department of

electrical &
computer
engineering

2001 annual report

the university of new mexico
Welcome to the Electrical and Computer Engineering Department (EECE) at the University of New Mexico! This annual report provides a summary of the administrative, teaching, research, and service activities of the Department during the last year.

Our School of Engineering was ranked again among the top 50 engineering schools in the nation by US News & World Report, and ranked 16th by the Institute for Scientific Information (ISI) out of the top 100 federally funded institutions with regard to the impact of research papers for the period 1996–2000.

We had a very successful year for faculty recruiting. The four new faculty hired in 2001 have markedly strengthened the Department’s program in optical communications, photonics, and microelectronics.

On Aug. 17, 2001 the faculty gathered for a retreat at the Hyatt Regency Tamaya in Bernalillo. The agenda included discussions on preparing for ABET, the EECE Outcomes Assessment Plan, the EECE Strategic Plan, and establishing strategic objectives for the 2001–2002 academic year.

In the area of laboratory development we made several improvements to both our teaching and research facilities. The EECE 238 laboratory course went through a major overhaul, as part of a larger ongoing effort to modernize the VHDL course, new equipment with VHDL programmable logic capability was installed in the laboratory. The High Performance Computing Laboratory was remodeled and expanded, and a new Pulsed Power, Beams and Microwaves Laboratory was constructed. The PURSUE (Preparation for University Research of Students in Undergraduate Education) Program completed the first of three upgrades in the introductory electronics laboratory. The newly purchased equipment, combined with LabView software and P-SPICE, provides students with hands-on experience and practical training required for industry jobs. Also, the first phase of UNM’s new semiconductor clean room in the Manufacturing Training and Technology Center (MTTC) is now fully operational and being used by our students.

Our Graduate Program continues to grow, increasing its applicant pool and its national prominence. Over 800 students applied to the EECE Graduate Program; only 90 (11%) were accepted. Our graduate student seminar series, established in January 1999, was highly successful again this year, attracting several distinguished scholars from all over the world.

Several faculty and students received international and national awards. Prof. Edl Schamiloglu and I were elected Fellows of the IEEE and Prof. Marek Osinski became an SPIE Fellow. Prof. David Bader received an NSF CAREER Award and Prof. Edl Schamiloglu was awarded a $5 million MURI grant. Prof. Peter Dorato was named director of a new NASA center, the Center for Intelligent Systems Engineering (ISE), which is funded at $1,200,000 per year.

The EECE monthly newsletter, Wired, continued to be published throughout the year. Back issues can be found on our Web site, which was given a face lift in August of 2001. The scholarly works of the faculty during the current fiscal year were significant in all facets, including journal publications, conference papers, book chapters, and authored books. Research funding this year reached a total of $13,310,152.

Finally, two of our faculty have started new high-tech companies, Zia Lasers and Elisar Software. Both companies played a pivotal role in helping the Department achieve its objective of impacting Albuquerque’s local economy in a positive way. Several of their employees are former UNM students. A couple of other start-ups are currently in the works as well.

Thank you for taking the time to learn about our department. For more information, please visit our Web site at www.eece.unm.edu.

Best regards,

Christos Christodoulou
contents

welcome! a letter from the chair .......................................................... 2

department information ........................................................................ 4

faculty .................................................................................................. 6

new faculty ............................................................................................ 8

joint appointees .................................................................................... 8

research faculty ..................................................................................... 9

undergraduate program ......................................................................... 10

graduate program ................................................................................ 12

computer engineering .......................................................................... 14

advisory council .................................................................................. 17

ace: center for autonomous control engineering .................................. 18

ise: center for intelligent systems engineering .................................... 18

pursue: preparation for university research of students in undergraduate education ................................................................. 19

chtm: center for high technology materials ......................................... 20

istec: ibero american science & technology education consortium ...... 21

eece in the news .................................................................................. 22
teaching laboratories
Electronics
Digital Logic
Microprocessors
Computer Design
Microwave/Antennas
Software Engineering
Wireless Communications
Advanced Microprocessors
High-Performance Computing
Networked Multimedia and Parallel Computing

research laboratories
Visualization
NASA ACE Center
Optical Spectroscopy
CHTM Clean Rooms
Crystal Growth Facility
PURSUE Research Program
High-Performance Computing
Antenna & Computational EM
Pulsed Power, Beams and Microwaves
Networked Multimedia and Parallel Computing
Robotics, Artificial Intelligence & Vision (RAIV)
image and video Processing and Communications (ivPCL)
High Performance Algorithms & Applications Research Group (HPAA)

degrees awarded
BS Electrical Engineering ________________ 40
BS Computer Engineering ________________ 8
MS_________________________________ 29
PhD ________________________________ 10

scholarly activities
Refereed journal papers ________________ 63
Book chapters _________________________ 9
Books________________________________ 10
Conference papers ________________ 107
Patents ______________________________ 4

sponsored research
Total research funding __________ $13,310,152

corporate & private donations
Total donations ____________________ $710,896
faculty awards

**eece outstanding teacher**
Dr. Charles Fleddermann

**eece outstanding researcher**
Dr. Marek Osinski

**gardner-zemke research professorship**
Dr. Edl Schamiloglu

**gardner-zemke teaching professorship**
Dr. Peter Dorato

**lawton-ellis award**
Dr. Gregory Heileman

**unm regents lecturer**
Dr. David Bader

**school of engineering senior research excellence award**
Dr. Edl Schamiloglu

**membership in the russian academy of science**
Dr. Mo Jamshidi

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**graduate seminar series**
Over 25 presentations by international lecturers from various universities and industries around the world.
CHAOUKI T. ABDALLAH  
Professor, Associate Chair,  
Director, Graduate Program  
PhD, Georgia Institute of Technology  
**Interests:** Control systems and wireless communications, theory of computation.

PETER DORATO  
Gardner-Zemke Professor,  
Director, Center for Intelligent Systems Engineering (ISE)  
DEE, Polytechnic Institute of Brooklyn  
**Interests:** Optimal control, robust design in feedback control systems.

MAJEED M. HAYAT  
Associate Professor  
PhD, University of Wisconsin at Madison  
**Interests:** Optical communication, statistical communication theory, signal and image processing, communication networks, applied probability and stochastic processes.

MO JAMSHIDI  
Professor, Director, Center for Autonomous Control Engineering (ACE)  
PhD, University of Illinois at Urbana-Champaign  
**Interests:** Large-scale system theory and applications, computer-aided system design, energy and resource systems analysis, robotics.

BALU SANTHANAM  
Assistant Professor  
PhD, Georgia Institute of Technology  
**Interests:** Statistical signal processing, statistical communications, digital signal processing, time-frequency analysis, adaptive filtering, general signal processing.

Marios Pattichis  
Assistant Professor  
PhD, University of Texas at Austin  
**Interests:** Digital image and video processing and communication, medical imaging, digital signal processing.

L. Howard Pollard  
Assistant Professor  
PhD, University of Illinois at Urbana-Champaign  
**Interests:** Computer architecture, digital design, hardware description languages, embedded systems, microprocessors.

Wei Wennie Shu  
Associate Professor  
PhD, University of Illinois at Urbana-Champaign  
**Interests:** Operating systems and resource scheduling, system support for parallel computing, multimedia networking.

Christopher E. Smith  
Assistant Professor  
PhD, University of Minnesota  
**Interests:** Robotics, computer vision, medical image processing, intelligent transportation systems, virtual collaborative environments.

John Sobolewski  
Associate Professor, Associate Vice President of Computer and Information Research and Technology (CIRT)  
PhD, Washington State University at Pullman  
**Interests:** Data communications, networking, computer architecture, system information and design, medical application of computers.

Min-You Wu  
Associate Professor  
PhD, Santa Clara University  
**Interests:** Multimedia systems, multimedia networking, parallel programming systems, computer architecture.
physical electronics and photonics group
applied electromagnetics, microelectronics (fabrication), photonics

STEVEN R. J. BRUECK
Professor, Director, Center for High Technology Materials (CHTM)
PhD, Massachusetts Institute of Technology
Interests: Nanoscale lithography, nanoscience, nonlinear optics and lasers, laser spectroscopy and laser-material interactions.

CHRISTOS G. CHRISTODOULOU
Professor, Department Chair
PhD, North Carolina State University
Interests: Modeling of electromagnetic systems, phased array antennas, antennas for wireless communications, microwave systems, applications of neural networks in electromagnetics.

CHARLES B. FLEDDERMANN
Professor, Associate Dean, School of Engineering
PhD, University of Illinois at Urbana-Champaign
Interests: Plasma processing, physical electronics, photovoltaics.

CHARLES F. HAWKINS
Professor
PhD, University of Michigan
Interests: VLSI design and testability, IC failure analysis, IC reliability.

STEPHEN D. HERSEE
Professor
PhD, Brighton Polytechnic, England
Interests: Semiconductor materials, microelectronics and optoelectronic devices.

DIANA HUFFAKER
Associate Professor
PhD, University of Texas at Austin
Interests: Semiconductor lasers, group III-nitrides, quantum dots.

STANLEY HUMPHRIES, JR.
Professor
PhD, University of California at Berkeley
Interests: Numerical electromagnetism, accelerator technology, plasma physics.

RAVINDER K. JAIN
Professor
PhD, University of California at Berkeley
Interests: Quantum electronics, optoelectronics, electro-optics, experimental solid-state physics.

SANJAY KRISHNA
Assistant Professor
PhD, University of Michigan, Ann Arbor
Interests: Mid-infrared detectors using self-organized quantum dots, mid-infrared detectors using low bandgap antimonides, interband laser for high speed long haul communication using quantum wells and quantum dots as the active region.

LUKE F. LESTER
Associate Professor
PhD, Cornell University
Interests: High speed and high power semiconductor lasers, tunable lasers, III-V semiconductor devices, quantum dots.

KEVIN J. MALLOY
Professor, Associate Director, CHTM
PhD, Stanford University
Interests: Semiconductor physics, materials, and devices; waves in periodic media.

DONALD A. NEAMEN
Professor
PhD, University of New Mexico
Interests: Semiconductor materials and devices, electronics.

MAREK OSINSKI
Professor
PhD, Institute of Physics, Polish Academy of Sciences
Interests: Optoelectronic devices and materials, group-III nitrides, semiconductor lasers, computer simulation, VCSELs, high-power diode lasers, mid-IR devices, degradation mechanisms and reliability, photonic integrated circuits.

EDL SCHAMILOGLU
Gardner-Zemke Professor
PhD, Cornell University
Interests: Physics and technology of charged particle beam generation and propagation, high power microwave sources, plasma physics and diagnostics, electromagnetic wave propagation, and pulsed power.

THOMAS W. SIGMON
Professor
PhD, Stanford University
Interests: Semiconductor physics, device physics and process technology; pulsed laser processing of electronic materials, fabrication of polysilicon thin film devices on flexible plastic substrates and metals, development of spin polarized injection and transport in semiconductor materials.

J. SCOTT TYO
Assistant Professor
PhD, University of Pennsylvania
Interests: Time-domain electromagnetics, electromagnetic modeling, wideband radar, polarimetric and spectral remote sensing.
The EECE Department welcomed four new faculty members in 2001:

**Diana Huffaker** is a new associate professor and is affiliated with the Center for High Technology Materials (CHTM). She received her PhD from the University of Texas at Austin. From 1996 to 2000, Dr. Huffaker worked as a postdoctoral associate, then as a research scientist at the University of Texas. At CHTM, her research group is focused on crystal growth (MBE and MOCVD) of arsenide-nitrides and quantum dots, characterization of novel materials for optoelectronic devices, growth methods and characterization of quantum dots for single photon, single electron based devices.

**Sanjay Krishna** joins us as assistant professor, also affiliated with CHTM. He received his PhD in applied physics in May 2001 from the University of Michigan, Ann Arbor. The title of his thesis was “Study of Quantum Confined Energy Levels in Self-Organized In(Ga,Al)As/(Ga,Al)As Quantum Dots and Their Application to Mid-Infrared Sources and Detectors.” Dr. Krishna's present research interests include growth, fabrication, and characterization of self-organized quantum dots for interband lasers and intersubband detectors.

**Scott Tyo** is a new assistant professor. He served in the United States Air Force from 1994 to 2001, attaining the rank of captain. From 1999 to 2001, he was an assistant professor in the Electrical and Computer Engineering Department at the US Naval Postgraduate School in Monterey, Calif. His research interests are in applied electromagnetics, including microwave and optical remote sensing, polarimetric and spectral imagery, and UWB antenna design.

**Majeed Hayat** joins us as associate professor. He earned his PhD at the University of Wisconsin-Madison. Most recently he taught as an associate professor at the Electro-Optics Graduate Program and the Department of Electrical and Computer Engineering at the University of Dayton. Dr. Hayat's research interests include optical communication, statistical communication theory, signal and image processing, communication networks, and applied probability and stochastic processes.
# Research Faculty

- **Gregory P. Starr**  
  Professor, Mechanical Engineering  
  PhD, Stanford

- **Hy Dinh Tran**  
  Assistant Professor, Mechanical Engineering  
  PhD, Stanford

<table>
<thead>
<tr>
<th>Research Faculty</th>
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| **Theofilos Cacoullos**  
  Research Professor  
  PhD, Columbia |
| **John A. Gaudet**  
  Research Associate Professor  
  PhD, Air Force Tech |
| **Edward W. Taylor**  
  Research Scholar  
  MS, New Mexico |
| **Michael Chryssomallis**  
  Research Assistant Professor  
  PhD, Democritus University of Thrace (Greece) |
| **Arthur H. Guenther**  
  Research Professor  
  PhD, Penn State |
| **Nader Vadiee**  
  Research Associate Professor  
  PhD, New Mexico |
| **David F. Cox**  
  Research Professor  
  PhD, Utah State |
| **Naz Islam**  
  Research Professor  
  PhD, Rensselaer |
| **Harry T. Weaver**  
  Research Professor  
  PhD, Auburn |
| **Larry Ralph Dawson**  
  Research Professor  
  PhD, USC |
| **Naj Islam**  
  Research Professor  
  PhD, New Mexico |
| **James R. Luke**  
  Research Assistant Professor  
  PhD, New Mexico |
| **Omar Manasreh**  
  Research Professor  
  PhD, Arkansas |
| **Rodrick A.B. Devine**  
  Research Professor  
  PhD, Warwick (England) |
| **Stanley Z. Peplinsky**  
  Research Professor  
  MS, Tennessee Space Institute |
| **Gregory W. Donohoe**  
  Research Assistant Professor  
  PhD, New Mexico |
| **Elizabeth Ann Ritchie-Tyo**  
  Research Assistant Professor  
  PhD, Monash (Australia) |
| **Roderick A.B. Devine**  
  Research Professor  
  PhD, Warwick (England) |
| **Omar Manasreh**  
  Research Professor  
  PhD, Arkansas |
| **Jody W. Gambles**  
  Research Professor  
  PhD, Idaho |
| **Thomas M. Shay**  
  Research Professor  
  PhD, Colorado State |
| **Sterling R. Whitaker**  
  Research Professor  
  PhD, Idaho |
| **Edward W. Taylor**  
  Research Scholar  
  MS, New Mexico |
| **Petr G. Eliseev**  
  Research Professor  
  DrSc, Russian Academy of Sciences |
| **Walter M. Shedd**  
  Research Professor  
  PhD, Northeastern |
| **Quan Shi**  
  Research Assistant Professor  
  PhD, New Mexico |
The Electrical and Computer Engineering (EECE) Department continues to be recognized locally, nationally, and internationally for the quality of its Undergraduate Program.

Alliances have been forged with local and multinational industries and the national laboratories to provide projects and mentoring opportunities for students working on senior design projects. An engineer from these organizations acts as a mentor to the students, helping them formulate, develop, and test their designs. The local companies benefit by having a team of engineers help them solve a problem, and the students benefit by being exposed to real-life engineering problems. Interacting with multinational industries introduces the concept of internationalization, preparing the students for the global economy. We intend to develop entrepreneurs, not just excellent professionals. Industry response to this program has been overwhelming, and the EECE Department has received more requests for student projects than it has student teams.

An asset of the Department is the ethnic and gender diversity of the student population, and we intend to develop this potential even more. We have also been aggressive in establishing undergraduate exchange programs with several countries in Ibero-America such as Spain, Brazil, Mexico, Venezuela, Colombia, and Chile.

National recognition for the EECE Department is also demonstrated by the diverse group of recruiters who come to campus each year vying to hire our graduates. In the past year Hewlett-Packard, Agilent Technologies, IBM, Ford, Intel, Honeywell, and others have sponsored recruiting fairs and have conducted interviews with EECE students. Feedback from these recruiters indicates that our graduates make first-rate engineers who are able to make significant contributions to these companies. As a result EECE graduates continue to find high-paying jobs and are accepted into graduate schools nationwide. We continue to attract top quality students, including recipients of National Merit Awards and University Regents Scholarships. We continue to be the top-ranked EECE Department in the state of New Mexico and the only accredited Computer Engineering Program.

The Department and its industry partners have invested in upgrading several laboratory facilities. We have key partnerships with Motorola, Texas Instruments, Xilinx, Intel, Sun Microsystems, Microsoft, and Hewlett-Packard. In addition, with the assistance of the PURSUE Program, the electronics laboratories have been enhanced with e-learning tools.

EECE is committed to making its Undergraduate Program as “user-friendly” as possible and a fun experience. We are constantly responding to student feedback by developing our advisement programs, administrative services, laboratory facilities, and courses being offered. In addition, as part of an ongoing Outcomes Assessment program, a survey is sent to EECE alumni, seeking their thoughts on the quality of the education they received at UNM. The results from this survey will help fine-tune the undergraduate program, allowing the Department to graduate the highest quality engineers possible.

For more information please visit the Undergraduate Program portion of the EECE Web site at http://www.eece.unm.edu/under/under.htm, or contact Dr. Ramiro Jordan, director of the Undergraduate Program, at 505.277.2630 or rjordan@eece.unm.edu.
IEEE Awards EECE Undergraduates

Three EECE undergraduate students were awarded by the Albuquerque IEEE for outstanding papers. “Fuzzy control,” authored by Rebecca Lopez and Tiffany Silva, received first place. Second place went to Matthew Totin for his paper “Photodetection.” The three students competed in the regional IEEE competition in Phoenix. They performed their research within the PURSUE Program (see page 19).

An example of a senior project, by Grant Martin and Andrea Contreras, in conjunction with Boeing SVS, Inc.
The Department of Electrical and Computer Engineering Graduate Program continues to grow in size and national prominence at an ever-increasing pace. The ranking of the School of Engineering at the University of New Mexico (UNM), heavily weighted by the EECE Department’s statistics, has ranked in the top 50 for four years in a row in the U.S. News & World Report “Best Graduate Schools: Top Engineering Schools” annual survey. In the April 2, 2001 listing, UNM was listed as number 48. Based on fall 2001 statistics, the only regional universities ranking higher than UNM in engineering were the University of Texas-Austin, Texas A&M, Rice University, the University of Colorado-Boulder, and the University of Arizona. UNM tied with Arizona State University and the University of Delaware, and ranked higher than every other university in Utah, Colorado, Arizona, Texas, and New Mexico; it was the only university ranked in the top 50 in the state of New Mexico.

The year 2001 was a busy one for curriculum development in EECE. The Graduate Program revamped its curriculum and introduced many new courses that are now listed in the new UNM Catalog covering the period 2001–2003. New graduate courses include laboratory courses in the fields of Applied Electromagnetics (Microwave Engineering, Pulsed Power and Plasma Science, Computational Electromagnetics, and Antenna Theory); the microelectronics fabrication course entitled Device-Level Semiconductor Simulation TCAD Tools; courses in Computer Engineering entitled Embedded Systems and Multimedia Systems; and the Controls Systems Laboratory course, designed to provide hands-on experience at the upper division undergraduate level.

The number of applicants to the EECE Graduate Program continues to grow. We have screened more than 800 students for the academic year 2001–2002. Due to the limited slots available, the EECE faculty have admitted around 90 graduate students. This reflects the rising selectivity of our program. Due to the growth in the Computer Engineering program, and to better reflect the various activities of its faculty, Computer Engineering is now organized into four large tracks: high-performance computing, computer networks and systems, image processing, and computational intelligence. Computer Engineering, followed by Signal processing and Communications remain the two most sought-after specializations in our graduate program. Our current enrollment of 215 graduate students is almost double what it was four years ago, and 95 of our current students are PhD candidates. This translates to an average of three PhD students per faculty, on par with top research universities. The average GRE scores and the GPA of new graduate students entering the Program were higher than they have been in the past 5 years.

The PhD qualifying exam has also been revised to better measure applicants’ potential to conduct advanced research. While it continues to be offered twice a year, it now covers graduate courses only, including a major and a minor area of study. During the last academic year, 20 students took the exam. Moreover, the PhD qualifying exam has replaced the Masters oral exam.

The EECE graduate office continues to automate its operations and expects to have all of its databases electronically available (using a Web browser) to personnel with the appropriate access codes and credentials.

Graduate Assistantships continue to be a priority. Each semester the Department funds over 25 Teaching Assistantships to support professors teaching undergraduate and graduate courses. Sponsored research obtained by EECE faculty, including those affiliated with the Centers, has provided funding for over 100 Research Assistantships. Furthermore, in addition to the tuition waiver that accompanies each Assistantship, the Department now provides health care coverage for graduate students.

The EECE Department continues to work on introducing a new professional degree program, the Master of Engineering in Electrical and Computer Engineering. The department is also pursuing potential graduate study programs with various universities in Spain, Italy, Brazil, and Venezuela.

For more information please visit the Graduate Program portion of the EECE Web site at http://www.eece.unm.edu/graduate/graduate.htm, or contact Dr. Chaouki Abdallah, director of the Graduate Program, at 505.277.0298 or chaouki@eece.unm.edu.
A graduate student at the Center for High Technology Materials (CHTM)
The Computer Engineering group (CompE) supports an ABET-accredited Bachelor of Science degree, along with MS and PhD graduate degrees. The group maintains a number of nationally recognized teaching and research laboratories in the areas of high-performance and parallel computing, multimedia and advanced networking, telecommunications, robotics, embedded systems, software engineering, neural networks, virtual reality, biomedical computation, and digital image and video processing.

The Networked Multimedia Laboratory performs research in the area of parallel and distributed computing for distributing digital media content over networks to users. The current projects in the laboratory include multimedia servers, stored content delivery, cache networks, delivery of live and near-live media, and proxy placement. In 2001, three students who work in the laboratory graduated with MS degrees, four students passed the PhD qualifying exam, and one student passed the comprehensive exam. Five papers were presented in conferences, and four papers were published in journals.

The Robotics, Artificial Intelligence, and Vision (RAIV) Laboratory has been funded over the past year by Sandia National Laboratories, Medview, Inc., and Real Time Innovations. Currently, the laboratory’s work is focused on two areas. The first is developing techniques for reducing operator fatigue and increasing manipulation/navigation accuracy by using visual servoing to automatically execute operator assigned tasks such as grasping, tracking, and aiming. The second is designing a proof-of-concept simulator that allows one to demonstrate the advantages of using virtual or augmented reality environments during laparoscopic or endoscopic surgical procedures. In phase two (expected to start during 2002), the laboratory plans to develop the target system that will provide both virtual reality and augmentative reality environments, allowing surgeons to train students, to practice complex procedures, and to utilize enhanced reality during endoscopic surgery. These virtual environments will be built using data from a real-time vision system that will process images from an endoscopic camera and combine this with camera position information supplied by magnetic field-based sensors. The goal is a system that can build and update virtual views of the surgical field during an operation, allowing surgeons an unprecedented ability to observe and visualize their patients’ bodies from the inside out.

The Homunculus Project takes an integrated approach to developing the theory, design, simulation, and comprehension of biologically motivated artificial life forms such as intelligent robots. The project is by necessity interdisciplinary, multifaceted, and very long term in scope. The project has four main components: 1) neural networks, 2) advanced human computer interfaces (virtual reality), 3) high-performance computing, and 4) robotics. The Homunculus Research Laboratory is the home of a network-interfaced robot habitat that supports research in the theory and implementation of biologically motivated autonomous robot systems. The laboratory contains computer workstations for robot software development and neural network visualization, as well as a small electronics and mechanical shop.

The Visualization Laboratory houses an SGI Onyx 2 machine, a four processor SGI Onyx 1.5, an SGI Octane, four SGI O2s, a four node graphics Linux cluster, and Linux workstations. The laboratory houses a totally immersing virtual reality station that uses head mounted displays, head and hand tracking, 3-D sound synthesis and localization, and custom interface tools to create the immersed virtual experiences. In addition, the laboratory has a built-in 6 by 8 foot rear projection display system that supports 3-D viewing, accompanied by a professional sound system.

Our Software Engineering Laboratory is used for the senior computer engineering capstone design course. Projects in this course often lead to research contracts and have external funding.
The High-Performance Computing Laboratory advances our understanding of the main factors required for designing practical parallel algorithms, and develops techniques and data sets for experimentally validating results. This year, the laboratory received support from National Science Foundation grants (one CAREER, three ITR, two DEB) to investigate high-performance algorithms for scientific applications, including the study of computational biology for modeling landscape ecology, reconstructing complex evolutionary histories, computing optimal phylogenetic trees under genome rearrangement metrics, and integrating computational methods, molecular evolution, and phylogeny in comparative chloroplast genomics. In 2001, the laboratory supported one postdoctoral, 16 graduate, and two undergraduate students. To meet the growing interest in this advanced computing area, the laboratory renovated an adjacent room and doubled in size. This laboratory now holds more than a dozen Sun workstations, including eight brand-new Sun Blade 100 workstations (purchased with internal grants from Sun Microsystems), HP laser printers, and a world-class research library in parallel computation. The laboratory supports undergraduate (NSF Research Experience for Undergraduates) and graduate research assistants and is funded by several National Science Foundation sponsored research projects in the area of high-performance algorithms for scientific applications and computational biology and genomics. Our laboratory develops its research on our 14-processor, 14 GB, Sun E4500 shared-memory machine. We received over $100,000 in equipment donations from Sun Microsystems and Myricom for a research project in high-performance SMP cluster computing with Myrinet-based Sun HPC clusters. In 2001, the laboratory disseminated its research in peer-reviewed publications (five journal and 14 conference papers).

The image and video Processing and Communications Laboratory (ivPCL) performs research in fundamental image processing algorithms, Computer Aided Diagnosis (CAD), wireless video communications, and 3-D reconstructions from ultrasound video. The laboratory research on fundamental image processing algorithms is focused on the development of the next generation of digital image processing algorithms that will be mapped to the modern SIMD architectures, Field Programmable Gate Array (FPGA) architectures, and parallel processing architectures. A member of this group, Paul Rodriguez, currently holds the record for having developed the world’s fastest Fast Fourier Transform (FFT) algorithm on a Pentium III/Pentium 4 PC. These efforts are currently supported by Xilinx Corporation and the Albuquerque High Performance Computing Center. The laboratory’s research on Computer Aided Diagnosis is focused on the development of a fully automated, computer-based, system that can segment (i.e., select) and classify chest radiographs of miners with Pneumoconiosis. Currently, the automated system can detect the lungs, parenchymal regions in the lung, and classify each region into normal/abnormal, with about 70% accuracy. The laboratory’s research on Computer Aided Diagnosis is supported by Kestrel Corporation through a subcontract from NIH. The laboratory’s research on 3-D reconstructions from cardiac ultrasound aims to produce 3-D reconstructions of the heart, and to assess cardiac function from ultrasound video images. The project has resulted in a real-time adaptive segmentation, an adaptive sampling system, and also some 3-D reconstructions of stationary objects. A novel, multidimensional Amplitude Modulation Frequency Modulation (AM-FM) is used for modeling the ultrasound video. This project is pursued through a collaborative effort with the UNM Children’s Hospital Heart Center.

The Computer Design Laboratory enables students to use up-to-date tools and instruments to implement complex designs combining data manipulations and algorithm control mechanisms. The stations in use allow for designs of up to 200,000 gates in FPGAs, along with expansion to additional hardware modules, such as extra memory, A/D and D/A converters, as well as other I/O capabilities. This functionality can be used for special purpose hardware (FFT, filtering, video processing, etc.) or system-on-a-chip development. UNM has access to the M.CORE architecture for teaching and research at both microprocessor-level activities, and activities that involve a chip-level description of the M.CORE processor combined with other I/O and computational units. The Divertinanza project in the laboratory implements a hand-held educational tool for use at the grade-school level. This system has an M68000 level processor, with built-in PWM, UART, LCD interface, 4 MByte Flash memory, 128K Static RAM, Infrared communication channel, joystick user interface, and battery power.

Many of our faculty’s research projects have attracted venture capital and have led to the establishment of high-continued next page
Tech companies in the areas of information security and digital rights management, image processing and geographic information systems, broadband networking, programmable logic, and medical imaging.

Recent highlights and accomplishments

Three National Science Foundation Information Technology Research (ITR) awards were given to Drs. David Bader and Bernard Moret (joint appointment, Computer Science) to investigate shared-memory parallel algorithms for problems in computational biology, reconstructing complex evolutionary histories, and computing optimal phylogenetic trees under genome rearrangement metrics.

One of our newest faculty, Dr. David Bader, was awarded the National Science Foundation Faculty Early Career Development (CAREER) Award.

A National Science Foundation Biocomplexity award was given to a team of collaborative national researchers to investigate integrating computational methods, molecular evolution, and phylogeny in comparative chloroplast genomics.

CompE received significant donations of state-of-the-art software from industrial partners Microsoft Corporation, Rational Software Corporation, and Elsia Software Corporation to support our new Software Engineering Laboratory and teaching facilities.

Xilinx Corporation has donated Spartan2 FPGA (200k gate) prototyping boards, a VirtexE FPGA (2 million gate) device mounted on a Celoxica PCI board, CPLD XC95 prototyping boards, Xilinx Foundation 3.3i software, SysGen, and Xtreme DSP. The new boards and software have been used to renovate the computer design undergraduate teaching laboratories.

CompE established a new Multimedia Laboratory with advanced high-performance parallel and distributed computing and networking technologies for distributing digital media content.

The High-Performance Computing Laboratory established collaborations with Sun Microsystems HPC Division and IBM Advanced Computing Technologies Center for early access during the design phase of next-generation high-performance computers.

CompE has received several million dollars of externally-funded interdisciplinary research projects from NSF, DARPA, DOE, NASA, and NIH in the areas of high-performance computing, visualization, next generation Internet, telemedicine, functional brain imaging, information security, distance education, and computer-aided diagnosis.

Faculty were published in numerous high-quality journal publications and gave many conference presentations. Our faculty hold several editorial positions in IEEE and ACM journals and organize a number of well-known conferences in robotics, medical imaging, neural networks, parallel and distributed computing, multimedia, and high-performance computing and networking.

In 2001, CompE continued community involvement in area high schools and minority programs, learning museums, the mentoring of middle and high school students, and the support of public television science programs.

For more information please visit the Computer Engineering portion of the EECE Web site at http://www.eece.unm.edu/ce/ce.htm or contact Dr. Wennie Shu, area chair of Computer Engineering, at 505.277.1433 or shu@eece.unm.edu.
Prof. Peter Dorato, EECE, has been named director of a new School of Engineering center, the Center for Intelligent Systems Engineering (ISE), with Codirector Professor Timothy Ross of the Department of Civil Engineering.

The center is funded by a five-year NASA Group 2 University Research Centers (URC) grant for support of minority student graduate studies related to NASA strategic enterprises. The funding level is $1,200,000 per year with yearly renewals. Prof. Dorato is the principal investigator the first year of the grant, NASA-Ames Grant No. NAG 2-1480, with a starting date of May 1, 2001.

The center focuses on the design of intelligent systems, that is, systems with a high degree of autonomy. Current areas of investigation include cooperative satellite arrays, cooperative robotics, diagnostics of turbulent flow, fuzzy-logic modeling, intelligent biomedical engineering, and intelligent image processing.

The NASA grant also supports research at three partner institutions: North Carolina A&T, New Mexico State University, and New Mexico Highlands University. NASA has been supporting research efforts here at the University of New Mexico since 1995 under the Center for Autonomous Control Engineering (ACE), directed by Prof. Mo Jamshidi (see above).
pursue
preparation for university research of students in undergraduate education

since its creation in Aug. 1998, PURSUE (NASA PAIR) Program has funded 130 research and education projects and has assisted 350 undergraduates, 85 graduate students, 50 faculty members, 20 high school science teachers, and 30 visiting high school students at UNM and its PURSUE partner institutions: Bernalillo High School, Southwestern Indian Polytechnic Institute (SIPI), Technical Vocational Institute (TVI), and the New Mexico Highlands University (NMHU).

The program enhances the quality of mathematics, science, engineering, and technology (MSET) education of undergraduate students, specifically those from minorities and underrepresented groups. The program fulfills its mission through the undergraduate research experience, support of cross-disciplinary research projects, mentoring, integration of research into the undergraduate curricula, course curriculum enhancement and development, and new faculty development.

Pursuing graduate students mentor undergraduate students. Mentoring and teamwork are the culture of the PURSUE Program. PURSUE’s vision is to make mentoring a graduate school requirement.

Included in the 130 projects are: the development of greenhouse environmental control, enhancement of the electronics laboratory, UNM Regener Hall Physics lecture demonstrations, integration of freshman lecture and laboratory in chemistry, computer visualization of physical chemistry, fluid mechanics studies for aerodynamic flow control, a search for extra-solar planets, laser refrigeration in solids, studies of strong forces, avian ecology of Chaco Canyon, a cooperative microsatellite array, seasonal geochemical response of a shallow alluvial aquifer, and distributed collaborative mobile robots projects.

Pursue has been a leader in education projects, enhancing and upgrading 17 introductory level undergraduate laboratories. The PURSUE Program-funded projects in the UNM EECE Department have involved 125 undergraduate and 21 graduate students. PURSUE Program has funded 42 research and education projects at EECE, with total funding amounting to more than $265,000.

One of the most recent laboratory enhancement projects at EECE is the enhancement and upgrade of the electronics laboratory. Drs. Nader Vadiee and Charles Fleddermann guided the operation along with an undergraduate senior student team consisting of Jeffrey Bach, Mark Dixon, Michael Elyea, and Matthew Totin, and former LabView team member Larry Eckhardt. The team

For more information please visit the PURSUE Program Web site at http://pursue.unm.edu or call Dr. Nader Vadiee, the program director, at 505.277.0327.
CHTM is a research and education center at the University of New Mexico, specializing in the hardware layer of information technology—opto- and microelectronics and nanoscience—and working with materials, fabrication, devices, and subsystems. Annual contract revenue for CHTM amounts to around $7.5 million: 80% federal, 20% industry. CHTM personnel include:

- 15 faculty from EECE, Physics, Chemical and Nuclear Engineering, and Mechanical Engineering
- 15 research faculty, staff, and postdoctoral associates
- 10 technical staff
- 8 administrative staff
- 63 graduate students
- 6 undergraduate students

Major developments for the year 2001 included the development of a spin-off company, Zia Lasers, which works in quantum dot lasers for telecommunications. CHTM also procured a major new contract with the Army Advanced Sensors CTA Program. Proposals during the past 18 months have totaled $63,112,677. CHTM is proud to have three MS (thesis) students and three PhD students who graduated in 2001.

news

- Research Prof. Arthur H. Guenther has been awarded the New Mexico Distinguished Public Service Award by Governor Gary Johnson.
- Prof. Stephen Hersee was presented with the “Outstanding Speaker” award at the Office of Naval Research (ONR) Workshop on Challenges in Porous and Amorphous Wide Gap Semiconductors, held June 10–14, 2001 in Newfoundland.
- On Jan. 18, 2001, Tom Wunsch, an EECE PhD student (Prof. Kenneth Jungling, advisor), received the “Algie Lance Best Paper Award” at the 2001 Measurement Science Conference.
- The CHTM research group led by Profs. Luke Lester and Kevin Malloy won the Photonics West 2001 Award. The $1,000 prize for best paper was awarded at this year’s Photonics West 2001 event in San Jose, Calif., sponsored by SPIE.

For more information please visit the CHTM Web site at http://www.chtm.unm.edu or call Dr. Steven Brueck, the program director, at 505.272.7800.
**ISTEC** began when the University of New Mexico visited several Latin American countries in the summer of 1990 to identify and evaluate opportunities for collaborative projects. The ISTEC consortium that formed as a result of the visit now includes more than 90 academic institutions in more than 20 countries in North, Central, and South America and Europe. The objectives of the Consortium are to conceive, plan, and carry out activities of higher education, research and development, and technology transfer for the purpose of facilitating scientific and technical progress of Ibero-American countries. ISTEC participants encourage the free flow and access of information in the pursuit of technical excellence.

**Events**

In the year 2001, Motorola and ISTEC organized and sponsored a series of science and technology consciousness-raising events called “IT Challenges.” Among its goals were:

- to promote scientific knowledge and share opportunities;
- to influence the renewal of laws and policies relevant to technology and R&D (research and development) initiatives;
- to develop strategies to promote incentives for R&D, available through international organizations;
- to encourage the growth and retention of talent and professionals in the areas of R&D;
- to raise consciousness about the market potential in Latin America;
- and to heighten awareness of the opportunities and potential applications of software in the new digital-based economy of electronic transactions.

Participants included governmental agencies, R&D institutions, universities in the region, research centers, leading technology companies, and international organizations.

The 3rd IFAC Workshop on Time Delay Systems (TDS 2001) was held Dec. 8–10, 2001 in Santa Fe, N.M. The event was sponsored by the International Federation of Automatic Control with the support of the EECE Department, University of New Mexico. This third workshop followed the first two workshops on Linear Time-Delay Sys-

tems held in July 1998 (Grenoble, France) and in September 2000 (Ancona, Italy), and included further applications to communication networks, bioengineering, and economics.

From Sept. 5–7, 2001 the IEEE Conference on Control Applications & International Symposium on Intelligent Control (CCA/ISIC 2001) was held in Mexico City. This meeting highlighted the multidisciplinary areas of control systems applications as well as intelligent control. The general theme of the conference was: Eclectic Applications and Intelligent Control in the New Millennium.

**Research Study on Libraries and Databases**

As part of continued collective negotiations, the Consortium has established the Liblink Initiative as one of its first priorities, according with its belief that timely information is fundamental to the education of our students. UNESCO commissioned ISTEC to undertake a study regarding their database and information needs. The results of this study serve as a vital tool in our progress, providing access to information regarding the number, type, and availability of scientific databases to which our students have access, and how much of their universities’ budgets are dedicated to databases, among other information. The resulting publication is currently available from the Executive Office.

**Special Discount Program**

The ISTEC Executive Office created the Special Discount Program (SDP) to provide a liaison between its industrial and institutional members. The main objective of this service is to continue establishing state-of-the-art laboratories with reduced costs for ISTEC member institutions. Some of the industrial members participating in this effort are: Metrowerks, Sun Microsystems, Khoral Research, Inc., Mentor Graphics, and Microsoft/Nortel Networks.

For more information please visit the ISTEC Web site at [http://www.istec.unm.edu](http://www.istec.unm.edu) or call Dr. Ramiro Jordan, the program director, at 505.277.2412 or rjordan@eece.unm.edu.
EECE Alum Helps Design a *Time Magazine* Invention of the Year

An EECE alumnus, Dr. Ray Byrne, is on the design team for a tiny robot that was honored in *Time Magazine* as one of its Inventions of the Year for 2001. Dr. Byrne, who received his PhD from EECE, works at Sandia National Laboratories.


EECE Joins GWEC

The EECE Department has been accepted as a member of the “Global Wireless Education Consortium” formed by Lucent, Ericsson, Motorola, Vodafone, Verizon, AT&T Wireless, Nortel Networks, Nokia, Telcordia Technologies (formerly Bellcore), Raytheon, and Agilent Technologies to increase the quality and quantity of students in the wireless and Information Technology field.

UNM Ranked 5th as High-Impact US University in Materials Science

*From a UNM Public Affairs News Release*

The University of New Mexico is ranked 5th out of the top 100 federally funded institutions in regard to the impact of materials science papers over the years 1996–2000 by the Institute for Scientific Information (ISI). The list is published in ISI’s Science Citation Index which measures the number of times a paper is cited by other researchers.

Abhaya K. Datye, director of UNM’s Center for Micro-Engineering Materials (CMEM), said the ranking shows that UNM truly has a broad-based materials science effort, since it includes all papers from UNM and their citation frequency.

Datye said this ranking shows that research at UNM has the breadth and the quality that bring it within the top five nationwide.

The University of Southern California is ranked 1st with 170 papers and 8.50 citations per 1996–2000; Harvard University is ranked 2nd with 177 papers, 8.18 citations; 3rd is University of California, 405 papers, 7.60 citations; 4th is Princeton University, 166 papers, 5.57 citations. UNM, ranked 5th, with 131 papers and 5.18 citations.

“This recognition is very significant since UNM’s overall research funding in this area is minuscule in comparison with the powerhouses we are being compared with,” Datye said. “We hope this recognition will help us attract students to our programs and to attract additional research funding.”

To read the complete article, go to [http://www.unm.edu/news/Releases/Oct30isi.htm](http://www.unm.edu/news/Releases/Oct30isi.htm).

EECE Receives Donations from Elizar Software Corporation

The Elizar Software Corporation presented EECE with a check for $10,000 on August 28, 2001. Combined with a gift given in April, Elizar’s contributions for the calendar year total $17,000. In a letter to Department Chair Christos Christodoulou, Robert W. Pratt, CFO praised the quality of EECE graduates, and stated it was Elizar’s hope that their donation would further develop the excellent software engineering curriculum. EECE thanks Elizar for its generous contributions.

EECE Profs. Elected Fellows of IEEE

The EECE Department is pleased to announce that two of its faculty, Prof. Edl Schamiloglu and Prof. and Department Chair Christos Christodoulou, have been elected Fellows of the IEEE (Institute of Electrical and Electronics Engineers, pronounced “I triple E”). Schamiloglu was recognized “for his contributions in the area of generation and propagation of intense pulsed charged particle beams.” Christodoulou was recognized “for his contributions in the area of application of neural networks in adaptive antenna arrays.”

The preeminent professional society in electrical and computer engineering, the IEEE has more than 365,000 individual members, both professionals and students. Their Web site states, “[T]he IEEE Grade of Fellow is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. A brief citation is issued to new Fellows describing their accomplishments and the total number selected in any one year does not exceed one-tenth percent of the total voting Institute membership.”
Fleddermann Appointed
School of Engineering
Associate Dean for
Academic Affairs
From a UNM Public Affairs News Release

Charles B. Fleddermann has been appointed as the University of New Mexico School of Engineering (SOE) associate dean for academic affairs, effective spring 2002 semester, announced SOE Dean Joe Cecchi.

Fleddermann is professor of Electrical and Computer Engineering (EECE).

“Professor Fleddermann has an outstanding record in teaching and research at UNM,” said Cecchi. “He also has served the university extensively at all levels, has been active in professional societies, and has established significant collaborations with external partners. With this range of engagements and experiences, Professor Fleddermann brings to the associate dean position an important faculty perspective and an appreciation of both the challenges and opportunities that lie ahead for the School and the University.”

Fleddermann said his main priority in this new position is to prepare SOE for its next accreditation visit.

“I also plan to improve the visibility of SOE academic programs, and help improve access to our programs for our local customers,” he said.

Fleddermann joined UNM 16 years ago after receiving his PhD in electrical engineering from the University of Illinois at Urbana-Champaign (UIUC). Professor Fleddermann also received an MS in electrical engineering from UIUC, and a BS in electrical engineering from the University of Notre Dame.

To read the complete article, go to http://www.unm.edu/news/Releases/Nov28fleddermann.htm.