“The problems facing humanity and our planet are multifaceted and multidisciplinary, and they will only be solved by a network of experts.”

Dr. Chaouki Abdallah
Chair, Electrical & Computer Engineering
University of New Mexico
Message from the Chair

As I begin my third year as the chair of the ECE department at UNM, I am more resolute, more optimistic, and a little less naive about the future of my department and the professions of electrical and computer engineering. This annual report conveys a sense of my optimism and will link you, our friends and colleagues, to the exciting happenings at our department.

In the last few years, my technical interests have gravitated toward the study of networks and distributed systems. It was probably a stroke of luck that my professional life has mirrored these technical interests, as I have become a more connected node in the social networks of my department, university, and higher education.

The running themes in this annual report are multidisciplinary and multinational research and education, as well as the power of network and systems thinking.

It is fashionable now for educators to refer to the “flatness of the world” and to “rising above the gathering storm.” While such popular metaphors contain clear messages, I believe that a hidden message is that the connections that make us stronger also make us more susceptible to attacks, viruses, and disasters.

Weaving strong webs of knowledge

It is in fact the power and the curse of the network that allow both information and misinformation to spread widely. As (engineering) educators in a connected world, it is our duty to give our students a healthy dose of respect and understanding of these links.

In a world where knowledge and information are being generated and spread at dizzying speeds, it is indeed our social links and connections that matter most. As we reach for our favorite search engine, we access the web of knowledge in a world that has been flattened, and we can rise above various storms.

I believe that engineering is an art. It is indeed the imagination and creativity that are so often overlooked (and difficult to teach) that separate great engineers from good ones.

Building new links

Here is one example. Our department is now a major node in a new network involving other UNM departments and colleges as well as the city of Albuquerque, the state of New Mexico, and a number of digital media and film companies. This network is creating a unique arts and engineering degree to be inaugurated in fall 2007—UNM’s Interdisciplinary Film & Digital Media Program—that will graduate a new breed of engineers. They will be well equipped to manage the confluence of computer engineering and visualization with the fine art side of story telling, animation and gaming in today’s digital media.

We have also reinforced our international links as described in greater details in the graduate office section on the following two pages. We are carefully forming new links to colleagues and universities in Europe, Latin America, and Asia on our way to designing a global engineering degree.

Another reason for my optimism is this: The road ahead is full of complex problems, and complex problems cry out for teams of creative problem solvers. Who among us believes that clean power generation will be solved by one individual? Or that fixing and strengthening our physical infrastructure will be done in a short time by one university or even one country? Indeed, the problems facing humanity and our planet are multifaceted and multidisciplinary, and they will only be solved by a network of experts.

I hope that you will consider this report a connection to our hub of exciting research and programs. Should you be interested in strengthening the link, please contact me.

Chaouki T. Abdallah
Department Chair
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The Art of Systems Engineering

The running themes in this annual report are multidisciplinary and multinational research and education, as well as the power of network and systems thinking.

The Art of Systems Engineering
Expanding In Several Directions

A major thrust of the graduate office this year has been collaboration of the ECE faculty’s participation in the assessment of research doctorate programs organized by the National Research Council. This assessment helps universities improve the quality of their graduate programs by using benchmarking, with the goal of enhancing the nation’s overall research capacity. The graduate office coordinated the reporting of various PhD program metrics over the past five years.

To respond to the growing interest among our students in various aspects of bioengineering, we have started a new bioengineering emphasis. We have intentionally kept it fairly broad to facilitate interaction with many existing emphases in both electrical and computer engineering.

One of the first students in the bioengineering emphasis, Ms. Lai Xu, received one of seven 2007-08 fellowships awarded by UNM’s Program in Interdisciplinary Biological & Biomedical Science.

Another new emphasis introduced this year is computer graphics and vision, which accommodates students who are interested in digital media and computer vision.

Community Outreach Is Win-Win

Our Graduate Program also expanded its educational, research and community service partnerships with business and local communities during 2006-07. These relationships promote quality education as well as connections within the community.

For instance, three ECE graduate students visited the eighth-graders at northeast Albuquerque’s Desert Ridge Middle School to give them a sense of what engineering is all about. They brought an international twist, as they are from Spain, Greece and Fiji and gave some unique perspectives to the eighth-graders.

To encourage collaborative research and intellectual interactions with international universities, the ECE Department has established several exchange agreements and dual degree programs. We have signed a cooperation agreement as well as a dual degree agreement with the Universidad de Concepcion in Chile. We have also started our student/faculty exchange program with Shanghai Jiao Tong University, with ten students exchanged in 2006-07.

We have eyes for worldwide talent

This year we also continued our highly successful EYES (Expand Your Engineering Skills) program by selecting seven high-caliber undergrads from the India Institute of Technology, two from China, and one from Mexico to undertake an eight-week summer internship at UNM. Students in the EYES program are selected based on their academic record, experience and ability to undertake independent research, and they join the ECE Department to conduct research under the supervision of an academic advisor.

We anticipate that about five “graduated” EYES and exchange students will join our graduate program in fall 2007. The positive effects of our EYES and exchange programs include cultural experiences as well as graduate student recruitment.

Finally, ECE’s graduate program continues to improve both in quality and numbers. The number of international applicants increased by about 20 percent this year, and our selectivity remains around 33% overall. We graduated 13 PhDs and 48 MSs in 2006-07, and we anticipate a larger number of PhD graduates in the upcoming year.
If I could use just one word to describe the ECE Department’s undergraduate programs at UNM, it would be quality. Quality is a term easily used but much harder to achieve. I would like to describe our recent progress as we continually improve the quality of the undergraduate education that we provide.

Number of Students Served

The undergraduate enrollment in our department has followed the national trends. Since 2003 the electrical engineering program’s enrollment has remained fairly constant, with an average of roughly 150 students. The computer engineering program mirrored the enrollment declines witnessed nationwide. At the end of 2002, the program had more than 80 students. As a result of the bursting of the so-called “Internet bubble,” by 2005 our computer engineering enrollment was reduced by approximately 50 percent, and it has held fairly steady since that time.

Given this difficult climate—and recognizing that, because we are the state’s flagship university, the majority of our student population will always come from New Mexico—the department has placed significant attention on recruiting the best and brightest of New Mexico’s high school students. During the past year the department hosted numerous recruiting events and laboratory tours, drawing more than 600 students who were interested specifically in engineering, science and math. One immediate positive result is that in the School of Engineering’s survey of incoming freshmen for fall 2007, many cited these events as a major influence in their decision to attend the University of New Mexico.

We have also committed $40,000 toward a recently established ECE Scholars Program that provides scholarships to approximately ten outstanding incoming freshmen per year. When these are added to the State of New Mexico’s Lottery Success Scholarship, it is possible for these students to study in a top-tier ECE department at little or no cost. With the cost of higher education soaring nationwide, the value offered by the department’s programs is compelling.

One result of these initiatives is that we are witnessing an upsurge in enrollment in our freshmen-level engineering courses. More important, we have experienced an increase in the quality of student applying for entry into our department in their sophomore year.

Faculty Growth

Our students can expect to have extensive interaction with faculty. The ECE Department consists of 30 full-time faculty members, many of them recognized worldwide for their research contributions. These same scholars regularly commit to teaching our entry-level undergraduate courses, and many have received teaching awards from the department, the School of Engineering, and the university.

We also recently contracted with two full-time, very talented lecturers, Ed Graham (see page 42) and Honggang Yu (who will join us in fall 2007), both of whom bring a wealth of experience to the department.

The department also has the advantage of drawing upon adjunct faculty from a large and impressive local population of scientists and engineers associated with national laboratories and industry. A number of these adjuncts have longstanding affiliation with the department. For instance, see the Senior Projects on page 32-33. These result from the teaching and mentoring of Dr. Marv Daniel, who has been with ECE for seven years.

Regarding our faculty, ECE has been particularly successful, and fortunate, in attracting and retaining a significant number of highly talented professors and instructors—to our students’ advantage.

Top-Notch Learning Labs

Finally, let me mention our facilities. The quality of the undergraduate laboratories in UNM’s ECE Department rivals that of any program in the country. In order to maintain state-of-the-art laboratories and ensure that our students are using the latest hardware and software tools, ECE spends approximately $100,000 per year on laboratory equipment and supplies and receives twice this much in donations from companies such as Xilinx, Microsoft and IBM, just to name a few. To support these facilities, the department also recently hired a full-time laboratory director, Mr. Mike Majedi. Please see page 27 for lists of ECE’s teaching and research laboratories.

When all of the quality factors I’ve described are taken into account, in conjunction with our low student-to-instructor ratio and forward-looking curricula, the result is a world-class engineering education that we are proud to provide to students at the University of New Mexico.

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Roberta M. Menicucci
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With three nominations and an established research and mentoring record, Vincent Calhoun was accepted this year as a member of the American College of Neuropsychopharmacology. He received ACNP’s Young Investigator Award in December 2006.

Dr. Calhoun received a $1.8 million NIH grant in April 2007 for his project titled “Multivariate methods for identifying multi-task/multi-modal brain imaging biomarkers.” His team is applying engineering principles to analyze functional and structural magnetic resonance images, diffusion tensor images, and electro-encephalography to determine whether the fused data can help differentiate control subjects from people diagnosed with diseases like schizophrenia. Portions of his work were published in the March 2007 American Journal of Psychiatry.

In July 2006, Dr. Calhoun also received a $600,000 NSF grant for his project titled “Collaborative Research: SEI: Independent Component Analysis of Complex-Valued Brain Imaging Data.”

Director of the MIND Institute’s Medical Imaging Analysis Lab, Dr. Calhoun serves as advisor to six graduate students, one of whom, Lai Xu, received a 2007-08 fellowship with UNM’s Program in Interdisciplinary Biological & Biomedical Science.

Dr. Calhoun worked at Johns Hopkins, Yale, and the Olin Neuropsychiatry Research Center at Hartford Hospital prior to joining ECE during the fall 2006 semester. He holds a joint appointment as adjunct associate professor with Yale University’s Department of Psychiatry.

Prior to joining ECE’s Systems and Controls Group in August 2007, Rafael Fierro held a postdoctoral appointment with the GRASP Lab at the University of Pennsylvania and a faculty position with the Department of Electrical and Computer Engineering at Oklahoma State University.

Dr. Fierro has taught courses in robotics, control of hybrid systems, and linear systems. His research interests include distributed control of multi-vehicle systems, hybrid and embedded systems, optimization-based cooperative control, and mobile sensor networks. His work has been funded by the Army Research Office and National Science Foundation.

Rafael Fierro directs ECE’s Multi-Agent, Robotics, Hybrid and Embedded Systems (MARHES) Laboratory. MARHES is an interdisciplinary laboratory dedicated to research and education in hybrid and embedded systems, and robotics. Also, Dr. Fierro and his group are developing “Robotic Games” with the goal of stimulating the interest of children and increasing their appreciation for science, math and engineering.

Dr. Fierro was the recipient of a Fulbright scholarship and a 2004 NSF CAREER award. In 2006 he was elected Professor of the Year by the student chapter of Eta Kappa Nu at OSU.
ECE Proudly Welcomes

Nasir Ghani, Associate Professor

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Degrees:
PhD, University of Waterloo, Ontario, Canada 1997
ME EE, McMaster University, Hamilton, Ontario, 1992
BE Computer Engineering, University of Waterloo, Ontario, 1991

Before accepting an associate professorship with ECE’s Computer Engineering Group, Nasir Ghani was an associate professor in the ECE Department of Tennessee Tech University. In that post since 2003, he received an NSF CAREER Award to study hybrid multi-domain cyber-infrastructures.

Dr. Ghani also established an undergraduate telecom research program at Tennessee Tech and developed two graduate courses in networking. In addition, he contributed to the design of a proposed optical backbone for Tennessee.

Prior to his academic career, Dr. Ghani spent six years in industry, holding positions as a senior system architect at Sorrento Networks and as a senior research engineer at Nokia. He also worked with Motorola and IBM in Canada.

Dr. Ghani is a senior member of IEEE and has co-chaired various international conferences and given many invited talks. He has published extensively and has received many research grants. He has supervised nine masters students and holds two patents.

His research interests include optical networks, traffic engineering, network virtualization and services, simulation, and stochastic modeling.


Four New Professors

Jamesina Simpson, Assistant Professor

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Degrees:
PhD, Northwestern University, Evanston, IL, 2007
BS EE, Northwestern University, Evanston, 2003

ECE’s Applied Electromagnetics Group welcomes Jamesina Simpson, who brings a wide range of research interests and experience. To date, she has used the finite-difference time-domain (FDTD) solution of Maxwell’s equations to develop novel ultrawideband waveguiding interconnects for ultrahigh-speed digital data buses, study geophysically induced ultralow-frequency and extremely low-frequency electromagnetic phenomena in the Earth-ionosphere waveguide, and investigate optical interactions with living tissues.

Dr. Simpson’s doctoral dissertation was titled “Three-Dimensional FDTD Modeling of Impulsive Extremely Low-Frequency Electromagnetic Wave Propagation in the Global Earth-Ionosphere Waveguide,” for which she received the Best Dissertation Award from the EECS Department at Northwestern University.

To support her graduate studies at Northwestern, she was awarded the NSF Graduate Research Fellowship as well as fellowships, assistantships and awards from IEEE’s Antennas & Propagation Society (APS), IEEE’s Microwave Theory and Techniques Society, the McCormick School of Engineering, and Intel Corp. In addition, she was a student paper contest finalist at IEEE’s 2003 APS International Symposium, and she received support as an undergraduate from Intel, Northwestern, and the German Academic Exchange Service.
2006-07 By the Numbers

Faculty & Faculty Publications –

- 79 faculty members
- 30 professors
- 25 research professors
- 10 adjunct professors
- 14 joint appointments from other departments
- 3 endowed chairs

Faculty publications include

- 3 books
- 4 book chapters
- 91 journal papers
- 186 conference papers

Accreditation –

UNM has the largest electrical engineering program in New Mexico and the only accredited computer engineering program in New Mexico.

ECE is accredited by the Accreditation Board for Engineering and Technology (ABET).

Funding –

- $12,157,349 in research spending
- $7,308,375 in new research contracts
- $108,406 in donations received

UNM ranked #85 of 1,243 academic institutions for federal science and engineering funding (NSF for FY2004).

UNM maintains a “very high research” designation by the Carnegie Foundation for the Advancement of Teaching, the foundation’s highest ranking.

Degrees Awarded –

- Total Undergraduate Degrees - 64
  - Bachelor’s in EE - 53
  - Bachelor’s in CompE - 11

- Total Graduate Degrees - 61
  - Masters - 48
  - Doctorate - 13

Research –

Some of the areas of exceptional research excellence at ECE are:

- pulsed power and high-power electromagnetics
- photonics and microelectronics
- advanced graphics & visualization

ECE offers masters and doctoral degrees in the areas of

- optoelectronics
- applied electromagnetics
- microelectronics
- optical science & engineering
- high-performance computing
- computer networks & systems

Center for High Technology Materials:

Several of ECE’s electrical engineering faculty members form the core of UNM’s internationally respected Center for High Technology Materials. This interdisciplinary research and development center has programs in nanotechnology, optoelectronics, microelectronics, optics and materials science as well as two NSF-funded Integrated Graduate Education Research Traineeship (IGERT) fellowship programs, one in Nanoscience and Microsystems and one in Integration of Nanotechnology with Cell Biology and Neuroscience.

Graduate EE program

- #32 (among U.S. public universities)
- #57 (all U.S. universities)

Graduate CompE program

- #38 (U.S. public universities)
- #63 (all U.S. universities)

U.S. News & World Report rankings. UNM has the only graduate EE and CompE programs in New Mexico ranked by USN&WR.

Assistantships Provided to Students –

- 25 Graduate Assistantships
- 105 Research Assistantships
- 10 Project Assistantships

Degrees Offered –

ECE offers masters and doctoral degrees in the areas of

- image processing
- computational intelligence
- control systems
- signal processing
- communications
- computer architecture

Enrollment –

427 students enrolled, fall 2006

(See discussion on page 8)
Getting Agile With Digital Images —

UNM’s new Advanced Graphics Lab (AGL) is the brainchild of Professor Pradeep Sen. Working with colleagues ECE Professor Tom Caudell and Computer Science Professor Joe Kniss, Dr. Sen has quickly ramped up an ambitious combination of courses, research projects, and funding sources from which UNM students are already benefiting.

Aligning with UNM’s and New Mexico’s initiatives to develop unparalleled digital media and film talent within the state, AGL is dedicated to research in computer graphics, visualization, imaging and computer vision.

AGL works with UNM’s ARTS Lab, an exciting, interdisciplinary center that focuses on research in digital media (see http://artslab.unm.edu/). While the ARTS Lab approaches research in digital media from a broad perspective, encompassing interests ranging from theater to architecture to the fine arts, AGL specifically focuses on the science and algorithms of computer graphics. The researchers in AGL hope that their work will enable fundamentally new kinds of rendering and imaging techniques that could change the future of storytelling.

Dr. Sen brings his years of experience working with the Graphics Lab at Stanford University and his passion for developing imaging tools that will enable the next generation of digital graphics production. Dr. Caudell brings his career in the engineering and art of visualization, including his experience directing the Visualization Lab located at UNM’s ARTS Lab. Dr. Kniss, a graduate of the University of Utah’s SCI program, is an expert in visualization and computer graphics.

Together they create the critical mass of researchers required to establish an ambitious program of graphics research. They have developed a set of courses in computer graphics, including some that are unique to UNM, designed to prepare ECE and CS students for the competitive world of computer graphics for both production and research.

One example is Dr. Sen’s spring 2007 course, Real-Time Rendering & Graphics Hardware. In it students learned about graphics architectures, GPU programming, and the latest techniques for real-time global illumination, such as precomputed radiance transfer. These are typically not covered in traditional classes.

AGL produced a 2007 paper for IEEE Vis titled “IStar—A Raster Representation for Scalable Image and Volume Data,” that describes a new method of representing essential semantic components of an image, such as discontinuities and boundaries, in a traditional raster image. The method also develops a new application of topology to multivariate, sampled data.

And the innovations are just beginning.

The New Advanced Graphics Lab

The Creators of AGL

Dr. Pradeep Sen’s research focuses on real-time rendering and graphics hardware. In particular, he is interested in global illumination algorithms on the graphics processing unit (GPU), interactive image-based rendering techniques, and real-time technologies to aid in the visualization of medical data sets. His work also examines the acquisition and display of image-based data such as light fields and reflectance fields. With his work in Dual Photography, he is also a leader in the emerging field of computational photography.

Dr. Tom Caudell’s research focuses on neural networks, virtual reality, machine vision, robotics and genetic algorithms. His interest in virtual reality stems from the desire to create visualizations of the behavior of complex systems such as the brain.

The article on page 18 describes his recent appointment to direct UNM’s Center for High Performance Computing and the many research collaborations—which he often calls “co-laboratories—in which he participates. As he says, “I’ve always liked interdisciplinary areas. Moving into the gaps between disciplines really forces you to learn new things.”

Dr. Joe Kniss’s research focuses on visualization and computer graphics. He specializes in volume rendering techniques, which make images of forms that don’t have a distinct surface, such as smoke, fire and clouds. The technique is also valuable for medical imaging. He recently published a book on the topic titled Real-Time Graphics. Dr. Kniss recently received an NSF grant to study the acquisition and display of uncertainty in visualizations. Since data acquisition and simulation generates at best an approximation of reality, the goal is to understand how reliable the data and its visualizations are so that informed decisions can be made.
“Co-laboratories” Player Directs

UNM appointed ECE Prof. Tom Caudell to direct its Center for High Performance Computing beginning Feb. 1, 2007. Prof. Caudell’s research in visualization and neural networks has long relied on high-performance computing, and he has been actively involved with CHPC since its beginnings in 1994.

The center supports faculty-led, computing-based research throughout UNM and fosters interdisciplinary collaborations based on computation. Dr. Tim Thomas is the center’s deputy director.

High-speed computation is a critical tool in research and creative activity in many academic disciplines today. One example is the university’s ARTS Lab (Art, Research, Technology & Science), which has been referred to as a confluence of art and technology with an emphasis on computation. Formed in 2001 in response to Gov. Bill Richardson’s Media in Education Strategic Plan, the ARTS Lab is helping to develop the unique capabilities the university has in digital media.

“It’s part art, part engineering,” Caudell says. “We want to train students so they’ll be able to work in those areas here in New Mexico.” Digital media use extensive computing power. UNM in fall 2007 launched its Film and Digital Media Program with curricula and major tracks in computer engineering, computer science, business, law, and fine arts.

Virtual Seeing Amplifies Seeing

Besides the ARTS Lab’s applications to the state’s film industry, its multidisciplinary network of campus talent is applying engineering and the arts to analyze complex abstract data. One example is Caudell’s own work using virtual reality and visualization to help scientists and engineers better understand their software systems and data. Limits in our ability to comprehend the content of complex theories and simulations can make it difficult to apply computational research. Caudell created UNM’s Visualization Lab, located adjacent to the ARTS Lab facility, in 1998 to advance the science of visualization and virtual environments so they can more effectively amplify human comprehension.

Such collaborative virtual environments can be used in areas such as medical simulation and network intrusion detection. One example is a project called Telehealth Outreach for Unified Community Health, or Project TOUCH, that’s being used to train student physicians. Affiliated with UNM’s Health Sciences Center and the University of Hawaii, Project TOUCH seeks to close gaps in healthcare education, training and performance by using advanced computing and the next-generation Internet.

Caudell is also part of the team in ECE and Computer Science that is creating the new Advanced Graphics Lab described on page 16. Resource centers like this lab and the ARTS Lab, according to Caudell, are “seeding collaborations between the digital arts and digital sciences, forming places where people like that can rub shoulders,” where otherwise their expertise doesn’t typically converge.

For students, one result is interdisciplinary courses in areas such as game development and digital story telling. “Writing code is a small part of it,” Caudell says. “Successful game development involves story, action, narrative, game mechanics, 2D and 3D art models, scenes and sound—these fuzzy, semi-quantitative things are all important to the success of a game and have not been traditionally considered part of an engineering curriculum.”

UNM Joins Sony Imageworks’ IPAX

Collaborations like these among students and faculty at UNM helped lead to Sony Pictures Imageworks’ February 2 announcement that UNM has been named a member of Imageworks Professional Academic Excellence program. Other IPAX members include Stanford, USC, Carnegie-Mellon and MIT.

UNM has the only membership given to an entire university. “Because the program that we’re creating is so interdisciplinary, this was the only way we could join,” said Christopher Mead, Dean of the College of Fine Arts, in UNM’s February 6 press release. “Sony has found that students coming out of universities are too narrow in their training and specializations,” said Mead, whereas Sony needs “people who are interdisciplinary in their ability to understand both the science and the art of visual image generation.... What excited the people at Imageworks was that we were doing exactly what they were looking for.”

UNM’s virtual co-laboratories—as Prof. Caudell sometimes calls them—took another big stride forward in January 2007 when New Mexico launched its connection to LambdaRail, the national, ultra-high-speed computer network that enables its member research centers to collaborate on computationally intensive work. CHPC hosted the kickoff with keynote speaker Gov. Richardson on January 19.

For information about the Center for High Performance Computing, see www.hpc.unm.edu/ or contact Prof. Caudell at tpc@ece.unm.edu.
Applying engineering principles, ECE Prof. Vincent Calhoun is analyzing different types of brain imaging data to see if combining information from the different modes will make it possible to differentiate control subjects from people diagnosed with disabilities like schizophrenia. Dr. Calhoun is director of Image Analysis and MRI Research at the MIND Institute (Mental Illness and Neuroscience Discovery), a nonprofit neuroscience research center on UNM’s north campus. He received a $1.5 million NIH grant in April 2007 to investigate “Multivariate methods for identifying multi-task/multi-modal brain imaging biomarkers.”

It’s a promising approach in which few researchers worldwide have expertise.

As director of MIND’s Medical Image Analysis Laboratory, Dr. Calhoun is leading researchers in the quest to develop and optimize methods and software for quantitative analysis of structure and function in medical images, with particular focus on psychiatric illness. The researchers are looking for more sophisticated ways to analyze brain imaging data gleaned from functional magnetic resonance imaging (fMRI), diffusion tensor imaging (DTI), electroencephalography (EEG), and structural imaging. These brain imaging modes have been available for some time, but the results have been difficult to interpret when looking for such things as biomarkers in schizophrenia.

The work involves applying data-driven approaches, which are useful for extracting potentially unpredictable patterns within data, and adding prior information as constraints. The researchers’ algorithms draw heavily on image processing, adaptive signal processing, estimation theory, neural networks, statistical signal processing, and pattern recognition.

Dr. Calhoun recently told a reporter, “What is unique (about the MIND Institute) is its focus on mental illness and the fact that it has all of this excellent technology in one place.” As CNN reported in September 2006, the MIND Institute “has perhaps the largest collection of sophisticated brain imaging devices in the world.”

The progress that Calhoun and his team are making is earning the attention of the media. Portions of his work were published in a paper he co-authored for the March 2007 American Journal of Psychiatry. UNM’s newspaper, UNM Today, reported on his work in April 2007 and the fall 2007 issue of the School of Engineering’s magazine will include a feature story about his work. The MIND Institute’s first newsletter featured Calhoun in its cover story.

Dr. Calhoun brings a unique perspective to his research. With a doctorate in electrical engineering, he worked at the psychiatry department of Johns Hopkins for 12 years, as well as Yale University and the Olin Neuropsychiatry Research Center at Hartford Hospital, prior to joining ECE as an associate professor in fall 2006. He currently holds a joint appointment as adjunct associate professor with Yale University’s Department of Psychiatry.

He recently explained his perspective this way: “I’ve seen good ideas from engineers go to the point of a paper and then stop because the engineer doesn’t know how to address questions of relevance in psychiatry. And psychiatrists don’t understand how to read an engineer’s paper. So I’ve learned how to work with psychiatrists but think about things from an engineering perspective.” (Fall 2007 issue of the School of Engineering magazine.)

In July 2006, Dr. Calhoun also received a $600,000 NSF grant for his project titled “Collaborative Research: SEI—Independent Component Analysis of Complex-Valued Brain Imaging Data.” A member of the American College of Neuropsychopharmacology, he received ACNP’s Young Investigator Award in December 2006. He serves as advisor to six graduate students, one of whom, Lai Xu, received a 2007-08 fellowship with UNM’s Program in Interdisciplinary Biological & Biomedical Science.
Nanowire Breakthrough Catches On

For several years now, engineers have realized that gallium nitride nanowires have many compelling features for revolutionary optoelectronics and high-speed electronics devices. A major barrier to progress has been the lack of control of the nanowire growth process, and this has prevented the transfer of these fascinating semiconductor objects out of the lab into mainstream production.

In a recent breakthrough, ECE Professor Stephen Hersee and his team have developed a scalable and mass-producible GaN nanowire growth process that may finally enable industry to take advantage of the many benefits that these nanowires offer.

The process—invented by Dr. Hersee and two of his students, Xinyu Sun and Xin Wang—enables fabrication of uniform arrays of GaN nanowires such that the position, orientation, diameter and length of each nanowire is precisely controlled. The process appears to be scalable to full wafer size, meaning that in one process step literally billions of identical nanowires can be created.

Dr. Hersee filed four invention disclosures in 2006-07 related to the nanowire process and also for novel optoelectronic and electronic device applications of GaN nanowires. A local startup company, Nanocrystal, was launched in 2006 based on his nanowire technology, and two more companies have purchased an option to license it.

Dr. Hersee’s team in 2006 authored three journal papers on the topic (one of these was highlighted in Nature Nanotechnology’s August 2006 issue) and, in trips that took him to Sweden and France, he has so far delivered four invited papers.

DARPA and AFRL in 2006 awarded a $250,000 seed contract to develop nanowire-based LEDs and lasers to Dr. Hersee and his colleague at UNM’s Center for High Technology Materials, ECE Prof. Steve Brueck, as co-principal investigators. With this, and additional funding from Sandia National Labs and AFOSR, Dr. Hersee is collaborating with Sandia National Laboratories in Livermore, Calif., and Albuquerque and two industrial partners to develop the technology.

Neuroscience Meets Nanotechnology

Applying nanotechnology to cell biology and neuroscience is the thrust of an NSF Integrative Graduate Education and Research Traineeship (IGERT) directed by ECE Professor Marek Osinski.

The program—titled Integrating Nanotechnology with Cell Biology and Neuroscience—offers $30,000, one-year fellowships plus tuition and health insurance to PhD students, with the goal of developing interdisciplinary scholars with strong research skills.

Graduate Degree Now Offered in Nanoscience & Microsystems

This year UNM became the first university in the Southwest to offer a master’s and doctoral program in nanoscience or nanomaterials. The new Graduate Degree in Nanoscience and Microsystems is offered jointly by the School of Engineering and the College of Arts and Sciences, and more than 70 faculty members in nine academic departments support the program.

Demand for graduates in nanotechnology is increasing steadily in the United States, although only a few universities offer degrees in the field. UNM is one of the first universities in the country to offer a PhD in this emerging discipline.

The courses in nanoscience and Microsystems are currently offered in a number of departments across UNM. Qualifying students can also apply for NSF-sponsored nanoscience and Microsystems, or NSMS, fellowships for study in the program (see www.chtm.unm.edu/igert/).

The fellowship is an IGERT program that bridges the properties of the nanoscale to microsystem functions and takes advantage of UNM’s unique breadth in materials synthesis and self-assembly, nanolithography, interrogative platforms, and functional micro/macrosystems. Special emphasis is placed on translating these technologies to changes in the way we diagnose, treat and ultimately prevent cancer.

For more information about the NSMS degree program, contact the program director, Prof. Abhya Datye of the Chemical and Nuclear Engineering Department at datye@unm.edu.
Gridline Takes On the Digital Divide

Bridging the digital divide with affordable gateways that transform into digital opportunities is the goal of a young company for which ECE Prof. Ramiro Jordán serves as an executive officer.

A strategic partner of the Ibero-American Science and Technology Education Consortium (ISTEC), Gridline Communications Holdings Inc. was formed in 2004 and is located in UNM’s south campus industrial park. It provides broadband Internet access primarily over power lines (BPL/PLC) while also accommodating wi-fi, wi-max, fiber, satellite and emerging wired and wireless technologies. Gridline also builds broadband content, Web services, and applications to connect remote areas of the world to the Information Highway.

Launching a new service in a foreign market requires special skills and local knowledge. Gridline incubates and capitalizes future high-tech companies that emanate from or through ISTEC’s academic members, and it helps bring ideas from the laboratory to the marketplace. This includes identifying opportunities, venture capital, and management talent as well as assessing technologies, intellectual property protection, and marketing strategies.

Sixty-one percent of the U.S. population resides in rural areas. BPL will be the preferred mode of connectivity for 33 percent of new broadband customers and 13 percent of existing customers by 2012 according to a July 2004 report by Research Reports International. TelecommTrends International reports that the United States’ BPL market will grow from about $100 million in 2005 to $4.4 billion by 2011. On the other side of the Atlantic, a 2006 mandate requires all European Union member nations to implement smart metering. Besides the U.S. and E.U., Gridline targets Latin America, Asia, the Pacific, North Africa, and the Middle East.

ECE and ISTEC form the building blocks on which R&D, curricula, training, business development and entrepreneurial activities are developed by Gridline for its partners.

The company participated in ISTEC’s June 2007 general assembly in Ecuador, and Terry Dillon, the company’s president and CEO, noted that “These key alliances represent a great opportunity for us to become stakeholders in the region’s integration by creating business and social opportunities, generating wealth and encouraging entrepreneurship.”

Worldwide Opportunities for Students

Brazil
University of Campinas: ECE offers joint M.S. and Ph.D. degrees.

Chile
Universidad de Concepción: ECE offers joint M.S. and Ph.D. degrees.

China
Shanghai Jiao Tong University: Joint M.S. and Ph.D. degrees in development.

Italy
University of Rome II—Tor Vergata: Joint M.S. and Ph.D. degrees in development.

India
India Institute of Technology: 8-week internship for undergraduates from India’s premier engineering university. See http://www.ece.unm.edu/eyes/.

ISTEC @ UNM
The Ibero-American Science & Technology Education Consortium: ECE shares resources with ISTEC’s 150 educational and 10 industrial members throughout the Americas.

Spain
University of Vigo: Joint M.S. and Ph.D. degrees are in development.

500 From the Americas, Spain Convene in Ecuador

Under the theme of “Entrepreneurship for Sustainable Development,” the UNM-based Ibero-American Science and Technology in Education Consortium (ISTEC) held its 16th general assembly in June 2007 at the Universidad Técnica Particular de Loja in Ecuador.

More than 500 individuals participated from institutions in Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Ecuador, Mexico, Nicaragua, Panama, Peru, Paraguay, Puerto Rico, Spain, Uruguay, the U.S. and Venezuela. Session topics ranged from water, energy, health, and bio and nanotechnology to connectivity, entrepreneurship, sustainable development, ethnicity and culture.

Additional events focused on R&D, library linkages, advanced continuing education, science and technology entrepreneurship, and the Hewlett Packard sponsored “International Student Contest of Engineering for Sustainable Development.”

The State of New Mexico was represented by members of the Albuquerque Hispano Chamber of Commerce, ECE professors, and ISTEC and Gridline Communications Holdings staff.

Gridline is an ISTEC-affiliated company that provides Internet access and services primarily using power lines.

ISTEC is an international alliance of more than 150 industrial, academic and governmental organizations that supports education, science, technology and entrepreneurship in the Americas, Spain and Portugal. Created in 1990 by ECE Prof. Ramiro Jordán, ISTEC is an international 501(c)3 nonprofit that functions as an R&D center at UNM.

ISTEC’s vision is to be a “vehicle to advance socioeconomic and educational change for the creation of new wealth and improvement of the quality of life in Ibero-America.” The consortium has facilitated the exchange of more than 300 faculty, staff and students between UNM and institutions in Ibero-America, and it has created or supported laboratories in microelectronics, microprocessors, wireless communications, digital signal processing, digital image processing, FPGAs, and software engineering. See www.istec.org.
A new “quantum-dot camera” that captures images by detecting subtle gradations within the infrared spectrum is quickly getting the attention of organizations that can use its ability to virtually see through smoke and water vapor.

A continuously tunable photodetector invented by ECE professors Sanjay Krishna and Majeed Hayat, with the University of Arizona’s Scott Tyo, is designed to work in the long-wave infrared spectrum.

The first phase of their research project, funded through NSF, is titled “Quantum-dot sensors for Measures & Signatures Intelligence (MASINT) applications.” The National Consortium for MASINT Research (NCMR) is a Congressionally directed initiative to advance R&D in data sensing and analysis related to such sources as acoustic, seismic, radar, infrared and laser imaging data.

The technology is based on nanoscale quantum dots blended with signal and image processing. Unlike existing infrared sensors, the ECE team’s technology doesn’t depend on added optical filters in order to “tune in” to the different wavelengths within the long-wave infrared spectrum. This reduces cost and weight for the person who uses the device, which means it’s affordable for more uses.

Such as detecting toxic chemicals. To quote a May 1, 2007, UNM Today newspaper story, “The quantum-dot camera takes advantage of something called the quantum confined stark effect for the color tunable element. Think about putting the sensor on a satellite, then tuning it to see only certain kinds of rocks, vegetation or other materials of interest. Krishna and Hayat say the technology when further developed can be used for remote sensing of toxic chemical elements, or to do geological and environmental monitoring.”

Dr. Krishna—serving as principal investigator for the first phase—accepted on behalf of the team the 2006 NCMR Chief Scientist’s Award for Excellence, which NCMR awards to one project annually in recognition of excellence.

With $500,000 for the first year of the second-phase, the team is currently working with Los Alamos National Lab on field testing of a spectrally tunable mid-infrared focal-plane array.

Their related patent, titled “Spectrally Adaptive Quantum-Dot Infrared Sensors for Focal Plane Arrays,” was issued in May 2007 to professors Krishna and Hayat and their colleagues Dr. Tyo and ECE students Unal Sakoglu and Sunil Raghavan. The patent discloses a semiconductor detector with a tunable spectral response.

In June 2006, Krishna and Hayat received a three-year, $200,000 NSF grant for their related research on impact ionization-engineered and nanoscale quantum-dot-based avalanche photodiodes for reliable near- to long-wave infrared photon counting.

Seeing With Superman’s Eyes

Image taken with a 640 x 512 long-wave infrared quantum-dot camera.

The team traveled to Hawaii to receive the NCMR Chief Scientist’s Award for Excellence: professors Scott Tyo, Sanjay Krishna and Majeed Hayat.
Strong Ties With High Schools

“The Career Enrichment Center is looking forward to forming new and inventive ways to move our students from an interest in high school to UNM’s ECE Department.”
—Michael Lombardi, CEC Internship Director

“The UNM Engineering Department has been one of the easiest to establish real and beneficial collaborative ventures for my academy students.”
—Paul Stephenson, Academy Head, Engineering & Design Academy, Rio Rancho High School

ECE students mentor Bernallilo High teams at the annual New Mexico RoboRAVE.

Students volunteer to answer visitors’ questions at many events each year.

“La Cueva High School serves a highly technical community, as many parents are employed at facilities such as Sandia National Laboratories and Intel...UNM has been proactive in promoting interest and recruiting students ... via well-designed literature, tutoring sessions for science and math, and open house events rich with demonstrations and relevant information.”
—Rich Compaau, AP Physics Teacher/Science Dept. Co-Chair, La Cueva High School

College: A Big Decision

Electrical & Computer Engineering Department faculty and staff have devoted significant resources and time over the past two years in working to let prospective students—especially those in New Mexico—better understand what the field of engineering is and will become in our exciting times.

Among the most valuable assets in our growing network are the talent and enthusiasm of high school teachers who care passionately about their students’ futures. They teach the courses that are so important to success at the university-level engineering curriculum, such as math and science, and they inspire their students to learn more about fields that to some may at first seem daunting.

Besides addressing common misconceptions about what engineering is and who engineers are, ECE’s secondary-school outreach helps young students understand the importance and relevance of the math and science classes they are taking.

ECE’s professors help in every way they can, from participating in tours and events hosted in our building to mentoring interns, coaching youngsters with their robotics projects, and volunteering to prepare and present summaries of their own research.

Students and staff volunteer to attend and give demonstrations at the dozens of events held annually, both on and off campus, for aspiring young students interested in how things work, in improving things that don’t work so well, and in seeing the results of their creative problem solving.

The department is beginning to see the results. After two years of events that connected ECE professors and their work with youngsters who are doing well in math and science, freshman-level introductory courses are booked to capacity and the freshman advisors in Engineering Student Services are seeing a spike in the number of students who want to talk with them about engineering.

Helping Students Excel

With UNM President Schmidly’s initiative to support students’ success (see www.unm.edu/president on “The President’s Vision”), freshmen and sophomores preparing for admission into ECE have a valuable resource in ECE’s undergraduate academic advisor, who can help tailor a course of study that will meet each student’s unique goals in this rigorous and multifaceted program of study.

There are also several student groups that provide networks and resources to ECE students. These include the student chapter of IEEE and the honor societyEta Kappa Nu, Sigma Xi, and Tau Beta Pi. Eta Kappa Nu’s activities this year included its second induction ceremony for the Order of the Engineer.

Another resource is Engineering Student Services, a School of Engineering program that helps students stay engaged in learning and connects them with student groups, professional organizations, and scholarship opportunities.

ESS provides tutoring, mentoring, study groups, School of Engineering scholarships, computer lab facilities, internships and co-ops. It can also advise students who are completing their prerequisite courses (calculus, programming, physics, chemistry, etc.) for acceptance into the ECE department. See http://soemep.unm.edu.

ESS also supports the Hispanic Engineering and Science Organization, the American Indian Science and Engineering Society, the National Society of Black Engineers, and the Society of Women Engineers.

It also includes the campus-wide Women in Science and Engineering program, which offers job-shadowing, industry tours, mock interviews, networking and outreach. See www.unm.edu/~unwise.
**Electrical & Computer Engineering at UNM 2006-07 Annual Report**

**Students’ Excellence Shines**

**Outstanding Students –**
- Peter Knee, EE senior, fall 2006
- Craig Vineyard, CompE senior, fall 2006
- William Barva Jr., EE senior, spring 2007
- Mark Learns, CompE senior, spring 2007
- Tippcanoe Sounphonphakdy, School of Engineering Outstanding Senior
- Lucas Ervin, EE junior, fall 2006
- Ruben Salazar, CompE junior, fall 2006
- Gregory E. Smith, EE junior, spring 2007
- Nathan Dautenhahn, CompE junior, sp07
- Michael Basile, School of Engineering Outstanding Junior
- Justin Topmiller, sophomore, fall 2006
- Stephen Tomanay, sophomore, fall 2006
- Alfat Anwar Ali, sophomore, spring 2007
- Travis Miller, sophomore, spring 2007
- Sagar Dhakal, graduate student, fall 2006
- Elena Plis, graduate student, spring 2007
- Elena Plis, School of Engineering Outstanding graduate student

“There was no greater highlight in my professional development than when my team (at Google) was recognized for launching a platform I had worked on during my internship to decrease search time by a factor of an unsigned short int.

“I recommend that any student at UNM lucky enough to have taken the chance and pursue a career in engineering to take it, live through it, love it, and never be afraid to experiment with crazy ideas.

“There is no better time than now to be an engineer and to drive technology and culture of the times; to be directly responsible for the advancement of civilization and have an impact on the quality of life for your fellow (wo-)man by delivering the knowledge of the world through ways never imagined.”

—David Hendricks, ECE Bachelor’s degree in Computer Engineering, fall 2006

**Outstanding Student Service –**
- Jeannette Moore and DeMia Tapia, fall 2006
- Alim Haji, spring 2007

**Some Success Stories –**

Los Alamos native David Hendricks graduated with an ECE computer engineering bachelor’s degree in December 2006 and he is enthusiastic about being recruited by Google, where he now works “banging bits and abusing the latest hardware” as he puts it. “So what does a search engine have to do with computer and electrical engineering?” he asks. “Well, everything! It’s a culmination of all technologies, from the first gate flipped to the very last instruction executed.”

ECE graduate student Joseph Constantine won the American University of Beirut’s Abdul Hadi Debs Award for 2007

Lai Xu, received a 2007-08 fellowship with UNM’s Program in Interdisciplinary Biological & Biomedical Science

**Engineering Is for Problem Solvers**

Engineers Without Borders gained its first New Mexico chapter recently, thanks to students in ECE, Mechanical Engineering and the School of Architecture & Planning.

Electrical engineering major Jeannette Moore spent a couple of years planning the chapter, and in 2006 she and a handful of students and their two faculty advisors made it happen. By February 2007 the new EWB-UNM chapter had completed its first project: installing solar-powered electricity generators for two homes at the Navajo Nation’s Ramah Chapter in northwest New Mexico.

At dawn on a cold winter Saturday, eight students started digging in ice-packed soil to form the 20-foot trenches required to connect the units to the two Ramah homes. Their partners on the daylong project were faculty advisors ECE Prof. Chuck Hawkins and Civil Engineering Prof. Walter Gerstle along with two civil engineering friends and four employees of Sacred Power Corp., which assembled the equipment and provided essential coaching.

Moore sees EWB-UNM as an avenue for directing the considerable problem-solving energy of ECE’s senior projects toward pressing community needs. She and DeMia Tapia, who took over from Moore as president of the chapter during fall semester 2006, received ECE’s Outstanding Student Service Award in December for their work in founding the EWB chapter.


One of the three crews who were assigned to a site installed solar-powered electricity for this hogan near Ramah, N.M. They are (l. to r.) Prof. Chuck Hawkins, Daniel Garcia, Janus Herrera, Jeannette Moore and their “fearless leader,” Jonathan Begay from Sacred Power Corp.

Crew members gather to celebrate completion of the day’s work.
**Seniors’ Capstone Projects Tackle Real-World Problems**

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**Micro-Ring Detector Electronics**
Karl Westlake, Jeremy Wright  
Sponsor: Sandia National Labs  
Objective: Control the wavelength of a laser that is being used to produce resonance in a micro-ring waveguide, including the laser, laser controls, waveguide output analysis, and PID servo controller.

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**Revolution Switch Panels for Experimental Aircraft**
Chris Colson, David McIntire, Rudy Perea  
Sponsor: Vertical Power Inc.  
Objective: Develop an avionics system for experimental aircraft using modern-day technologies, including electronics and software for a switch panel that is used by the pilot.

The yearlong team projects completed by all ECE seniors prior to graduation are an important part of the engineering education. The projects on these two pages are examples of the work undertaken by this year’s graduates. For information about sponsoring research by ECE students, contact course instructor and student mentor Dr. Marvin Daniel at danielmarv@comcast.net.

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**Home Theater Personal Computer**
Chris Dziak, Pravin Patel, Andrew Steinbeisser, Craig Vineyard  
Objective: Centralize several common components of a home theater into one standalone system. The necessary hardware components must be integrated such that they function together properly. All of the required functions must be packaged both affordably and in an aesthetically pleasing manner.

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**Child Tracker Device**
Jason Ford, Shirli Siahc  
Objective: Children get lost all the time, and quickly. The goal of this project is to allow a parent to monitor a child’s location in large outdoor areas such as amusement parks. If the child leaves a predefined range, the parent can choose to switch the system to “locate” mode and locate the child using the information displayed on the parent unit.
As chair of the Electrical & Computer Engineering Department, Chaouki Abdallah wears many hats. He serves as an advisor to four PhD and four master’s students and teaches courses ranging from introductory electrical engineering to special graduate-level topics in control systems and theory.

At the same time, his research continues in systems theory, adaptive control, nonlinear systems, robotics, robust control, fault detection, complexity of control systems and networking.

A senior member of IEEE, he is a recipient of the IEEE Third Millennium Medal, the School of Engineering’s 2004 Senior Research Excellence Award, and ECE’s Gardner Zemke Professorship for 2002-05. He was also the first recipient of ECE’s Lawton-Ellis Award for combined excellence in teaching, research, and student/community involvement.

Dr. Abdallah served as director of ECE’s graduate program from 1999 through 2005. He played an active role in designing and implementing graduate program collaborations with Latin American and European countries. He is currently serving as general chair for IEEE’s 2008 Conference on Decision and Control.

Dr. Abdallah joined ECE in 1988, and was visiting professor at the Universita Degli Studi di Roma, Tor Vergata, Rome, in 2005. He has published four books and more than 200 peer-reviewed papers.
Steven R. J. Brueck, Distinguished Professor

The first professor in the hundred-year history of the School of Engineering to be named a UNM Distinguished Professor, Steven Brueck was promoted to this position in 2006. Just 23 other UNM faculty members have the title, which is the highest UNM bestows on faculty.

Dr. Brueck has provided both technical and administrative leadership as director of UNM’s Center for High Technology Materials since joining ECE in 1985. Generating more than $9 million annually in grants and contracts, CHTM is an internationally recognized center for optoelectronics, microelectronics and nanotechnology research.

Dr. Brueck is the founding editor of the IEEE Journal of Special Topics in Quantum Electronics and is a Fellow of the IEEE, the Optical Society of America, and the American Association for the Advancement of Science. In 1991 he received the UNM School of Engineering’s Outstanding Researcher Award, and in 2000 IEEE awarded him the Third Millennium Medal.

Dr. Brueck’s research explores the extension of optical lithography/microscopy to the high-resolutions necessary for future generations of ICs. He applies the capabilities of interferometric lithography to expand nanophotonic, nanoscale growth and nanofluidic science and technology.

He currently is faculty advisor to seven doctoral students, and he holds a joint appointment in Physics & Astronomy.

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Degrees:
Ph.D., Electrical and Computer Engineering, Massachusetts Institute of Technology, 1971
M.S., Electrical Engineering, Massachusetts Institute of Technology, 1967
B.S., Electrical Engineering, Columbia University, 1965

Thomas P. Caudell, Professor

Tom Caudell was appointed to direct UNM’s Center for High Performance Computing beginning in February 2007. The center supports faculty-led, computing-based research throughout UNM, and the center’s staff fosters interdisciplinary collaborations based on computation. See page 18 for more information.

Dr. Caudell is creator of a software application called Flatland, named in honor of Edwin Abbott’s 1884 book by that name, designed to serve as a virtual laboratory that scientists can use to experiment with computational problems in a natural and intuitive manner, especially using models of cognitive neural systems.

Promoted to full professor in 2007, Dr. Caudell’s research interests include neural networks, virtual reality, machine vision, robotics and genetic algorithms. He teaches courses in programming, computer games, neural networks, virtual reality, computer graphics and pattern recognition.

He has been active in the field of virtual reality and neural networks since 1986, has more than 75 publications in these areas, and in 1993 helped organize IEEE’s first Virtual Reality Annual International Symposium. He is also an active member of the IEEE, the International Neural Network Society, and the Association for Computing Machinery.

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Faculty spotlight:
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Degrees:
Ph.D., Physics, University of Arizona, 1980
M.S., Physics, University of Arizona, 1978
B.S., Physics, Honors, California State University, 1973
B.S., Mathematics, California State University, 1973

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Faculty spotlight:
www.ece.unm.edu/morenews/profile_caudell.html

Degrees:
Ph.D., Physics, University of Arizona, 1980
M.S., Physics, University of Arizona, 1978
B.S., Physics, Honors, California State University, 1973
B.S., Mathematics, California State University, 1973
Jingkuang Chen, Associate Professor

Delivering life-saving treatment to patients on a cell-by-cell basis is what drives Jingkuang Chen’s current research. He is developing implantable transducers, high-resolution ultrasound imager arrays, thermoelectric coolers, and magnetic deep brain stimulators.

His implantable ultrasound transducer array is a miniaturized probe that can, at the cellular level, create ultrasound images, freeze or heat cells, sense temperature, and deliver drugs or electrical stimulation. The device is a micromachined, ultrasonic transducer/imager array that lies along a silicon probe half the diameter of a human hair (less than 100 microns) that can be implanted into neural tissue and fine vessels. It can generate high-frequency (>25MHz) acoustic signals at a driving voltage of less than 40 volts.

Dr. Chen is currently serving as major advisor to three doctoral students and teaches classes in MEMS transducer devices and analog circuit design.

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Degrees:
PhD Electrical Engineering, University of Michigan, Ann Arbor, 1996
MS Electrical Engineering, National Taiwan University, Taipei, 1986
BS Electrical Engineering, National Taiwan University, Taipei 1984

Christos G. Christodoulou, Professor

Recipient of ECE’s 2007 Lawton-Ellis Award for excellence in teaching, research, and student/community involvement, Christos Christodoulou was also named the IEEE Antennas and Propagation Society Distinguished Lecturer for 2007-09.

He was semi-plenary speaker in 2006 for the first European Conference on Antennas and Propagation, held in Nice, France, and was keynote speaker both at IEEE’s 2006 International Workshop on Antenna Technology and at the 2007 International Workshop & Expo on Anticounterfeiting, Security & Identification held in Xiamen, China.

He co-authored two books published in October 2006:

Dr. Christodoulou taught a two-week course on antennas at Jiao Tong University in Shanghai in May 2007, and this year was on technical or advisory committees for conferences in Hangzhou and Xiamen China and in the UK and Vietnam.

His research is in the areas of modeling of electromagnetic systems, reconfigurable systems, machine learning applications in electromagnetics, and smart antennas. A Fellow of IEEE, he served as ECE’s chair from 1999-2005 and received the School of Engineering’s Outstanding Senior Researcher of the Year Award in 2006.

Dr. Christodoulou is advisor to 11 doctoral students and 7 master’s students.

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PhD Electrical Engineering, North Carolina State University at Raleigh, 1985
MS Electrical Engineering, North Carolina State University at Raleigh, 1981
BS Physics with Solid State Electronics option, American University in Cairo, Egypt, 1979

Additional Titles:
IEEE Fellow
Charles B. Fleddermann, Professor

Associate Dean for Academic Affairs, School of Engineering
Interim Dean, Graduate Studies

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Degrees:
PhD Electrical Engineering, University of Illinois at Urbana-Champaign, 1985
MS Electrical Engineering, University of Illinois at Urbana-Champaign, 1980
BS Electrical Engineering, University of Notre Dame, 1977

This year Charles Fleddermann added service as UNM’s Acting Dean of Graduate Studies to his current role as the School of Engineering’s Associate Dean for Academic Affairs, a post he has held since 2002.

Dr. Fleddermann is principal investigator on a $1.8 million NSF grant for 2004-08 to train and send graduate teaching fellows into Albuquerque’s West Mesa secondary and elementary schools. The fellows’ objective is to boost both learning and teaching of math and science with lessons in optics and photonics.

Dr. Fleddermann developed an engineering ethics course for ECE in response to the ABET standard of incorporating ethics topics into the undergraduate engineering curriculum. His 1999 undergraduate textbook, Engineering Ethics, now in its third edition, is used by a number of universities nationally and internationally. It addresses the ways in which technology raises ethical concerns for engineers and how engineers can avoid ethical problems before they happen.

His main research area is plasma processing of semiconductor materials, which involves using ionized gases to pattern transistors and other electronic devices during the manufacturing of integrated circuits such as microprocessor chips.

Dr. Fleddermann also works with optical diagnostics of plasmas, plasma etching of ceramics, and solar photovoltaic devices.

Mark A. Gilmore, Assistant Professor

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Degrees:
PhD Electrical Engineering, University of California, Los Angeles, 1999
MS Electrical Engineering, Northeastern University, Boston, 1992
BS Electrical Engineering, Boston University, Boston, 1986

The helicon-cathode (HELCAT) basic plasma science device in Mark Gilmore’s lab, which he and his team constructed with funding from the DOE Office of Science, began operating at its full-power magnetic field of 2.2 kG in August 2007 when its final phase of construction—installation of chilled water cooling—was completed.

With this phase complete, HELCAT can now also operate its dual RF and thermionic cathode plasma sources simultaneously.

Three grants funded this year by the DOE and NSF are supporting continued basic plasma science by Dr. Gilmore and his two colleagues in the Plasma and Fusion Science Group—Research Associate Professor Christopher Watts and Research Assistant Professor Alan Lynn. The grants address basic plasma physics topics in the areas of laboratory astrophysics, laboratory solar physics, and fusion energy.

Dr. Gilmore’s current research focuses on the physics and control of turbulence and transport in both laboratory and fusion plasmas. He collaborates on research in fusion energy and plasma astrophysics with scientists at Los Alamos National Laboratory, on pulsed-power research with engineers at Sandia Laboratories, and on high-power microwave devices with colleagues at ECE and the Air Force Research Lab in Albuquerque.

He currently serves as major advisor for eight students.
Edward D. Graham, Visiting Professor/Lecturer

With considerable experience in industry and research, Ed Graham is an invaluable resource to ECE’s students and faculty. His research interests include semiconductor devices and circuits, noise theory, and statistical analysis and probabilistic considerations.

Dr. Graham worked at Sandia National Laboratories for 30 years, ultimately serving as director of Operations and Engineering. After Sandia, Dr. Graham served as president and CEO of the Semiconductor Industry Suppliers Association (SISA), and in 2001 he joined Semiconductor Equipment and Materials International as senior director for Consortia Interfaces.

Graham is a Registered Professional Engineer in the State of New Mexico and an Amateur Extra Class radio license (N5HH). He teaches a number of varied courses within the ECE Department.

Charles F. Hawkins, Professor

When one of his students came to him in fall 2006 to ask if he would serve as faculty co-sponsor to UNM’s first-ever chapter of Engineers Without Borders, Chuck Hawkins saw a chance to support his students in a new way. He gave an enthusiastic “Yes!” and the chapter members have already made their mark with a solar-energy project on the Navajo Reservation (see http://www.ece.unm.edu/morenews/borders.html).

When he’s not busy supporting his students, Dr. Hawkins pursues his interest in CMOS electronics, test, reliability and failure analysis, and he gives about three conference tutorials each year. He works with Sandia National Laboratories’ IC Development Group, a collaboration that began in 1984, and has served as a consultant to Intel, Philips Research Labs, Xilinx and Advanced Micro Devices.

He served as editor of Electron Device Failure Analysis magazine from 1999-2003 and, with colleagues at Sandia Labs, Intel and AMD, he has produced several best and honorable-mention papers at IEEE’s International Test Conference and at ASM’s International Symposium on Test & Failure Analysis. He served as general chair of ITC in 1996.

Dr. Hawkins has co-authored three books, including CMOS Electronics: How it Works, How it Fails, with Jaume Segura, IEEE Press 2004, and is working on a fourth book titled Introduction to CMOS Digital Electronics.
Promoted this year to full professor, Majeed Hayat and his recently graduated student Brad Ratliff received a 2007 Creative Award from UNM’s intellectual property licensing organization in recognition of their November 2006 patent titled “Uniform, Nondisruptive and Radiometrically Accurate Calibration of Infrared Focal-Plane Arrays Using Global Scene Motion.” Their co-patent awardees are Dr. Scott Tyo and Dr. T. Turner of the University of Arizona.

Dr. Hayat is also co-holder of a patent issued in May 2007, “Spectrally Adaptive Quantum-Dot Infrared Sensors for Focal Plane Arrays,” with ECE Prof. Sanjay Krishna, Dr. Tyo of Arizona, and graduate students Unal Sakoglu and Sunil Raghavan. Both patents have already been licensed by Albuquerque companies.

The latter patent is related to a research collaboration with professors Krishna and Tyo titled “Quantum-dot sensors for Measures & Signatures Intelligence (MASINT) applications.” It has yielded the first demonstration of a continuously tunable photodetector designed to work in the long-wave infrared spectrum. With $500,000 in follow-up funding from the Defense Intelligence Agency, the team is undertaking phase two, “Intelligent Spectral-Sensing Systems Based on Tunable Infrared Quantum-Dot Focal Plane Arrays,” through Los Alamos National Lab.

With these and other projects underway Dr. Hayat also completed arrangements in 2007 for a joint-degree agreement between UNM and Universidad de Concepcion in Chile.

Faculty leader of ECE’s Digital Rights & Knowledge Engineering Research Group (DRAKE), Greg Heileman also serves as faculty advisor for UNM’s student branch of the IEEE Computer Society, serves as associate editor of the Journal of Experimental Algorithmics published by the Association for Computing Machinery, and is a senior member of IEEE.

Dr. Heileman was ECE’s Distinguished Teacher for 2000 and is the 2001 recipient of its Lawton-Ellis Award for combined excellence in teaching, research, and student/community involvement. He also received the School of Engineering’s Teaching Excellence award in 1995.

His research and teaching interests are in digital rights management, information security, theory of computing and information, machine learning, and data structures and algorithmic analysis.

Dr. Heileman held a research fellowship in 2005 at the Universidad Politécnica de Madrid, and in 1998 he held a similar position at the Universidad Carlos III de Madrid.

He authored the 1996 textbook, *Data Structures, Algorithms and Object-Oriented Programming.*
Manuel Hermenegildo, Professor

A member of the European Union's high-level advisory group in information technology and a Fulbright Scholar, Manuel Hermenegildo holds joint professorships with UNM's Computer Science Department and with the Technical University of Madrid.

He serves as area editor of the Journal of Applied Logic, editorial adviser of the Journal of New Generation Computing, president of the International Association for Logic Programming, and a member of the executive committee of the European Association for Programming Languages and Systems.

Dr. Hermenegildo has published more than 150 refereed papers in the areas of programming languages, program development tools, advanced compilation techniques, abstract interpretation, parallelizing compilers, parallel and distributed processing, and artificial intelligence. He has given more than 20 invited talks and tutorials at major conferences on these topics.

After fourteen years of service in Spain as professor and later director of the Spanish National Research Directorate, Dr. Hermenegildo joined ECE in 2003 as the Prince of Asturias Endowed Chair in Information Science & Technology. He currently serves as advisor to three students.

Stephen D. Hersee, Professor

With four invention disclosures filed in 2006-07 related to the growth and device applications of GaN nanowires, Dr. Hersee authored four invited papers and three journal papers on the topic in 2006. One of these was highlighted in Nature Nanotechnology's August 2006 issue.

The process—originated by Dr. Hersee and two of his students, Xinyu Sun and Xin Wang—enables fabrication of uniform arrays of GaN nanowires such that the position, orientation, diameter and length of each nanowire is precisely controlled. A local startup company was launched in 2006 based on this technology, and two more companies have purchased an option to license it.

Dr. Hersee and his team are also investigating the effect of threading defects on high-brightness light-emitting diodes. They have developed a way to measure the dislocation density inside working devices, which is shedding light on how these defects affect the electrical and optical performance of high-brightness LEDs. Dr. Hersee's research is currently funded by DARPA, ARL and AFOSR.

He was named UNM's Outstanding Teacher of the Year for 2001-02. He teaches courses in microelectronics, circuit analysis and semiconductor devices, and he currently serves as major advisor to three students. He holds eight patents and has published and presented more than 160 papers.
Diana L. Huffaker, Associate Professor

UNM’s Fellowship program in Nanoscience and Microsystems (NSMS), which is directed by Diana Huffaker and sponsored by an NSF/NCI Integrated Graduate Education Research Traineeship (IGERT) grant, currently supports seven UNM engineering students.

Dr. Huffaker is Region 6 chair of Women in Science and Engineering.

Her research interests include crystal growth (MBE, MOCVD) and characterization of novel materials for optoelectronic devices; growth methods and characterization of quantum dots for single photon, single electron based devices; photonic lattice fabrication and characterization; and optical interconnects and integrated optoelectronics based on VCSEL technology.

She received a Alexander Von Humboldt Fellowship in 2004, which she completed at Technical University in Berlin, and received the Young Scientist Award at the 2002 Compound Semiconductor Symposium. Dr. Huffaker has served as chair and organizer of a number of IEEE workshops and conferences, and is currently serving a three-year term on the IEEE Lasers & Electro-Optics Society board of governors.

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MS Material Sciences, University of Texas at Austin, 1990
BS Engineering Physics, University of Arizona, 1986

Ravinder K. Jain, Professor

As head of UNM’s Fiber-Optic Devices and Optoelectronics Group at the Center for High Technology Materials, Ravi Jain pursues research in optical interconnects, fiber telecom and datacom subsystems and devices, fiber lasers and amplifiers, fiber and waveguide devices, fiber sensors, fluorescence lifetime- and depolarization-based biosensors, diode and diode-pumped solid-state lasers and applications.

Dr. Jain holds more than 20 patents, and he currently teaches courses in optoelectronics.

He has published in more than 75 scientific and technical journals and made more than 125 presentations to major professional societies. Dr. Jain holds a joint professorship with UNM’s Physics & Astronomy Department, and he held ECE’s Endowed Chair in Microelectronics from 1992-97.

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BS EE, University of California at Santa Barbara, 1970
AB Physics, U.C. Santa Barbara, 1970

As head of UNM’s Fiber-Optic Devices and Optoelectronics Group at the Center for High Technology Materials, Ravi Jain pursues research in optical interconnects, fiber telecom and datacom subsystems and devices, fiber lasers and amplifiers, fiber and waveguide devices, fiber sensors, fluorescence lifetime- and depolarization-based biosensors, diode and diode-pumped solid-state lasers and applications.

Dr. Jain holds more than 20 patents, and he currently teaches courses in optoelectronics.

He has published in more than 75 scientific and technical journals and made more than 125 presentations to major professional societies. Dr. Jain holds a joint professorship with UNM’s Physics & Astronomy Department, and he held ECE’s Endowed Chair in Microelectronics from 1992-97.

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MS EE & Computer Sciences, U.C. Berkeley, 1974
BS EE, University of California at Santa Barbara, 1970
AB Physics, U.C. Santa Barbara, 1970
Sudharman Jayaweera, Assistant Professor

Winner of the best paper award at IEEE’s 2006 International Conference on Advanced Video and Signal-Based Surveillance, Sudharman Jayaweera traveled to Sydney, Australia, in November to receive the award. His paper is titled “Large System Decision Fusion Performance in Inhomogeneous Sensor Networks.”

Dr. Jayaweera’s research interests include wireless communications, statistical signal/image processing, wireless sensor networks, information theory, quantum information processing, and biomedical image processing.

Dr. Jayaweera’s industry experience includes developing wireless geolocation and tracking algorithms for the proprietary RadioCamera technology of US Wireless Corporation in 1998-99 and several summer internships.

Currently he serves as associate editor of EURASIP Journal on Advances in Signal Processing, and he is co-chairing the subcommittee on Software-Defined and Cognitive Radios at the 2008 IEEE Radio and Wireless Symposium. Dr. Jayaweera has served on technical program committees for more than ten IEEE conferences, and he received the best paper award at the 2003 IEEE Wireless Personal Multimedia Conference.

Dr. Jayaweera, who joined ECE in 2006, has published more than 55 peer-reviewed journal and conference papers and serves as major advisor to five students. He also served as the director of ECE’s 2007 EYES summer internship program for international students. He teaches courses in multiuser communications, and detection and estimation theory.

Ramiro Jordán, Associate Professor

Recipient of the School of Engineering’s 2007 Harrison Service Award, Ramiro Jordán’s research focuses on software engineering, multidimensional signal processing, communication networks, and embedded systems.

In 1990, Dr. Jordán founded the Ibero-American Science and Technology in Education Consortium, an international alliance of industry, academia, government agencies, and organizations focused on education, science, technology and entrepreneurship in the Americas and Iberian Peninsula. ISTEC’s objective is to create alliances among participants, build business opportunities, enhance curricula, establish joint R&D efforts, and encourage entrepreneurship.

In June 2007, ISTEC held its 16th general assembly at the Universidad Técnica Particular de Loja in Ecuador, with more than 500 participants from institutions in Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Ecuador, Mexico, Nicaragua, Panama, Peru, Paraguay, Puerto Rico, Spain, Uruguay, the U.S. and Venezuela. Session topics ranged from water, energy, health, and bio and nanotechnology to connectivity, entrepreneurship, sustainable development, ethnicity and culture.

Gridline Communications Holding, Inc, is a partner of ISTEC of which Dr. Jordán was an early shareholder and serves as an executive officer. Headquartered on UNM’s south campus, Gridline made progress in 2006-07 toward its goal of providing broadband access to remote areas of the world.

See page 24 for more information about Gridline.
Sanjay Krishna, Associate Professor

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Degrees:
PhD University of Michigan at Ann Arbor, 2001
MS Electrical Engineering, University of Michigan at Ann Arbor, 1999
MSc Physics, Indian Institute of Technology, Madras, 1995
BSc Physics, SSSIHL, Bangalore, India, 1994

For research on quantum-dot sensors for Measures & Signatures Intelligence (MASINT) applications, Sanjay Krishna and his team received the 2006 Chief Scientist Award for Excellence from the National Consortium for MASINT Research. The project demonstrated a continuously tunable, quantum-dot-based photodetector designed to work in the long-wave infrared spectrum. Dr. Krishna was PI with Scott Tyo of the University of Arizona and ECE Prof. Majeed Hayat as co-PIs.

With $500,000 in follow-up funding from the DIA, the team is now working with Los Alamos National Lab on field testing. Dr. Krishna is co-holder of a related patent issued in May 2007 titled “Spectrally Adaptive Quantum-Dot Infrared Sensors for Focal Plane Arrays” with professors Hayat and Tyo along with ECE graduate students Unal Sakoglu and Sunil Raghavan. The patent discloses a semiconductor detector with a tunable spectral response.

In addition, Dr. Krishna heads a group of about 20 researchers who are investigating next-generation infrared sensors based on nanoscale quantum dots and strain-layer superlattices. He has received more than $6 million in externally funded research grants.

Dr. Krishna is co-founder of ECE’s Expand Your Engineering Skills (EYES) program, which brings high-caliber international students to ECE for summer research under the guidance of a faculty advisor. He is the recipient of the Gold Medal from IIT and an IEEE Outstanding Engineer Award.

Luke F. Lester, Associate Professor

Promoted by ECE to full professor in 2007, Luke Lester received ECE’s Excellence in Teaching Award in 2007 and the School of Engineering’s Junior Faculty Research Award in 1997.

Dr. Lester has four U.S. patents and seven patents pending in semiconductor lasers, detectors, and III-V semiconductor fabrication techniques.

He teaches courses in optoelectronics, semiconductor lasers, semiconductor physics, microelectronics processing, and semiconductor materials and devices, and he currently serves as major advisor to eight students.

He contributed to quantum-dot research that led to development of a semiconductor laser with a lower threshold, purer signal, and wider-wavelength range of operation than any other existing semiconductor laser. He co-founded Zia Laser, Inc. to commercialize the technology and served as the company’s chief technical officer for two years. The company was purchased by Nanosemiconductor GmbH in November 2006.

Dr. Lester received a UNM University Libraries faculty acknowledgement award in 2006 “for his scholarly achievement and exemplary contributions to the School of Engineering.” A senior member of IEEE, Dr. Lester has published more than 150 journal articles, conference presentations and invited papers, and his work is estimated to have at least 1,500 citations.
Kevin J. Malloy, Professor

Additional Titles:
Associate Dean for Research, School of Engineering

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Degrees:
PhD Electrical Engineering, Stanford University, 1984
MS Electrical Engineering, Stanford University, 1980
BS Electrical Engineering, Notre Dame, 1978

Dividing his time between ECE, the Farris Engineering Center, and UNM's Center for High Technology Materials, Kevin Malloy's research interests include the coherent states of semiconductors, disorder in ionic semiconductors, and wave propagation in periodic structures, and he teaches courses in semiconductor physics and devices.

A member of the editorial advisory board for the CRC Critical Reviews in Solid State and Materials Sciences, he is also a member of the IEEE Electron Devices Society, the Materials Research Society, and the American Vacuum Society.

Dr. Malloy received the School of Engineering's Research Excellence Award in 1994 and its Teaching Excellence Award in 1996.

Yasamin Mostofi, Assistant Professor

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Degrees:
PhD Electrical Engineering, Stanford University, 2004
MS Electrical Engineering, Stanford University, 1999
BS Electrical Engineering, Sharif University of Technology, Tehran, 1997

For their work on "robust functionality and active data management for cooperative networks in the presence of WMD stressors," Yasamin Mostofi and her colleagues, ECE Prof. Majeed Hayat and Computer Science Prof. Patrick Bridges, received $400,000 in Defense Threat Reduction Agency funding in 2007.

Dr. Mostofi currently works in two areas: decision and control in cooperative sensor networks under communication constraints, and optimization and signal processing for mobile communication systems.

This includes sensing, estimation and control of dynamical systems over a network; collaborative information processing in multi-agent mobile networks; optimization of real-time wireless networks; optimum allocation of computation and communication resources; cross-layer designs; and development of decentralized solutions.

She is currently major advisor to two MS and two PhD students and teaches courses in wireless communications and networked control systems.

Dr. Mostofi's industry experience includes summer internships at Bell Labs in 1999 and at National Semiconductor in 2001.
She was a post-doctoral scholar at CalTech from 2004-06, and she has published 15 conference papers and four journal papers.

A recipient of the Bellcore Fellow-Advisor Award at Stanford, she is a member of IEEE and an elected member of Sigma Xi.
Marek Osinski, Professor

A s program director of UNM’s fellowship program on Integration of Nanotechnology with Cell Biology and Neuroscience, one of Marek Osinski’s current focuses is to develop application of rapidly evolving nanotechnologies to cell biology and neuroscience.

An NSF-funded Integrated Graduate Education Research Traineeship (IGERT) program, the fellowship supported five students in 2006.

Dr. Osinski’s research interests include synthesis and characterization of colloidal nanocrystals, biomedical applications of colloidal quantum dots, nuclear radiation detectors, development of semiconductor ring-laser-based rotation sensors, high-density arrays of mid-infrared-emitting diodes, modeling and simulation of optoelectronic devices, and growth and properties of novel optoelectronic materials.

A Fellow of the Society for Photo-Optical Instrumentation Engineers (SPIE) and of the Optical Society of America, Dr. Osinski has chaired or co-chaired 25 SPIE conferences and symposia, edited 20 SPIE Proceedings volumes, and served on numerous conference program committees. He has authored or coauthored more than 390 technical papers and five book chapters, and he holds five patents.

Dr. Osinski holds joint professorships with UNM’s Physics & Astronomy and Computer Science departments.

Marios S. Pattichis, Assistant Professor

P romoted this year by ECE to Associate Professor, Marios Pattichis was also awarded the School of Engineering’s Harrison Faculty Excellence Award for 2006.

Dr. Pattichis and his co-authors won the best paper award at the 2006 Conference on Artificial Intelligence Applications and Innovations, which was held by the International Federation for Information Processing in Athens, Greece. The paper, titled “Classification of Atherosclerotic Carotid Plaques Using Gray Level Morphological Analysis on Ultrasound Images,” has been invited for 2007 publication in the International Journal of Applied Intelligence.

Dr. Pattichis is actively involved in coaching and supporting high-school students interested in engineering, and in summer 2007 he developed and led two 2-week Summer Digital Academies sponsored by ECE’s FPGA Mission Assurance Center and the Career Enrichment Center of Albuquerque Public Schools. His students were introduced to programmable digital logic and designed their own digital circuits.

Dr. Pattichis is director of ECE’s Image & Video Processing and Communication Lab. Recipient of ECE’s 2004 Teacher of the Year award, he holds a joint appointment with UNM’s Department of Radiology.
L. Howard Pollard, Assistant Professor

Digital design, computer architecture, parallel processing, digital signal processing, multimedia learning, and programmable logic are Howard Pollard’s research interests.

Dr. Pollard’s work experience at the Systems Group at Reticon and the technical staff at Lockheed Missiles and Space honed his skills in digital electronics and computer systems, and his doctoral work focused on fault-tolerant protocols for bus communications.


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MSEE, Electrical Engineering, Utah State University, 1977
BSEE, Electrical Engineering, Utah State University, 1971

Andres C. Salazar, Professor

Sharing his time between ECE and UNM’s Anderson School of Management as the PNM Chair in Microsystems, Commercialization and Technology, Dr. Andres Salazar supports technology development in New Mexico in four areas: creation of a Microsystems industry cluster in central New Mexico, commercialization of technology from New Mexico-based scientific centers of excellence, business training of technologists to increase the pool of entrepreneurial teams in the state, and incubation and facilitation of funding for the state’s technology-based start-ups.

He was adjunct member of the staff at the NM Department of Economic Development during 2005-06 and was co-founder of High Desert Venture Camp, a nonprofit corporation dedicated to fostering entrepreneurship in New Mexico.

A UNM alumnus and native New Mexican, Dr. Salazar received UNM’s Distinguished Engineering Alumnus award in 2002.

He teaches signals and systems, probabilistic methods, and entrepreneurial engineering, and he currently serves as advisor to ECE undergraduates enrolled in UNM’s 3-2 engineering/MBA program and to ECE graduates interested in a double master’s program in ECE and business.

Dr. Salazar joined ECE in 2002 after a 34-year career in the high-tech industry in positions ranging from chairman, CEO, general manager, VP and CTO at companies located in California, Michigan, New Jersey, Massachusetts, Florida and Georgia.

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MBA, Business, Heriot-Watt University, U.K., 1998
PhD, Electrical Engineering, Michigan State University, 1967
MSEE, UNM, 1985
BSEE, UNM, 1964 (with distinction)
BA Math & English, UNM, 1964 (with distinction)

Additional Titles:
PNM Endowed Chair in Microsystems, Commercialization and Technology
Recipient of ECE’s 2000 and 2005 Distinguished Teacher Award, Balu Santhanam is a member of ECE’s Wireless Communications Group.

Dr. Santhanam’s research is in the areas of signal processing, DSP, digital communications and information theory. These include adaptive filtering, time-frequency analysis and representations for nonstationary signals specifically AM/FM type signals, co-channel signal separation, MAI suppression in multi-user communications, and aerial image enhancement in optical lithography.

The courses Dr. Santhanam teaches include digital communication theory, signals and communications, digital signal processing, spacial array processing, and probability theory and stochastic processes.

Dr. Santhanam co-founded the department’s EYES international exchange program.

He is a senior member of IEEE, an associate editor of the International Journal of Electrical Engineering and Computers, a reviewer for several IEEE transaction journals, and a member of the ASEE and the SPIE professional societies.

A $1.2 million ONR grant awarded in August 2006 is funding three years of counter-IED research by Edl Schamiloglu, SAIC, the University of Michigan, and his ECE colleagues professors Christos Christodoulou, Mark Gilmore, Carl Baum, Mikhail Fuks, and post-doctoral student Herman Bosman.

Dr. Schamiloglu directs ECE’s Pulsed Power, Beams & Microwaves Lab and the Institute for Infrastructure Surety. His book High Power Microwaves, with two co-authors, is “considered the defining book for the field” according to the publisher’s description, and in 2007 was published in its second edition.

Dr. Schamiloglu presented two plenary addresses in September 2006. One, “Improved Performance of Magnetrons Using the Transparent Cathode,” was presented at the 14th Symposium on High Current Electronics held in Tomsk, Russia. The other, “High-Power Magnetrons and Ubitrons Driven by Transparent Cathodes,” was presented at the First Euro-Asian Pulsed Power Conference, held in Chengdu, China. His team has filed provisional patents on this technology.

He also presented an invited lecture at Novosibirsk State University in Russia in September 2006.

Dr. Schamiloglu served as general chair for IEEE’s 2007 International Conference on Pulsed Power and Plasma Science, hosted in Albuquerque in June 2007. He was elected EMP Fellow of the Summa Foundation in 2006 and is senior editor of IEEE’s Transactions on Plasma Science.
Pradeep Sen, Assistant Professor

After launching UNM's new Advanced Graphics Lab, dedicated to research in computer graphics, visualization, imaging and computer vision, Pradeep Sen has gathered funding and provided opportunities for students interested in these fields. AGL is part of UNM's ARTS Lab, which focuses on interdisciplinary research on digital media.

Dr. Sen's research interests include real-time rendering and graphics hardware, especially global illumination algorithms on the GPU, the use of real-time technologies to aid in visualization of medical data sets, and acquisition and display of light fields, which relates to the emerging field of computational photography.

He teaches courses in real-time rendering and graphics hardware, and he has authored a number of papers in this area. These include two Eurographics Graphics Hardware conference best papers, one titled “Silhouette Maps for Improved Texture Magnification” in 2004 and one co-authored with Stanford colleagues in 2002 titled “Efficient Partitioning of Fragment Shaders for Multipass Rendering on Programmable Graphics Hardware.”

Dr. Sen also co-authored two SIGGRAPH papers: “Dual Photography” in 2005 and “Shadow Silhouette Maps” in 2003.

He has acted as a reviewer at a number of graphics conferences and is a member of the Society of Hispanic Professional Engineers. Dr. Sen holds a joint appointment with Computer Science.

Wei Wennie Shu, Associate Professor

The faculty advisor for ECE's Networked Multimedia and Parallel Computing Lab, Wennie Shu teaches courses in distributed systems, ad hoc wireless networks, computer operating systems, and computer networks.

Her research is focused on distributed and parallel systems, multimedia networking with audio/video stream scheduling, ad hoc wireless and sensor networks, multicast overlay network services, and modeling and simulation of biomedical cell signaling.

Dr. Shu is a member of both the Computer and the Communication societies of IEEE, and she is a member of the Association for Computing Machinery's Special Interest Group on Operating Systems. She also referees for the National Science Foundation and is a reviewer for various IEEE journals and transactions.

She has taught and conducted research in the computer science and engineering departments at Yale, the State University of New York at Buffalo, and the University of Central Florida.

Additional Titles:
Associate Chair Director, ECE Graduate Program

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Degrees:
PhD Electrical Engineering, Stanford University, 2006
MS Electrical Engineering, Stanford University, 1998
BS Computer and Electrical Engineering, Purdue University, 1996
With research interests that include statistical modeling of VLSI systems, analysis of signal and power integrity in high-performance and low-power VLSI systems, innovative design techniques to deal with random/systematic variations, robust and manufacturable circuit design approaches, and reconfigurable digital systems, Payman Zarkesh-Ha currently serves as major advisor to three students and teaches courses in VLSI design.

He is a senior member of IEEE and a member of the Association for Computing Machinery. He was a senior research engineer at LSI Logic Corp., working on interconnect architecture design for the next ASIC generations, before joining ECE in 2006. He has been industry liaison with Semiconductor Research Corp. and Microelectronics Advanced Research Corp. since 2001, and he has been serving as technical committee member of System Level Interconnect Prediction (SLIP) Workshop since 2001.

Dr. Zarkesh-Ha won the Kharazmi Award, the most prestigious scientific award in Iran, in 1997. He holds nine patents, is author of a book chapter, and author or co-author of more than 35 peer-reviewed journals and conference papers.
Joint Faculty Appointments

Edward S. Angel
Professor, Computer Science
Ph.D., USC
Interests: Computer graphics, scientific visualization

Jean-Claude M. Diels
Professor, Physics & Astronomy
Ph.D., Brussels, Belgium
Interests: Laser physics and nonlinear optics, ultrafast phenomena

Robert V. Duncan
Professor, Physics & Astronomy; Associate Dean, College of Arts & Sciences
Ph.D., UC-Santa Barbara
Interests: Precision measurements, remote sensing, experimental tests of fundamental physics

Frank L. Gilfeather
Professor, Mathematics & Statistics
Ph.D., University of California at Irvine
Interests: Algorithm engineering, experimental tests of fundamental physics

Terran D.R. Lane
Assistant Professor, Computer Science
Ph.D., Purdue University
Interests: Structural health monitoring, application of artificial intelligence in structural engineering and biomechanics

Herbert Tanner
Assistant Professor, Mechanical Engineering
Ph.D., NTUA, Greece
Interests: Robotics, cooperative control, multi-agent systems coordination and planning

Wolfgang G. Rudolf
Professor, Physics & Astronomy
Ph.D., Jena, Germany
Interests: Laser physics, ultrashort light pulses, time-resolved spectroscopy and imaging

Monsoor Sheik-Bahae
Associate Professor, Physics & Astronomy
Ph.D., SUNY-Buffalo
Interests: Lasers and photonics, coherent and ultrafast processes in semiconductors, laser cooling of solids, nonlinear optics

Gregory P. Parr
Professor, Mechanical Engineering
Ph.D., Stanford
Interests: Robotics and dynamic systems and controls

Mahmoud RedaTaha
Assistant Professor, Civil Engineering
Ph.D., Calgary, Canada
Interests: Structural health monitoring, application of artificial intelligence in structural engineering and biomechanics

Ronald Lumia
Professor, Mechanical Engineering
Ph.D., Virginia
Interests: Robotics, automation, image processing

Jack K. Molver
Professor, Physics & Astronomy; Sr. Associate VP for Research
Ph.D., Rochester
Interests: Laser physics and nonlinear optics, quantum optics, nonlinear science

Bernard M.E. Moret
Professor, Computer Science
Ph.D., Tennessee
Interests: Algorithm engineering, experimental algorithms

Timothy J. Ross
Professor, Civil Engineering
Ph.D., Stanford
Interests: Structural system reliability, structural dynamics, autonomous control, fuzzy logic, fuzzy set theory, risk assessment

ECE Research Professor Emeritus Arthur H. Guenther passed away on April 21, 2007. During his exceptionally distinguished career in two quite different fields—pulsed power and optics—Dr. Guenther retired from many of the major scientific institutions in New Mexico. However, he never retired from life, from his love of optics and pulsed power, and from bringing people together to create new synergies and opportunities. His legacy will continue to affect his beloved fields of research as well as all of us who were touched and inspired by his enthusiasm and creativity.

Dr. Guenther was known worldwide for his work in nuclear simulation, laser technologies, optics and pulsed power during a career that began with service in the USAF ROTC during his collegiate days. Graduating with his PhD from Penn State in 1957, he was assigned to Kirtland Air Force Base in Albuquerque.

After 16 years at the base, he transferred to civil service and took the lead in making lasers and optics a part of the AFWL (now the Air Force Research Laboratory) mission at Kirtland. He served as chief scientist there for 15 years, and later served as chief scientist for advanced defense technology at Los Alamos National Laboratory.

While at AFRL, Dr. Guenther was awarded the Distinguished Senior Executive Award by President Ronald Reagan. He was elected to the Russian Academy of Science for his work in improving communications between the Soviet Union and the United States.

He was also a longtime science advisor to both Republican and Democratic governors in our state, and he played a major role in creating the New Mexico Centers of Technical Excellence, including UNM’s Center for High Technology Materials, in the early 1980s. As a professor in the ECE Department, his office was located at CHTM.

Often referred to as Mr. Tech Transfer, Dr. Guenther was involved with Space New Mexico and the Spaceport, Explorer, New Mexico MESA (mathematics, engineering, science, achievement), and the Governor’s Science & Technology Advisory Council. Recognized as a pioneer in pulsed power technology, he was instrumental in the publication of many educational and reference texts in that area and received IEEE’s 1989 Peter Haas Award for “Outstanding Contributions to Pulsed Power Technology.” His particular interest was laser triggered spark gaps and gas discharge phenomena.

Art also made major contributions related to laser-induced damage in optical materials and pulsed power, leveraged by the students and post docs he mentored and his tireless efforts to disseminate scientific knowledge through international technical conferences.

He was also a worldwide ambassador for optics and played a major role in optics education in New Mexico, from the UNM Graduate Degree Program in Optical Science & Engineering to the West Mesa High School Photonics Academy.

Dr. Guenther donated his optics-related papers and books to UNM’s CHTM, and all of his remaining papers and books to his colleague, ECE Professor Edl Schamiloglu. In June 2007, the Optical Society of America and SPIE renamed their jointly sponsored congressional fellowship the Arthur H. Guenther Congressional Fellowship Program.

The IEEE Pulsed Power Science and Technology committee renamed its outstanding graduate student award after Dr. Guenther as well.

Staff Member Frank Mercer’s Excellent Work Recognized

ECE staff member Frank Mercer, Systems Analyst II, earned the School of Engineering’s Technical Staff Excellence Award for 2006-07.

Recognized

ECE Research Professor Emeritus Arthur H. Guenther passed away on April 21, 2007. During his exceptionally distinguished career in two quite different fields—pulsed power and optics—Dr. Guenther retired from many of the major scientific institutions in New Mexico. However, he never retired from life, from his love of optics and pulsed power, and from bringing people together to create new synergies and opportunities. His legacy will continue to affect his beloved fields of research as well as all of us who were touched and inspired by his enthusiasm and creativity.

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