (with American flag) pursued his interest in electronics. That interest paid off when he won the U.S. World Youth Skills Competition, capstone of the Consumer Electronics Manufacturers Association convention early in 1999. Tim spent the fall preparing for the world competition in Montreal, where he placed 4th. The contest attracted 600 competitors from 34 countries.

ECE graduate student John Sullivan got more than he expected after he took in a homeless Siamese cat: she delivered seven kittens! (Good homes have been found for all.)

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