The ECE Current

ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT, UC SANTA BARBARA

Fall 2012 issue

Celebrate the transformation...

50 YEARS

With a look back...

and a step forward...

News Flash...

This issue of our annual newsletter contains interviews with alumnus Bobby Brar and Professor Petar Kokotovic, announcements of recent awards received by faculty, highlights of two faculty research initiatives, articles on undergraduate capstone project award winners, and details concerning events associated with our 50th Anniversary Celebration. Additionally, we welcome three new faculty, Jon Schuller (Nanophotonics), Yasamin Mostofi (multi-agent systems, mobile sensor networks, and wireless communications), and Pradeep Sen (computer graphics and imaging). These faculty were selected after a broad National search with over 500 total applicants. There is much more happening on campus than we can include in this newsletter, so whenever you have the opportunity, please come by campus. We would love to show you around.

Jerry Gibson, Department Chair

In February of this year **Professor Steve DenBaars was elected to the National Academy of Engineering** (NAE) in recognition of his "contributions to gallium nitride-based materials and devices for solid state lighting and displays." Election to the NAE is among the highest professional distinctions accorded to an engineer. Since joining UCSB in 1991, DenBaars has helped pioneer the field of solid state lighting. His specific research interests include growth of wide-bandgap semiconductors (GaN based) and their application to Blue LEDs and lasers, and high power electronic devices.

For more ECE news, visit: ece.ucsb.edu/news/

Current NAE members:

Rod Alferness (2003)
David Auston (1989)
John Bowers (2005)
Larry Coldren (2004)
Steve DenBaars (2012)
Arthur Gossard (1987)
Petar Kokotovic (1996)
Herbert Kroemer (1997)
Umesh Mishra (2009)
Sanjit Mitra (2003)
Lawrence Rabiner (1983)

ECE Celebrates 50 years of excellence!

We are commemorating ECE's 50th Anniversary during the 2012-13 academic year. As part of the celebration, 3-time alumnus and D2 Technologies Chairman and CEO, David Wong presented a Distinguished Lecture on November 2nd. His lecture, entitled "From Voice Processing Research to Serial Startups," covered his journey from ECE freshman to his fifth or sixth startup company 25 years later. Wong described both failures and successes, shared amusing anecdotes, and provided extraordinary insights into the entrepreneurial process. The lecture was the second in the series celebrating our 50th anniversary. The first lecture was presented on Friday, April 27th, by Stanford University's Robert Gray and titled, "California Coding: Early LPC Speech in Santa Barbara, Marina del Rey, and Silicon Valley and its Accidental Impact on the Internet Protocol." This talk highlighted UCSB's role in the early development of the ARPAnet and VoIP.

For upcoming events, visit: ece.ucsb.edu/anniversary/

Robert Gray (left) and David Wong (right) presenting lectures as part of ECE's 50th Anniversary Distinguished Lecture Series.

Alumni Spotlight

Bobby Brar

Dr. Bobby Brar received his MS and Ph.D in Electrical Engineering from UCSB in 1992 and 1995, respectively, having studied the InAS/AlSb/GaSb compound semiconductor material system for high-speed electronic and optoelectronic applications. In 1999 he joined the Teledyne Scientific Company to manage the Advanced III-V Devices and Material department. Brar presently runs TSC, Teledyne's R&D Laboratory, with over 100 technical staff developing technologies in Materials, Optics, Information Sciences, and MEMS/Electronics.

Q: How did ECE propel you in your specialty and career path?

A: When I was a student UCSB was already well known for compound semiconductors. They had a phenomenal faculty including many well-known pioneers from Bell Labs. So I got to study under the best professors in the field, and having a really amazing advisor, Herb Kroemer, was a great incentive to work hard and to make something out of it when I graduated.

Q: What did you find to be unique about the department?

A: There is a collaborative atmosphere between all the professors. I think that was unique to UCSB and it's trying to be replicated by other institutions now. For example, when I was a student I never really had to go to a professor to use his/her equipment. I just worked directly with the students, and that was really cool because it fostered collaboration between students.

Q: What has been one of your proudest moments since joining industry?

A: In our field teamwork is the most important thing. Any of my proud moments have involved a number of other people that have made contributions, and I've been fortunate to be on those teams. We've done work making the world's fastest transistors, world's fastest circuits, and world's most low-powered circuits. There's really cool stuff going on and I'm really happy to have been a part of those teams.

Q: How do you interact with UCSB from a professional and personal standpoint now that you're at Teledyne?

A: Right now we are doing quite a bit of work with UC Santa Barbara. We work very closely with Professor Rodwell, who has really been a pioneer for high-speed semi conductors as well as high-speed circuits. We have also worked with consultants at UC Santa Barbara, including Professor Kroemer who has been a consultant with us for 30 years. This means I get to see him and interact professionally and personally once a month.

Q: What is your advice for students starting their engineering careers this fall and students continuing as graduate students?

A: For first-years I strongly encourage you to make sure you enjoy what you're doing. If you don't enjoy it, then find something that you will. That's the most important thing. Secondly, get a good study group. I know that sounds silly, but it's critical. You can have fun and cut loose with them, but you all know you have to get work done. For graduate students, my advice is to enjoy it and don't be in a hurry to get out because this is an opportunity to learn something at a depth you will never get ever again. If you get a good solid foundation, your research life or engineering life in that field will be longer.

Q: Why do you think it is important to give back?

A: You're going to wear the UCSB badge for the rest of your life, so it's important that the school continues to thrive and do well. More importantly, it's amazing how a little money can go a long way in a student's life. So if you're inclined to give, any amount can make a big difference in the life of a struggling student in this day and age. And it's ECE's 50th anniversary so I recommend alumni come to one of the events to see what's going on and what's happened in the last 10 years. It's absolutely amazing how this program has risen in quality, stature, and rankings across the world.

To see a video of this interview, visit ece.ucsb.edu/profiles/brar/

Brar with fellow ECE Advisory Board member Robert Hammond and his former mentor, ECE Professor Herb Kroemer, at the 2012 ECE Advisory Board meeting.

Research Initiatives...

Controlling the Phase of Light
Professor Larry Coldren

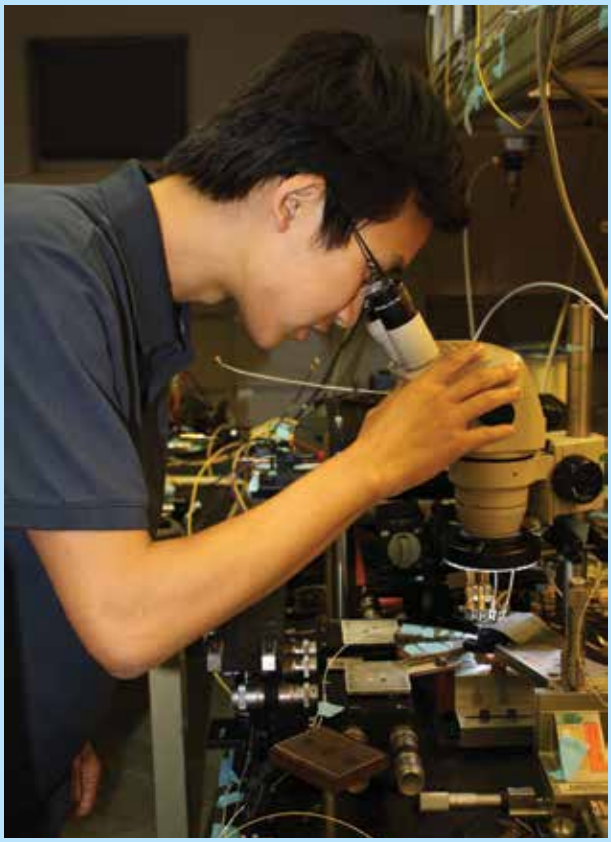
In modern communication devices, such as radios, cell phones and computers, phase-locked loop (PLL) technology is widely applied to make communication fast and reliable. The researchers from Professor Larry Coldren (lasers and photonic integrated circuits) and Professor Mark Rodwell's group (ultra-high-speed electronics) are working on extending this idea to the optical world. By using optical phase-locked loops (OPLLs), full engineering control of the phase of lightwaves used in optical communication and sensing systems has been achieved. Coherent optical wavelength synthesis, useful in Light Detection and Ranging (LIDAR), Optical Coherence Tomography (OCT), and fiber-optic receivers, has been realized within a footprint smaller than a thumbnail.

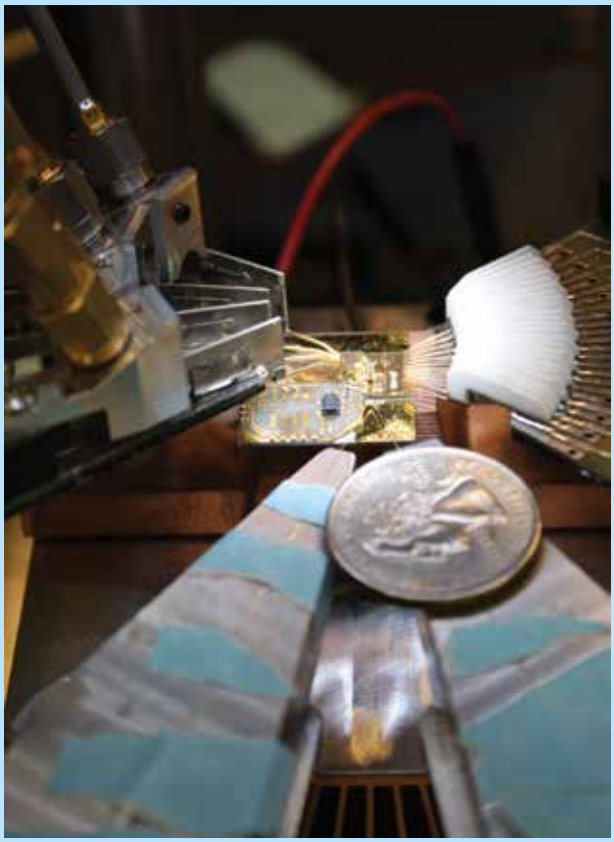
Historically, even though controlling the phase of the light has been the dream of many researchers, it has proven hard to implement because of environmental fluctuations and inherent system sensitivity caused by the very short wavelengths involved. However, photonic integration overcomes these barriers. Utilizing the photonic integration technology developed by UCSB researchers on an InGaAsP/InP semiconductor platform, Professor Coldren's group integrated the whole optical system, including lasers, detectors, etc., on a single chip, which not only makes the system size much smaller, but also significantly improves the system stability and reliability.

By fully controlling the phase of light, the laser wavelength accuracy can be improved by more than a million times, which enables the building of ultra-sensitive ultra-accurate coherent optical communication and sensor systems. For example, coherent LIDAR systems with improved accuracy, having applications in topographic mapping, geomatics, archaeology, geography, seismology, forestry, remote sensing, and, atmospheric physics, are enabled. OCT systems with micron-level accuracy for fiber optic sensing as well as biological imaging are also made more practical.

In fiber-optic receivers, highly-integrated optical phase-locked loops can accurately synchronize the phase (and frequency) of the local oscillator with that of the transmitting laser with almost no relative phase error. This enables higher sensitivity and higher spectral efficiency while consuming much less power than alternative state-of-the-art receivers. All three aspects are desired in future communication systems.

To learn more, visit: ece.ucsb.edu/Faculty/Coldren/





A New Frontier in Biosensing using a Quantum Mechanical Transducer

Professor Kaustav Banerjee

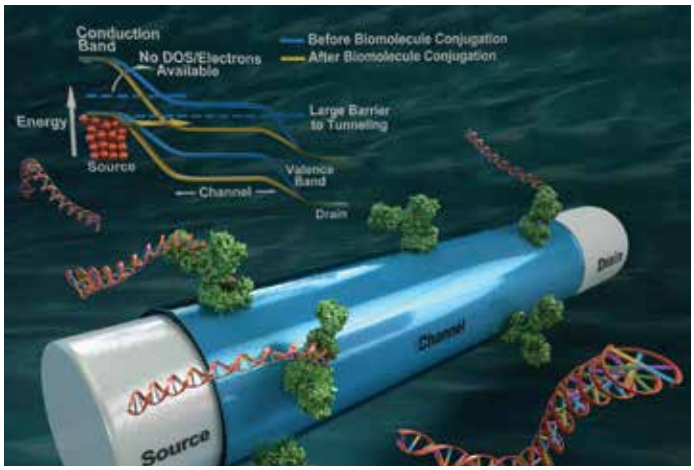


Fig. 1. Schematic of a Tunnel-FET biosensor proposed by Banerjee and its band diagram illustrating band-to-band-tunneling triggered by biomolecule conjugation. (Artwork by Peter Allen, UCSB).

Biosensors based on conventional field-effect-transistors (CFET) have been gaining momentum and attention as a viable technology for the medical, forensic, and security industries since they are very cost-effective compared to optical detection procedures. Such biosensors allow for scalability and label-free detection of biomolecules – removing the step and expense of labeling target molecules with fluorescent dye. The principle of action of a FET biosensor is similar to the FETs used in digital circuit applications, except that the physical gate is removed and the work of the gate is carried out by the charged biomolecules that are to be detected. For immobilizing these biomolecules, the dielectric surface enclosing the semiconductor is coated with specific receptors, which can bind to the target biomolecules (a process called conjugation). However, the thermionic emission current injection mechanism in CFET based biosensors puts fundamental limitations (minimum subthreshold swing of 60mV/decade, which implies that the gate voltage of the FET needs to be lowered by at least 60 mV in order to lower the drain current by one decade) on their maximum sensitivity and minimum detection time.

Professor Kaustav Banerjee and his group have recently shown (Applied Physics Letters, 100, 143108, 2012) that it is possible to overcome the fundamental limitations in CFET based biosensors by employing a tunnel-FET (TFET) sensor (Fig. 1). The TFET biosensor has been shown to be both time-efficient and 10,000 times more sensitive than sensors based on conventional FETs. The key concept behind their device is to leverage biomolecule conjugation to bend the energy bands in the channel region leading to the quantum-mechanical phenomenon of band-to-band tunneling (Fig. 1) that is a fundamentally different current injection mechanism. This results in an abrupt increase in current, which is instrumental in increasing the sensitivity (Fig. 2) and reducing the response time of the proposed sensor. The sharp (<60mV/decade) turn-on feature of the TFETs also allow ultra-low voltage and low off-state-leakage (and hence low power) operation that is desirable for hand-held, battery operated point-of-care biosensors as well as for deployment of such sensor arrays in remote locations.

The TFET biosensor has established the foundation for a new generation of ultra-sensitive biosensors that open new opportunities for detection of biomolecules at extremely low concentrations. The unique advantages of the TFET biosensor are expected to have tremendous impact on the fundamental research in genomics and proteomics as well as pharmaceutical, clinical and forensic applications, including the growing market of in-vivo diagnostics. Moreover, since the TFETs can be easily integrated in the widely available silicon-based semiconductor technology, they can be mass produced in a cost effective manner. The TFET biosensor idea has been resonating across the scientific world and has appeared in nearly all the leading science and technology websites including EE Times, R&D Magazine, Science Newsline, etc, and was selected in the Research Highlights of Nature Nanotechnology for May 2012. Banerjee and his group are currently working on the experimental demonstration of the device and also seeking collaborations with the medical and health industries.

To learn more, visit: nrl.ece.ucsb.edu

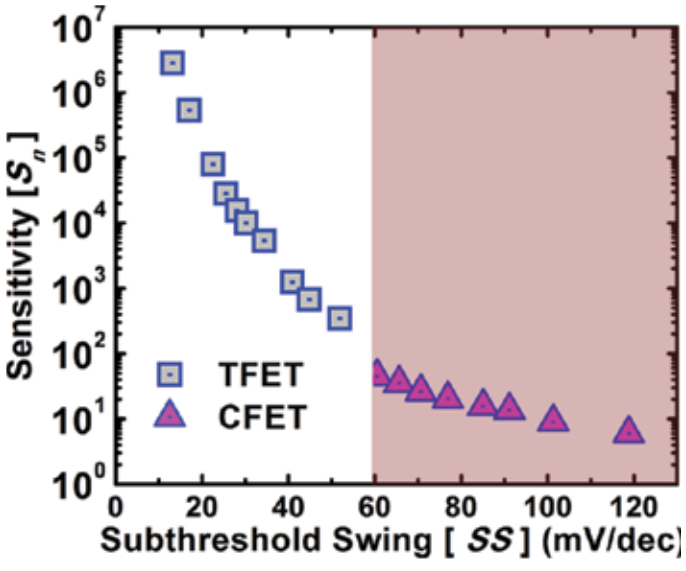


Fig. 2. Sensitivity for biomolecule detection is found to improve substantially with decrease in the subthreshold swing (SS).

Welcome New ECE Faculty!

Pradeep Sen joined the ECE department as an Associate Professor in September 2012 with MS and PhD degrees in Electrical Engineering from Stanford University. Sen graduated from Purdue University with a BS in Computer and Electrical Engineering in 1996 before completing his graduate studies at Stanford in 2006. From 2006 – 2012, he was a faculty member in the ECE department at the University of New Mexico, where he built up a research program in computer graphics. Sen has received the NSF CAREER award and two best-paper awards at computer graphics conferences.

His research interests are in the areas of computer graphics, computational imaging, and computer vision. Specifically, within computer graphics he studies new algorithms and techniques for rendering photorealistic synthetic images from scene data. These images can be used in a wide variety of applications, from entertainment (special effects for feature films and videogames) to medical applications, to tele-presence. In computational imaging, he works on developing new imaging techniques that will considerably improve the quality of consumer photography.

Jon Schuller joined the ECE department in the summer of 2012. A born-again Gaucho, he graduated from UCSB with a BS Degree in Physics before completing a PhD in Applied Physics at Stanford University. His doctoral work on nanophotonics, the study of light-matter interactions at nanometer length-scales, comprised research in plasmonics, metamaterials, and CMOS-compatible photonics. As a Fellow of the Columbia University Energy Frontiers Research Center, he applied nanophotonics concepts and techniques towards the fundamental study of solar cell materials and design.

His current research concerns novel physical phenomena that occur when light interacts with objects of subwavelength dimensions. He exploits these discoveries to make smaller, faster, and more efficient photonics technologies. In his doctoral thesis, he used engineered nanoscale structures as constituents in materials with novel optical properties. As a postdoc, he applied this research in reverse. By studying the optical properties of real materials he developed new understanding of the underlying molecular constituents. He plans to combine these two research directions. Engineered nanoscale systems will serve as a framework for understanding and influencing electromagnetic phenomena in atoms and molecules. Ultimately, he hopes this research will lead to a future where optical properties are controlled and engineered at the atomic and molecular level.

Yasamin Mostofi received the BS degree in electrical engineering from Sharif University of Technology, Tehran, Iran, in 1997, and the MS and PhD degrees in the area of wireless communication systems from Stanford University, in 1999 and 2004, respectively. She recently joined the ECE department at UCSB as an Associate professor. From 2006 to 2012, she was a faculty in the Department of Electrical and Computer Engineering at the University of New Mexico. Prior to that, she was a postdoctoral scholar in control and dynamical systems at the California Institute of Technology from 2004 to 2006.

Mostofi is the recipient of the Presidential Early Career Award for Scientists and Engineers (PECASE) and the US National Science Foundation (NSF) CAREER award, and she is a member of the IEEE. She received the Bellcore fellow-advisor award from the Stanford Center for Telecommunications in 1999. She also won the 2012 IEEE Outstanding Engineer Award of Albuquerque and the 2008-2009 Electrical and Computer Engineering Distinguished Researcher Award from the University of New Mexico. Her current research lies at the intersection of the two areas of communications and control/robotics in mobile sensor networks. Current research projects include communication-aware navigation and decision making in robotic networks, compressive sensing and control, obstacle mapping, robotic routers, and cooperative information processing.

Professor Steve Butner Retires

After 31 years with ECE, Professor Steve Butner has retired, leaving a legacy of exemplary service to the Department, the CE program, the College, and the campus. Bringing valuable industrial experience in computer and operating systems software design, Butner joined the faculty in 1981 on the very same day as fellow Professor Emeritus Steve Long.

"Our families became close friends and continue to be to this day. While our backgrounds and research were quite different, we found common ground to work together on IC design," Long said. "At that time, there was much interest in using GaAs FETs for high speed digital LSI/VLSI. We collaborated on these circuits for about a decade. Our research groups shared many happy times at Goleta Beach."

Professor Butner with students from ECE 189A/B at a ceremony during the 2012 Capstone Senior Project Presentation Day.

Most recently Butner's research focused on both general- and special-purpose computer architectures of high performance and/or high-reliability applications, very large-scale integrated circuit structures and their influence on computer design, and interconnection networks for parallel and distributed computer systems.

Some of his most notable contributions to the department have been as a teacher. He initiated and has taught the Computer Engineering Capstone course that all CE graduates are required to complete for the past 8 out of 9 years, each year winning the "Outstanding Faculty Member" awarded by the Engineering Student Council. He also served as ECE Chair from 1994 to 1998, and played a crucial role guiding the ABET accreditation of both ECE and subsequently the CE program.

Q & A with
Petar Kokotovic

Professor Emeritus Petar Kokotovic joined the ECE department in 1991. He helped form and went on to direct until 2003 what is now the Center for Control, Dynamical Systems, and Computation. His research focused on nonlinear control, both robust and adaptive. He initiated the development of a popular nonlinear recursive design, backstepping, and is one of the highly cited authors in his field and in engineering. Known for his passion for mentoring, he has supervised 35 Ph.D. students and 20 postdoctoral researchers, with whom he co-authored numerous papers and ten books.

Q: What are the biggest changes you have seen in the past 20 years in the ECE department?

A: There has been a whole change of generations. We have a tremendous group of super talented young faculty. I think it's exciting how new, young, and accomplished the department is now. Those who I call young are my colleagues in their 40s and 50s who have accomplished a lot. The number of recognitions that have come to the department in the forms of memberships to national academies, societies, and awards, and the crop of graduate students and their careers greatly benefit the department.

Q: Can you tell us about founding the CCDC (formerly CCEC) and its beginnings?

A: My formal appointment was April 1, 1991 and the center had already been formed. The initial plan was to take over the building that was still available through the college from a different federally funded center of robotics, but I didn't want to do that. I was in favor of sharing interests, and I felt that having a joint seminar was much more important, so we created that. Instead of teaching separate courses in chemical engineering, mechanical engineering, and electrical engineering, we put it all together so that the graduate students came from all different departments. Our classes became bigger and we were able to offer much more diversity of courses with the same number of faculty.

Q: What accomplishments within the center are you most proud of?

A: Primarily, the success of the students and the growth of young faculty who have become national and international stars. It's pretty amazing how successful they are and how well-known they are. A group of 14-15 faculty with about 60-70 graduate students, many of whom have accomplished a lot and have wonderful positions in both industry and academics. This is a great outcome, and the many awards people have received and the many distinctions, and invitations to give lectures show this. I think this is very much unique in the center.

Q: You have served on (and chaired) numerous PhD and MS committees. Are there any particular success stories you'd like to share?

A: I would say that success stories are due to the students themselves. Very often there comes extraordinary talent, and all the credit goes to the mentor. I remember two or three of my students, hard working, and wonderful young men. They were initially so insecure, but wow, what a success they were! The key is to encourage their hidden abilities and allow them to surface. I myself had the three most remarkable mentors one can imagine. You feel like family with them. Basically to the end of their lives, I remained in contact. So it goes way beyond the relationship as a mentor and mentee. I once wrote a little autobiographical sketch that the whole nature of research can lead to an introverted genius sitting somewhere doing research alone, but it's so much more fun to do research together – to have it as a social activity; to have the fulfillment to see other people succeed or help you succeed.

Q: How do you give back to the college (UCSB)?

A: In today's climate, the state – well, education – it's under attack, losing resources. I think we, as citizens, could do more and should do more, to apply political pressure to our representatives not to allow the impoverishment of higher education and education in general. The University of California system is a grand idea that has worked so well for so long. We have to save it and develop it, so my idea of giving back is getting engaged to prevent the destruction of the University of California system.

To see a video of this interview, visit ece.ucsb.edu/profiles/kokotovic/

Student Spotlight...

Professor Gibson receives Pathways Grant

Jerry Gibson, ECE Chair and UC-HBCU Initiative PI and his ViVoNets Lab received a Pathways Grant and collaborated with two students from Jackson State University this past summer. The students, Adeola Odunsi and Lemnyuy Bernard Nyuykongi, visited Gibson's ViVoNets Lab this past summer and worked on transrating and transcoding in video compression. Both Nyuykongi ("Transcoding in Video Compression") and Odunsi ("Transrating in Video Compression") presented their research and posters at the 2012 UCSB Summer Undergraduate and Graduate Research Colloquium. Since bandwidth is limited in cellular networks, transrating or transcoding may be used to reduce the bandwidth required to send video to a user's cell phone. Transrating, as opposed to transcoding, allows for the video to be encoded once at the server but, with the knowledge of certain parameters (the capabilities of the device, the user's preferences and also the bandwidth available on the wireless channel), the required bit rate is reduced to match the available wireless channel bandwidth. The two students from Jackson State University were a part of the UC-HBCU Initiative, which is a faculty grants program that seeks to improve the participation of African Americans/Blacks in UC graduate programs, particularly Ph.D. programs, by investing in relationships and efforts between UC faculty and Historically Black Colleges and Universities (HBCUs). Adeola Odunsi enrolled in the Computer Engineering Masters program in Fall 2012, with a particular emphasis on computer networking. She is one of only three students from the UC-HBCU initiative system wide to enroll in graduate school on a UC campus in the Fall quarter. Another HBCU student will be visiting Gibson's lab in the Summer 2013.

Award winning Capstone projects

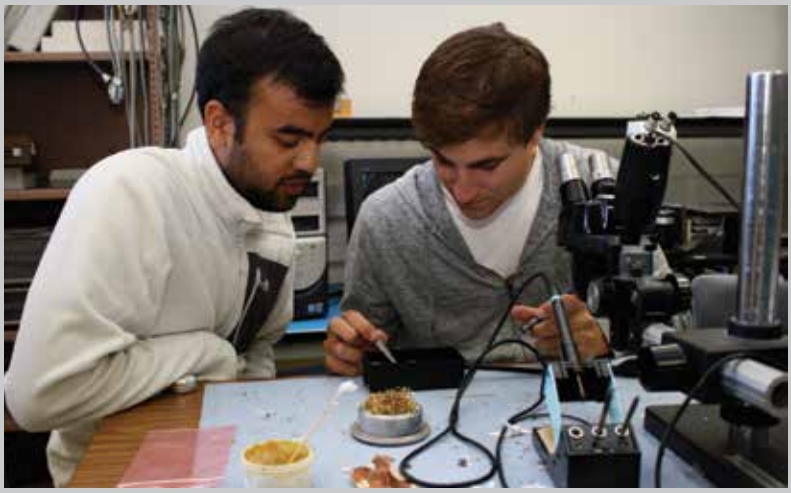
Project: Android Quickdraw

Award: Won Best Projects-ECE 188A/B

Description: Android-based glucose meter

Team: Laurel Hopkins, Bassel Ihsan, Taishi Kato

Sponsor/Mentor: Professor Luke Theogarajan



Project: BrightBlu

Award: People's Choice Award at the finals of the UCSB Technology Management Program's New Venture Competition (NVC) and 2nd place in the "Tech Push" track

Description: Smartphone controlled Bluetooth home automation complete with the world's first app-store for your home.

Team: Sidhant Bhargava, Ben Chang, Taylor Umphreys

Sponsor: Solid State Lighting Services, Inc.

Mentors: Morgan Pattison, Jim Honea

For more information, visit: ece.ucsb.edu/academics/undergrad/capstone/

The ECE Student Office

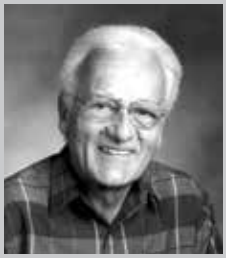
Processes over 1,500 graduate applications a year.
Oversees the largest graduate student enrollment per department on campus.
Oversees two undergraduate majors: Electrical Engineering and Computer Engineering.

The ECE Student Affairs staff are:
Val de Veyra, Student Affairs Manager, Erika Klukovich, Graduate Admissions Coordinator, Alejandro Reyes, Undergraduate Program Assistant, and Libby Straight, Webmaster & Computer Engineering Assistant.

Recognitions

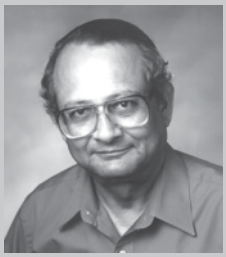
Kaustav Banerjee
Elected as **IEEE Fellow** for his seminal contributions to modeling and design of nanoscale integrated circuit interconnects.

John Bowers
Received the **John Tyndall Award** from the IEEE Photonics Society for his international leadership in the development of novel optoelectronic devices.



Petar Kokotovic
Elected as **Foreign Member of the Russian Academy** of Sciences in recognition of his scientific merits and achievements throughout his career.

Hua Lee
Received a **Technical Achievement Award** from the International Symposium on Acoustical Imaging for his work on ultrasound tomographic microscopy and synthetic aperture sonar imaging, as well as his service.



Sanjit Mitra
Recieved the **2013 IEEE Gustav Robert Kirchhoff Award** for outstanding contributions to the fundamentals of filter design.

Chris Palmstrom
Named a **Materials Research Society Fellow** for his distinguished accomplishments and their outstanding contributions to the advancement of materials research, worldwide.

Mark Rodwell
Honored with **Doluca Family Endowed Chair** for research which extended the limits of high-frequency radio, high-speed optical communications, and powerful imaging applications.

Luke Theogarajan
Named co-recipient of the **2011 Northrop Grumman Excellence in Teaching** award.

Thank you to our 2011-2012 Donors!

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Michael D'Errico '92
Lale and Tunç Doluca '81
Catherine Flores and Tony Tarango '94
Patricia and David Giuliani '68
Toni and Thomas Guckert '79/'79
Jeffrey Hartman '81
Madhu Iyer '05
Mr. George V. Leming
Mr. David Li
Claudia and John Mazurkiewicz '73
Mr. Phillip M. Metzen
Sharyne and Gene Miller
Mr. John M. Nakata '78
Dr. Erdal Paksoy
Mr. Archie George Perlegos
Mr. Ridah N Sabouni
Ms. Joan M. Saniuk
Dr. and Mrs. Michael D. Santos
Mr. and Mrs. Naftali Sauerbrun
Linda and Jeffrey Schlageter '65/'65, '67
Lynne and Carl Steffens '85
Thomas Stockton '65, '67
Mr. David R. Styerwalt
Debbie and Steve Umphreys

Teaching Awards

Steve Butner and Luke Theogarajan

Professors Steve Butner and Luke Theogarajan were selected as the outstanding Faculty Members in Computer Engineering and Electrical Engineering, respectively, for 2011-12. The graduating seniors in the program made this selection based on teaching excellence.

To see more awards, visit: ece.ucsb.edu/news/

Invest in the Department of Electrical and Computer Engineering

The goal of the Department of Electrical and Computer Engineering at UC Santa Barbara has always been to provide our students with the best possible opportunities to learn and develop. The faculty, students, and administration have created an atmosphere of interdisciplinary and collaborative research that is renowned throughout the Nation and is the cornerstone of our success.

Your investment in the Department of Electrical and Computer Engineering plays a critical role in our ability to fulfill our mission and provides essential support of ECE's teaching program and research enterprise.

Department funding opportunities include:

-**Unrestricted support** to be allocated to the highest priority needs by the Department Chair.

-**Roger Wood Endowment**, established in honor of esteemed faculty member Roger C. Wood, supports undergraduate and graduate fellowships, faculty, and state-of-the-art teaching facilities.

-**Undergraduate laboratory** renovations to maintain and upgrade the quality of essential facilities for teaching and research. Priority renovations and naming opportunities include: Digital Lab, Controls Lab, Computer Engineering Lab, High Speed Communications Lab, Microwave Lab, Digital Signal Processing Lab, and the Instructional Clean Room.

-**Endowed chair** establishment which honors, encourages, and supports the professors whose brilliant minds and commitment to education and research promote the University's mission.

Students working in the CE Capstone Project Lab

Current Endowed Chairholders include:

John Bowers,
Fred Kavli Chair in Nanotechnology

Mark Rodwell,
Doluca Family Chair in Electrical and Computer Engineering

Herbert Kroemer,
Donald W. Whittier Chair in Electrical Engineering

Larry Coldren,
Fred Kavli Professor of Optoelectronics and Sensors

Please use the donation form below and enclosed envelope to make your annual gift to the Department of Electrical and Computer Engineering.

For more information about how you can support the Department, please contact Melinda Glasgow Douglas at 805-893-2580 or melinda.glasgow@ia.ucsb.edu.

To give to ECE online, visit https://www.giveucsb.com/ece.htm

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YES! I WANT TO SUPPORT ECE!

Name_____ Former Name (if any) _____

Address_____ City_____State_____Zip_____

E-mail address_____Degree_____ Field_____

Please include a **business card** in the return envelope provided so we can update our records!

GIFT DESIGNATION

☐ Please direct my gift where the need is greatest in ECE at the discretion of the Department Chair

☐ Roger Wood Endowment

☐ Please use my gift for the following:_____

Enclosed is my gift of:

☐ $1,000 - $9,999 Chancellor's Council

☐ $500 - $4,999 Young Alumni Chancellor's Council (Alumni since 2002)

☐ $500 ☐ $250 ☐ $100 ☐ Other _____

☐ Matching Gift Employer:_____

Matching Gift Form is enclosed: ☐ Yes ☐ No

PAYMENT METHOD

☐ I have enclosed a check payable to **UC Santa Barbara Foundation**.

☐ Please charge $_____now to my credit card.

☐ VISA ☐ Master Card ☐ American Express ☐ Discover

Name (as it appears on card):_____

Account Number:_____

Exp. Date _____ Signature:_____

PLEASE TELL ME HOW I CAN

☐ Make a gift using securities

☐ Enjoy the benefits of estate planning

THANK YOU FOR YOUR GENEROUS GIFT!

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