

NORTHWESTERN UNIVERSITY
McCORMICK SCHOOL OF ENGINEERING

ECE NEWS



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Chairman's Message

Welcome to the Electrical and Computer Engineering Department of Northwestern University. It was indeed a pleasure to return from my sabbatical year last year when I was involved in a startup company called AccelChip. While the experiences of starting a company were wonderful, I really looked forward to returning to the ECE Department as Chairman this year.

The 2002-03 academic year was an eventful one. We recruited two new faculty; several of our faculty won major awards; our faculty and graduate students continued to perform outstanding research in various fields which resulted in numerous publications and research grants; we continued to support undergraduate research funded by grants from Motorola; and we hosted two speakers in the ECE Distinguished Lecture Series. Finally, Synplicity Corporation donated to the ECE Department \$2.3 million of software for teaching and research. In the remainder of this message, I will elaborate on some of these accomplishments.

Faculty

During 2002-03, our 29 faculty (17 full professors, 7 associate professors, and 5 assistant professors) included five endowed chairs, three named professors

of teaching excellence, seven faculty who have received NSF PYI / NYI / CAREER awards, seven IEEE Fellows, one ACM Fellow, one APS Fellow, two OSA Fellows, one Booth awardee, and one Terman awardee. Two of our emeritus faculty are members of the National Academy of Engineering.

We made significant progress toward our goal of recruiting and tenuring excellent faculty members. One new faculty member joined our Department, **Robert Dick** (Ph.D., Princeton, 2002), as



Prith Banerjee

an assistant professor in the embedded systems area. I am also pleased to announce that **Seng-Tiong Ho** was promoted to the rank of full professor effective Jan. 1, 2004.

During 2002-03, we recruited for faculty in computer architecture, VLSI design/CAD, networks/communications, and solid state. I am pleased to report that, after considering more than 350

applicants, we will be joined by two new faculty in Sept. 2003: **Dr. Gokhan Memik** (Ph.D., UCLA, 2003) as an assistant professor in computer architecture; and **Dr. Seda Ogrenci Memik** (Ph.D., UCLA, 2003) as an assistant professor in VLSI/CAD.

Faculty Awards

Three of our assistant professors, **Randy Berry**, **Yehea Ismail**, and **Hai Zhou** received the NSF CAREER award for 2003, one of the most prestigious honors for junior faculty in the U.S. As part of this award, each will receive funding of \$400,000 over five years which can be used to support graduate students and other research expenses.

These awards bring the total number of recipients of the NSF CAREER (or its predecessors, the NSF Young Investigator and the NSF Presidential Young Investigator) awards in our Department to 7 out of 29 faculty. Other recipients of the NSF CAREER, PYI and NYI awards include **Prith Banerjee**, **Alok Choudhary**, **Randy Freeman**, and **Seng-Tiong Ho**.

Prof. Prem Kumar was elevated to the Fellow membership grade of IEEE "for the development of nonlinear optical devices for communication networks." This brings the total number of IEEE Fellows in our Department to 7 out of 29. Our other IEEE Fellows include **Prith Banerjee**, **Abe Haddad**, **Michael Honig**, **Aggelos Katsaggelos**, **Martin Plonus**, and **Allen Taflove**.

Prof. Prem Kumar has also been appointed the SBC Professor of Information Technology in the McCormick School of Engineering for 2003-06. The SBC Chair (formerly the

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Ameritech Chair) is awarded for a three-year term to a full professor in our Department in recognition of his or her outstanding contributions to the field of information technology. Previous SBC / Ameritech Chair holders include **Michael Honig** and **Aggelos Katsaggelos**.

Prof. Aggelos Katsaggelos received the Meritorious Service Award of the IEEE Signal Processing Society for his outstanding service to that Society in many capacities, and in particular as Editor-in-Chief of the *IEEE Signal Processing Magazine*.

Prof. Manijeh Razeghi was elected to the Fellow grade of the International Engineering Consortium.

Asst. Prof. Yehea Ismail received the Best Teacher Award from our ECE Department during 2002-03.

Profs. Alan Sahakian and **Allen Taflove** were named to Northwestern's Best Teachers list by the University's Associated Student Government. **Prof. Taflove** was also included on ISIHighlyCited.com, the Institute of Scientific Information's list of most-cited researchers worldwide.

Research Activity

During 2002-03, the ECE Department's research funding was \$7.5 million, an increase from the \$6.9 million of the previous year. This works out to be an average of \$258,000 per faculty member.

Our faculty continue to publish a large number of papers in prestigious journals and conference proceedings. During 2002-03, our 29 faculty wrote 2 books, 9 book chapters, 89 journal papers, and 98 conference papers. One of the papers received a Best Paper Award.

Our faculty have transferred the results of their research to established companies such as Motorola and Intel, and to startup companies such as AccelChip, Phosistor, and 67 Kilohertz.

Finally, **Profs. Prem Kumar** and **Horace Yuen** recently demonstrated a new high-speed quantum cryptography method codenamed "AlphaEta" that had been developed under a \$4.7 million DARPA research project.

Students

During 2002-03, the ECE Department was home to 246 undergraduate students, of whom 110 were EE majors and 136 were CompE majors. Our Department thus operated with a student-to-faculty ratio of 8.5. We graduated 73 students with B.S. degrees in either EE or CompE. Our student academic quality continues to be excellent, with the median SAT score for our entering freshmen at 1400.

During 2002-03, we were also home to 119 graduate students, of whom 100 were in the Ph.D. or M.S./Ph.D. programs and 19 students pursued the M.S. only. We granted 22 Ph.D. degrees and 32 M.S. degrees over the course of the year.

One of the most exciting developments during this past year was the large increase in the number of undergraduates engaged in research under the guidance of faculty advisors. A key factor here was generous support from Motorola which allowed us to offer stipends to undergraduate students and unrestricted grants to their faculty advisors. 13 undergraduates participated in Motorola projects. In June 2003, Motorola hosted a poster session at its Schaumburg headquarters during which our Motorola-supported undergraduate and graduate students presented the results of their research efforts.

Student Placement in Companies and Universities

We continued our efforts to place our graduating students in the top ECE companies. To this end, we again generated ECE Resume Books that contained one-page resumes for B.S. and M.S. students and two-page resumes for Ph.D. students. These were sent to more than 40 companies.

A significant number of our B.S. graduates accepted engineering positions. These were with a wide variety of established and startup companies including Accenture, Epic Systems, Ford Motor, Honeywell, IBM, Integrated DNA Technologies, Ingenient Technologies, MacMaster-Carr, Microsoft, Motorola, National Instruments, and UBS Warburg.

Our B.S. graduates pursuing Ph.D. degrees will be attending Brown, Caltech, Cornell, Michigan, Northwestern, Stanford, University of Illinois at Urbana-Champaign, and Yeshiva University.

Our Ph.D. graduates accepted positions at Accenture, Agilent, RawThrills, Microsoft, Boeing, and Pixonics. Two are joining academia at the University of Wisconsin-Madison, and the University of Pittsburgh.

Distinguished Lectures

On Oct. 10, 2002, **Dr. Walter Willinger** of AT&T Labs presented the ECE/CS Distinguished Lecture titled "Separating Wheat From Chaff: On Internet Modeling and Model Validation." **Prof. Erich Ippen** of MIT visited us on Jan. 13, 2003 and presented the Motorola Distinguished Lecture titled "Femtosecond Optics."

Industrial Interactions

During 2002-03, Motorola, Inc. continued to support our Department through the Motorola Center for Telecommunications Research, funded at \$600,000 per year. In addition, the Motorola Foundation provided us with \$100,000 to support undergraduate research, the Distinguished Lectureships, and graduate student recruiting.

In addition, Synplicity Corporation donated to our Department software valued at \$2.3 million for use in our research and teaching in VLSI design. As part of this donation, we received 20 copies each of Synplify Pro, Synplify ASIC, Certify, and Amplify. These tools will facilitate our students' learning about the design of field-programmable gate arrays (FPGAs) and application-specific integrated circuits (ASICs).

It's Good to be Back!

I wish to personally express best wishes to our ECE Department faculty, students, alumni, and friends. It's good to be back!

Regards,

Prith Banerjee

Walter P. Murphy Professor

Prof. Prem Kumar Elevated to IEEE Fellow and Appointed the SBC Professor of Information Technology



In recognition of his world leadership in the field of advanced photonic and quantum communication and information processing systems, **Prof. Prem Kumar** has been elevated by the IEEE to the membership rank of Fellow, and appointed the SBC Professor of Information Technology in the McCormick School of Engineering for 2003-06. Prof. Kumar is Director of the Center for Photonic Communication and Computing (CPCC), which conducts research on expanding the speed and level of integration of optical and optoelectronic systems, and exploiting fundamental laws of Nature to accomplish communication, signal processing, and computing in radically new ways. Key McCormick collaborators in the Center include **Prof. Horace Yuen** and **Selim Shahriar** (ECE), **Bill Kath** (Applied Math), and **Bruce Wessels** (Materials Science and ECE).

Three projects illustrate the scope and importance of CPCC research. The first project is “Ultra-Secure and Ultra-Efficient Quantum Cryptographic Schemes for Optical Systems, Networks, and the Internet,” sponsored by the Defense Advanced Research Projects Agency and the U.S. Air Force. Here, Profs. Yuen and Kumar are leading a team that is developing new quantum cryptographic technology suitable for implementation over normal fiber-optic networks and satellite links. Potentially, this technology can replace the existing cryptographic “gold standard” which involves computational algorithms, and thereby greatly improve information security for data transmitted over the Internet. Also involved in this project are two industrial partners, Telcordia Technologies of Red Bank, NJ, and BBN Technologies of Cambridge, MA, which are developing prototype systems for integration into core optical networks.

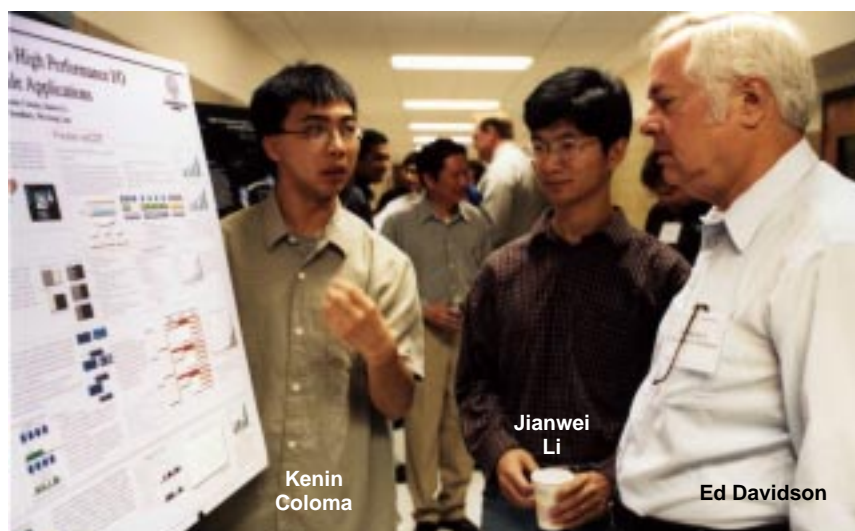
A second CPCC project of note is “Quantum Information Technology: Entanglement, Teleportation, and Quantum Memory.” This is a multi-disciplinary university research initiative (MURI) in collaboration with MIT and sponsored by the U.S. Army Research Office. Here, Profs. Shahriar, Yuen, and Kumar are attacking the problems involved in generating, receiving, refreshing, and storing quantum information transmitted over noisy and lossy communication channels. The MIT/NU team is comprised of technical leaders spanning both theory and experiment in areas of quantum communication and measurement, quantum computation, nonclassical light-beam generation and detection, nonlinear optics in bulk crystals and optical fibers, computational complexity and error-correcting codes, and atomic physics.

A third CPCC project, “Data Processing Modules Using High-Nonlinearity Fiber for Advanced Optical Networking,” is sponsored by National Science Foundation. Here, Profs. Kath and Kumar are developing numerical models and experimental realizations of all-optical data-processing modules that use high-nonlinearity microstructure fibers to achieve operation at rates of tens of billions of bits per second. This could empower the *next-next-generation* Internet.

Scenes from the ECE Advisory Board Meeting, May 16, 2003



Scenes from the Graduate Student Poster Fair



Three ECE Faculty Receive Prestigious NSF CAREER Awards



Randy Berry

Asst. Prof. Randy Berry received the B.S.E.E. degree from the University of Missouri-Rolla in 1993 and the M.S. and Ph.D. degrees in EECS from MIT in 1996 and 2000, respectively. In 1998, he was on the technical staff at MIT Lincoln Laboratory in the Advanced Networks Group. In addition to the NSF CAREER award, he was named the ECE Department's Best Teacher for 2001-02. His research interests include wireless communications, data networking and information theory.

Prof. Berry's CAREER award supports his research on "cross-layer" resource allocation in wireless networks. Recently, there has been much interest in exploring such techniques where a stronger coupling is allowed between traditional network layer boundaries. At the physical layer, the fundamental performance trade-offs as given by information theory are, in many cases, well understood. When higher-layer objectives such as delay enter the picture, much less is known. Prof. Berry's work draws on ideas from information theory, communication theory, and networking to gain insight into fundamental architectural trade-offs in these settings.

Asst. Prof. Yehea Ismail received the B.S.E.C.E. degree from Cairo University in 1993 and the M.S. and Ph.D. degrees in EE from the University of Rochester in 1998 and 2000, respectively. In addition to the NSF CAREER Award, he was selected as the 2002 IEEE Circuits and Systems Society Outstanding Young Author, and was named the ECE Department's Best Teacher for 2002-03. His research interests include interconnect noise, innovative circuit simulation, and related circuit-level issues in high-performance VLSI technology.

Prof. Ismail's CAREER award supports his research on deep-submicron VLSI design for clock speeds exceeding 10 GHz. His work investigates coupling and crosstalk noise, frequency-dependent interconnect models, high-temperature effects on the reliability of circuits and interconnects, and physical design techniques to minimize noise and power. Prof. Ismail will also create a new educational curriculum that copes with the advances in the VLSI field and encourages collaboration between industry and academia via internships and partnerships.



Yehea Ismail



Hai Zhou

Asst. Prof. Hai Zhou received the B.S. and M.S. degrees in computer science and technology from Tsinghua University, Beijing, China, and the Ph.D. from the University of Texas at Austin in 1999. From 1999 to 2001, he was a senior R&D engineer in the Advanced Technology Group of Synopsys, Inc., Mountain View, CA. His research interests include VLSI design automation, algorithm design, and formal methods.

Prof. Zhou's CAREER award supports his research on formal methods for silicon complexity in nanometer VLSI design. The work will help to solve the VLSI design productivity crisis by applying formal methods to the silicon-complexity problem. Silicon complexity refers to the impact of previously neglected physical phenomena such as coupling noise, process variations, and soft errors. Timing verification, design optimization, and statistical analysis and optimization will be studied in this project.

New Faculty for 2003-04



Gokhan Memik

Dr. Gokhan Memik received his B.S. degree in computer engineering in 1998 from Bogazici University, Istanbul, Turkey, his M.S. degree in computer engineering in 2000 from Northwestern University, Evanston, IL, and his Ph.D. degree in electrical engineering from UCLA in July 2003, where he majored in embedded computing systems under the supervision of Prof. William H. Mangione-Smith. His Ph.D. thesis titled, *Microarchitectures for High-Performance, Power Efficient Network Processors*, introduced several optimizations for network processor microarchitectures including cache-miss detection and data filtering. He is also the author of *NetBench*, a widely used benchmarking suite for network processors. NetBench includes 11 representative applications that are used to evaluate different network-processor architectures.

Dr. Memik's research interests are in computer architecture, embedded systems, compilers, and design automation. He is the author of two book chapters and over 25 journal and refereed conference publications in these areas.

Dr. Seda Ogresci Memik received her B.S. degree in electrical engineering from Bogazici University, Istanbul, Turkey in 1998. She earned her M.S. degree in computer engineering from Northwestern University in 2000 and her Ph.D. degree in computer science from UCLA in July 2003. Her thesis, titled *Design Planning for Synthesis*, introduced a design methodology targeting systematic enhancement and planning of freedom in design metrics during behavioral synthesis stage of the CAD flow. Dr. Memik has authored two book chapters and over 20 technical papers. She worked with Fujitsu Laboratories of America in the summer of 2001. Her research interests include computer-aided design for VLSI, reconfigurable computing, and synthesis for programmable systems.



Seda Ogresci Memik

Alumnus Honored

ECE alumnus **Dr. Timothy P. Hogan**, an assistant professor in Michigan State University's Department of Electrical and Computer Engineering, received the Junior Withrow Award for Distinguished Scholarship. The Withrow Award recognized Dr. Hogan's "exemplary teaching and service" to his department and to Michigan State's College of Engineering. Dr. Hogan is a June 1996 Ph.D. graduate of our Department, mentored by **Prof. Carl Kannewurf**.



On June 6, 2003, these ECE Department students presented posters at Motorola headquarters in Schaumburg, IL on their undergraduate and graduate research projects supported by the Northwestern University Motorola Center. From left to right: **Yoni Torchman, Elliott Parsons, Adam Russell, John David, Jung Ryu, Peijuan Liu, Owen Piette, Yishen Sun, Greg Lou, Hyunjeong Lee, Eren Soyak, Jianwei Huang, Carey Tischler, and Ryan Stoner.**

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