

Three Seniors Take Awards at Regional Research Competitions

During April, Prashant Poddar '04, Eric Geissenhainer '04, and Pujitha Weerakoon '04 were honored for their research.

Poddar '04, who also earned an A.B. degree in economics and business, took first place in the research paper contest at the Institute of Electrical and Electronics Engineers Region II Student Activities Conference hosted by Cleveland State University.

In addition, as the lone undergraduate among 15 graduate students, Poddar took second place in the student paper contest at the IEEE Sarnoff Symposium on Advances in Wired and Wireless Communications, Princeton, N.J. His coauthored paper with research mentor **William Jemison**, and others, "Optimization of Optical/Microwave Interaction in a Mode-Locked Microchip Laser," was published in the symposium digest.

Poddar used microwave-photonic techniques to improve high-speed wireless applications such as telemedicine, multimedia distribution, and advanced satellite and military communications. He worked in collaboration with the Center for Microwave-Lightwave Engineering at Drexel University, which has modified its laser design as a result of his research. He will pursue a Ph.D. in microwave communications at Purdue University, having gained admission to several of the top 10 engineering programs in the country.

Last year, Poddar was the fourth Lafayette student in as many years to receive an IEEE Microwave Theory and Techniques Society Undergraduate Scholarship.

Currently working as an intern with Agere Systems, Allentown, Pa., before pursuing a Ph.D. in electrical and computer engineering at Oregon State University, **Geissenhainer '04** won the Walter B. Morton Student Paper Contest sponsored by the Lehigh Valley Section of the Institute of Electrical and Electronics Engineers. His paper reported on his successful development of energy-efficient analog power amplifiers for applications ranging from robots and wired data communication systems to consumer audio.

Geissenhainer graduated with honors and won a research assistantship. His thesis was advised by **John Nestor** and **David Rich**. He previously worked as an EXCEL Scholar with Rich to find ways of speeding up Internet



Prashant Poddar '04 (right) worked with William Jemison on microwave-photonic techniques.

connections. "Lafayette is an excellent place to conduct research," he says. "My thesis and research papers have helped prepare me for graduate studies."

An honors graduate, **Weerakoon '04** won third place for his oral presentation among about 30 entries at the Northeast Bioengineering Conference hosted by Western New England College. He presented a research breakthrough that would increase safety, enhance monitoring, and eliminate expensive, invasive surgery when ventricular assist devices are used as a "bridge" cardiovascular system for patients awaiting donor hearts for transplant.

"Lafayette is a great institution with faculty who genuinely care about your future and well being," Weerakoon says. "My research professors have helped me succeed not only academically but in other ways in a competitive environment and still keep my priorities straight."

At the conference, Weerakoon and **Matthew Loh '04** each presented independent research guided by **Yih-Choung Yu** for which they both graduated with honors in electrical and computer engineering. ■

Ghanim '03 Receives Fulbright Grant

With a career goal of developing cutting-edge ideas in the field of communications and computer networks for use in entrepreneurial or consulting capacities, **Tarik Ghanim '03**, of Amman, Jordan, has received a Fulbright Student Award to pursue graduate studies in electrical and computer engineering in the United States.

Ghanim, who graduated magna cum laude last May with a B.S. in electrical and computer engineering, received a B.A. in International Studies this May. He is the fifth Lafayette student to receive a Fulbright grant in the last five years.

A member of Phi Beta Kappa, Ghanim says he selected Lafayette because of its "strong engineering program, coupled with its liberal arts atmosphere." Ghanim conducted an EXCEL Scholars project in which he designed virtual computer circuits with power supplies in varying voltages for communications devices.

"With its intellectually atmosphere, Lafayette provided me with the challenge to attack real-world questions using the areas of expertise that I developed in my academic training," Ghanim says. "I was involved in a place of multiculturalism and individualism. My Lafayette experience was enriching in all aspects and has prepared me for any upcoming challenges that life has to offer." ■

Bowen '05 Awarded Grant to Attend Conference

Through a travel grant awarded to Lafayette, **Oliver Bowen '05**, an electrical and computer engineering major, was able to participate in the university booth at the ACM/SIGDA Design Automation Conference during June.

Each year ACM/SIGDA sponsors a university booth which allows students and/or faculty to demonstrate electronic design automation tools, instructional materials, and design projects.

Oliver demonstrated a tool which he developed for visualizing large designs written in Hardware Description Languages (HDLs). He worked as an EXCEL Scholar with **John Nestor** on this project.

The grant was awarded to Lafayette by the Association for Computing Machinery Special Interest Group on Design Automation (ACM/SIGDA). ■

Mission:

Our mission is to be one of the nation's premier undergraduate ECE departments. We are dedicated to providing students a thorough technical preparation, the continuous development of professional awareness, and a heightened sense of social responsibility.

This mission statement leads to three major goals:

- (1) to bring together students of high ability and a faculty composed of teacher-scholars in the major fields of electrical and computer engineering for the purpose of learning through study, inquiry, discourse, and discovery—our people.
- (2) to maintain a continuous evolution of curriculum, pedagogical practices, and resources to educate students in the guiding principles of the engineering profession and the best practices in both electrical and computer engineering—our program.
- (3) to create an interactive environment between students and faculty which fosters a dedication to learning and an appreciation of both the history and future of the discipline—our learning environment.

OBJECTIVES

Graduates will have the ability to:

- educate themselves continually;
- adapt to changing job assignments/challenges;
- function in a team and provide leadership;
- apply their engineering education in solving a broad range of problems;
- be involved in professional/public/community service;
- excel in their chosen area of professional activity;
- communicate in a mature and effective manner; and
- appreciate business enterprise, technology management, and social and legal issues.

PROGRAM OUTCOMES

Upon graduation, students will:

- value life-long learning and understand contemporary issues;
- function in a multidisciplinary team;
- analyze data and communicate results;
- solve broad-based engineering problems in a socially conscious and ethical manner;
- be able to design, simulate, build, and test both complex analog and digital circuits;
- use mathematical technique and science knowledge to model and analyze communication and control systems;
- use modern engineering hardware and software tools;
- be able to formulate an engineering problem and solve it by creating, debugging, and testing a team-based solution;
- understand microscopic material properties and how they are used to develop modern electronic devices.

From the Department Head

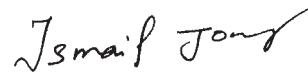
Welcome to the second edition of *ECE: Electrical and Computer Engineering*. We have just completed a very exciting year that began with the dedication of the Acopian Engineering Center. We've settled into our new offices and laboratories on the fourth floor and this issue is filled with exciting news about our program, our students, and our faculty.

We would like to include news about electrical and computing engineering alumni and alumnae. Please send us information about your careers and professional endeavors for our next issue. Write or send email to the contacts provided in the staff box at the lower left.

We hope that you will stop by and visit us when you are on campus or keep up to date with department news through the web site. We are blessed to have such a dedicated, high performing, and loyal cadre of alums.

To my colleagues at Lafayette and other institutions, we thank you for your continued support of our program, and for your interest in our graduates and research.

Thanks to all the alumni, parents, and friends who have contributed to the department through gifts or volunteering their time to help students with advice or internships. A special thanks to Afnan Mian '95 and Hewlett Packard for the donation of a HP DesignJet 800 PS poster printer to the department.



Ismail I. Jouny



Ismail Jouny (right) involves many students including Joshua Porter '06 (left) in his research on robotics.

Improving Control of Robotic Arms

Marquis Scholar Joshua Porter '06 is completing research that may impact the use of robotics in several real-life situations. An electrical and computer engineering major with a minor in mathematics, he is working with Ismail Jouny.

"Josh has been writing computer code and building a small circuit to control the arms of a robotic arm manipulator," explains Jouny. "There are five separate motors on this robot, and he's trying to control the mechanical finger and move it from one point in space to another."

"The software for the arm is written in Java and runs on a computer with the Linux operating system," says Porter. "Since the robot does not currently provide any feedback to the computer, the computer must determine where the robot is based on where it started and how

long it has been moving. Using this information, the computer can move the robot arm from one place to another using an algorithm I wrote to calculate the necessary motions."

"Porter says the research has made him realize that systems which require human input to get them started "are very susceptible to error—tiny inaccuracies in measuring or calibration can quickly turn into larger mistakes."

Porter is pleased with the benefits of programs like EXCEL and attributes its success to Lafayette's close community of scholars and professors.

Porter is a Bible study leader in Lafayette Christian Fellowship, member of College Choir, reporter for *The Lafayette*, and secretary and cochair of the recycling committee of Lafayette Environmental Awareness and Protection. ■



is produced annually by the Office of Public Information for the Electrical and Computer Engineering Department and distributed to Lafayette engineering alumni and students. The department welcomes your comments and letters. Send to: Ismail I. Jouny, ECE Department, Acopian Engineering Center, Lafayette College, Easton, PA 18042; (610) 330-5414, jounyi@lafayette.edu. www.lafayette.edu.

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Electrical and Computer Engineering Faculty: Ismail I. Jouny, Professor and Head; John Greco, Professor; William Hornfeck, Professor; Kim Bennett, Associate Professor; William Jemison, Associate Professor; John Nestor, Associate Professor; David Rich, Associate Professor; Yih-Choung Yu, Assistant Professor; Jeff Gum, Visiting Assistant Professor

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Redda '05 Designs Microprocessors

Working as an EXCEL Scholar with John Nestor, Merhawi Redda '05 of Addis Ababa, Ethiopia, is conducting research to significantly shorten the time it takes to design computer microprocessors.

Redda, an electrical and computer engineering major with a minor in East Asian religions, is using an approach in which microprocessor design is simplified by improving the design of computer hardware.

"Merhawi and I are devising a more efficient way to connect the various layers of microprocessor chips," explains Nestor. We use a process called maze routing. The goal is to find the shortest paths between connection points in a grid graph, while keeping in mind that one connection may block others."

For more than 40 years, the Lee algorithm has been the classic used for maze routing. It requires a lot of time, so Nestor and Redda are working to create a hardware accelerator.

Redda is a member of Institute of Electrical



Merhawi Redda '05 (right) is working on devising a more efficient way to connect the layers of microprocessor chips in EXCEL Scholar research with John Nestor.

and Electronics Engineers and vice president and telecommunications chair of Minority Scientists and Engineers. He volunteers with the Landis Community Outreach Center and also plays intramural sports. ■

Faculty News

John Greco submitted an NSF-CCLI proposal and is presenting two papers at the ASEE conference in Salt Lake City, Utah. He teaches Digital Circuits and Senior Design I and is preparing a new robotics course.

William Hornfeck developed a new Values and Science/Technology Seminar (VAST) on energy resources, which he taught in spring semester. He plans to lead a group of students in the semester-abroad program at Vesalius College, Brussels, in spring 2005. Active on several College committees, he also attended workshops and conferences on fuel cell research during the year.

William Jemison was on sabbatical this year, working with colleagues at Lehigh University, Bethlehem, Pa. He also supervised the work of two students, Ekaterina Jager '05 and Prashant Poddar '04, and continues as associate editor of *IEEE Microwaves Magazine*.

Ismail Jouny continues his research on land mine detection and target identification. His work was recognized in the March 2004 *The Institute* (published by IEEE). He taught Electromagnetics while Bennett was on leave and continues to teach Communications and Digital Signal Processing.

John Nestor, who received tenure this year, continues to teach Computer Organization

and VLSI (Circuit Design and System Design). This year, he taught Digital Circuits I and will teach Senior Design I in fall 2004. Active in research and teaching, he has a pending NSF grant proposal.

David Rich taught the electronics sequence and an elective in IC design. He published papers with students and continued his involvement in IEEE technical committees. He introduced a ready-to-test printed circuit board into the electronics labs this year and advised 10 junior design projects.

Yih-Choung Yu continued work on modeling of ventricular assist devices. He supervised two honors students and has published several papers with them. He taught Signals and Systems, Biomedical Signal Processing, and Digital Control Systems.

Jeff Gum, visiting assistant professor, taught Computer Communications Networks, Circuits, Applied Optoelectronics, and supervised Senior Design II. His team of 12 students designed, built, and tested two robots that navigate in a multi-zoned area. He supervised several independent studies and will be with the department next year.

Kim Bennett will continue his leave in Shanghai, China for another year. ■



"Lafayette is classified as one of the nation's most academically competitive colleges and is committed to providing the best possible undergraduate education in the liberal arts, sciences, and engineering for men and women who can benefit from the Lafayette experience." —*Peterson's Four-Year Colleges, 2004*

Class of 2004 Graduate Success

Five students in the Class of 2004 are pursuing graduate studies and 90 percent of the others were employed at the time of graduation.

The students and their schools are:

Pujitha Weerakoon, Yale University;
Prashant Poddar, Purdue University;
Eric Geissenhaeiner, Oregon State University;
Chris David, Worcester Polytechnic Institute; Will Sutey, Johns Hopkins University. ■

Skrzypecki '04 Studies Engineering of Crayons

An electrical and computer engineering graduate currently working for Lockheed Martin, Manon Skrzypecki '04 had an unusual opportunity to gain firsthand knowledge of the professional world during an externship at Binney & Smith, the world-famous manufacturer of Crayola crayons.

Skrzypecki's experience focused on the nuts and bolts of the machinery that produces Crayola crayons and other art supplies. She shadowed Michael Miletics '95, an A.B. engineering graduate, manager of plant and corporate engineering, Binney & Smith, headquartered in Easton, as part of the January interim externship program with alumni and parent sponsors.

One of Skrzypecki's hopes was to learn about management. "One meeting that I attended was in response to the company getting a new machine," she says. "Every type of engineer was there, mechanical, environmental, etc." ■



Manon Skrzypecki '04 (left) with Michael Miletics '95.

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Robots Find Their Way

Twelve students worked together to create robots for this year's senior design project. The electro-mechanical creations are able to navigate along a dark strip from region to region using two-way communication via a central station. The communication network involves both wireless and wired links. A control station monitors robot activities and issues control commands, sanity checks, and navigation information.



The group which included Brooks Barrett, Joseph Galyean, Tom Gauntner, Shaun Heilmann, Rob Lane, Salman Mujahid, John Nawrocki, Kristen Radecsky, Jason Salisbury, Manon Skrzypecki, Jeff Stofanak, Andrew Thomas, was divided into sections—motor control, power supply, navigation, communication and operating system. The students were advised by Jeff Gum. ■

THE LAFAYETTE Experience

- Student-focused teaching and mentoring by an exceptionally qualified faculty, committed to each student's success.
- A challenging, broad-based academic curriculum that offers strong programs in the liberal arts, sciences, and engineering.
- A small college environment with large college resources.
- A friendly residential community offering an exciting social life with a broad spectrum of extracurricular activities.

Students and Faculty Coauthor Papers and Presentations

B. Cochenour '03, C. Chai '03, and D. Rich "Sensitivity of High-Order Loudspeaker Crossover Networks with All Pass Response," *Journal of Audio Engineering Society*, No. 10, Vol. 51, October 2003, 898-911.

B. Cochenour '03 and D. Rich, "A Virtual Loudspeaker Model to Enable Real-Time Listening Tests in Examining the Audibility of High-Order Crossover Networks," No. 5908; and R. Perruzzi, M. White, D. A. Rich, J. Nestor, E. Gessenhainer '04, M. Johnston '03, "An Efficient Low-Power Audio Amplifier with Power Supply Rails Tracking the Output by Means of Pulse Width Modulation," No. 5920, *Proceedings of the 2003 International Audio Engineering Society Conference*, New York, October 2003.

M. Loh '04 and Y.-C. Yu, "Voice-Coil Actuator Control Design for Use in an Elastance-Based Mock Circulatory System," forthcoming, American Control Conference, Boston, Mass., 2004.

M. Loh '04, "State Feedback Control of a Starling Responsive Mock Circulatory System"; and P. Weerakoon '04, "Development of a Qualitative Validation Process for Cardiovascular System Model Evaluation," Biomedical Engineering Society, Nashville, Tenn., October 2003.

V. Oktem '04 and I. Jouny, "Automatic Detection of Malignant Tumors in Mammography using Fractal Analysis" *Proceedings of CARS* (Computer Assisted Radiology and Surgery), Chicago, Ill., 2004.

V. Oktem '04 and I. Jouny, "Automatic Detection of Malignant Tumors in Mammograms," IEEE-EMBS Conference, 2004.

P. Poddar '04, D. Yoo, W. D. Jemison, A. Madjar, P. Herczfeld, "Optimization of Microwave/Optical Interaction in a Mode-Locked Microchip Laser," *Sarnoff Symposium on Advances in Wired and Wireless Communications*, April 2004, 5-8.

P. Weerakoon '04 and Y.-C. Yu, "Sensitivity Analysis of Cardiac Function Detection for Patients with Ventricular Assist Device Support"; and M. Loh '04 and Y.-C. Yu, "Feedback Control Design for an Elastance-Based Mock Circulatory System," Northeast Bioengineering Conference, Springfield, Mass., April 2004. ■

2004 Honor Graduates

The following students, listed with the title of their theses and their faculty advisers, graduated with honors in electrical and computer engineering.

Christopher L. David, "Moving Light Profile Adapter for the DMX512 Network," John Greco

Erik D. Geissenhainer, "A General Purpose High Quality, Very Efficient Amplifier," David Rich and John Nestor

Matthew R. Loh, "Development of an Elastance-Based Mock Circulatory System and the Derivation of a Model and Control Scheme for the Associated Voice-Coil Actuator," Yih-Choung Yu

Volkan Oktem, "Automatic Detection of Malignant Tumors in Mammography," Ismail Jouny

William G. Sutey, "FPGA Implementation of a 32-Bit RISC-Pipelined Microprocessor," William Hornfeck and John Nestor

Pujitha Weerakoon, "A Sensitivity Analysis of the Cardiac Function for Patient with Ventricular Assist Device Support," Yih-Choung Yu ■