UNLV | ELECTRICAL & COMPUTER ENGINEERING

AUGUST 2015 NEWSLETTER

ARRAY OF ACCOMPLISHMENT

Engineering professor Shahram Latifi draws on a breadth of knowledge to craft elegant solutions to problems fraught with complication.

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Shahram Latifi, professor of electrical and computer engineering and Harry Reid Silver State Research Award winner.
(Aaron Mayes/UNLV Photo Services)

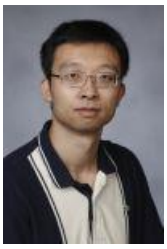
As Bijan Salimi, a prominent Nevada engineer recently put it, "the depth and breadth of his knowledge in his field are truly remarkable." It's an assessment shared by many, including the committee of scholars that earlier this year conferred upon Latifi the 2014 Harry Reid Silver State Research Award. The award, UNLV's most prestigious research honor, singles out faculty members whose work achieves a rare trifecta of attainments: It significantly advances the recipient's academic field, addresses real-world needs and concerns, and contributes to Nevada's economic growth and development.

Latifi, who grew up in Iran, discovered early on that math and engineering would be his calling. He was still a sophomore when he was chosen to join a delegation of students representing Iran in the International Math Olympiad competition, the annual "world championship" of numbers.

Latifi was introduced to engineering during his senior year. After graduation Latifi enrolled at Tehran University, then, as now, one of Iran's top destinations for math and engineering. Latifi graduated with a master's degree in electrical engineering in 1980.

Because Iran lacked

MESSAGE FROM DEPARTMENT CHAIR



With 2014/2015 academic year already behind us, we are geared up to start yet another new and exciting academic year with a larger ECE department that welcomes nearly 600 existing and new students (undergraduate and graduate students combined) and 18 returning faculty. Each of these ECE family members, the faculty, staff, and students, has made, and will continue to make his/her fair contributions to the success of the department.

The current newsletter contains inspiring stories that highlight faculty personal stories and research activities, curricular development, student activities, and alumni achievements. These stories truly reflect the fact that the department is bursting with award-winning faculty and student leaders involved in a myriad of important and yet fun work. And our alumni are apparently doing very well in the real world. I am sure you will enjoy reading these stories as much as I did.

I would also like take this opportunity to thank anyone who is willing to offer financial support to the department, which shall help us replace aging equipment, acquire new facilities, and provide much-needed support to our students.

Last but not least, I am eager to hear from you about your ideas, thoughts, and suggestions on how to strengthen the UNLV ECE department for our students. This is particularly important as we are going through another ABET accreditation cycle, and when UNLV has positioned itself to become a top-tier university.

Enjoy the newsletter!

Yingtao Jiang, Professor and Chair
Email: yingtao.jiang@unlv.edu
Tel: (702) 895-2533

institutions offering further advancement, the youthful engineer knew that progressing in his career meant moving on. That place was Louisiana State University in Baton Rouge, La., the humid home of crawfish boil, étouffée, and an excellent engineering program.

Soon, Latifi was making important contributions to LSU's highly regarded computer engineering program. After completing a master's degree, he moved on to the doctoral program. His dissertation involved the design of computer networks composed of millions of processing elements.

"I started with computer networks for what we call massively parallel systems," Latifi says. "At that time we were looking for ways to help machines with tens of thousands of processing nodes act in harmony on very complex, computationally intensive problems."

Learning new sets of skills has become a hallmark of Latifi's career. He arrived at UNLV in 1989, convinced that the small but ambitious electrical and computer engineering department at the Howard R. Hughes College of Engineering would be a good place for him to pursue a variety of projects.

One of Latifi's first successes arose from that "massively parallel" computing work he had pursued as a doctoral student. It remains among his most important contributions.

In disciplines involving supercomputing — bioinformatics, weather forecasting, robotics, and artificial intelligence, just to name a few — massively parallel systems have revolutionized the way research is conducted. Latifi's work in the early 1990s helped make this possible.

The 1991 paper resulting from that work has been described as a "milestone" that "opened up a new avenue of research." It has since been cited by scholars across the world.

Theorizing about ways to improve supercomputing did not limit Latifi's interest in more practical concerns. While still relatively new to UNLV, he served as a computer networking consultant for a local branch of the Lockheed Corporation and assisted a Las Vegas law firm investigating the circumstances surrounding the death of a man who may have been electrocuted.

Other consulting work followed, and Latifi has since continued to build bridges to the private sector, especially in developing technologies aimed at improving public health, safety, and security. His projects have included advancements in "partial iris recognition," systems that allow security screeners to identify malefactors who attempt to conceal their faces; next-generation unmanned aerial vehicles, a.k.a., drones, that will one day assist emergency-services personnel; and advanced image-processing algorithms, computer code that can make intelligible otherwise unreadable remotely sensed objects.

Latifi has also worked on a major data collection project aimed at assessing the pace of climate change, and has teamed up with NASA to think about ways of keeping deep-space astronauts in good trim. Not surprisingly, this latter project also involves a form of remote sensing.

When it's not possible to include a physician on a spacecraft, how, Latifi wanted to know, "can we efficiently monitor the astronauts?" The answer, he says, will likely involve creating better "cognitive systems," technologies that allow machines and people to interact more naturally. Such systems will certainly produce benefits here on this planet.

When these and other research interests are coupled with Latifi's long experience organizing information-technology conferences — events that for more than two decades have brought hundreds of prominent international scholars to Las Vegas and the UNLV campus — a picture emerges of a high-energy scholar whose interests and expertise defy the notion that today's academe is all about specialization.

Asked whether there might be a common thread binding together his extraordinarily diverse oeuvre, Latifi pauses for a moment. "That's a very good question," he says, then briefly describes how mathematics — his first love — has been a crucial component throughout his career.

"Apart from that, I was fortunate to have been exposed to different aspects of electrical engineering, from the traditional, high-voltage electrical work to the more modern computer engineering," he says. "This enabled me to tackle a variety of assignments that at the time seem to have nothing in common."

It's a breadth of knowledge that has made him both a popular instructor of undergraduates and an advisor and mentor to more advanced students. Awards like the Silver State Research prize are wonderful honors, Latifi acknowledges, but he says that his work with these engineers of the future will define his legacy.

Reprinted courtesy of *UNLV Innovation* Magazine

ALUMNI SPOTLIGHT: SURESH VISHNUBHATLA

Suresh Vishnubhatla is Executive Vice President, Long Term Care Operations for PharMerica Corporation (NYSE: PMC). In his role, he oversees product development, information technology, pharmacy services, clinical services, customer services and revenue cycle management for the company. Mr.Vishnubhatla started his career at Emerson Electric Corp. and subsequently worked at BodyMedia (acquired by Jawbone) and Millennium Pharmacy Systems. His work during his career was focused on rapidly growing businesses by launching innovative products and services, building scalable platforms and developing customer focused service organizations. He owns several US and international patents and the products were recognized by several national and international publications. He served as a judge at the 2015 Spring Senior Design Competition.

RESEARCH SPOTLIGHT

Dr. Emma Regentova is working currently in collaboration with Dr. Alexsander Barzilov (Mechanical Engineering Department) on the development of **a novel neutron-photon tomography**. This interdisciplinary research funded by the UNLV Faculty Opportunity Awards addresses applications such as non-destructive testing, security and inspection. The nondestructive evaluation of complex objects, specifically of their shape and material composition is crucial for ensuring domestic security. Imaging technologies are employed in harbors and airports as well as at border crossings. Typically, x-ray methods are used for evaluating geometry of objects being examined. Although this is effective in finding hidden items of a specific shape, such as knives, guns, or unique devices, for example, bombs, it does not discriminate between materials of similar geometry and density. In the past, Dr. Regentova worked with Varian, Security and Inspection products on dual-energy megavoltage radiography for detecting nuclear materials in cargo containers. The current research is a step forward in developing a reliable method for searching for organic-based explosives /illicit materials and masked nuclear materials. The use of dual-radiation, that is neutron and photon radiography, enables more efficient material discrimination. Dr. Barzilov and his student, Jessica Hartman, perform computational modeling using Monte Carlo neutron and photon transport codes. Dr. Regentova works with her Ph.D. student, Mr. Ali Pouryazdanapah Kermani, on the development of advanced algebraic methods for tomographic reconstruction and data fusion for material identification and visualization. The developed methods will be verified further by the interdisciplinary researchteam by experiments in the UNLV particle accelerator facility.

PATENT AND COMMERCIALIZATION

Kyma Technologies, Inc., a leading supplier of advanced materials solutions that promote safety and energy efficiency announced the availability of the EM-Dot™ [http://www.kymatech.com/our-products/devices/81-emdot] as a new type of high performance electromagnetic sensor in its Jan. 5, 2015 news release. The technology behind the EM-Dot™ is protected under US patent 7,482,814 which is entitled "ELECTRIC/MAGNETIC SENSOR" and was invented by an ECE faculty, Professor Robert Schill and research scientist Marc Popek. Kyma signed an exclusive license to this technology in 2013 and has been working towards its commercialization ever since.

The EM-Dot™ has a small, pen-like form factor and measures the temporal change in the electric or magnetic flux density simultaneously at a single point in space. Transitions between electric and magnetic field dominance (or equivalently, between the open and the short circuit states) can be monitored as characteristic changes on sub-nanosecond or slower time scales. Unlike most other electromagnetic sensor designs, the EM-Dot is symmetric and electrically matched. The output of the sensor operating in the

differentiating mode can be easily converted into either electric or magnetic field in both time and frequency domain.

The EM-Dot™ has a broad frequency response which Kyma has documented between 1 MHz and 1GHz. Simple extrapolation suggests that its sensitivity may easily extend to 10GHz and beyond. Applications are manifold and include aerospace, pulsed power, power electronics, ground fault detect, electric grid, automotive, plasma physics, and materials science.

Kyma plans to add a number of supporting products in the near future - e.g., signal amplifiers and low-cost oscilloscopes.

(Courtesy of *Kyma Technologies 2015*)

CURRICULUM SPOTLIGHT

Dr. Ke-Xun (Kevin) Sun will offer a new graduate course, ECG758R, "Optical Sensing", in Spring 2016. Topics covered: Optical sensing overview, fiber optics, fiber optics components, scattering, laser sources, optical detection, modulation, fiber responses to disturbances, optical interferometry, laser stabilization, atomic clocks, time and frequency transfer, multiplexing, diffractive optics sensors, acoustic sensors, seismic deformation sensors, photonic Doppler velocimetry, remote sensing, biosensors, quantum enhancement.

FIELD TRIPS OF ECE STUDENTS





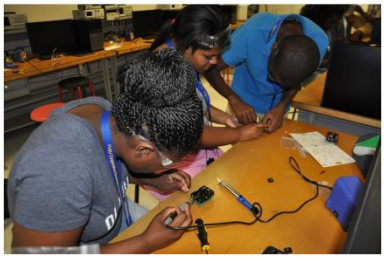
Electrical and Computer Engineering (ECE) is a vast discipline. Almost everything we do or interact with in our daily lives has electrical and computer engineering involvement. Real life examples of engineering projects involve not only electrical and computer engineering but also involve and integrate applications of other multidisciplinary fields for example: mechanical, civil, architectural, materials, transportation and other disciplines. The ECE Department at UNLV believes good student education incorporates a component of providing a broad big picture of real projects at the commencement of their engineering program to help students visualize how the various disciplines and personnel fit together.

ECE introduced the first year engineering students to real life applications of engineering - projects- through several field trips. Some of the field trips (pictures from left to right) included UAV Program at U.S AFB (MQ9 – Reaper Drone), McCarran Airport and Control Room operations, CSP Solar plant, and Natural Gas Fired plant operations for generation of electricity; and the icon of Las Vegas- the Bellagio Fountains technical operations- predominantly electrical and mechanical and hydraulic engineering applications. The students saw real life projects that will put in perspective, to some degree, the technical aspects of theoretical principles which they will learn during the course of their degree programs.

In addition, the students interacted with sponsors who may be contacts for students' future suitable employment. The field trips were organized and conducted by Ashok EM Sudhakar, Esq, P.E. DEE, CGC. ECE Graduate Instructor with very broad support in all aspects from the Dean of Engineering, Dr. Rama Venkat, and former ECE Chair, Dr. P. Stuberrud.

View more pictures at: http://ece.unlv.edu/index.html?navi=trips

COMMUNITY OUTREACH


The ECE Department hosts the MSEA (Mathematics, Science, and Engineering Academy) event each year during the summer. MSEA is an early intervention program that targets minority and female high school students starting in the ninth grade. The students selected to participate in MSEA are academically conscientious and considered the cream-of-the-crop in their respective schools across the country. During each summer (from 9th grade to 12th grade), the students are exposed to advanced mathematical concepts, and hands-on laboratory experiments beyond what they are taught at their high schools.

A component of this year's MSEA involved those students transitioning from 9th grade to 10th grade visiting the UNLV campus for one week in July where they were introduced to various engineering, geoscience and health physics disciplines. Their visit included time spent in laboratories such as one of the electrical engineering labs where they assembled and soldered electronic circuits (see pictures above). They were assisted by ECE faculty, staff and students.

NOTABLE PUBLICATIONS

- Sean Anderson (MS graduate student) and Dr. Robert A. Schill, Jr. published an article on the characterization of plasma constriction as observed in their pulsed power discharge tube experiments. [Sean Anderson and Robert A. Schill, Jr., "Nonlinear Theory Modeling Electron Beam Constriction in a Pulsed Power Discharge," **IEEE Trans. Plasma Science**, Vol. **43**, No. 6, June 2015, pp. 2011-2020. http://ieeexplore.ieee.org/xpl/tocresult.jsp?isnumber=4360151

Although the experiments are not discussed in the paper, the nonlinear theory tends to agree with experimental results identifying a window where plasma constriction will occur. The experiments and theory were motivated to help explain pinch physics in a non-equilibrium plasma pinch configured in the form of a dense plasma focus. Currently, two applications (patent pending) are under investigation. Dr. Schill believes that the applications may be of potential interest to the Department of Defense and Homeland Security. Dr. Schill is the director of the Energy Materials Interaction Technology Initiative of Nevada (EMITION) Center housed in the College of Engineering.

- Mobile Cloud Computing (MCC) enables mobile devices to use resource providers other than mobile devices themselves to host execution of mobile applications. Various mobile cloud architectures and scheduling algorithms have been studied recently. However, how to utilize MCC to enable mobile devices to run complex real-time applications while keeping energy efficiency in check remains a challenge.

Former ECE graduate student Ting Shi (now working in Dallas, Tx) and two ECE faculty, Dr. Mei Yang and Dr. Yingtao Jiang, along with two other scholars then visiting the ECE department attacked this scheduling problem based on the notion of local mobile clouds and their mathematical models of the mobile devices and applications. Results of their findings have been summarized in an article, titled "An Energy-Efficient Scheduling Scheme for Time-constrained Tasks in Local Mobile Clouds," to appear in **Pervasive and Mobile Computing**. This article is an extension of the work that won the same authors the best paper award in 2014 International Conference on Ubiquitous and Future Networks.

In essence, the researchers described a resource discovery scheme and proposed an adaptive, probabilistic scheduling algorithm for scheduling real-time applications in local mobile clouds. Experimental results clearly confirmed that the proposed adaptive probabilistic scheduler can help reduce the average energy consumption per task successfully completed while achieving a high task completion rate, two often competing parameters. Other desirable features of the proposed scheduler include its excellent scalability with respect to the number of source nodes, and high adaptability with respect to a wide range of task types that show distinctively different characteristics.

This work was partially funded by NSF EPSCoR (IIA-1301726).

- Dr. Pushkin Kachroo with Neveen Shlayan (graduated Ph.D. student, now faculty) and collaborators from U.C. Berkeley, Civil Engineering at UNLV, and F.A.S.T., developed a new way to validate traffic flow detectors by quantifying the human bias when using video detectors for comparison. This technique and its application are presented in Pushkin Kachroo, Neveen Shlayan, Alexander Paz, Shankar Sastry, and Shital K. Patel, "Model based Methodology for Validation of Traffic Flow-detectors by Minimizing Human Bias in Video Data Processing," **IEEE Transactions on Intelligent Transportation Systems**, vol. 16, issue 4, pp. 1851-1860, 2015. [http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=7017578&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D7017578] This work was performed for a specific project funded by F.A.S.T.

Dr. Pushkin Kachroo with Pankaj Maheshwari (graduated Ph.D. student), Romesh Khaddar (graduated M.S. student), and faculty from Civil Engineering developed first ever dynamic models to study sustainability at a macro level. This work was based on the Ph.D. dissertation work of Pankaj Maheshwari with help in coding, programming and mathematical analysis from Romesh Khaddar. Pushkin Kachroo and Alexander Paz were Co-advisors. The work got published as: Pankaj Maheshwari, Pushkin Kachroo, Alexander Paz, and Romesh Khaddar, "Development of control models for the planning of sustainable transportation systems," **Transportation Research Part C: Emerging Technologies**, 55, 474-485, 2015. [http://www.sciencedirect.com/science/article/pii/S0968090X15001138]

- UNLV ECE Professors R. Jacob (Jake) Baker and Peter A. Stubberud, Ph.D. student Yacouba Moumouni, M.S. student Angsuman Roy, and undergraduate student Matt Meza attended the IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS) held in Fort Collins, CO from August 2-5, 2015.

Yacouba presented two papers, "Buffer Sizing of Concentrated Photovoltaic Batteries: An Economic Analysis" and "Application of Used Electric Vehicle Batteries to Buffer Photovoltaic Output Transients" and gave two poster presentations "Concise Thermal to Electrical Parameters Extraction of Thermoelectric Generator for Spice Modeling" and "Improved SPICE Modeling and Analysis of a Thermoelectric Module." Angsuman and Matt co-authored a paper entitled "An FPGA Based Passive K-Delta-1-Sigma Modulator," along with Joey Yurgelon who wasn't able to attend.

Professor Stubberud presented a paper entitled "Overload Analysis of Continuous Time Sigma Delta Modulators" co-authored with recently graduated PhD student Kyung Kang who started a new job in southern California and was unable to attend.

Additional information can be found at: https://www.engr.colostate.edu/mwscas2015/ and copies of the papers are found at: at: http://cmosedu.com/jbaker/papers/papers.htm

The MWSCAS is the longest running circuit design conference where Professor Baker served as the conference's technical program chair this year.

- This summer, Prof. Y. Baghzouz attended three IEEE-sponsored international conferences where he presented papers that he co-authored with his students:

1. K. Hurayb, Y. Moumouni, F. A. da Silva,Y. Baghzouz, "Impact of Partial Shading on the Performance of A Grid-Tied Photovoltaic System", Int. Conf. on Clean Electric Power (ICCEP), Taormina, Italy, June 16-18, 2015

Link: http://www.iccep.net/

Results: Given a particular shade geometry on a PV system and solar irradiance, the maximum output power the system can be determined analytically with acceptable accuracy.

2. W. Peng, B. Blackstone, Z. Mohammad, P. Ginobbo, Y. Baghzouz, "On Determining the Control Techniques Embedded in a Commercial Single-Phase Grid-Tied PV Inverter", PowerTech, Eindhoven, Netherlands, June 28-July 2, 2015 **Link:** http://powertech2015-eindhoven.tue.nl/

Results: There are numerous MPPT and active anti-islanding techniques and each leaves a unique signature in the voltage and/or current waveforms. A detailed analysis of the measured waveforms can lead to the specific control method embedded in a particular inverter.

3. Z. Mohammad, R. Hurt, Y. Baghzouz, "Experimental Test on Temperature Rise of Conductors in Roof-Mounted Conduits", IEEE-PES General Meeting, Denver, CO, July 26-30, 2015. **Link:** http://www.pes-gm.org/2015/

Results: The experimental data shows that the new temperature adders required by the 2014 NEC when determining the ampacity of electrical conductors on roof-mounted conduits are over-conservative and un-necessary.