Welcome to the Electrical and Computer Engineering Department (ECE) at the University of New Mexico! This annual report provides a summary of the teaching, research, and service achievements of the ECE Department during the 2002-03 Academic Year.

Three new faculty joined our ranks this year: Dr. Andres C. Salazar (Ph.D. Michigan State), was selected to fill the PNM Endowed Chair in Microsystems, Commercialization and Technology, a joint appointment with the Anderson Schools of Management; Dr. Manuel Hermenegildo (Ph.D. University of Texas-Austin) of the Universidad Politécnica de Madrid was selected to fill the Prince of Asturias Endowed Chair in Information Science and Technology, a joint appointment with the Computer Science Department; and Dr. Mark Gilmore (Ph.D. UCLA) joined the applied electromagnetics group with expertise in the area of plasma physics, plasma diagnostics and microwave engineering. We have continued to develop our laboratories and have made several improvements to both our teaching and research facilities. We now have a Coordinated Systems and Control Laboratory, a multidisciplinary facility which provides hands-on experience to students in control courses offered by the Electrical, Mechanical, and Chemical Engineering Departments in the School of Engineering.

The ECE graduate program continues to grow and mature. Each year our selectivity increases. Our acceptance ratio currently ranges from 15-20% per year. We have about 260 full time graduate students, of which 121 are Ph.D. students. The Commission on Higher Education approved a new Master of Science in Optical Science and Engineering degree program, which is offered jointly by the departments of ECE and Physics and Astronomy. Also, we now offer an Engineering-MBA Program in collaboration with the Anderson Schools of Management.

The scholarly works of our faculty have increased in every area, including journal publications, conference papers, book chapters, and authored books. The ECE faculty continued to receive national and international awards. Professor Edl Schamiolouglu’s program on high power microwaves and pulsed power was reviewed on local television and in The New York Times and The Washington Post. Research funding this year surpassed the $10 Million mark.

Thank you for taking the time to learn about the ECE Department. For more information, please visit our website at: www.ece.unm.edu

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NEW FACULTY

Andres C. Salazar

Andres C. Salazar, New Mexico native and UNM graduate with a Ph.D. in electrical engineering from Michigan State University, was selected PNM Chair in Microsystems, Commercialization and Technology. He filled this position beginning Fall 2002.

The PNM Chair, with the title of professor, is a joint appointment between the School of Engineering and the Anderson Schools of Management, and is funded by the PNM Foundation to help provide world-class instruction in the commercialization of, and advanced training in, microsystems technology.

"This chair is a nice fit with the PNM Foundation," said Barbara Barsky, past-president of the PNM Foundation and a member of the search committee, "because the Foundation is focused on improving educational opportunities in the state. One way to accomplish this goal is to support outstanding faculty who will challenge students to achieve greatness."

Salazar’s experience is a mix of engineering, research and business development, and leadership. In addition to his doctorate, he also has a M.B.A. from Edinburgh Business School at Heriot-Watt University in Scotland and a master’s degree in electrical engineering from UNM. His undergraduate degrees from UNM are in math and electrical engineering. Besides teaching courses in both the engineering and business areas, Salazar will be involved in helping to grow the microsystems industry base in New Mexico.

Manuel Hermenegildo

Professor Manuel Hermenegildo of the Universidad Politecnica de Madrid has been selected to fill the Prince of Asturias Endowed Chair in Information Science and Technology at the University of New Mexico.

UNM and Spain hope to strengthen institutional links and scientific collaboration between the United States and Spain through the Prince of Asturias Endowed Chair, to the benefit of both countries. Hermenegildo will begin his duties at UNM in Fall 2003 in the Departments of Computer Science and Electrical and Computer Engineering.

Mark Gilmore

Mark Gilmore joined the Applied Electromagnetic’s group as an Assistant Professor in January 2003. He received his B.S. in electrical engineering from Boston University in 1986 and worked as an electrical engineer in Delphax Systems of Canton, MA for the next four years, where he conducted applied research relating to ion deposition printing processes.

Gilmore left industry in 1990 to pursue a M.S. degree at Northeastern University in Boston. In 1999, Gilmore obtained his Ph.D. in electrical engineering at UCLA and remained at UCLA as a research staff member.

Gilmore will continue his research on reflectometry-based plasma diagnostics at UNM, taking this diagnostic to National Fusion facilities such as the National Spherical Torus Experiment at Princeton and the DIII-D Tokamak at General Atomics in San Diego. He has also established collaborative research projects with faculty at UNM, and scientists at the national laboratories in New Mexico.
DEPARTMENT INFORMATION

RESEARCH LABORATORIES

CORPORATE & PRIVATE DONATIONS
Total donations............................$430,476

SPONSORED RESEARCH
Total research funding.............$10,158,460

TEACHING LABORATORIES

DEGREES AWARDED
BS Electrical Engineering..............47
BS Computer Engineering..............22
MS.............................................60
PhD............................................12

SCHOLARLY ACTIVITIES
Refereed journal papers..............71
Book chapters...........................6
Books.........................................5
Conference papers....................125
Patents.......................................4
FACULTY AWARDS

Chaouki T. Abdallah
Charles B. Fleddermann
Gardner-Zemke Award

David A. Bader
Speaker, Distinguished Visitors Program
IEEE Computer Society

Majeed M. Hayat
Lawton-Ellis Award

Stephen D. Hersee
UNM Outstanding Teacher of the Year Award

Arthur H. Guenther
David Richardson Medal
Optical Society of America

Diana L. Huffaker
Compound Semiconductor Symposium’s
Young Scientist Award

Sanjay Krishna
Powe Junior Faculty Enhancement Award
Oak Ridge Associated Universities

Edl Schamiloğlu
Good Will “Ambassador Award”
City of Albuquerque

J. Scott Tyo
NSF Career Award

Wei Wennie Shu
ECE Outstanding Teacher Award

J. Scott Tyo
ECE Outstanding Researcher Award
UNDERGRADUATE PROGRAM

The Electrical and Computer Engineering Department (ECE) continues to be recognized locally, nationally, and internationally for the quality of its undergraduate programs. 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. Engineers from these organizations act as mentors to ECE students, helping them formulate, develop, and test their designs. We have also pursued establishing undergraduate exchange programs with several countries in Ibero-America, such as Spain, Argentina, Brazil, Mexico, Venezuela, Colombia, and Chile.

National recognition of the ECE Department can be inferred by the diverse group of recruiters who come to campus each year to hire our graduates. During the past year Hewlett-Packard, Agilent Technologies, IBM, Ford, Intel, Honeywell, Xilinx, and others have sponsored recruiting fairs and conducted interviews with ECE students. The Department continues to attract top students who qualify for the National Merit Award and the University Regents Scholarship. UNM’s School of Engineering continues to be the flagship engineering program in the State of New Mexico and the ECE Department has the only accredited Computer Engineering program in the state. One of the undergraduate program’s assets is the ethnic and gender diversity of the ECE student population.

The Department is fortunate to have many scholarship opportunities for its students. Over the past five years, five different donors have stepped forward to establish scholarship endowments for electrical engineering students who have earned a 3.00 GPA. The scholarships range from $2,000-10,000 per academic year.
UNDERGRADUATE PROGRAM

ECE is also fortunate to have a strong relationship with Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL). Several engineers working at these sites have offered ECE students engineering internships each semester to qualifying undergraduates. Also, several engineers and scientists from the federal laboratories have served as adjunct faculty, offering ECE students a perspective of real-life working experiences in the field of engineering. To fulfill one of ECE's strategic goals our faculty involve undergraduate students in research, so that they gather experience interacting directly with graduate students and faculty on research projects.

With the assistance of some willing and capable students, the Eta Kappa Nu Honorary Society has developed a tutoring program that provides a student tutor for each of the ECE engineering core courses. This program has proven to be an extremely valuable resource for our students and has helped them do well in their classes. In the past tutoring had been available only in math, physics, and chemistry through other departments on campus.

The IEEE Honorary Society has also been more active this past year by hosting a number of social events that bring students, faculty, and staff together.

A new program has been developed in collaboration with the Anderson Schools of Management whereby students can embark on a five-year course of study to obtain a BS in Electrical or Computer Engineering and an MBA in Management. This program is specifically geared towards students who are interested in managing a company, starting their own company, doing project management or getting involved in entrepreneurial ventures, rather than devoting their careers to research in a laboratory setting or teaching.
FACULTY

Chaouki T. Abdallah
Gardner-Zemke Professor, Associate Chair; Director, ECE Graduate Program
PhD, Georgia Institute of Technology
Interests: Control systems and wireless communications.

David A. Bader
Associate Professor, Regents’ Lecturer
PhD, University of Maryland
Interests: High-performance computing, parallel computation, computational biology and genomics, remote sensing and image processing.

Steven R. J. Brueck
Professor and Director, Center for High Technology Materials (CHTM)
PhD, Mass. Institute of Technology
Interests: Laser-material interactions, electro-optic devices, laser spectroscopy.

Thomas P. Caudell
Associate Professor
PhD, University of Arizona
Interests: Neural networks, virtual reality, machine vision, robotics and genetic algorithms.

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

Peter Dorato
Gardner-Zemke Professor
DEE, Polytechnic Institute of Brooklyn
Interests: Optimal control, robust design in feedback control systems.

Charles B. Fleddermann
Gardner-Zemke Professor and Associate Dean of the School of Engineering
PhD, University of Illinois
Interests: Plasma processing, physical electronics, photovoltaics.

Mark A. Gilmore
Assistant Professor
PhD, University of California-Los Angeles
Interests: Plasma physics, plasma diagnostics, magnetic confinement fusion, microwave engineering.

Charles F. Hawkins
Professor
PhD, University of Michigan
Interests: VLSI design and testability, IC Failure Analysis, IC Reliability.

Majeed M. Hayat
Associate Professor
PhD, University of Wisconsin-Madison
Interests: Optical communication, statistical communication theory, signal and image processing, communication networks, applied probability and stochastic processes.
FACULTY

Gregory L. Heileman
Professor
PhD, University of Central Florida
Interests: Data structures and algorithmic analysis, theory of information and computing, machine learning and pattern recognition.

Manuel Hermenegildo
Prince of Asturias Endowed Chair in IST
PhD, University of Texas at Austin
Interests: Advanced Programming Environments, Programming Languages, Constraint and Logic Programming, Resource-Aware High-Performance and Distributed Computing, Compilers.

Stephen D. Hersee
Professor
PhD, Brighton Polytechnic (England)
Interests: Semiconductor materials, microelectronics and optoelectronics devices.

Diana L. Huffaker
Associate Professor
PhD, University of Texas-Austin
Interests: Semiconductor lasers, group III-nitrides, quantum dots.

Ravi Jain
Professor
PhD, University of California-Berkeley
Interests: Quantum electronics, optoelectronics, electro-optics, experimental solid-state physics.

Mo Jamshidi
Regents’ Professor and Director, Autonomous Control Engineering (ACE) Center
PhD, University of Illinois
Interests: Large-scale system theory and applications, autonomous control for robotic agents, biomedical modeling and simulation, space autonomy.

Ramiro Jordan
Associate Professor, Associate Chair; Director, ECE Undergraduate Program; Director, ISTEC
PhD, Kansas State University
Interests: Data communications, multidimensional signal processors and software engineering.

Sanjay Krishna
Assistant Professor
PhD, University of Michigan-Ann Arbor
Interests: Design, fabrication and characterization of mid-infrared detectors using self-organized quantum dots, studying mid-infrared detectors using low bandgap antimonides, investigating 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. High temperature electronics, microwave devices, tunable lasers, III-V semiconductor devices.

Kevin Malloy
Professor and Associate Director, CHTM
PhD, Stanford University
Interests: Semiconductor physics, device physics.

Marek Osinski
Professor
PhD, Polish Academy of Sciences (Poland)
Interests: Semiconductor lasers, optoelectronic devices and materials, group-III nitrides, degradation mechanisms and reliability, computer simulation.
FACULTY

Marios Pattichis
Assistant Professor
PhD, University of Texas-Austin

L. Howard Pollard
Assistant Professor
PhD, University of Illinois
Interests: Computer architecture, digital design, fault tolerance, microprocessors.

Andres C. Salazar
PNM Endowed Chair in MCT
PhD, Michigan State University
Interests: Commercialization of technology, microsystems and MEMS applications, business planning.

Balu Santhanam
Assistant Professor
PhD, Georgia Institute of Technology
Interests: Statistical signal processing, statistical communications, digital signal processing, time-frequency analysis, adaptive signal processing, and general signal processing.

Edl Schamiloglu
Gardner-Zemke Professor
PhD, Cornell University
Interests: Physics and technology of charged particle beam generation and propagation, high power microwave sources, pulsed power science and technologies, plasma physics and diagnostics, electromagnetics and wave propagation.

Wei Wennie Shu
Associate Professor
PhD, University of Illinois at Urbana-Champaign

Thomas Sigmon
Endowed Chair in Microelectronics & Optoelectronics
PhD, Stanford University
Interests: 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.

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

Scott Tyo
Assistant Professor
PhD, University of Pennsylvania
Interests: Time-domain electromagnetics, electromagnetic modeling, wideband radar, polarimetric and spectral remote sensing.

Min-You Wu
Associate Professor
PhD, Santa Clara University
Interests: Parallel Programming Systems, Multimedia Systems, Parallel and Real-time OS, Computer Architecture
GRADUATE PROGRAM

The ECE Graduate Office had a banner year in 2002-03. Our selectivity is currently at 19% as we continue to receive a large number of applications from around the globe. Our current student body contains students from the USA, India, China, Turkey, Jordan, Brazil, Mexico, Greece, Egypt, Ukraine, Malaysia, Costa Rica, Russia, Bangladesh, Taiwan, Columbia, South Korea, Bolivia, Pakistan, Peru, Ecuador, Germany, Panama, Italy, Turkey, Lebanon, Croatia, Burkina Faso, Iran, Thailand, and Nepal. We currently have 260 graduate students of which 121 are pursuing a Ph.D. degree. The Department and its faculty support more than 100 research assistants and 20 graduate (teaching) assistants. Our domestic graduate student body remains at 50% at the Masters level, and hovers around 25% for Ph.D. students. In a testimony to our strong research areas, the largest number of Ph.D. students are in the Optoelectronics area (29), followed by the Computer Engineering area (23), the Signals and Communications area (21), the Optical Science and Engineering area (14), the Systems and Controls area (13), the Applied Electromagnetics area (11), and the Microelectronics area (10).

The Commission on Higher Education approved a new Master of Science in Optical Science and Engineering degree program, which is offered jointly by the departments of ECE and Physics and Astronomy. This program reflects the strengths in the State of New Mexico in the area of optics and photonics.

New Microprocessor Development

In the international arena, we are finalizing a joint Masters program with the University Carlos III in Madrid, Spain, and a joint Masters and Ph.D. program with the University of Campinas, Brazil. We expect to receive our first students from Campinas in the Spring 2003, and from Carlos III in the Fall 2004 semester. We have also started an exchange program with the University of Rome, Tor Vergata, with the ultimate goal of initiating a joint Masters and Ph.D. program between our two Universities.

The current graduate application process, the graduate handbook, and all related material have been automated and are available on our website. While safeguarding student confidentiality, we are making our graduate student database available for online searches to our faculty. Our graduate seminar series, attended by all incoming M.S. and Ph.D. students, continues to attract speakers from Israel, France, Australia, England, and the leading universities around the US.
The Center for High Technology Materials (CHTM) provides a research environment for graduate and undergraduate students in photonics and optoelectronics, complementing the academic program of the Department of Electrical and Computer Engineering (ECE).

During year 2002, 6 ECE students received their Ph.D. degrees through CHTM, and another 8 received their M.S. degree in Electrical Engineering.

Currently, over 70 graduate students are conducting research at CHTM, more than half of whom are working towards advanced degrees through the Department.

In addition, 9 ECE faculty and 8 ECE research faculty conduct their research through CHTM.

Nanotechnology, quantum dot lasers, and nanoscale lithography continue to be major research interests at CHTM. Significant advances have been made in the areas of nanoheteroepitaxy, immersion interferometric lithography, nanofluidics and quantum-well detectors.

Highlights of year 2002's research funding included AFOSR's continuing support of CHTM's optoelectronics work, British Aerospace Systems' second round of funding for the multi-university consortium on sensor technology, and ONR's support of GaN heterojunction bipolar transistor research. In addition, CHTM's equipment base was strengthened by an NSF equipment grant for a vacuum STEM.

For more information, please visit the CHTM website at http://www.chtm.unm.edu or call Dr. Steven Brueck, CHTM's Director. 505-272 7800
UNM PURSUE (NASA PAIR) Program received $500,000 for its 5th year of activities. The program focused resources on the enhancement and development of six undergraduate laboratories this year. The targeted laboratories were selected on the basis of student impact, multi-disciplinary nature, significance to the respective department or college/school strategic plan, and the potential for the integration of NASA-related research into the undergraduate curriculum. Two of the targeted labs are described below:

Coordinated Systems and Control Laboratory

The CSC Laboratory provides lecture demonstrations for undergraduate systems and control courses offered in the Electrical, Mechanical and Chemical Engineering Departments. This multi-disciplinary lab also offers design and development projects for advanced undergraduate students in those departments. The 6 available stations include:

- Rotary Pendulum system – Position Control
- Translational Inverted Pendulum System
- Three Tank System
- Magnetic Levitation System
- Rhino Robot Module
- Adept Robot

Intelligent Distributed Multi-Agent Robotics Systems (IDMARS) Laboratory

This new laboratory focuses on several research and educational programs in the area of Robotics. For example, a mobile robot, LOBOT Jr. was created in the IDMARS Laboratory as a tool to teach high school and middle school students about robotics. Students are given a robot kit by their instructor, which includes the necessary parts and instructions needed to get the robot up and running. The students are taught step by step how to assemble the robot and learn about each component, what it does and why it's important to the functioning of their robot. Students are exposed to concepts involving micro controllers, sensors, electronics circuit design, soldering, microprocessors, computer programming (Java), and wireless communications.
LOS LIBERTADORES: AN ITC GATEWAY / PORTAL FOR IBEROAMERICA
Ibero-American Science and Technology Education Consortium (ISTEC)
ISTEC, Inc. - Executive Office
801 Yale NE
Albuquerque, NM 87131
Tel: (505) 277-7974; Fax: (505) 277-2986
www.istec.org

Since its inception in 1990, ISTEC has been a non-profit organization comprised of educational, research, industrial, and multilateral organizations throughout the Americas and the Iberian Peninsula. The Consortium’s mission is to foster scientific, engineering, and technology education, joint international research and development efforts among its members, and to provide a cost-effective vehicle for the application and transfer of technology.

The Consortium’s goals are:

- Carry out innovative programs in IT for the development of human capital emphasizing the involvement of both public and private institutions that implement training, research, and academic exchanges in science and technology within the region
- To provide the region with a multilingual (English, Spanish, Portuguese, and other), easily accessible, and well-organized web-based system, which allows the offering of electronic services to participating institutions
- Accelerate the technology transfer from industry to academia in an adequate and appropriate manner
- Identify gaps in the innovation and research schemes in order to expand educational and training opportunities
- Promote direct foreign investment as a catalyst for private and public commitments and promote the creation of incentives to attract new companies
- Contribute to the long-term enhancement of engineering and science curricula in the academic institutions by providing them with information and discussion forums about industrial needs in the region
- Provide complete information about R&D projects in the region and continually update information about available sources of funding for these projects

We are closely working with the Government of the Rio Grande do Sul, Brazil, regarding the creation of the Ibero-American Center for Advanced Electronics Technology (CEITEC). Tied to this effort is the MEMS Initiative with Sandia National Laboratories to establish collaborative efforts using the latest tools in this field, and the incubation of spin-offs. This center of excellence coordinates and maximizes the region’s software, electronics and telecommunications industries, and will produce global Ibero-American leaders in microelectronics and nanotechnology.

Currently, we are working with Los Alamos National Laboratory, and IEEE for the advancement of engineering and science education and R&D in the region.

We believe the ISTEC Model will help in bridging the Digital Divide that afflicts all nations. This divide can be transformed into Digital Opportunities with Information Technology (DD ... to ... DO IT!).
Mohammad Akbarzadeh
Research Assistant Professor
PhD-UNM

Jerald C. Buchenauer
Research Professor
PhD-Cornell University

John A. Gaudet
Research Associate Professor
PhD-Air Force Institute of Technology

Arthur H. Guenther
Research Professor
PhD-Pennsylvania State University

Michael Chryssomallis
Research Associate Professor
PhD-University of Thrace

Larry Ralph Dawson
Research Professor
PhD-University of California

Roderick A.B. Devine
Research Professor
PhD-University of Warwick

Abdel-Rahman A. El-Emawy
Research Assistant Professor
PhD-Colorado State University

Naz Islam
Research Professor
PhD-Rensselaer Polytechnic Institute

Omar Manasreh
Research Professor
PhD-University of Arkansas

Nader Vadiee
Research Associate Professor
PhD-UNM

Petr G. Eliseev
Research Professor
PhD-Lebedev Physics Institute

J.S. Kirsten Mills
Research Associate Professor
PhD-Nottingham University

Mikhail Isaakovich Fuks
Research Professor
PhD-Gorky, Russia State University

Stanley Z. Peplinsky
Research Scholar
MS-University of TN Space Institute

Elizabeth Ann Ritchie-Tyo
Research Assistant Professor
PhD-Monash University

Thomas M. Shay
Research Professor
PhD-Colorado State University

Walter M. Shedd
Research Professor
PhD-Northeastern University

Edward W. Taylor
Research Scholar
PhD-UNM

Harry T. Weaver
Research Professor
PhD-Auburn University