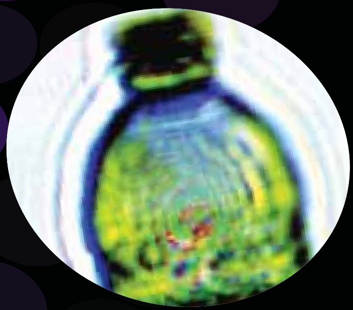
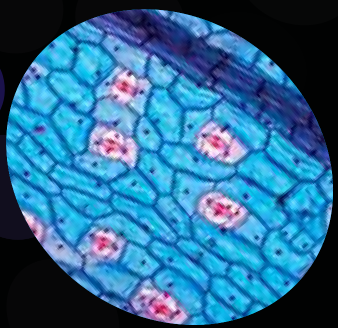
UCLA

Henry Samueli School of Engineering and Applied Science

Electrical Engineering





Annual Report 2011-2012

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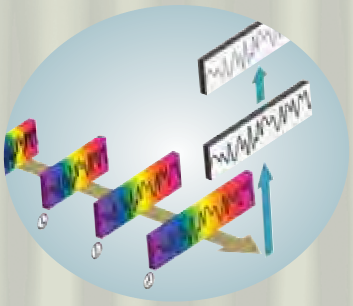


Another Year of Advancement

Chair M. C. Frank Chang

I am pleased to share with you the activities of UCLA Electrical Engineering for academic year 2011-2012. Research conducted by our faculty, staff and students have resulted in many exciting advances.

Three Assistant Professors, Danijela Cabric, Lara Dolecek and Benjamin Williams, were each awarded with the National Science Foundation's CAREER award, the federal agency's most prestigious award in support of junior faculty. The CAREER program also provides funding for innovative research to each of the awardees. Associate Professor Aydogan Ozcan, himself an NSF CAREER recipient in 2010, was honored with the Presidential Early Career Award for Scientists and Engineers (PECASE) and Assistant Professor Robert Candler received the Army Research Office Young Investigator Award.

Additional honors were awarded to our faculty for their scientific and teaching contributions — Professor Yahya Rahmat-Samii was awarded the UCLA Distinguished Teaching Award for his dedication and effectiveness as an educator and Professor Henry Samueli was honored with the Marconi Prize for his pioneering development in broadband radio-on-chips. Professor C. Kumar Patel was inducted into the National Inventors Hall of Fame for first realizing the carbon dioxide laser, which has been extensively used in the advancement of medical, industrial and military fields almost 50 years after its invention.

On the research front, Professors Asad Abidi and Frank Chang have realized a universal radio receiver in commercial CMOS that can cover the entire communication bands below 3GHz. Professors Oscar Stafsudd and Warren Grundfest are developing real-time optical cancer detection techniques and Professors Tatsuo Itoh and Benjamin Williams are investigating Terahertz laser antennas that will lead to advanced functionality for THz devices.

Our students and graduates have also made significant research developments. Distinguished Ph.D. Dissertation Awards were granted to:

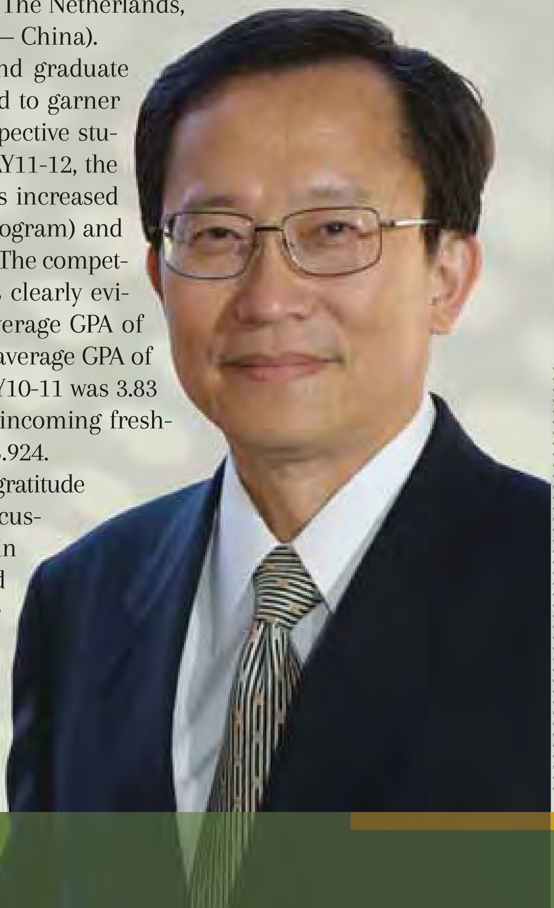
- Adrian Tang for his mm-wave and THz imaging techniques that can be used to detect concealed weapons up to 500 GHz in commercial CMOS.
- Ali Motafakker-Fard for his high-speed optical imaging techniques which can slow down, amplify and capture extremely fast events.
- Thomas Courtade for his work on source coding which have applications to the data-centric world we live in today.

David Murphy's paper on the development of a universal radio receiver architecture to cover the entire communications bands from 80 MHz to 2.7 GHz without using external SAW-filters, a collaboration between UCLA and Broadcom, was awarded the ISSCC 2012 Distinguished Technical Paper Award.

Our alumnus Dr. Kinam Kim (UCLA Ph.D. 1994) was elected as a Foreign Associate of the National Academy of Engineering. And eight graduates recently accepted academic appointments, both here in the US (UCLA, UC Davis, Florida International University) and abroad (National Tsing Hua University —Taiwan, Gwangju Institute of Science & Technology — Korea, Delft University — The Netherlands, and Tsinghua University — China).

Our undergraduate and graduate programs have continued to garner much interest from prospective students. From AY10-11 to AY11-12, the number of applicants has increased by 8% (undergraduate program) and 36% (graduate program). The competitiveness of admission is clearly evidenced by comparing average GPA of incoming freshmen: the average GPA of incoming freshman in AY10-11 was 3.83 compared to that of our incoming freshman class with a GPA of 3.924.

We extend our deepest gratitude to our friends, alumni, customers and collaborators in industry, government and academia — with your continued support, we will continue to strive for both academic and educational excellence.



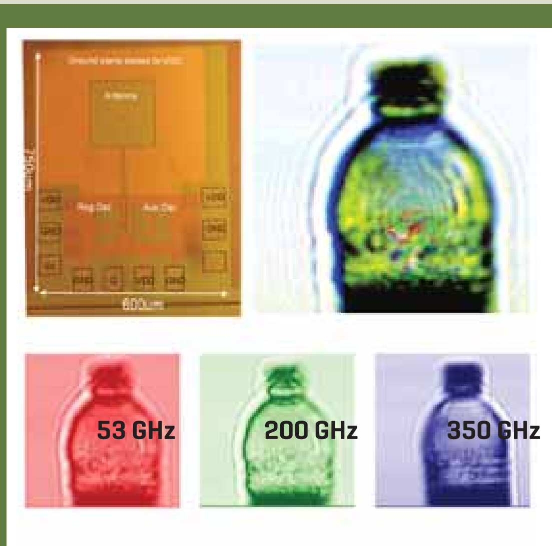
CMOS Millimeter-Wave and THz Imaging Techniques

Adrian Tang

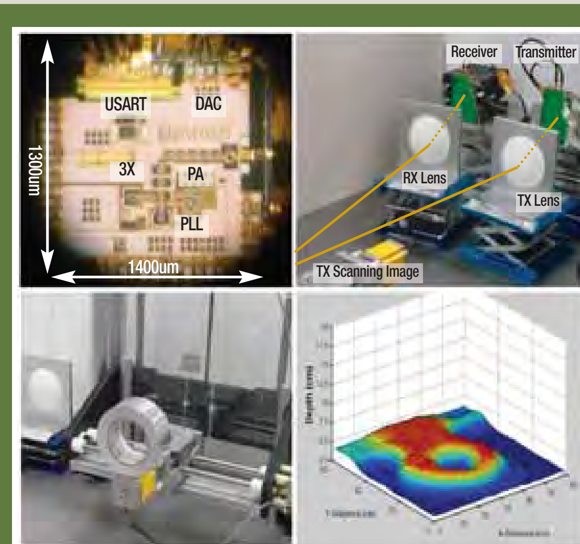
Advisor: Professor M. C. Frank Chang

Millimiter-Wave and THz imaging is an exciting research area creating new possibilities of detecting concealed weapons, contraband materials and even trace gases using the unique physical properties of mm-wave and THz radiation. Here at UCLA, we have developed several new techniques to construct THz detectors based on super-regenerative receivers at frequencies up to 495 GHz and noise equivalent powers as low as 1fW/Hz05. An antenna-less regenerative reception approach was demonstrated at 245 GHz which uses regenerative passives to act as a radiator, greatly improving imaging receiver noise performance. Secondly, an Intermodulated regenerative reception technique was demonstrated at 350 and 495 GHz as a means to image in multiple bands, and operate above fmax, the device unity gain frequency. Quench-synchronized focal plane arrays were developed which allow super-regenerative receivers to operate in close proximity without suffering from quench coupling super-regenerative interference. Finally, a full 144 GHz 3D imaging radar based on successive-approximation ranging is presented which achieves sub-cm resolution in an all CMOS implementation. 3D imaging is critical to overcome the narrow-band effects of mm-wave and THz imaging including ghosting, specular material responses, low reflection diversity and incidence angle losses. The demonstrated radar system sets the record for radar accuracy in silicon technology.

Professor Henry Samueli examines Adrian Tang research project.



A CMOS 350 GHz color THz imaging receiver developed at UCLA.

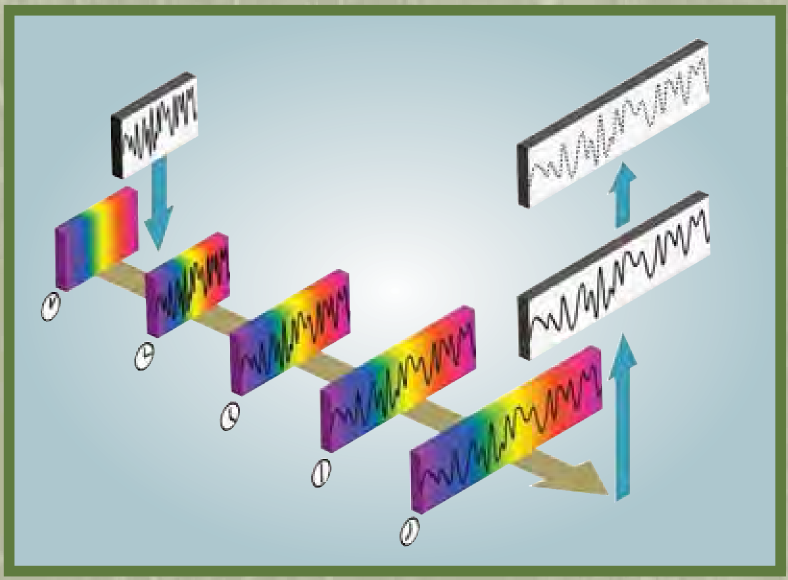


A CMOS 144 GHz 3D mm-wave imaging radar system developed at UCLA.

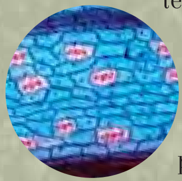
Photonic Time-Stretch for High-Speed Analog-to-Digital Converter and Imaging

Ali Modafakker-Fard
Advisor: Professor Bahram Jalali

Real-time instrumentation is an underlying platform for a broad range of industrial, scientific, and medical applications. The demand for such instruments capable of detection and diagnostics in a very short time scale is rapidly growing. While alternative approaches based on strobe light effect provide valuable information about an event, capture of transient and rare-occurring events will require true real-time instruments with fine time resolution and long record length. Such events are often indicative of either measurement error or that the population has a heavy-tailed distribution, which they carry vital information with a major impact. In the context of optics, these instruments are needed to capture and quantify fast transient errors in optical communication systems, biological systems, etc.

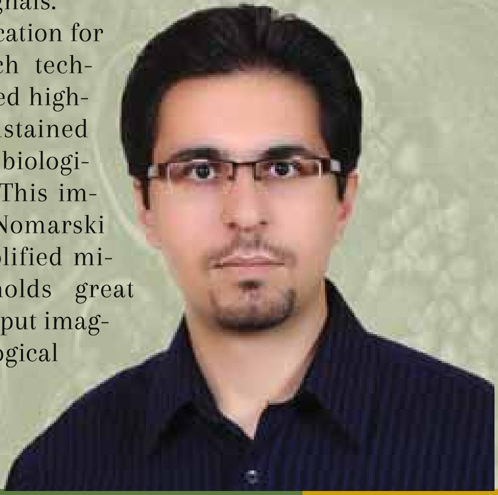


The photonic time-stretch is a novel technique that can slow down, amplify, and capture fast events. It provides a versatile tool for analog-to-digital conversion, imaging, and spectroscopy. In the context of analog-to-digital converters (ADC), the photonic time-stretch has proven its capability for achieving wideband signal digitization and characterization with high dynamic range and resolution. In order to meet stringent requirements for many applications, the photonic time-stretch should provide very high dynamic range over a broad analog bandwidth. Fundamentally-new distortion suppression techniques, such as broadband linearization technique, which offers an improvement of more than 2.5 effective-number-of-bits (ENOB) over previous linearization techniques is achieved. The time-bandwidth product (i.e., spectral efficiency) of the time-stretch ADC is significantly improved via a polarization-multiplexing technique. The impact of optical nonlinearity on fidelity of electrical signal captured by time-stretch ADC and upper limits on the resolution imposed by optical nonlinearity are identified for the first time. Furthermore, several architectures and implementations employing real-time burst sampling (RBS) for high-speed performance monitoring of phase- and/or amplitude-modulated optical signals are introduced, making the time-stretch ADC viable for advanced optical networks.



In addition, a new method for capture of ultrafast optical signal using photonic time-stretch technique without the need for E/O and O/E conversions is introduced to increase its versatility for performance monitoring in intelligent and re-configurable optical networks. This novel approach also suggests a path to real-time recording of complex (phase and amplitude) optical signals.

Finally, a spin-off application for the photonic time-stretch technique, enabling high-speed high-contrast imaging of unstained transparent objects (e.g., biological cells) was developed. This imaging modality, called Nomarski serial time-encoded amplified microscopy (N-STEAM), holds great promise for high-throughput imaging and screening of biological cells and tissues.



Multiterminal Source Coding

Thomas Courtade
Advisor: Professor Richard Wesel

Rate distortion theory is the study of the fundamental tradeoff between the size to which data can be compressed, and the fidelity to which it can be reproduced. In 1959, Claude Shannon gave a precise characterization of this tradeoff when compression is performed by a single encoder. Extending this result to more general cases has proven to be extremely difficult. In fact, characterizing the rate distortion region (i.e., the set of attainable distortions for given compression rates) for the setting where two separate encoders observe correlated sources is one of the most well-known, long-standing open problems in the field of multiterminal source coding. Indeed, this problem is usually referred to as *the* multiterminal source coding problem. Despite a great deal of work by leading researchers, this problem remained unsolved for nearly four decades except in degenerate cases (i.e., where at least one source is compressed losslessly). In 2008, this changed when Wagner et al. [1] characterized the rate distortion region for jointly Gaussian sources subject to mean square error distortion constraints. While the importance of Wagner's result was undeniable, the arguments he employed were tailored to the extremal peculiarities of the Gaussian distribution and it was still not clear whether the problem could be solved in any other setting of interest. The latter point was particularly frustrating for researchers, since many modern applications of multiterminal source coding (e.g., data mining, pattern recognition, distributed compression in computer networks) deal with sources that can rarely be modeled by Gaussian random variables.

This set the stage for the award-winning paper [2], in which Courtade and Weissman introduced *logarithmic loss* as a penalty function for rate distortion problems. The study of logarithmic loss is not new – it is a canonical utility function in the theories of prediction, learning, and games – but Courtade and Weissman were the first to explicitly study it in a rate distortion context. Briefly, logarithmic loss is a natural penalty function where reconstructions are allowed to be "soft decisions", i.e., an assignment of likelihoods to possible outcomes rather than deterministic decision values. It is frequently the case that soft decisions are permitted in relevant applications of rate distortion theory. For instance, consider data mining: an online advertiser mines a database of past customer purchases to predict what the customer will buy next. A deterministic decision is not required here; the advertiser can generate a list of potential purchases indexed by likelihood and advertise in a Bayes-optimal fashion so as to maximize its profit. Where is the rate-distortion tradeoff in this setting? The advertiser must make decisions in real-time, and is therefore limited in the number of database queries that can be made before recommending a product. Thus, the goal is to maximize the profit (which, under certain assumptions, is roughly equivalent to minimizing logarithmic loss) subject to a limited number of database queries. Many data mining, pattern recognition, and distributed compression problems fit into this framework, and hence the study of logarithmic loss in rate distortion theory is well-motivated from both practical and theoretical perspectives.

In addition to introducing logarithmic loss, Courtade and Weissman's work [2] provides complete solutions to two multiterminal source coding problems under logarithmic loss: the classical multiterminal source coding problem itself, and the so-called CEO problem (another long-standing open problem). Remarkably, these solutions place no restriction on the source distributions (unlike in [1], where the sources are restricted to be jointly Gaussian). These results constitute the second complete solution to the multiterminal source coding problem in the forty-year history of the field (second only to [1]), and the first – and only – solution for non-Gaussian source distributions. Moreover, Courtade's thesis demonstrates that several other interesting problems can also be solved in the context of logarithmic loss.

In summary, Courtade's work on logarithmic loss can be viewed as a connection between Shannon-theoretic source coding and the theories of pattern recognition, learning, and data mining. Given the super-exponential growth in the amount of data that is collected for analysis, there are many exciting applications of this research.

[1] A. Wagner, S. Tavildar, and P. Viswanath, "Rate region of the quadratic gaussian two-encoder source-coding problem," *Information Theory, IEEE Transactions* on, vol. 54, pp. 1938 –1961, May 2008.
[2] T. A. Courtade and T. Weissman, "Multiterminal source coding under logarithmic loss," *Proceedings of the 2012 IEEE International Symposium on Information Theory*, pp. 766-770. (see also arXiv/1110.3069).

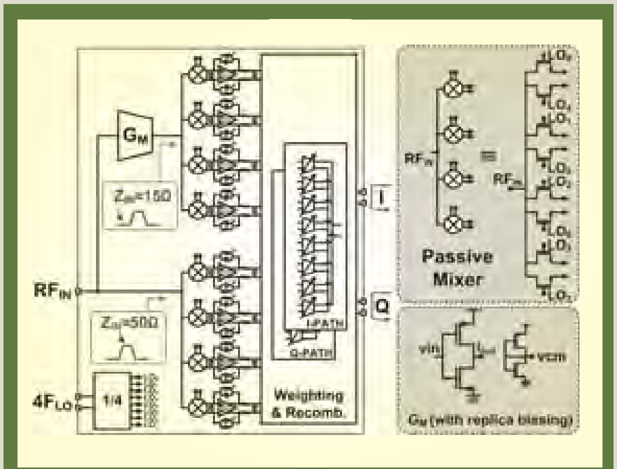
A Blocker-Tolerant, Noise-Cancelling Receiver Suitable for Wideband Applications

David Murphy

Advisors: Professors M. C. Frank Chang & Asad Abidi

Narrowband receiver front-ends invariably make use of external RF filtering to prevent large out-of-band signals corrupting the wanted signal. Since RF filters are almost always fixed, multiple front-ends are required to cover the large number of frequency bands serviced by a modern wireless device. Without fixed RF filtering, a single wideband receiver that is tunable over the entire spectrum of interest could be employed, but the inability of such a solution to handle interferers has prevented commercial adoption. If this issue could be overcome, a wideband approach would have some distinct advantages including: lower pin count, simplified package design, reduced Bill-of-Materials (BOM) and faster design times. In addition to these potential savings in conventional multi-band designs, a highly-linear wideband receiver is fundamental to the flexible, universal radio platform known as Software-Defined-Radio (SDR).

Eliminating RF filtering is challenging because of two undesirable mechanisms, namely gain compression and reciprocal mixing. A conventional narrowband design makes use of an off-chip SAW filter and a tuned LNA to provide voltage gain at the wanted frequency, while suppressing any out-of-band blockers. By contrast, a conventional wideband design has no selectivity and amplifies both the wanted signal and any blockers present. Given the voltage amplification required to achieve a competitive noise figure and the low supply voltages used in modern CMOS processes, a large out-of-band blocker will inevitably cause a wideband LNA to clip. This will increase noise and distortion in the receiver. Moreover, because passive filtering is prohibited, desensitization due to reciprocal mixing of LO phase noise by blockers is of increased concern.



Noise-Cancelling Receiver Architecture

These mechanisms imply that for a wideband receiver to be considered blocker-tolerant, it must avoid voltage gain at blocker frequencies and should generate LO signals with very low phase noise. While industry has shunned wideband receiver design, it has been the focus of academia for some years and recent years have seen some innovative designs. These designs termed “blocker-tolerant” and/or “mixer-first” receivers have two common features: they employ passive-mixers and they suppress voltage gain at blocker frequencies. However, these approaches come at the expense of either noise figure or wideband operation. What is needed is a wideband blocker-tolerant receiver that exhibits a sufficiently low noise figure that it may be used in place of multiple narrowband low-noise front-ends.

With this goal in mind, a collaboration between UCLA and Broadcom Corporation has led to the development of a new receiver architecture that can tolerate large out-of-band blockers without relying on SAW pre-filters, and *without sacrificing noise performance*. The design evolves from noise-cancelling theory, but avoids voltage gain at blocker frequencies by employing two separate passive-mixer-based down conversion paths. The innovation of using two separate down-conversion paths enables noise cancelling *with no voltage gain prior to baseband filtering*. This approach significantly relaxes the trade-off between noise, out-of-band linearity and wideband operation. The resulting prototype is functional from 80MHz to 2.7GHz, achieves a sub-2dB noise figure, and tolerates 0dBm blockers.

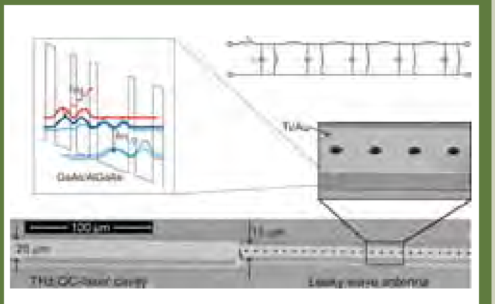
The resulting paper, titled “A Blocker-Tolerant Wideband Noise-Cancelling Receiver with a 2dB Noise Figure”, was presented at the International Solid Sate Circuits Conference (ISSCC) 2012, and received the Distinguished-Technical-Paper Award. The work also formed David Murphy’s Ph.D. thesis. His advisers on the project were UCLA’s Prof. Mau-Chung Frank Chang and Prof. Asad Abidi, while Hooman Darabi provided guidance at Broadcom. Other co-authors were Amr Hafez, Ahmad Mirzaei, and Mohyee Mikhemar, all of whom are UCLA EE graduates.

Terahertz Laser Antennas

Assistant Professor Benjamin Williams
Professor Tatsuo Itoh

The terahertz spectral range (1-10 THz, λ~30-300 µm) has remained technologically underdeveloped compared to the neighboring microwave range (longer wavelengths) and infrared range (shorter wavelengths) — hence closing this "terahertz gap" is motivated by the desire to make use of the entire electromagnetic spectrum. Although many advances have taken place in recent years, it remains difficult to generate, detect, and control radiation at these frequencies.

The availability of compact, efficient laser sources in the THz range promises to enable applications in fields as diverse as chemical and biological sensing, security screening, explosive and drug detection, astrophysics and space science, medical imaging, nondestructive evaluation of materials, and short-range high-bandwidth communications. The groups of Assistant Professor Benjamin Williams and Professor Tatsuo Itoh have been collaborating to develop new concepts for THz lasers and antennas based upon the marriage of THz quantum cascade lasers with microwave transmission-line metamaterials.



Leaky-wave Antennas: Guided-wave and antenna devices are made possible by the use of THz QC lasers with holes in transmission lines .

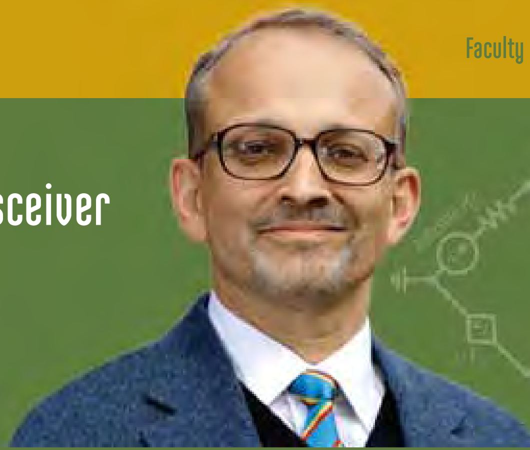
The proximity of the THz range to both the microwave and infrared/optical ranges has allowed the use of many hybrid device concepts that borrow liberally from the adjacent spectral ranges. For example, this research project is developing terahertz semiconductor laser sources — an approach typically associated with the photonic regime. For the quantum cascade lasers, low-dimensional semiconductor heterostructures (i.e. quantum wells composed of the compound semiconductors GaAs and AlGaAs) are designed to create "artificial molecules" with customized properties that emit THz radiation due to stimulated emission of photons between quantized energy states. However, unlike a typical semiconductor laser, in which the laser waveguide is kept free of metals to avoid losses, the waveguides for the THz lasers make extensive use of metals, and bear much closer resemblance to the microstrip transmission lines found in microwave integrated circuits. In this project, the research teams are leveraging these similarities to develop devices based upon the concepts of "transmission line metamaterials" that have been developed in the microwave over the past decade in the Itoh group. By loading transmission-lines with networks of capacitors and inductors, one is able to engineer the frequency and phase response to achieve many novel properties for guided-wave and antenna devices.

Engineering the efficiency, pattern, and direction of the emitted beam from a THz QC laser is an ongoing research challenge. Depending upon the particular application, it may be desirable to have a narrow and directional beam to concentrate the THz power, or to "steer" the direction of radiation. We have established a promising new approach based upon so called "leaky-wave antennas" integrated with the THz QC laser. One can model this antenna structure using a network of inductors and capacitors, and then use a straightforward transmission line theory to predict their properties. For example, the width and height of the antenna determines the values of the capacitance CR and the inductance LR, inserting holes allows separate control of the inductance LL.

These antennas support a propagating electromagnetic mode that gradually "leaks" THz radiation into free space in a particular direction, depending upon the frequency. This is shown in the figure, where THz lasers at different frequencies radiate beams at different angles. We consider these results to simply be the first steps towards laser antennas which can direct a beam in nearly any direction, forwards or backwards, and can steer their beam dynamically using electronic control. This will lead to advanced functionality for THz devices, assisting applications in THz radar, imaging, and spectroscopy.

Benjamin Williams Receives NSF CAREER Award

The National Science Foundation CAREER award is the most prestigious award in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, education and their integration. The award will fund research on new ways to tune the wavelength of a terahertz semiconductor laser across a broad fractional bandwidth. Williams is the director of the Terahertz Devices and Intersubband Nanostructures Laboratory. He is a Henry Samueli Engineering Fellow and a member of CNSI. In 2008, he was awarded a Young Faculty Award from DARPA.



The Challenge of the Universal Radio Transceiver

Professor Asad Abidi

For as long as wireless communication existed, there has been the search for the universal communicator: one device that can be easily used to scan every band, tune in to receive any channel with any bandwidth, and transmit in any unused band. The multi-mode mobile phone of today is edging towards this idea, with its support of world bands to communicate voice, data, video, location, and other services. But inside a small phone may be packed six to ten individual radio transceivers provided by several chip vendors, each custom-developed for a specific band and form of communication. Clearly, this approach will soon reach its limits.

Modern wireless devices can be partitioned into two distinct sections: a radio and a digital baseband. The continued scaling of CMOS IC technology enables the baseband section to perform feats of great complexity in equalizing, detecting, and generating the modulated waveforms, driving the communications device ever closer to theoretical limits. It is the radio section that poses large hurdles. In spite of considerable progress in miniaturization and a lowering of power consumption, there is no universal radio in sight yet.

Why is this? The universal radio receiver is the best example of the difficulty of building analog circuits that interface with nature. Incoming radio signals vary from the very weak — so small that they may be swamped by thermodynamic fluctuations of charges in the receiver's components — to the very strong — so large that they can drive the amplifiers designed for weak signals to the ends of their useful operational range, causing distortions on the output. In conventional receivers, fixed passive filters make it possible for weak and strong signals to co-exist by blocking out (that is, by reflecting back) all but a narrow swatch of signals surrounding the wanted signal in a small band. But these filters are not possible in a universal receiver. The amplifier circuits must pass very large — often unwanted — signals without distortion, or the filters must be made tunable across many bands. Both approaches push circuit design as we know it to its limits.

Our recent research shows a way of breaking away with the classic trade-off between low distortion (high linearity) and poor sensitivity (large noise) in an amplifier. For example, in all-electronic tunable filters at the antenna can pass one channel carrying data in the TV band (which extends from 50 MHz to 800 MHz), while strongly suppressing (by ten times) the adjacent and nearby channels which may contain signals being broadcast from high-power TV transmitters. These electronic filters themselves are vulnerable to the noise-linearity trade-off that amplifiers must face.

A universal receiver or transmitter will need local oscillators of unprecedented performance. They must be tunable over decades of frequency, from 50 MHz to 5000 MHz, while delivering a spectrum that resembles a pure single tone more closely than any oscillator developed for commercial purposes has delivered in the past. Furthermore, the oscillators must be integrated on the same CMOS chip as the radio.

Transmitters must be efficient, even when they produce a signal of modest power output. The best conversion efficiency is usually obtained by tuning the transmitter output with narrowband matching networks, and by customizing the power amplifier to features of the modulated waveform. Neither is possible in a universal transmitter. Any transmitter must not violate very stringent regulations on the power it might inadvertently emit into neighboring channels and nearby bands. Custom transmitters rely on fixed filters to suppress out-of-band emissions, but the universal transmitter cannot. Nor is it feasible to use tunable filters developed for the receiver at the transmitter output, since the strongest received signal is only a tiny fraction of the many volts that will appear at the transmitter, and an active filter will almost surely be driven into saturation.

And, finally, what if the transmitter is driving a large signal into the same antenna in one band when, at the same time, the receiver is tuned to a weak signal in another band? Since both share a common antenna, how can the transmitter be isolated so that it doesn't overdrive the receiver into dysfunction with its large signal?

These various problems illustrate the challenge of the universal radio front-end. Taken together, they define much of the frontier of analog circuit design. Our multi-pronged research is aligned on this frontier.

NSF CAREER Award for Danijela Cabric for Cognitive Co-existence in Heterogeneous Wireless Networks

Professor Cabric's CAREER Award recognizes her career development plan entitled Cognitive Co-existence in Heterogeneous Wireless Networks.

Efficient spectrum sharing among disparate wireless systems without inter-system communication is the central problem in expanding existing and developing future wireless technologies. Due to lack of cooperation among systems, the interference management becomes the main challenge. The interference problem is currently addressed by physical-layer and network-layer communities in a fundamentally different way. There is no principled framework that unifies these approaches. Professor Cabric aims to explore an integrated physical and network layer approach for spectrum sharing by developing algorithms and protocols that will allow heterogeneous networks to co-exist and maintain required interference constraints. The underlying paradigm for our framework is cognitive co-existence based on enhanced awareness about network topology, location and traffic behavior of users.

The proposed approach tightly couples physical and network layer functionalities with practical considerations, and fundamentally rethinks the conventional approaches for protocol designs and cross-layer optimization. The proposed framework is based on the novel idea of incorporating detailed real-time measurements and prediction of spectrum usage, including traffic parameters and spatial distribution of all active transmitters belonging to heterogeneous networks, into the design of cognitive protocols that respond to the actual spectrum occupancy in time, frequency, and space. Professor Cabric will explore the following critical enabling technologies of this framework (Fig. 1):

1 Identification of non-cooperative spectrally-overlapped transmitters based on location and modulation parameters;

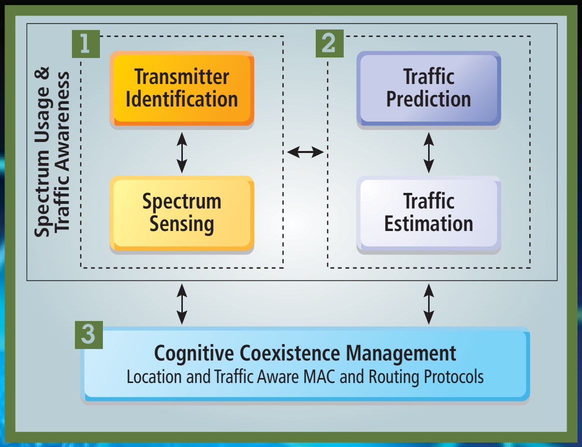
2 Analysis and tracking of spectrum usage based on traffic estimation and prediction;

3 Cognitive co-existence protocols for spectrum sharing with combined traffic and location awareness.

The objective of this research is to comprehensively analyze performance gains achieved by exploiting traffic and location awareness while taking into account measurement uncertainties, estimation and prediction errors, physical limitations, and protocol overhead. The research approach is based on a closed loop between theoretical analysis and development of new algorithms with their implementation and experimental verification on the reconfigurable wireless testbed with networking capabilities and network simulation tools.

The algorithms, protocols and tools developed by this research will have practical impact on a broad range of wireless systems that share same spectrum resources including: current and future unlicensed bands, vehicular and safety networks, cellular infrastructure and femto cells, emergency and defense networks.

Prof. Cabric is the director of the Cognitive Reconfigurable Embedded Systems Lab (http://cores.ee.ucla.edu). The lab focuses on all modern radio technologies, with an emphasis on systems that enable more efficient utilization of the spectrum. Cabric is a Henry Samueli Engineering Fellow and is recipient of a 2009 Okawa Foundation Award.



Professor Lara Dolecek Receives NSF CAREER Award for Innovative Research on Future Data-Storage Systems

Remember when a gigabyte was a lot of data? Today, consumers have terabytes of information, and companies are processing exabytes and zettabytes of data. Data is now a hot commodity. Recent advancements in machine learning have allowed information technology companies to extract real value— in terms of business strategy and revenues—from their data. Big Data platforms combined with cloud computing are allowing even the early startups to perform advanced statistical analysis on their data. The modus operandi is to collect as much data as possible: throw nothing away! Large companies like Google, Facebook, Microsoft, and Yahoo! are buying new data centers every month. A typical data center alone costs tens of millions of dollars in amortized cost. To curb this skyrocketing cost, new solutions cognizant of operational constraints of storage systems must be invented now to ensure that data revolution lives on.

Fundamentally common to all storage technologies are channel coding schemes. Results from coding theory have been used with phenomenal success in storage, and practical coding schemes have helped make computer storage ubiquitous. However, currently available coding schemes have hit a performance wall: existing codes are designed for simple channels (such as binary erasure and binary symmetric channel) and do not match the needs of new storage technologies where the data must be packed as densely as possible on increasingly adverse mediums. Resulting performance provisioning not only violates fundamental information-theoretic laws but directly increases the cost of a storage system.

Professor Dolecek's proposal titled "Channel Coding Paradigms For Next Generation Storage Systems" aims to fundamentally rethink channel coding methods with applications to emerging storage systems. This work is funded through NSF CAREER program, the highly selective 5-year research grant that the National Science Foundation (NSF) awards to junior faculty members who are likely to become academic leaders of the future. Specifically, Prof. Dolecek's project creates a coding-theoretic foundation that embraces, rather than ignores, adverse physical and operating conditions to increase the capacity of the upcoming storage technologies. The key insight in this work is that the data can be better represented in groups of bits (called non-binary symbols), rather than individual bits. This representation allows for the exploration and exploitation of the rich combinatorial structure of non-binary codes for the maximum benefit to storage applications. The developed framework not only advances the well-established field of coding theory but it also has a potential to substantially reduce the galloping cost of large-scale data storage systems: a novel non-binary coding method Prof. Dolecek and her students recently developed already outperforms the currently deployed coding schemes in ubiquitous solid state drives (in particular in the multilevel Flash technology) by 400%.

Assistant Professor Dolecek is in the signal and systems area of electrical engineering. Her research interests span coding and information theory, graphical models and statistical algorithms with applications to emerging systems for data storage, processing, and communication. She holds a B.S. (with honors), M.S. and Ph.D. degrees in Electrical Engineering and Computer Sciences, as well as an M.A. degree in Statistics, all from the University of California, Berkeley. In addition to NSF CAREER Award, she is a Hellman Fellow at UCLA, and received the 2007 David J. Sakrison Memorial Prize for the most outstanding doctoral research in EECS at UC Berkeley. Prior to joining Electrical Engineering Department of UCLA, she was a post-doctoral researcher at MIT. She is currently an Associate Editor for Coding Theory for IEEE Communication Letters and serves as a co-chair of the Data Storage Symposium at the 2013 IEEE ICNC conference.

Four times the performance improvement in coding schemes:
Substantial savings in large-scale data storage.

Professor Aydogan Ozcan Receives the Prestigious PECASE Award

Mobile lab: Cell phone microscopy improves healthcare in poor regions.

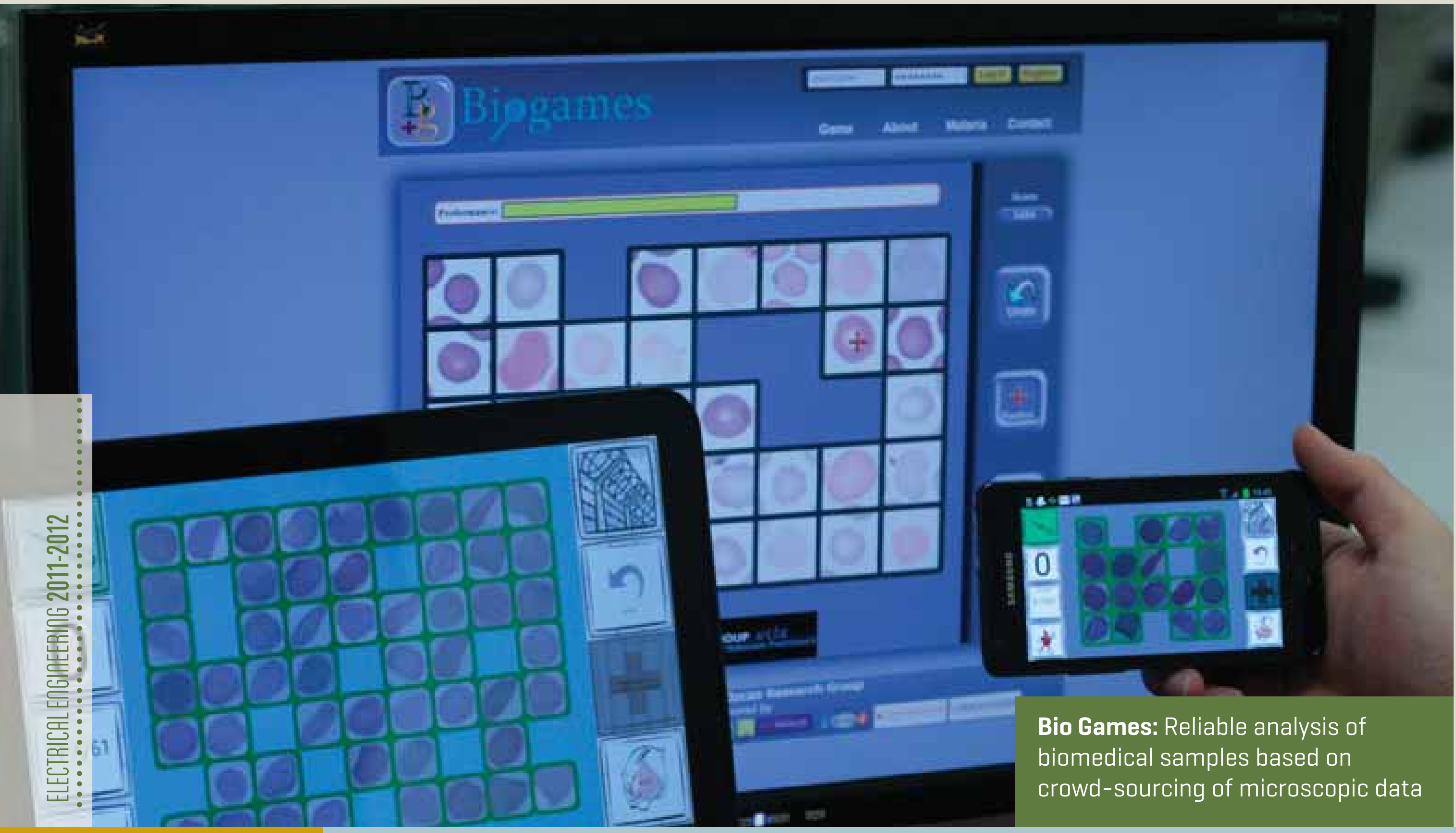
Aydogan Ozcan, associate professor of electrical engineering and bioengineering, has received the country's highest honor for science and engineering researchers who are at an early stage of their careers. Ozcan was one of 94 researchers announced by President Obama, as recipients of the Presidential Early Career Awards for Scientists and Engineers (PECASE).

Ozcan's research is in photonics and its applications in nano- and bio-technology. Most prominently, he has developed new powerful optical imaging and sensing architectures that can be incorporated into mobile phones. Essentially becoming mobile labs, these phones can analyze fluids to test for HIV, malaria, and other infectious diseases in body fluids, or analyze water quality following a disaster. These devices, which are relatively inexpensive to produce, have broad applications for improving healthcare in resource-poor regions.

"Ozcan's research in photonics applications, in particular his work with mobile phone platforms, holds great potential, and he is a truly deserving recipient of this honor," said UCLA Engineering Dean Vijay K. Dhir. "This award also reflects the excellence of the school's faculty, who are committed to conducting research that addresses the critical needs of the country across many areas."

Ozcan has already received several prominent honors for his research, including the National Science Foundation CAREER Award; the National Geographic Emerging Explorer Award; the National Institutes of Health Director's New Innovator Award; Young Investigator Awards from the Office of Naval Research and from the Army Research Office; MIT's TR35 Award, IEEE Photonics Society and SPIE Young Investigator Awards, and a Grand Challenges Explorations Award from the Bill and Melinda Gates Foundation, among others.

The PECASE award recipients are nominated by 16 federal department and agencies. The recipients' early accomplishments demonstrate the greatest promise in continuing America's preeminence in science and engineering.



Bio Games: Reliable analysis of biomedical samples based on crowd-sourcing of microscopic data

ARO Young Investigator Award for Rob Candler for Investigation of Energy Dissipation in Nanomechanical Resonators

Micro- and nanoscale resonators are on the verge of widespread adoption in the numerous electronic devices we encounter on a daily basis, such as smart phones, laptop computers, and displays. Resonators serve as the pulse of electronic systems by providing a reference for signal generation and transfer in communications, telling displays when to refresh, and numerous other functions where a sense of time is required. In fact, miscroscale silicon resonators have already replaced quartz-based resonators in many cell phones that are currently on the market. Despite the promise and even early success of these miniature resonators, their fundamental operation remains a mystery. Specifically, the ways in which they dissipate energy are not fully understood. Discovering these energy dissipation mechanisms is critical because energy dissipation increases phase noise in oscillator applications and also inhibits resonators from being used as narrow band filters. While a macroscale tuning fork resonator eventually stops ringing due to energy lost through collisions with air molecules and vibrations at the anchor, a nanoscale resonator is much more susceptible to energy loss mechanisms involving surface phenomena, a result of their higher surface area-to-volume ratios. This Young Investigator Award from the Army Research Office will support research targeted toward understanding and mitigating energy loss in nanoscale resonators.

This research in the Sensors and Technology Laboratory focuses on the fundamental operation of nanoscale resonators and has dual goals of scientific discovery (i.e., "Why doesn't a resonator ring forever?") and technology advancement (i.e., "What techniques can be applied to mitigate energy dissipation?). A focal point of the research involves investigating the coupling of electronic surface states with phonons, which is hypothesized as a cause of surface dissipation. Discoveries in the underlying causes of surface dissipation could enable techniques, such as strategically selected surface coatings, to reduce the energy dissipation.

Future prospects for this research thrust involve the use of energy dissipation as a sensing mechanism for surface adsorbates. While traditional methods of resonant frequency-based sensing relying on changes in resonator mass have been promising due to the effects of scaling, the introduction of energy dissipation-based sensing could enable a thousand-fold improvement in sensitivity for chemical and biological sensing.

Real-Time Optical Cancer Detection

Professor Oscar M. Stafsudd

Professor Warren Grundfest

In many cancer cases, patient survival rate is closely linked to tumor recurrence rates. To combat this, surgeons resect a margin of healthy tissue surrounding the suspected tumor typically leading to completely cancer free tissue margins and a decrease in tumor recurrence. While generous margins are possible in a number of cancers, many tumors occur in functional tissue where the removal of adjacent healthy tissue is extremely harmful to the health or quality of life of the patient, for example in the case of brain cancer.

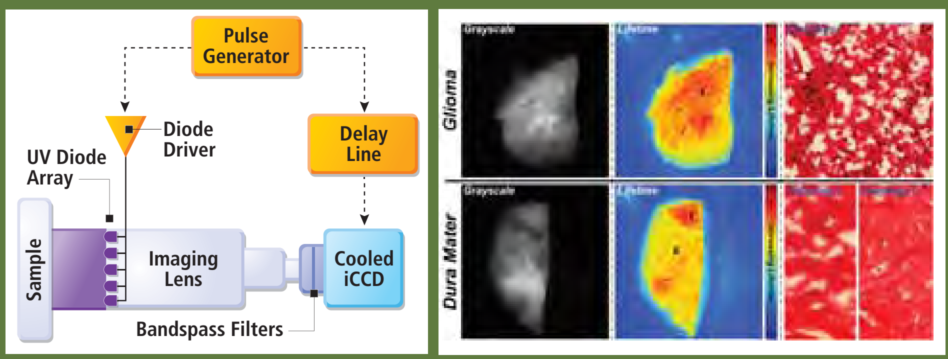
In brain cancer, the rigid skull does not allow an increase in cranial volume to accommodate the growing tumor. The resulting pressure can cause severe pain, functional impairment, and patient death. However, complete resection is nearly impossible because these cancers, gliomas and glioblastomas in particular, are diffusely infiltrating with irregular, indistinct margins. Generous margins, like those employed in skin cancer, often cannot be achieved and the integrity of vital functional tissue (speech, motor control, cognitive function, etc.) is often prioritized over complete resection.

To address this issue, the Stafsudd and Grundfest teams are developing and characterizing sensitive, high resolution intraoperative tumor margin detection and imaging techniques using novel contrast mechanisms based on lifetime fluorescence imaging technology. These techniques are similar to standard fluorescence imaging but offer additional discriminatory power and are more suited to *in vivo* imaging.

In standard (intensity) fluorescence imaging, the sample is pumped with a constant wave (CW) laser source (typically UV) and the auto-fluorescence of the material is observed. While fluorescence imaging has demonstrated the ability to identify tumors, the reported specificity is low and the technology has been limited due to difficulties with illumination, overlapping spectral signatures, and the presence of blood. This has prevented widespread clinical adoption. Previous work from our laboratory and reports in the literature have showed that time resolved fluorescence spectroscopy could improve specificity but the instrumentation was expensive, difficult to apply clinically, and computationally intensive.

Time resolved, or lifetime fluorescence imaging, is a technique where the auto-fluorescence of a sample is measured in both the wavelength and time domains. This is accomplished by exciting the sample with a very short pulsed laser and detecting the auto-fluorescence with respect to decay times at a range of wavelengths. Decay times are dependent on the biochemical composition of the material and significant imaging contrast can be generated employing decay time maps. Typical lifetime imaging techniques require the use of picosecond pulsed lasers, spectrophotometers, and photomultiplier tubes which constrains the system to pixel-by-pixel data acquisition and the concomitant requirement for large computer times. We have developed an imaging technique which uses nanosecond pulsed LEDs for illumination and a cooled, intensified gated CCD camera with dielectric filters for detection. A complete description of the technique has been published in the *Journal of Biomedical Optics*. Our normalized fluorescence method produces image intensity variations as a function of fluorescence lifetimes. This reduces the required computer power to that of today's laptops and allows for real-time imaging results.

We have shown the ability to discriminate normal from malignant tissue without the need for staining. This technology will have significant application in tissue bio banking as it will allow rapid characterization of the tissue at the surface of a tissue block.



Video rate, lifetime imaging system and results.

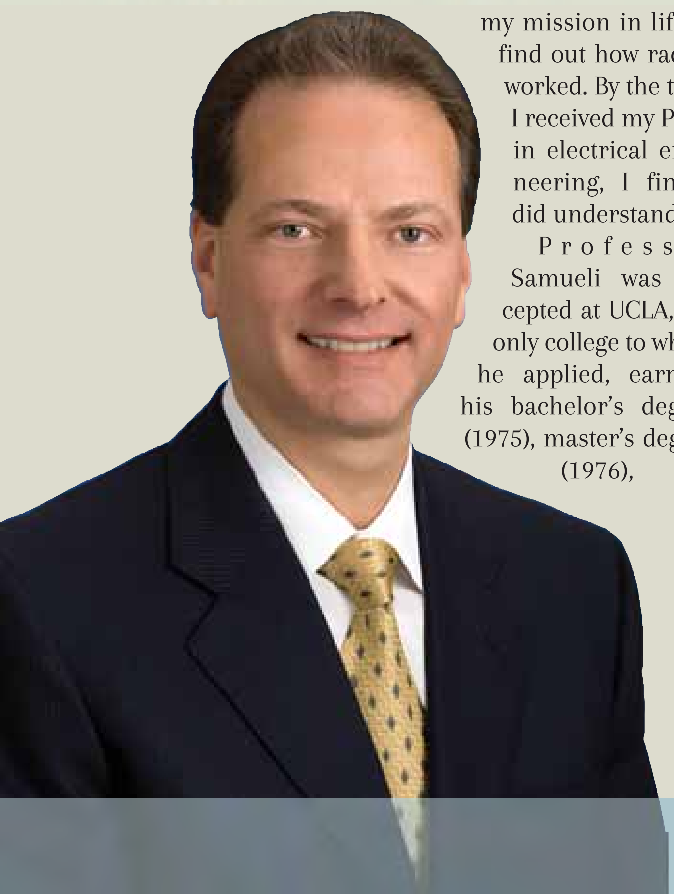
a. Block diagram of video rate lifetime imaging system.

b. Fluorescence emission image of the brain tumor sample.

Professor Henry Samueli Wins 2012 Marconi Prize

Professor Henry Samueli has been selected as the sole recipient of the prestigious 2012 Marconi Society Prize and Fellowship for his pioneering role in the development of broadband semiconductors. The Marconi Prize, an award considered the pinnacle honor in the field of communication and information science, is given each year to one or more scientists and engineers who – like radio inventor Guglielmo Marconi – achieve advances in communications and information technology for the social, economic and cultural development of all humanity.

Winning the Marconi Prize is particularly appropriate for Professor Samueli, whose career was inspired by an assignment to build a radio in his seventh grade shop class at Hubert Howe Bancroft Middle School in Los Angeles. "One assignment was to build a simple crystal radio set. I didn't think it was challenging enough so I asked to build a Heathkit shortwave radio instead." On the last day of class he brought it in, plugged it to a wall socket, and, to his teacher's astonishment, sound came out. "I wasn't surprised it worked – I'm sort of a perfectionist – but I had no idea how it worked," he says. "At that moment it became my mission in life to find out how radios worked. By the time I received my Ph.D. in electrical engineering, I finally did understand it."



Professor Samueli was accepted at UCLA, the only college to which he applied, earning his bachelor's degree (1975), master's degree (1976), and Ph.D. degree (1980), all in electrical engineering. His first course in his major was a circuit theory class taught by a relatively new professor, Alan Willson. When Willson subsequently introduced the first graduate digital signal processing class at UCLA, Samueli jumped at the chance to attend. He calls it "a life-changing event."

After receiving his Ph.D., Samueli took a job at technology leader TRW (later merged into Northrop Grumman) working on military broadband communications systems. Professor Willson invited him to take a part-time position as a visiting lecturer teaching a graduate-level digital filters course at the same time. He was a successful teacher from the start. "Henry got better student reviews than I did," Professor Willson recalls. "Students loved him."

In 1985, Professor Samueli joined the UCLA faculty full-time as an assistant professor. His industrial career had yielded several interesting ideas to pursue and he quickly put together a team of researchers. "We were just doing interesting research, publishing papers and presenting our work at conferences. Suddenly we were getting corporate inquiries from people wanting us to commercialize the technology for use in their products."

"Education made me what I am today," Professor Samueli says. "Broadcom would not exist today without the education and experience I gained at UCLA."

On his selection for the Marconi Prize, Professor Samueli says, "I'm very humbled. I look at the list of Marconi Fellows preceding me and think, 'I don't belong in that group.' It is an amazing honor and I'm deeply flattered. On the other hand, looking at it more broadly, as a company we have indeed accomplished a lot. I'm very proud of the impact we have had on our industry and on society."

Among his other honors, Professor Samueli was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) in 2000, a member of the National Academy of Engineering in 2003, and a Fellow of the American Academy of Arts and Sciences in 2004.

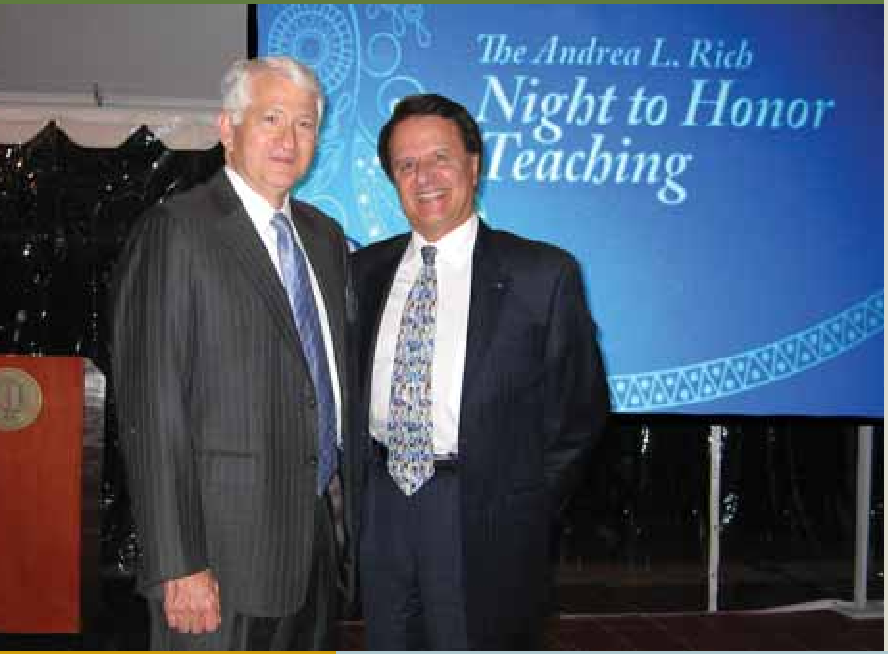
Professor Yahya Rahmat-Samii Receives 2011 UCLA Distinguished Teaching Award

The Distinguished Teaching Award was established at UCLA almost thirty years ago. It recognizes the outstanding teaching achievements of six of the best academic senate members covering the entire UCLA academic senate teaching activities each year. In 2011, UCLA's highest teaching prize was presented to Distinguished Professor Yahya Rahmat-Samii of the Electrical Engineering Department at an award ceremony, "Night to Honor Teaching", held at UCLA Chancellor Gene Block's residence with the citation: "The Academic Senate Committee on Teaching and the Office of Instructional Development present this award to Yahya Rahmat-Samii for outstanding contributions to university teaching".

Prior to receiving this teaching award, he also received the 2007 Chen-To Tai Distinguished Educator Award of the IEEE Antennas and Propagation Society and the 2010 UCLA School of Engineering Lockheed Martin Excellence in Teaching Award. Six of his Ph.D. students and three of his M.S. students have won the electrical engineering department's best thesis awards.

Professor Rahmat–Samii summarizes his teaching philosophy as "I make sure that students develop respect for the power of mathematical equations representing hidden mysteries of the physical reality. I tell them that these equations are like a treasure box, and they need to fully understand how to open them up and then you unravel their beauty."

Professor Yahya Rahmat-Samii (right) received the 2011 UCLA Distinguished Teaching Award from UCLA Chancellor Gene Block.



Memorizing mathematical equations is not important for Professor Rahmat–Samii. "I rather emphasize the need to develop a solid understating as how these equations have come about and how far they can be pushed for determining unknowns and discovering new knowledge. I always use simulations, referring to existing experiments and real world applications of abstract topics presented in the class."

Professor Rahmat–Samii likes to share his enthusiasm about teaching. "One must enjoy what one is doing no matter how busy one is. Students must feel that you like to teach as they can sense immediately who is excited to teach and who is not," he says.

In his courses, Professor Rahmat–Samii requires that students do a bit of historical research for the first homework about particular topics, scientists, or engineers related to the course material. He then assigns some interesting review papers for them to read. He points out that, "I always try to make the class attendance a fun experience for the students and attract them to the class. I am always on time and require that everyone to be on time. Periodically, I relate these kinds of experiences to what is expected of them when they go to the real job market."

In his teaching philosophy he amplifies, "One must keep students engaged in the conduct of the class. They must feel they are part of the class progress and not just observers. My philosophy is that if one cannot explain a topic clearly, then the person most likely did not understand that topic fully. I always keep students involved in the course. In the beginning of the class I say that every student should ask at least one question before the end of the class." Occasionally, Professor Rahmat-Samii calls the name of a student from the class roster and asks the person if he or she has a question.

He believes that some of the most important fundamental topics of the course need to be repeated over and over and this is done from time to time throughout the course. Professor Rahmat-Samii has received outstanding supportive words from his class room students and he consistently receives some of highest course evaluation scores within the department.

Distinguished Professor C. Kumar Patel Is a National Inventors Hall of Fame Inductee

Distinguished Professor C. Kumar Patel is one of the inductees in the 2012 National Inventors Hall of Fame for his intangible contribution in the development of the carbon dioxide laser in 1963 while at Bell Labs. Today, his discovery is currently applied in the medical field such as laser scalpel in surgery and laser skin resurfacing, other applications are in industrial and military fields.

The National Inventors Hall of Fame is a non-profit organization established in 1973 with a mission to recognize and promote American inventors who hold a U.S. patent and whose invention has greatly contributed to the advancement of technology which encourage human, social and economic progress. The organization is based in Alexandria, Virginia together with its co-founder, U. S. Patent and Trademark Office.

Professor Patel discovered laser action in CO_2 in 1963 while he was at Bell Labs, which led to the invention of CO_2, CO, and spin-flip Raman lasers. He subsequently founded Pranalytica, a manufacturer of mid-infrared quantum cascade laser systems and gas sensing instruments.

Patel has served as a program committee member for SPIE conferences on optically based biological and chemical detection, and has published numerous papers in SPIE conference proceedings and journals. He is the author of a paper on “QCL as a game changer in mid-IR standoff military applications” to be presented at SPIE Defense, Security, and Sensing 2012. After 32 years at AT&T Bell Laboratories, Patel became Vice Chancellor for Research at UCLA.

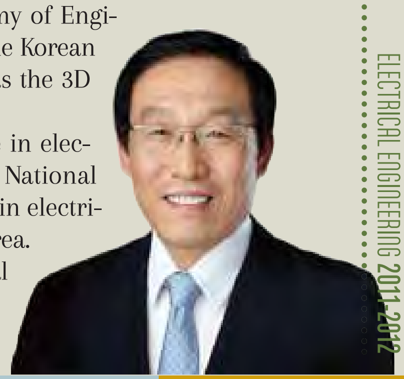
Professor Patel is decorated with a National Medal of Science, IEEE Medal of Honor, National Academy of Engineering, National Academy of Sciences and a Fellow of IEEE. Until now, Professor Patel is actively involved in the development of new laser systems.

Alumni Kinam Kim Elected to National Academy of Engineering

Kinam Kim, President and CEO of Samsung Advanced Institute of Technology, (SAIT) Samsung Electronics Co., Yong-in, Korea, was elected to the National Academy of Engineering as a foreign associate for contributions to semiconductor technologies for DRAM and non-volatile memories.

In 1983, he joined Samsung Electronics, where he led the development of various memory technologies, from 64 Kb to 4 Giga-bit densities for DRAM, from 2 Gb to 32 Gb and beyond for NAND Flash, and emerging new memories such as PRAM, MRAM, and other important technologies like CMOS Image Sensor for almost 30 years. Dr. Kim’s contributions to semiconductor memory technology have helped change the world of consumer electronics. He was the key to Samsung’s significant market growth with low-cost NAND manufacturing and has been responsible for today’s Samsung leading position in memory and semiconductor technology. He was awarded the grand prize of the entire Samsung Group twice in 1986 and 1996 for his achievements on 1 Mb DRAM and 1 Gb DRAM. He has published more than 450 technical papers and is the holder of over 150 patents; he has given numerous keynote, plenary and invited talks in ISSCC, IEDM, VLSI, among others. He is an IEEE fellow and a Samsung fellow. He was the recipient of 2008 Professional Achievement award of UCLA School of Engineering, and IEEE Reynold B. Johnson Storage data device technology award in 2009, to name a few. He was also awarded the Gold Tower order of Industrial Service Merit from the Korean government in 2010 for his leadership role for memory technology. In his current position as Chief Technology Officer of Samsung Group, he directs research and development for Samsung. He is a member of the Korean National Academy of Engineering (NAEK). He is also the chair of the Korean Printed Electronics Association as well as the 3D Fusion Industry Association of Korea.

Kinam Kim received the B. Sc. degree in electronic engineering in 1981 from Seoul National University, Seoul, Korea, the M.S. degree in electrical engineering from KAIST, Daejeon, Korea. He received the Ph.D. degree in electrical engineering from UCLA in 1994 under the guidance of professor Kang L. Wang.

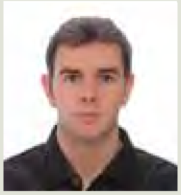


2011-2012 Student Awards

Distinguished Ph.D. Dissertation Award in Signals & Systems
THOMAS COURTADE
Advisor: Prof. Rick Wesel
"Two Problems in Multiterminal Information Theory"

Distinguished Master's Thesis Award in Physical & Wave Electronics
JOSHUA KOVITZ
Advisor: Prof. Yahya Rahmat-Samii (left)
"Nature-Inspired Optimization Techniques Applied to Antennas for Wireless Communications and Radar"

Distinguished PhD Dissertation Award in Physical & Wave Electronics
ALI MOTAFAKKER-FARD
Advisor: Prof. Bahram Jalali
"Photonic Time-Stretch for High-Speed Analog-to-Digital Conversion and Imaging"



Distinguished Master's Thesis Award in Signals & Systems
LUCA VALENTE
Advisor: Prof. Stefano Soatto
"Visual Exploration of Unknown Environments Using Level Set Functions"

Distinguished PhD Dissertation Award in Circuits & Embedded Systems
ADRIAN TANG
Advisor: Prof. Frank Chang (right)
"CMOS Millimeter-Wave Imaging Techniques"

Distinguished Master's Thesis Award in Circuits & Embedded Systems
BINGJUN XIAO
Advisor: Prof. Jason Cong (right)
"A Novel FPGA Architecture with RRAM-Based Reconfigurable Interconnects"

Outstanding Bachelor of Science Degree Award
JIA-JUN (DENNIS) ZHANG

2011-2012 Henry Samueli Excellence in Teaching Award Recipients:
ROJA BANDARI
SINA BASIR-KAZERUNI
SHIH-PENG (JIM) SUN

Christina Huang Memorial Prize
UZAIR SIKORA

2012 Graduation & Awards Ceremony
Back row from left to right: Professors J. Cong, R. Wesel, F. Chang, Y. Rahmat-Samii, T. Itoh, and D. Markovic.
Front row from left to right: B. Xiao, A. Huang (accepting the award for Roja Bandari), J. Kovitz, S-P. Sun, A. Tang, S. Basir-Kazeruni, J-J. Zhang, and U. Sikora.

PhD Recipients at the 2012 HSSEAS
Commencement Ceremony
June 16, 2012, Drake Stadium

Alumni Board

The mission of the Alumni Advisory Board is to provide critical and supportive advice to the UCLA Electrical Engineering Department in enhancing its leadership role in education and research.

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Special Projects
Program Director
Raytheon

Leonard Bonilla
Retired
Raytheon

David Doami
Director, Program Manager
Northrop Grumman

Vicky Gih
Design Engineer &
Product Lead
Northrop Grumman

Dan Goebel
Senior Research Scientist
Jet Propulsion Laboratory

Bill Goodin
Associate Director of
Alumni Relations,
UCLA Henry Samueli
School of Engineering
and Applied Science

Bob Green
Attorney
Christie, Parker,
and Hale, LLP

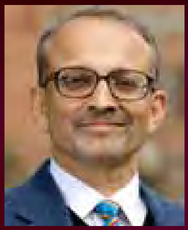
Sharon V. Hong
Systems Integration
Specialist
Motorola

Gigi Lau
Senior
Multi-Disciplined
Engineer
Raytheon

Asad Madni
EE AAB Chair
President and CEO (Retired)
BEI Technologies, Inc,

Members of National Academies

Asad A. Abidi



National Academy of Engineering

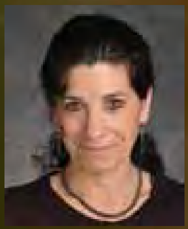
In 2007, Professor Asad A. Abidi was inducted into the National Academy of Engineering for his contributions to the development of MOS integrated circuits for RF Communications. Prior to joining UCLA in 1985, Professor Abidi worked at Bell Laboratories, as a member of the technical staff in the Advanced LSI Development Laboratory. He received a number of awards and honors throughout his career, including the 1988 TRW Award for Innovative Teaching, the 1997 IEEE Donald G. Fink Award, presented for the most outstanding survey, review, or tutorial paper published by the IEEE, and the 2008 IEEE Donald O. Pederson Award in solid state circuits.

M. C. Frank Chang

National Academy of Engineering

Professor Mau-Chung Frank Chang was elected to the National Academy of Engineering in 2008 for his contributions in development and commercialization of III-V-based heterojunction bipolar transistors (HBTs) and field-effective transistors (FETs) for RF wireless communications. Prior to joining UCLA, Professor Chang was the Assistant Director at Rockwell Science Center where he successfully developed and transferred AlGaAs/GaAs Heterojunction Bipolar Transistor (HBT) and BiFET (Planar HBT/MESFET) integrated circuits technologies from the research laboratory to the production line. His research focuses on the development of high-speed semiconductor devices, integrated circuits for RF and mixed-signal communication, and interconnect system applications. Professor Chang received the IEEE David Sarnoff Award (IEEE-wide Technical Field Award) in 2006 and the Pan Wen-Yuan Foundation Award in 2008.

Deborah Estrin



National Academy of Engineering

Professor Deborah Estrin holds the Jonathan B. Postel Chair in Computer Networking. Elected to the National Academy of Engineering in 2009, Professor Estrin led the development and deployment of wireless sensing systems that provide real-time, multifaceted information about natural and urban environments. She created the Center for Embedded Networked Sensing, a NSF research center. Professor Estrin was selected as the first Athena Lecturer of the Association for Computing Machinery's (ACM) Committee on Women in Computing and was honored with the Women of Vision Award for Innovation from the Anita Borg Institute for Women and Technology. She is a fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the ACM and the IEEE.

Tatsuo Itoh

National Academy of Engineering

Professor Tatsuo Itoh pioneered the interdisciplinary electromagnetics research beyond traditional electromagnetic engineering. He was elected to the National Academy of Engineering in 2003, "for seminal contributions in advancing electromagnetic engineering for microwave and wireless components, circuits, and systems". He developed several numerical methods to understand microwave problems, and developed the first CAD program for designing E-plane filters for millimeter wave systems. His research focuses in combining solid state devices and electromagnetic circuits for cost-effectiveness and system performance, developing the first global simulator for the RF front end. He also created the Active Integrated Antenna, which is not only a radiating element, but also a circuit element for the RF front end.

Kuo-Nan Liou

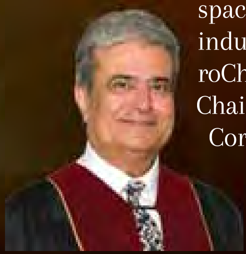
National Academy of Engineering

Professor Kuo-Nan Liou is director of the Joint Institute for Regional Earth System Science and Engineering. Professor Liou pioneered the use of combinations of remote sensors to obtain important cloud ice and aerosol parameters and climate radiative forcing. He derived the analytic four-stream solution for radiative transfer and discovered the depolarization principle to differentiate ice crystals and water droplets. Professor Liou was elected a Member of the National Academy of Engineering in 1999 and was the Chair of Special Fields and Interdisciplinary Engineering Section. Elected a Member of the Academia Sinica in 2004, Professor Liou is also a Fellow of the American Association of the Advancement of Science, AGU, AMS and OSA. He shared the Nobel Peace Prize bestowed on the Intergovernmental Panel on Climate Change in 2007.

Asad M. Madni

National Academy of Engineering

Professor Asad M. Madni was elected to the National Academy of Engineering in 2011 "for contributions to development and commercialization of sensors and systems for aerospace and automotive safety." Prior to joining UCLA, he was President, COO and CTO of BEI Technologies Inc., where he led the development and commercialization of intelligent micro-sensors and systems for aerospace, defense, industrial and transportation industries, including the Quartz MEMS GyroChip technology. Prior to joining BEI he was Chairman, President & CEO of Systron Donner Corp. where he developed RF & Microwave Systems & Instrumentation which enhanced Combat Readiness and provided the ability to simulate threat representative ECM



environments for warfare training. His honors include the IEEE Millenium Medal, IET Achievement Medal, TCI Marconi Medal and UCLA Professional Achievement Medal. In 2004, he received the UCLA Engineering Alumnus of the Year Award and in 2010 was awarded the UCLA Engineering Lifetime Contribution Award. He is a Fellow of the IEEE, IEE, IET, AAAS, NYAS, SAE, IAE and AIAA.

Stanley Osher

National Academy of Sciences

Professor Stanley Osher was elected to the National Academy of Sciences for "major contributions to algorithm development and applications in level set methods, high-resolution shock capturing methods, and PDE-based methods in imaging science." He has been at UCLA since 1976 and is Director of Special Projects at the Institute for Pure and Applied Mathematics. Dr. Osher was a Fulbright and Alfred P. Sloan Fellow, and received the NASA Public Service Group Achievement Award, the Japan Society of Mechanical Engineers Computational Mechanics Award, the SIAM Pioneer Prize, and the SIAM Kleinman Prize.

C. Kumar Patel

National Academy of Sciences, National Academy of Engineering

Professor C. Kumar Patel made numerous seminal contributions in gas lasers, nonlinear optics, molecular spectroscopy, pollution detection and laser surgery. He received numerous honors, including the National Medal of Science for his invention of the carbon dioxide laser. He also received the Lomb Medal of the Optical Society of America, the Franklin Institute's Ballantine Medal, the Pake Prize of the American Physical Society, and the Coblentz Society's Coblentz Prize.

Yahya Rahmat-Samii

National Academy of Engineering

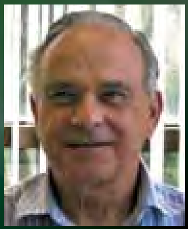
Distinguished Professor Yahya Rahmat-Samii was elected to the National Academy of Engineering in 2008 for his pioneering contributions to the design and measurement of reflector and handheld device antennas. Many of his design concepts are currently used in cell phones, aerospace, earth-observation satellites, and satellite dishes. Prior to joining UCLA, he was a Senior Research Scientist at Jet Propulsion Laboratory. His honors include the 2007 Chen-To Tai Distinguished Educator Award from the IEEE Antennas and Propagation Society; the 2005 International Union of Radio Science's Booker Gold Medal; the 2000 Antenna Measurement Techniques Association's Distinguished Achievement Award; the IEEE's Third Millennium Medal; a Distinguished Alumni Award from the University of Illinois, Urbana-Champaign. He holds the Northrop Grumman Chair in Electromagnetics.

Henry Samueli

National Academy of Engineering

Dr. Henry Samueli was elected to the National Academy of Engineering in recognition of his "pioneering contributions to academic research and technology entrepreneurship in the broadband communications system-on-a-chip industry". Dr. Samueli has over 25 years of experience in the fields of digital signal processing and communications systems engineering and is widely recognized as one of the world's leading experts in the field. He received his B.S., M.S. and Ph.D. degrees in electrical engineering from UCLA. Since 1985, Dr. Samueli is a professor in the Electrical Engineering Department. He is also well known as the co-founder of Broadcom Corporation. In 2010, Professor Samueli received the UCLA Medal.

Jason Speyer



National Academy of Engineering

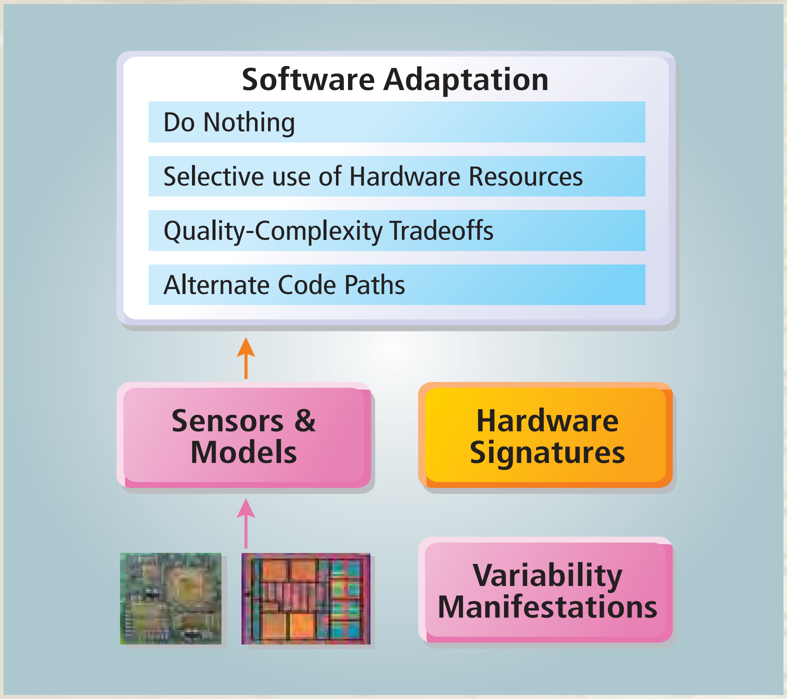
Professor Jason Speyer was elected to the National Academy of Engineering for "the development and application of advanced techniques for optimal navigation and control of a wide range of aerospace vehicles." He pioneered new deterministic and stochastic control, team and differential game strategies, estimation, and model-based fault detection, identification, and reconstruction theories and algorithms, as well as matrix calculus of variations for the Apollo autonomous navigation system. He pioneered the development and mechanization of periodic optimal control for aircraft fuel-optimal cruise and endurance, as well as differential carrier phase GPS blended with an inertial navigation system. He is a fellow of AIAA and IEEE (Life Fellow) and received the IEEE Third Millennium Medal as well as several AIAA Awards.

Eli Yablonovitch

National Academy of Engineering
National Academy of Sciences

Professor Eli Yablonovitch is a Fellow of the Institute of Electrical and Electronic Engineers, the Optical Society of America, and the American Physical Society. He has been awarded the Adolf Lomb Medal, the W. Streifer Scientific Achievement Award, the R.W. Wood Prize, and the Julius Springer Prize. He is The Northrop Grumman Opto-Electronics Chair, Professor of Electrical Engineering at UCLA, and also a Professor of Electrical and Computer Engineering at UC Berkeley.

Expedition into Hardware-Variability-Aware Software



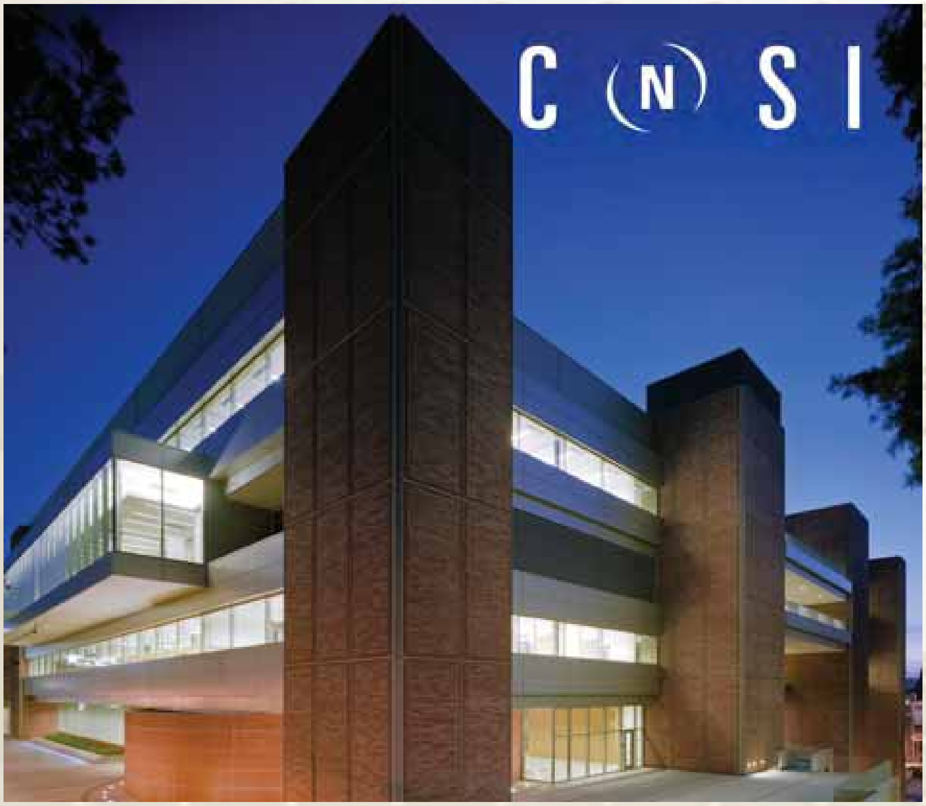
The National Science Foundation awarded $10 million to the research initiative "Hardware-Variability-Aware Software for Efficient Computing with Nanoscale Devices." The grant is part of the funding agency's Expeditions in Computing program, which rewards far-reaching agendas that "promise significant advances in the computing frontier and great benefit to society." Variability-aware computing systems would benefit the entire spectrum of embedded, mobile, desktop and server-class applications by dramatically reducing hardware design and test costs for computing systems while enhancing their performance and energy efficiency. The expedition's deputy director, Mani Srivastava, joins Lara Dolecek and Puneet Gupta from UCLA in a team of eleven researchers from various universities.

http://www.variability.org/

California Nano Systems Institute (CNSI)

The California NanoSystems Institute is an integrated research facility located at UCLA and UC Santa Barbara. Its mission is to foster interdisciplinary collaborations in nanoscience and nanotechnology; train a new generation of scientists, educators and technology leaders; generate partnerships with industry; and contribute to the economic development and the social well-being of California, the United States and the world. The CNSI was established in 2000 with $100 million from the state of California. An additional $900 million of support has come from federal research grants and industry funding. CNSI members are drawn from multiple disciplines within the Physical and Life Sciences, Engineering, Medicine, Neuroscience, and Public Health. This dynamic research setting has enhanced understanding of phenomena at the nanoscale and produced important discoveries in health, energy, and the environment and information technology.

http://www.cnsi.ucla.edu



Western Institute of Nano-electronics (WIN)

The Western Institute of Nanoelectronics is a multidisciplinary center that is the world's largest spintronic research effort. WIN was established in 2006 and is headquartered at UCLA, led by Electrical Engineering Professor Kang Wang. The institute involves collaborations among various Californian Universities which includes Stanford, Berkeley and UCLA. The institute's mission is to explore and develop advanced research devices, circuits and nanosystems with performance beyond CMOS devices. The Institute was established with funding totaling over $20 million in addition to spinning the STTRAM and NV Logic DARPA programs at UCLA totaling over about $16M. Furthermore, through these research efforts NIST awarded UCLA $6M to build the WIN-GEM building as part of the Engineering Building 1 replacement. WIN industry partners and consortia are organized through the Nanoelectronics Research Initiative which includes semiconductor companies such as Intel, IBM, Texas Instruments, NIST, Globalfoundries and Micron.

FCRP Center on Functional Engineered Nano Architectonics

FENA is part of the Focus Center Research Program (FCRP) initiated by the Semiconductor Research Corporation in an effort to expand pre-competitive, cooperative, long-range applied microelectronics research at US universities. The center, which was established in 2003, so far has received $38M, and is expected to receive an additional $15M through 2012. FENA aims to create and investigate new nano-engineered functional materials and devices, and novel structural and computational architectures for new information processing systems beyond the limits of conventional CMOS technology. FENA plays a key role in America's technology competitiveness as it addresses industry and DoD needs using the research university system, i.e. long-range, innovative applied research.

FENA

Focus Center
RESEARCH PROGRAM

Center for Excellence in Green Nanotechnology

King Abdulaziz City for Science & Technology (KACST) in Saudi Arabia and the Henry Samueli School of Engineering and Applied Science, are working together under a established Center of Excellence in Green Nanotechnology to promote educational, technology transfer and research exchanges, as well as an agreement with UCLA for research in nanoelectronics and clean energy for the next 10 years. From the UCLA side, the center is directed by Professor Kang L. Wang. KACST is both Saudi Arabia's national science agency and the nation's premier national laboratory. At the signing ceremony, KACST was represented by Prince Turki, the organization's vice-president for research institutes. The initial kick-off phase of $3.2 million will fund the center over three years in the following research areas:

- Nanostructures for high-efficiency solar cells
- Patterned nanostructures for integrated active optoelectronics on silicon
- Carbon nanotube circuits

The Electrical Engineering Department Overview

Faculty and Staff

Ladder Faculty	45 FTEs
Courtesy Appointments	13
Emeriti Faculty	13
Adjunct	7
Lecturers	19
Staff	44

Recognitions

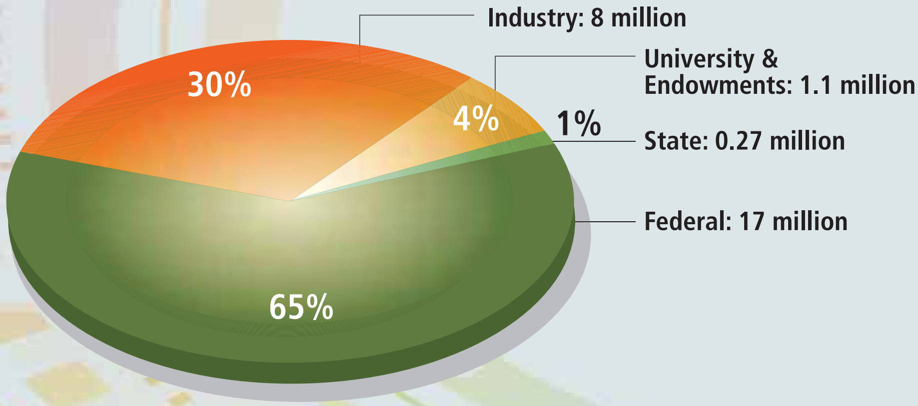
Society Fellows	36
NAE Members	12
NAS Members	3
National Medal of Science	1
Inventors Hall of Fame	1
Marconi Prize	1

Research Facilities

Laboratories and Research Groups: 37
Space: 100,772 square feet

Research Funding for 2011-2012:

$ 26.6M



Research Centers

The Electrical Engineering Department contributes to the following Research Centers:

California NanoSystems Institute (CNSI)
Center for Engineering Economics, Learning & Networks
Center for Excellence in Green Nanotechnology
Center for High Frequency Electronics (CHFE)
Center for Systems, Dynamics and Controls (SyDyC)
Expedition into Hardware Variability-Aware Software
Functional Engineered Nano Architectonics Focus Center (FENA)
Institute for Cell Mimetic Space Exploration (CMISE)
Institute for Digital Research and Education (IDRE)
Institute for Pure and Applied Mathematics (IPAM)
Institute for Technology Advancement (ITA)
Nanoelectronics Research Center (NRC)
Public Safety Network System (PSNS)
Water Technology Research Center (WaTer)
Western Institute of Nanotechnology (WIN)
Wireless Health Institute

Undergraduate Students

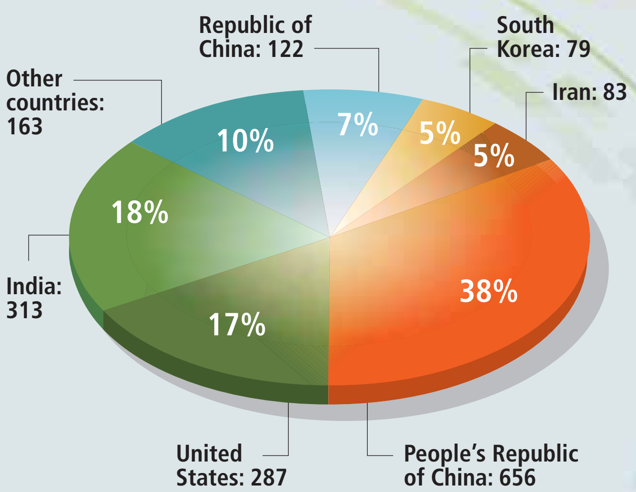
Students Enrolled	759
Applicants	1,121
Admitted	544
New Students Enrolled	223
Average Freshman GPA	3.924

Graduate Students

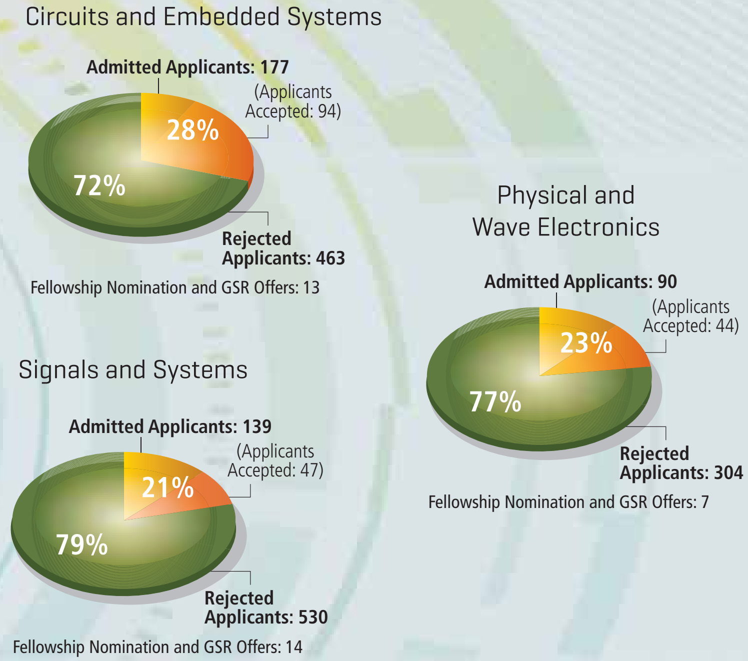
Students Enrolled	482
Applicants	1703
Admitted	406
New Students Enrolled	179
Average Incoming GPA	3.71

Graduate Applicants for Fall 2011

Total 1703



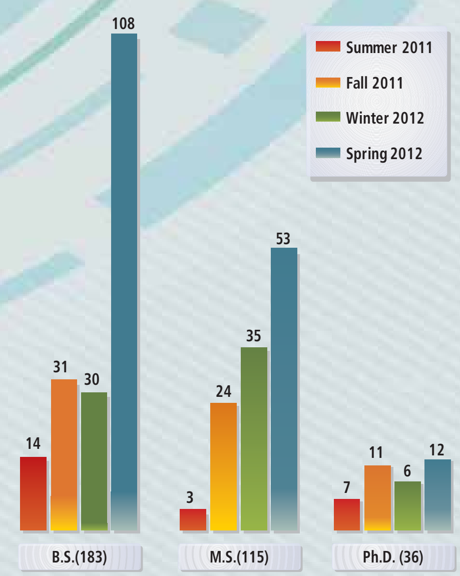
Graduate Students Admitted

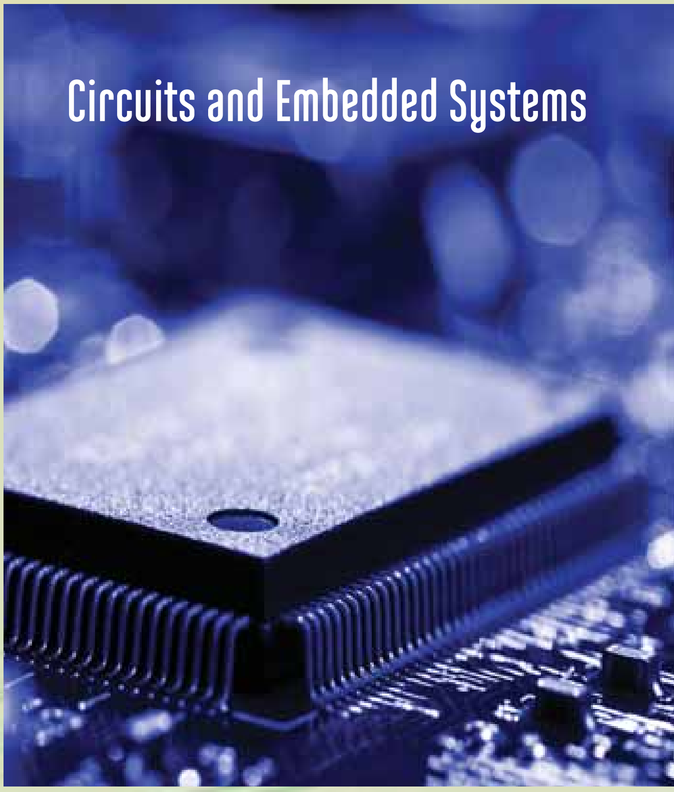


Graduate Student Fellowships

Department Fellowships	$746,445
Non-Resident Tuition Support for Teaching Assistants	$230,564
Dean's GSR Support	$159,192
Faculty Unrestricted Fellowships	$126,259
Dissertation Year Fellowships	$102,354
Ph.D. Preliminary Exam Top Score Fellowships	$50,421
Henry Samueli Partial Fellowships	$31,908
Chancellor's Prize	$30,000
Graduate Opportunity Fellowship	$29,618
Dean's Fellowship & Camp Funds	$29,285
KalosWorks/Chan	$11,773
Raytheon Fellowship	$11,773
Guru Krupa Foundation Fellowship	$9,907
Living Spring Fellowship	$9,907
Conference Travel Funds	$1,521
TOTAL	$1,580,927

Degrees Conferred in 2011-2012





M.C. Frank Chang

Distinguished Professor and Chairman
Wintek Professor of Electrical Engineering
Ph.D., National Chiao-Tung University, Taiwan, R.O.C., 1979
** Also in Physical and Wave Electronics*

High speed electronics including ultra high speed/ frequency devices and integrated circuits for radio, radar and imaging system applications.

- Academia Sinica, 2012
- National Academy of Engineering, 2008
- IEEE David Sarnoff Award, 2006

Asad A. Abidi

Distinguished Chancellor's Professor
Ph.D., University of California, Berkeley, 1981

CMOS RF design, high speed analog integrated circuit design, data conversion, and other techniques of analog signal processing.

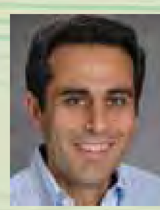
- National Academy of Engineering, 2007
- IEEE Donald Pederson Award, 2007
- Fellow, IEEE, 1996

Jason Cong

Chancellor's Professor
Ph.D., University of Illinois at Urbana-Champaign, 1990

Synthesis of VLSI circuits and systems, programmable systems, novel computer architectures, nano-systems, and highly scalable algorithms.

- ACM/IEEE A. Richard Newton Technical Impact Award in Electric Design Automation, 2011
- ACM Fellow, 2008
- Fellow, IEEE, 2000



Babak Daneshrad

Professor
Ph.D., University of California, Los Angeles, 1993

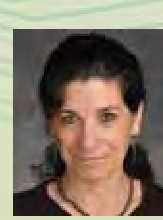
Wireless Communication Systems, High Performance Performance VLSI architectures and testbeds for wireless systems.

Danijela Cabric

Assistant Professor
Ph.D., University of California, Berkeley, 2007

Wireless communications system design; Cognitive radio networks; VLSI architectures of signal processing and digital communication algorithms; Performance analysis and experiments on embedded system platforms.

- NSF CAREER Award, 2012
- Okawa Foundation Award, 2009
- Samueli Fellow, 2008



Deborah Estrin

Distinguished Professor
Jonathan B. Postel Professor of Networking
Ph.D., Massachusetts Institute of Technology, 1985

Participatory Sensing, Mobile Health, Environmental monitoring, Open systems, Privacy.

- National Academy of Engineering, 2009
- Anita Borg Institute's Women of Vision Award for Innovation in 2007
- Fellow, AAAS, 2001

Puneet Gupta
Assistant Professor
Ph.D., University of California, San Diego, 2007

CAD techniques to enable design aware manufacturing. VLSI physical design for manufacturability, robustness and low-power. Software methods to mitigate hardware variability and reliability.

- IBM Faculty Award, 2012
- ACM/SIGDA Outstanding New Faculty Award, 2010
- NSF CAREER Award, 2009

Lei He
Professor
Ph.D., University of California, Los Angeles, 1999

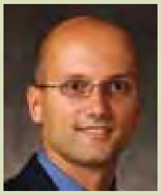
Modeling and simulation, programmable logic and reconfigurable computing, and embedded and cyber-physical systems for applications such as health care, electric vehicle and smart grid.

- Northrop Grumman Excellence in Teaching Award, 2005
- IBM Faculty Award, 2003
- NSF CAREER Award, 2000

William J. Kaiser
Professor
Ph.D., Wayne State University, 1984

Development of networked embedded computing for linking the Internet to the physical world. Distributed and wearable systems for advancing the quality and international accessibility of healthcare through Wireless Health.

- UCLA Gold Shield Faculty Prize, 2009
- Brian P. Copenhaver Award, 2005
- Allied Signal Faculty Research Award, 1995



Dejan Markovic
Associate Professor
Ph.D., University of California, Berkeley, 2006

Power/area-efficient digital integrated circuits for communication and healthcare applications, design with post-CMOS devices, design optimization methods and supporting CAD flows.

- NSF CAREER Award, 2009
- David J. Sakrison Memorial Prize, UC Berkeley, 2007

Sudhakar Pamarti
Associate Professor
Ph.D., University of California, San Diego, 2003

Mixed-signal IC design: wireless/wireline communication applications, digitally assisted analog/RF circuit design, delta-sigma modulation, quantization noise theory.

- NSF CAREER Award, 2010

Behzad Razavi
Professor
Ph.D., Stanford University, 1992

Analog, RF, and mixed-signal integrated circuit design, dual-standard RF transceivers, phase-locked systems and frequency synthesizers, A/D and D/A converters, high-speed data communication circuits.

- IEEE Pederson Award in Solid-State Circuits, 2012
- IEEE CICC Best Invited Paper Award, 2009
- UCLA Senate Teaching Award, 2007

Henry Samueli

Professor

Ph.D., University of California, Los Angeles, 1980

Digital signal processing, communications systems engineering, and CMOS integrated circuit design for applications in high-speed data transmission systems.

- Marconi Society Prize and Fellowship, 2012
- American Academy of Arts and Sciences, 2004
- National Academy of Engineering, 2003

Alan N. Willson, Jr.

Distinguished Professor

Charles P. Reames Endowed Professor of Electrical Engineering

Ph.D., Syracuse University, 1967

** Also in Signals and Systems*

Theory and application of digital signal processing including VLSI implementations, digital filter design, nonlinear circuit theory.

- IEEE Leon Kirchmayer Graduate Teaching Award, 2010
- IEEE W. R. G. Baker Award in Signal Processing, 1985 and in Circuits, 1994
- Fellow, IEEE, 1978

Majid Sarrafzadeh

Professor

Ph.D., University of Illinois at Urbana-Champaign, 1987

Embedded and reconfigurable computing; VLSI CAD; design and analysis of algorithms.

- Co-Director, UCLA Wireless Health Institute, since 2008
- Co-Founder, four Startups, since 2000
- Fellow, IEEE, 1996

Chih-Kong Ken Yang

Professor and Area Director

Ph.D., Stanford University, 1998,

High-speed data and clock recovery circuits for large digital systems, low-power, high-performance functional blocks and clock distribution for high-speed digital processing, and low-power high-precision capacitive sensing interface for MEMS.

- Fellow, IEEE, 2011
- IBM Faculty Development Fellowship, 2003-2005
- Northrup-Grumman Outstanding Teaching Award, 2003

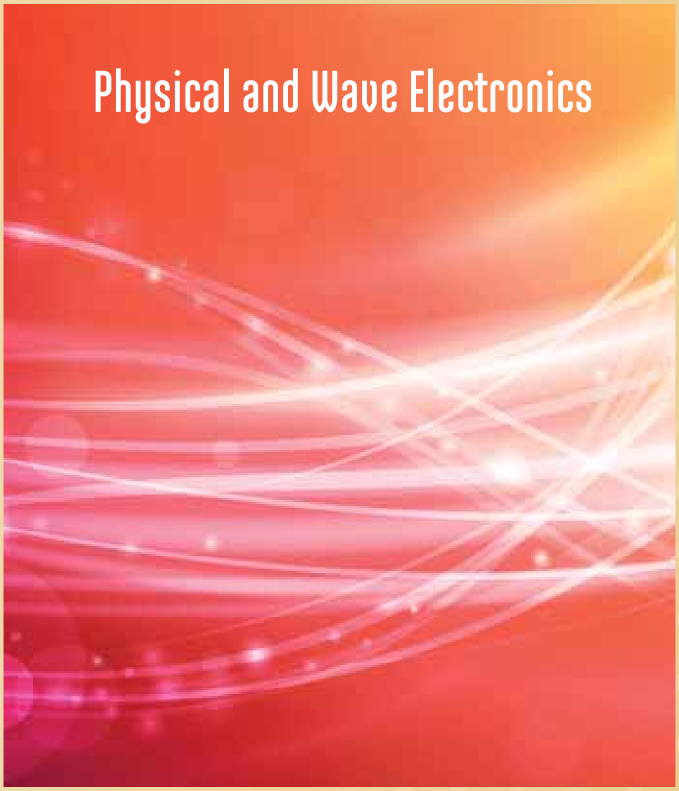
Mani B. Srivastava

Professor

Ph.D., University of California, Berkeley, 1992

Embedded and Cyber-Physical Systems; Distributed and Participatory Sensing; Mobile, Wearable, and Pervasive Computing; Wireless Networks; Power & Energy-aware Systems; Energy Harvesting Technologies; Applications in mHealth, Green Buildings, and Smart Grids.

- Fellow, IEEE, 2008
- Okawa Foundation Grant Award, 1998.
- NSF CAREER Award, 1997



Chi On Chui

Assistant Professor
Ph.D., Stanford University, 2004

Nanostructure Devices and Technology for Nanoarchitectonics, Nanotheranostics, and Nanoelectronics.

- HSSEAS Northrop Grumman Excellence in Teaching Award, 2011
- IEEE Electron Devices Society Early Career Award, 2009
- Okawa Foundation Award, 2007

Warren Grundfest

Professor
M.D., Columbia University, 1980

Lasers for minimally invasive surgery, magnetic resonance-guided interventional procedures, laser lithotripsy, micro-endoscopy, spectroscopy, photodynamic therapy, optical technology, biologic feedback control mechanisms.

- Fellow, SPIE, 1996
- Fellow, American Institute of Medical & Biologic Engineers, 1996

Katsushi Arisaka

Professor
Ph.D., University of Tokyo, Japan, 1985

High Energy and Astro-particle Experiments, Kaon Rare decays and CP violation, Ultra High Energy Cosmic Ray, Hadron Collider Experiment.

- UCLA Distinguished Teaching Award, 2010

Diana Huffaker

Professor
Ph.D., University of Texas at Austin, 1994

Directed and self-assembled nanostructure solid-state epitaxy, optoelectronic devices including solar cells and III-V/Si photonics.

- IEEE Fellow, 2008
- DoD NSSEFF Fellow, 2008
- Humboldt Research Award, 2004

Robert Candler

Assistant Professor
Ph.D., Stanford University, 2006

MEMS and NEMS devices, micro/nanoscale technology development, and the interface of physical microsystems with biology.

- ARO YIP Award, 2012

Tatsuo Itoh

Distinguished Professor
Northrop Grumman Professor in Microwave Electronics
Ph.D., University of Illinois at Urbana-Champaign, 1969

Microwave and millimeter wave electronics, guided wave structures, low power wireless electronics, integrated passive components and antennas.

- National Academy of Engineering, 2003
- Fellow, IEEE, 1982

Bahram Jalali

Professor and Area Director
Northrop Grumman Endowed Opto-Electronic Chair in Electrical Engineering
Ph.D., Columbia University, 1989

Silicon Photonics, Biophotonics, Real-time Instruments for biomedical and communication applications.

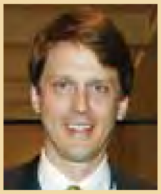
- R.W. Wood Prize, Optical Society of America, 2008
- Fellow, Optical Society of America, 2004
- Fellow, IEEE, 2003

Chandrashekar Joshi

Distinguished Professor
Ph.D., Hull University, England, 1979

Laser fusion, laser acceleration of particles, nonlinear optics, high-power lasers, plasma physics.

- Fellow, Institute of Physics (U.K.), 1998
- Fellow, IEEE, 1993
- Fellow, American Physical Society, 1990



Jack W. Judy

Professor
Ph.D., University of California, Berkeley, 1996

MEMS, microsensors, micro-actuators, microsystems and micromachining; magnetism and magnetic materials; neuro- engineering and neuro-silicon interfaces; distributed sensors, actuators, and information.

Kuo-Nan Liou

Distinguished Professor
Ph.D. New York University, 1970

Electromagnetic Scattering by Ice Crystals and Aerosols, Satellite Remote Sensing, Radiative Transfer, and Climate Modeling.

- COSPAR William Nordberg Medal (Application to Space Science), 2010
- Academia Sinica (Chinese Academy of Sciences, Taiwan), 2004
- National Academy of Engineering, 1999

Jia-Ming Liu

Professor
Ph.D., Harvard University, 1982

Nonlinear optics, ultrafast optics, semiconductor lasers, photonic devices, optical wave propagation, nonlinear laser dynamics, chaotic communications, chaotic radar, nanophotonic imaging, and biophotonics.

- Fellow, IEEE, 2008
- Guggenheim Fellow, 2006
- Fellow, American Physical Society, 2003

Warren Mori

Professor
Ph.D., University of California, Los Angeles, 1987

Advanced accelerator concepts, advanced light sources, inertial confinement fusion, nonlinear optics of plasmas, plasma physics, and massively parallel computing.

- Fellow, IEEE, 2007
- Fellow, American Physical Society, 1995

Aydogan Ozcan

Associate Professor
Ph.D., Stanford University, 2005

Photonics and its applications to nano and biotechnology.

- PECASE Award, 2012
- NSF CAREER Award, 2010
- NIH Director's New Innovator Award, 2009

C. Kumar Patel

Distinguished Professor
Ph.D., Stanford University, 1961

Condensed matter physics, especially the structure and dynamics of "interesting systems", broadly defined; spectroscopic techniques and detection methods; development of high power laser systems including quantum cascade lasers.

- National Inventors Hall of Fame, 2012
- National Medal of Science, 1996
- National Academy of Engineering, 1978

Yahya Rahmat-Samii

Distinguished Professor
Northrop Grumman Professor of Electrical Engineering/Electromagnetics
Ph.D., Univ. of Illinois at Urbana-Champaign, 1975

Personal communications, medical, miniaturized, fractal, reflectors, remote sensing, satellite and radio astronomy antennas; electromagnetic band gap, meta-materials, reflectar rays and frequency selective structures, computational and optimization techniques, modern antenna measurements and diagnostics.

- UCLA Distinguished Teaching Award 2011
- IEEE Electromagnetics Award, 2011
- National Academy of Engineering, 2008

Oscar M. Stafsudd

Professor and Vice Chair
Ph.D., University of California, Los Angeles, 1967

Mid-infrared lasers for applications in materials processing, dentistry, and surgery; ceramic laser media for high power laser systems; Raman imaging and time dependent fluorescent imaging for medical applications (cancer/ wounds); infrared detectors.

- Lockheed Martin Excellence in Teaching Award, 2011
- Fulbright Fellowship, 1986

Dwight C. Streit

Distinguished Professor
Ph.D., University of California, Los Angeles, 1986

Solid-state electronics, millimeter-wave devices and circuits, electronic materials, heterogeneous integration.

- National Research Council Lifetime Associate, 2008
- Northrop Grumman Distinguished Innovator, 2008
- National Academy of Engineering, 2001

King-Ning Tu

Distinguished Professor
Ph. D., Harvard 1968

VLSI processing and reliability, and 3D IC packaging technology.

- Fellow: APS, 1981, TMS, 1988, MRS, 2010
- Humboldt Award,1996

Kang L. Wang

Distinguished Professor
Raytheon Company Professor of Electrical Engineering
Ph.D., Massachusetts Institute of Technology, 1970

Nanoelectronics, spintronics and nanomagnetics; nanoscale science, devices and quantum systems; nonvolatile electronics and low dissipation devices; MBE; optoelectronics and solar cells.

- Semiconductor Industry Association Award, 2009
- Semiconductor Research Corporation Technical Excellence Award, 1995
- Fellow, IEEE, 1992

Yuanxun Ethan Wang

Associate Professor
Ph.D., University of Texas at Austin, 1999

High performance antenna array and microwave amplifier systems for wireless communication and radar; numerical modeling techniques; fusion of signal processing and circuit techniques in microwave system design.

Benjamin Williams

Assistant Professor
Ph.D., Massachusetts Institute of Technology, 2003

Terahertz and mid-infrared lasers and devices; low-dimensional semiconductor nanostructures for opto-electronics; sub-wavelength photonics, plasmonics, and meta-materials.

- NSF CAREER Award, 2012
- DARPA Young Faculty Award, 2008

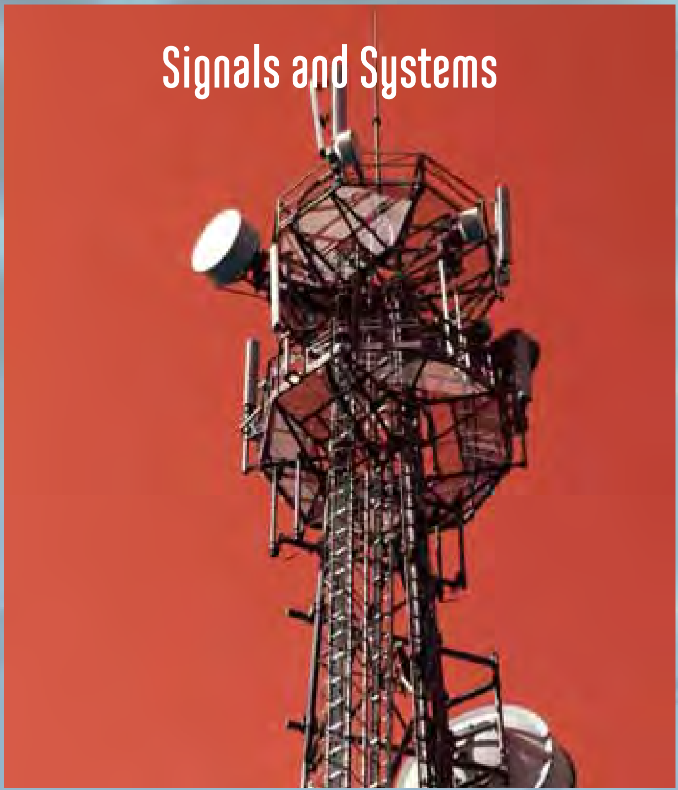
Jason C. S. Woo

Professor and Vice Chair
Ph.D., Stanford University, 1987

Solid state technology, CMOS and bipolar device/circuit optimization, novel device design, modeling of integrated circuits, VLSI fabrication.

- Fellow, IEEE, 2005

Signals and Systems



Panagiotis Christofides
Professor
Ph.D., University of Minnesota, 1996

Control theory for nonlinear, hybrid and distributed parameter systems, networked control, model predictive control, fault detection and fault-tolerant control, process control applications

- IFAC Fellow, 2011
- IEEE Fellow, 2009
- Donald P. Eckman Award, 2004

Lara Dolecek
Assistant Professor
Ph.D., University of California, Berkeley, 2007

Information and probability theory, graphical models, combinatorics, statistical algorithms and computational methods with applications to high-performance complex systems for data processing, communication, and storage.

- NSF CAREER Award, 2012
- David J. Sakrison Memorial Prize, UC Berkeley, 2007

Abeer Alwan
Professor
Ph.D., Massachusetts Institute of Technology, 1992

Speech processing, acoustic properties of speech sounds with applications to speech synthesis, recognition by machine and coding, hearing aid design, digital signal processing.

- Distinguished Lecturer, ISCA, 2010-2011
- Fellow, IEEE, 2008
- Fellow, Acoustical Society of America, 2003

Suhas Diggavi
Professor
Ph.D., Stanford University, 1998

Information theory with applications to wireless and sensor networks, network data compression and storage, network secrecy, machine learning and large scale data analysis algorithms.

A. V. Balakrishnan
Distinguished Professor
Ph.D., University of Southern California, 1954

Non-linear aeroelasticity and flutter systems research in green energy and palatal flutter.

- Doctor Honoris Causa, West University of Timisoara, Roumania, 2004
- Richard E. Bellman Control Heritage Award, 2001
- NASA Public Service Medal, 1996

Mark Hansen
Professor
Ph.D., University of California, Berkeley, 1994

Statistical analysis of large complex data. Statistical methods for embedded sensing. Streaming data analysis. Text mining and information retrieval. Information theory and its applications to statistics.

Alan J. Laub
Distinguished Professor
Ph.D., University of Minnesota, 1974

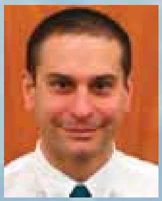
Numerical linear algebra, numerical analysis, high-end scientific computation, and computer-aided control system design, especially algorithms for control and filtering.

- Fellow, IEEE, 1986

Stanley Osher
Professor
Ph.D., Courant Institute, New York University, 1966

Innovative numerical methods for applications ranging from image science to control to electromagnetics to computational physics and beyond.

- American Academy of Arts and Sciences, 2010
- National Academy of Sciences, 2005



Gregory J. Pottie
Professor and Area Director
Ph.D., McMaster University, Canada, 1988

Wireless communications, modeling and reliable inference in sensor networks with application to wireless health.

- Fulbright Senior Scholar, 2009
- Fellow, IEEE, 2005
- Allied Signal Award for Outstanding Faculty Researcher in HSSEAS, 1998

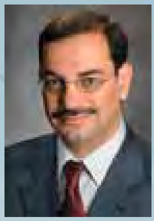
Vwani Roychowdhury
Professor
Ph.D., Stanford University, 1989

Models of computation: parallel systems, quantum information processing, nanoscale and molecular electronics, statistical algorithms for large-scale information processing, combinatorics and complexity and information theory, bioinformatics, cryptography.

Izhak Rubin
Distinguished Professor
Ph.D., Princeton University, 1970

Telecommunications and computer communications systems/networks; mobile wireless, optical, multimedia IP, ATM, satellite, and CATV networks; queueing systems, C3 systems/networks, network simulations and analysis, traffic modeling/engineering.

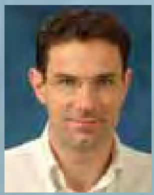
- Fellow, IEEE, 1987



Ali H. Sayed
Professor
Ph.D., Stanford University, 1992

Adaptive and statistical signal processing, adaptation and learning, adaptive networks, bio-inspired cognition, distributed processing, information processing, signal processing for communications, system theory, large-scale structured computations.

- Frederick E. Terman Award, 2005
- Kuwait Prize, 2003
- Fellow, IEEE, 2001



Stefano Soatto
Professor
Ph.D., California Institute of Technology, 1996

Estimation theory, control theory, video, image and signal processing, computer vision, robotics.

- Okawa Foundation, 2001
- David Marr Prize, 1999
- Siemens Prize, 1998

Jason L. Speyer
Distinguished Professor
Ph.D., Harvard University, 1968

Stochastic and deterministic optimal control and estimation with application to aerospace systems; guidance, flight control, and flight mechanics.

- National Academy of Engineering, 2005
- Life Fellow, IEEE, 2005
- Fellow, AIAA, 1985

Paulo Tabuada
Professor and Vice Chair
Ph.D., Technical University of Lisbon, Portugal, 2002

Modeling, analysis, and control of cyber-physical systems. Control and systems theory.

- Donald P. Eckman Award, 2009
- NSF Career Award, 2005

Mihaela van der Schaar
Chancellor's Professor
Ph.D., University of Technology, Eindhoven, The Netherlands, 2001

Information processing, Network Economics and Game Theory, Multi-user Communications and Networking, Multimedia Communications, Networking and Processing, Multimedia Systems, Distributed and large-scale stream mining systems

- Fellow, IEEE, 2010
- Editor in Chief, IEEE Trans. on Multimedia, 2011-2013
- NSF CAREER Award 2004

Lieven Vandenberghe
Professor
Ph.D., Katholieke Universiteit Leuven, Belgium, 1992

Optimization in engineering, applications in systems and control, circuit design, and signal processing.

- HSSEAS TRW Excellence in Teaching Award, 2002
- NSF CAREER Award, 1998
- Robert Stock Award, K.U. Leuven, 1993

John D. Villasenor
Professor
Ph.D., Stanford University, 1989

Methods, technologies, and systems used to capture information, convert it into digital form and transmit it efficiently and securely

- Nonresident Senior Fellow, The Brookings Institution, 2012

Richard D. Wesel
Professor and Associate Dean
Ph.D., Stanford University, 1996

Communication Theory, Channel Coding including Low-Density Parity-Check Codes and Turbo Codes, Information Theory, Network Optimization

- TRW Excellence in Teaching Award, 2000
- Okawa Foundation Award, 1999
- NSF CAREER Award, 1998

Kung Yao
Distinguished Professor
Ph.D., Princeton University, 1965

Communication theory, signal, acoustic, and array processing, wireless communication systems, sensor networks, chaos system theory, and VLSI and systolic algorithms and architectures.

- IEEE Joint Information Theory/Communication Theory Societies Best Paper Award, 2008
- Life Fellow, IEEE, 1994

Books by Faculty

Numerous textbooks on graduate and undergraduate instruction are authored by our electrical engineering faculty. These are samples of the publications.

Post-Graduation Academic Placement

Qun Jan Gu, 2007

Assistant Professor, U. C. Davis. Advisor: Frank Chang

Qun Jane Gu received the B.S. and M.S. from Huazhong University of Science and Technology, Wuhan, China, in 1997 and 2000, the M.S. from the University of Iowa, 2002, and the Ph.D. from UCLA, all in electrical engineering. She received a UCLA fellowship in 2003 and Dissertation Year Fellowship in 2007. In 2010, she joined University of Florida as an assistant professor. Since August 2012, she has joined U.C. Davis.

Jenny Yi-Chun Liu, 2007

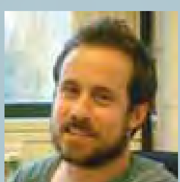
Assistant Professor, National Tsing Hua University. Advisor: Frank Chang

Jenny Yi-Chun Liu received her Ph.D. from UCLA in 2011. Her Ph.D study focused on self-healing millimeter-wave circuits and systems. She was a postdoctoral scholar at UCLA from 2011 to 2012 and later she joined the department of Electrical Engineering at National Tsing Hua University, Taiwan. Her current research interests include millimeter-wave and THz devices, circuits and systems, ultra low power systems, and reconfigurable radio.

Minjae Lee, 2007

Assistant Professor, Gwangju Institute of Science & Technology, Korea. Advisor: Asad Abidi

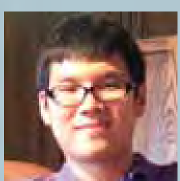
Dr. Minjae Lee's interests are in high speed ADC/DAC, clocking, CMOS RF circuits, time domain signal processing and power electronics for electrical vehicles.



Manuel Mazo, 2010

Assistant Professor, Delft University of Technology. Advisor: Paulo Tabuada

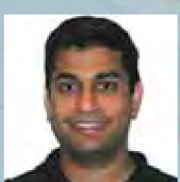
Dr. Manual Mazo received his Ph.D. degree in 2010. His research interest is mainly in Control Systems with concentration on theoretical foundations behind practical uses in modern control implementations.



Shaolei Ren, 2012

Assistant Professor, Florida International University. Advisor: Mihaela van der Schaar

Dr. Shaolei Ren received is B.S. degree in 2002 from Tsinghua University, his M.S. degree from Hong Kong University of Science and Technology (HKUST) in 2008, and his Ph.D. from UCLA in 2012. His research interest is in cloud computing, smart grid, social networking, network economics.



Rahul Singh, 2005

Adjunct Assistant Professor, UCLA/Departments of Bioengineering and Surgery.
Advisors: Elliott Brown and Warren Grundfest

Dr. Rahul Singh's research interests include ultrasound imaging, terahertz imaging and optical imaging techniques for oral, skin and prostate cancers.

Shenheng Xu, 2009

Associate Professor, Tsinghua University. Advisor: Yahya Rahmat-Samii

Dr. Shenheng Xu research interests includes reflector antenna theory, designs, and measurements, large space antennas, computational electromagnetics and optimization techniques

Fan Yang, 2002

Full Professor, Tsinghua University. Advisor: Yahya Rahmat-Samii

Dr. Fan Yang received his B.S. degree, 1997, and M.S. , 1999, from Tsinghua University. His research interests includes antenna theory, designs, and measurements, electromagnetic band gap (EBG) structures and their applications, computational electromagnetics and optimization techniques

Administration

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Industrial Affiliates Program

The Electrical Engineering Department is dedicated to initiating and forging partnerships with industry, in which both the school and the companies involved benefit from the exchange of technology innovations and talent. The Industrial Affiliates Program (IAP), initiated in 1981, provides a variety of services that include:

- Nurturing the talent pipeline between UCLA and IAP members
- Providing access to UCLA intellectual capital
- Exploring collaborative research opportunities
- Providing access to state-of-the-art research facilities
- Enhancing industry visibility on campus

The department also serves as an invaluable consulting resource to our affiliate members. In turn, a company's participation in IAP provides essential program enhancement and aid to students with a portion of the membership fees being applied towards laboratory, instructional and other equipment needs. More details are available at the IAP website:

http://www.ee.ucla.edu/people/industry

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Annual Report 2011-2012

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