NORTHWESTERN UNIVERSITY
McCORMICK SCHOOL OF ENGINEERING

ECE NEWS

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Chairman's Message

During the 2001-02 academic year, I had the privilege of serving as Interim Chairman of the ECE Department while Prith Banerjee was on a partial leave to work with his successful start-up company. I am grateful for the confidence shown by Prith and Dean Birge in entrusting the running of ECE to me. I wish to convey my thanks to the faculty and staff for their support, and for making my job during the past year easy. Special thanks are due to the friends of ECE and the ECE Advisory Board members for their continued support.

This message will provide a brief overview of the activity of the Department during the past year, with more details in the articles that follow.

Students

We start with our students, as they are our primary reason for being. Our undergraduate enrollment reached its highest level in more than 15 years due to the increase in the number of entering freshmen selecting Electrical Engineering (EE) or Computer Engineering (CompE) as their major. We had 35 freshmen in EE and 32 in CompE, and the total number of students was 148 in EE and 135 in CompE.

In This Issue:

Prof. Abe Haddad

What is more important are the activities of these students, who elected to participate in large numbers in research projects that were funded by Motorola and Microsoft. We had 13 projects involving 12 faculty and 17 undergraduate students. These were in addition to numerous students participating in McCormick's Design Competition and SunRayce.

At the graduate level, we had 108 M.S. and Ph.D. students enrolled this year. 23 Ph.D. degrees were granted by the Department, a rate of about .75 Ph.D. degree granted per faculty. Two of these Ph.D. students received the Department's Best Dissertation Award in view of the external recognition that their work received in the form of best-paper awards. These were Weimin Xiao, who worked with Prof. Michael Honig, and Steve Slivken, who worked with Prof. Manijeh Razeghi.

Faculty

In 2001-02, we were joined by four new faculty members. Selim Shahriar (Ph.D., MIT, 1992) joined us as an associate professor in the area of photonic systems. Three other faculty joined us as assistant professors: Renato Figueiredo (Ph.D., Purdue, 2001) in computer architecture; Ying Wu (Ph.D., University of Illinois, Urbana-Champaign, 2001) in signal, image, and video processing; and Hai Zhou (Ph.D., University of Texas, Austin, 1999) in VLSI design and CAD. Unfortunately, Renato left us on July 1 to move to a warmer climate.

Recruiting for the 2002-03 academic year was not as productive as we had hoped. Nevertheless, we are pleased to report that Robert Dick (Ph.D., Princeton, 2002) will join us in January 2003 as an assistant professor in the area of VLSI design and CAD. We are still continuing the search for a senior faculty member in the area of solid-state engineering and nanotechnology.

Awards and Honors

During 2001–2002, our Department faculty, students, and alumni received a number of significant recognitions for research and teaching.

At the top of the list is Prof. Valerie Taylor, who was promoted to full professor effective Sept. 1, 2002. Subsequently, she received the following awards and honors:

- IEEE Education Society Harriet B. Rigas Medal
- Computing Research Association A. Nico Habermann Award
- ACM Service Award for chairing the Richard Tapia Workshop
- Northwestern University Women in Leadership Pathbreaker Award
- University of California-Berkeley Engineering Alumni Society Outstanding Young Leader Award (first recipient of this new annual recognition)

A full write-up on Valerie's major awards is given in a following article.

Prof. Aggelos Katsaggelos received three major awards from the IEEE Signal Processing Society: the Meritorious Service Award; the Best Paper Award in *IEEE Transactions on Image Processing*; and appointment as an Associate Editor of the *IEEE Proceedings*.

Prof. Yehea Ismail received the 2002 IEEE Circuits and Systems Outstanding Young Author Award for his paper appearing in *IEEE Transactions on VLSI Systems*.

Prof. Allen Taflove was named to the Highly Cited Researchers list of the Institute for Scientific Information. This list of the world's most cited authors numbered only 97 engineers as of the end of 2001.

Profs. Allen Taflove and Alan Sahakian were listed by Northwestern's Associated Student Government on its honor roll of best teachers.

Prof. Michael Honig and his Ph.D. student Weimin Xiao received the 2002 IEEE Communications Society and Information Theory Society Joint Paper Award for their paper appearing in the *IEEE Transactions on Information Theory*.

Ph.D. student Steve Slivken (Manijeh Razeghi, advisor) received the Best Student Paper Award at the International Semiconductor Device Research Symposium in Dec. 2001.

Finally, alumna Susan Hagness (B.S. 1993, Ph.D. 1998), currently an assistant professor in the ECE Department of the University of Wisconsin-Madison, was named by MIT as one of the world's top 100 technologists under the age of 35.

Response to Program Review

Responding to our 2000–01 Program Review, we consolidated the Solid-State and Photonics Groups into a single group. We also began cooperative activities with the Computer Science Department by cross-listing several courses.

In addition, ECE and CS jointly sponsored a distinguished lecture series on computer architecture. The three speakers in the series were James Smith of the University of Wisconsin-Madison, John Stankovic of the University of Virginia, and Mendel Rosenblum of Stanford. In addition, we hosted a distinguished lecture by National Academy of Engineering member Tom Huang of the University of Illinois, Urbana-Champaign, on video indexing, retrieval, filtering, and summarization.

ECE Advisory Board Meeting

Our ECE Advisory Board met on May 17, 2002, almost 20 months after its previous meeting. This long delay was due to various events, including the Sept. 11, 2001 disaster. The Board meeting was very productive and helped to address several key issues facing ECE. We are very grateful for the attendance of the following Board members, who have been tireless in their support of ECE during the past: Tom Anderson (Hewlett-Packard); David Carney (AT&T, retired); Ed Davidson (University of Michigan, emeritus); John Dever (Honeywell, retired); Tom Ryan (Tellabs); John Spencer (Microsoft); Frank Splitt (Nortel, retired); Bill Tetzlaff (IBM); Patrick White (Sunflower Technologies); and Mark Randolph (Motorola, for Ken Zdunek).

Motorola Support

Motorola continues to be a very strong supporter of ECE. The NU-Motorola Center for Communications (with Prof. Aggelos Katsaggelos as Director), completed its fourth year of sponsoring graduate-level research projects. In addition, the Motorola Foundation provided support for our Department's distinguished lecture series and for undergraduate projects.

On June 7, 2002, all of the graduate and undergraduate students involved in Motorola-sponsored projects presented their results in a poster session at the Galvin Center of Motorola's international headquarters. We are grateful for Motorola's steadfast support that is enhancing the experience of our students.

Welcome Back, Prith!

Now that my year as interim chairman is over, I welcome Prith Banerjee back to the ECE Department helm. My thanks for a very rewarding year to everyone involved, especially our faculty, staff, students, alumni, friends, and Advisory Board members. My best wishes to Prith for continued success in leading ECE.

Best wishes,

Abe Haddad

Henry and Isabelle Dever Professor

A Banner Year for Prof. Valerie Taylor

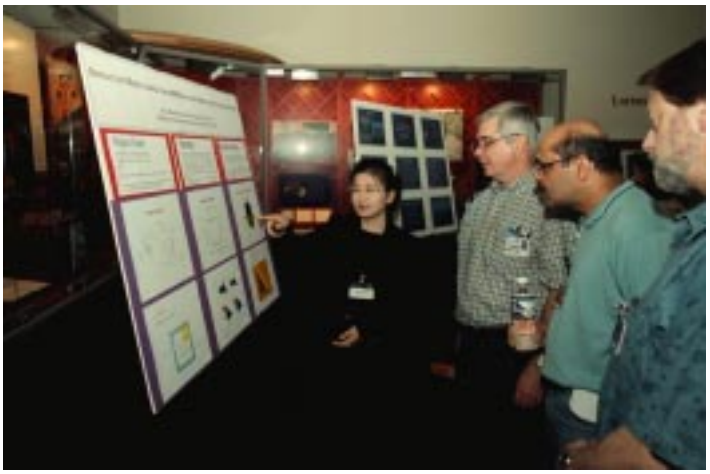
Prof. Valerie Taylor

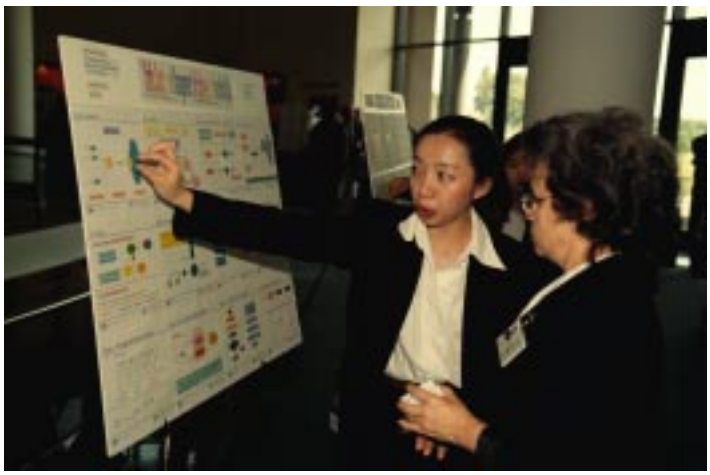
2001–2002 has been a banner year for Prof. Valerie Taylor. First, effective Sept. 1, 2002, she was promoted to the rank of Professor in our Department. Subsequently, she was elevated to Senior Membership in IEEE and received the following major awards:

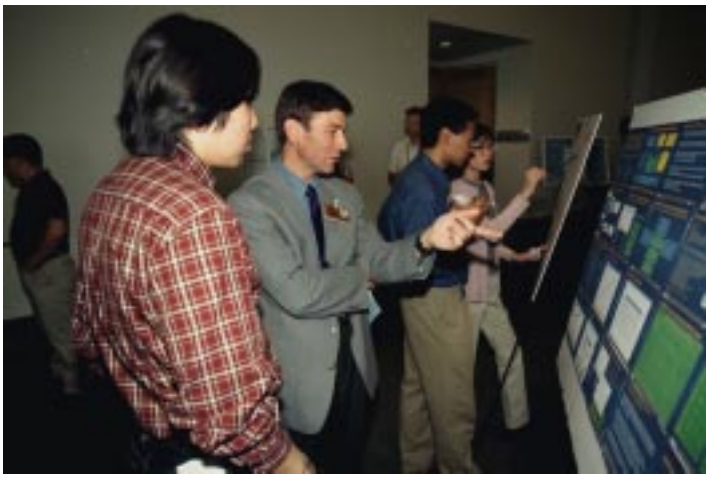
- 2001 Hewlett-Packard Harriet B. Rigas Award of the IEEE Education Society. The Rigas Award was presented to Valerie as the outstanding woman engineering educator. It consists of a $2,000 honorarium and a gold-plated medal.
- 2002 Pathbreaker Award of the Women in Leadership Conference at Northwestern University.
- 2002 A. Nico Habermann Award of the Computing Research Association. The Habermann Award was presented to Valerie for her outstanding contributions in aiding members of underrepresented groups within the computing research community.
- 2002 Outstanding Young Leader Award of the Engineering Alumni Society of the University of California–Berkeley. This newly created award honors a UC–Berkeley alumnus or alumna no more than 40 years old who has made a significant contribution to engineering and society. Valerie is the first person to receive this award, which will be presented to her in Nov. 2002.

The past year has also seen Valerie's research portfolio and prospects expand markedly. First, she is affiliated with the newly established NASA/DOD-sponsored Nanoelectronics and Computing University Research, Engineering and Technology Institute (URETI) at Purdue University, West Lafayette, IN. Second, she is affiliated with the proposed $13-million NSF-sponsored OptiPuter project at the University of California–San Diego, which would optimize ultrahigh-speed networks linking PC clusters and storage/visualization systems to enable scientists to interactively analyze massive amounts of data. Finally, Valerie is the principal investigator (along with co-investigators at Northwestern, University of Chicago, and IIT) of the proposed NSF-sponsored Distributed Optical Testbed (DOT) project. DOT would explore optical networking techniques to allow applications to robustly and efficiently utilize heterogeneous, distributed computing systems having a reconfigurable topology. The OptiPuter and DOT projects have been recommended for funding.

Scenes from the June 7, 2002 ECE Student Research Presentations
Galvin Center, Motorola International Headquarters
Schaumburg, Illinois







Bob Barnett
Motorola

Caroline Swinney
Motorola

Prof. Abe Haddad

Ken Zdunek
Motorola

Prof. Allen Taflove

Bob Barnett, Motorola

Ken Zdunek, Motorola

Prof. Aggelos Katsaggelos

New Faculty Member — Dr. Robert P. Dick

Dr. Robert P. Dick received his Ph.D. degree in electrical engineering in 2002 from Princeton University. His thesis advisor was Prof. Niraj K. Jha. Dr. Dick's current research interests include embedded systems design automation, probabilistic optimization algorithms (when there aren't complete and tractable alternatives), and ad-hoc wireless networks.

Robert is the author of the *Embedded Systems Synthesis Benchmarks Suite* (*E3S*), a collection of benchmarks based on embedded processor and task information from the Embedded Microprocessor Benchmark Consortium (EEMBC). *E3S* was developed for use in system-level allocation, assignment, and scheduling research. The current version, 0.9, contains 17 processors, e.g., the AMD ElanSC520, Analog Devices 21065L, the Motorola MPC555, and the Texas Instruments TMS320C6203. These processors are characterized based on the measured execution times of 47 tasks, power numbers derived from processor datasheets, and additional information, e.g., die sizes, some of which were necessarily estimated, and prices gathered by emailing and calling numerous processor vendors. In addition, *E3S* contains communication resources modeling a number of different busses, e.g., CAN, IEEE1394, PCI, USB 2.0, and VME.

Robert is also the co-author of *TGFF*, which creates problem instances for use in allocation and scheduling research. *TGFF* has the ability to generate independent tasks as well as task sets which are composed of partially ordered task graphs. A complete description of a scheduling problem instance is created, including attributes for processors, communication resources, tasks, and inter-task communication.

Alumna Prof. Susan Hagness Named by MIT as One of the World's Top 100 Young Technologists

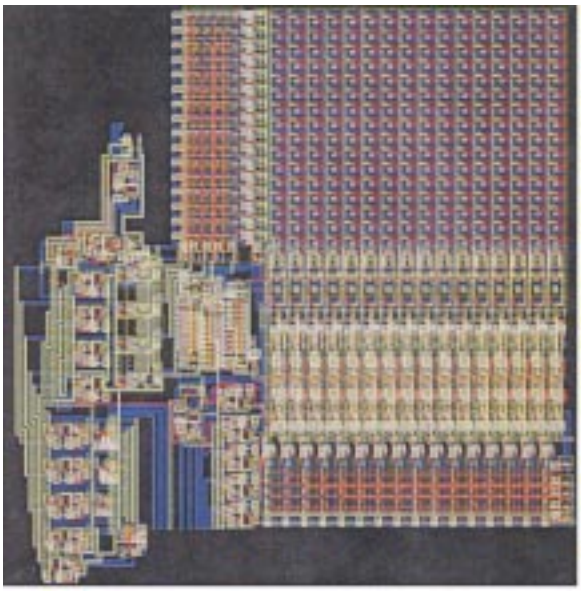
ECE Department alumna Susan Hagness (B.S. 1993, Ph.D. 1998), currently an assistant professor in the ECE Department of the University of Wisconsin–Madison, was recently named by MIT as one of the world's top 100 technologists under the age of 35. Her citation, which appeared in the June 2002 issue of *Technology Review, MIT's Magazine of Innovation*, focused on her research in early-stage breast cancer detection using a novel ultrawideband radar technology. Unlike existing X-ray mammography techniques, Susan's technology involves no painful breast compression, and no potentially cancer-causing ionizing radiation. It promises reliable detection of 2-mm malignant tumors having only one-sixteenth the volume of tumors at the detectability threshold of X-rays. Detection at such an early stage would probably save thousands of women's lives in the U.S. each year.

Currently, Susan is pursuing her breast cancer research as the principal investigator of four significant grants from the National Institutes of Health, the National Science Foundation (NSF), and the U.S. Army Breast Cancer Research Program. She has forged collaborations with engineers, scientists, and physicians at the University of Wisconsin and elsewhere.

Prior to being named to the MIT 100 list, Susan's brilliant work already had achieved wide recognition. She had received the NSF CAREER and PECASE awards, and the Booker Award of the U.S. National Committee of the International Union of Radio Science (URSI) as the outstanding young electromagnetics scientist in the U.S. In June, she delivered the keynote address at a major European electromagnetics symposium (a lecture normally presented by a senior full professor). Looking upon all of this with great pride is Susan's Ph.D. thesis adviser in our Department, Prof. Allen Taflove.

Prof. Yehea Ismail Receives Outstanding Young Author Award

Prof. Yehea Ismail received the 2002 IEEE Circuits and Systems Outstanding Young Author Award for his paper, "Effects of Inductance on the Propagation Delay and Repeater Insertion in VLSI Circuits," which appeared in *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, vol. 8, no. 2, pp. 195–206, April 2000. This award is especially noteworthy since the IEEE Circuits and Systems Society selects only one person for the award based on all of the society's publications in the previous two years.



Yehea is also very involved in educating undergraduates in the latest design and testing techniques for digital microcircuits. For example, students in ECE 391 and ECE 392 designed and tested the dynamic RAM shown in the color micrograph to the left. Steps in this procedure included: • defining the behavior of the circuit; • logic design and architecture; • circuit and transistor design; • layout; and • testing. The complexity of this successfully completed project attests to the advanced level and effectiveness of Yehea's instruction.

Prof. Selim Shahriar Stops Light in its Tracks

In an experiment that received worldwide publicity late in 2001 and early in 2002, Prof. Selim Shahriar and his research team succeeded in literally stopping photons of light that normally travel through space at nature's speed limit of 186,000 miles per second. Selim's group took a yttrium-silica crystal doped with the element praseodymium and chilled it to 450˚ below zero Fahrenheit, allowing light to be stored for 1/2000'th of a second before escaping. This had never been accomplished before in a solid material. In the future, this process can be tailored to trap the quantum state of a photon for long-term storage, thereby realizing a robust quantum memory for proposed ultrafast computers. Selim's work was published in *Physical Review Letters*, vol. 88, 2002.

Prof. Manijeh Razeghi at the June 2002 McCormick Ph.D. Hooding Ceremony with three of her doctoral graduates (from left to right): Dr. Christopher Jelen (Ph.D. June 1998); Dr. Steven Slivken (Ph.D. June 2002); and Dr. Brett Lane (Ph.D. June 2002). Also in the photo are Brett's spouse, Dr. Melissa Lane (Ph.D. June 2002), their two children, and Prof. Carl Kannewurf, Melissa's faculty advisor. Profs. Kannewurf and Razeghi have become spiritual grandparents to Brett's and Melissa's children.

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