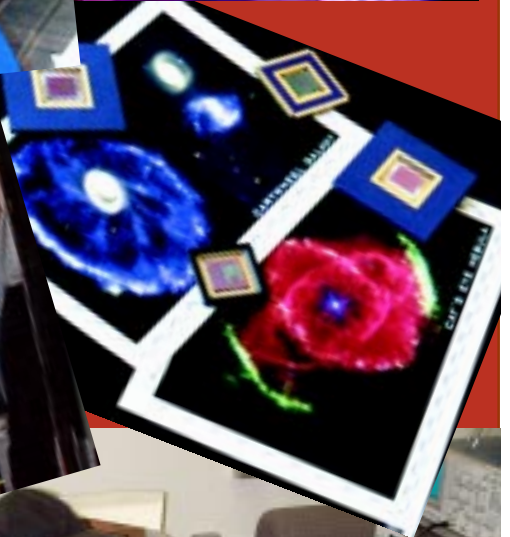


# ELECTRICAL & COMPUTER ENGINEERING

The University of New Mexico

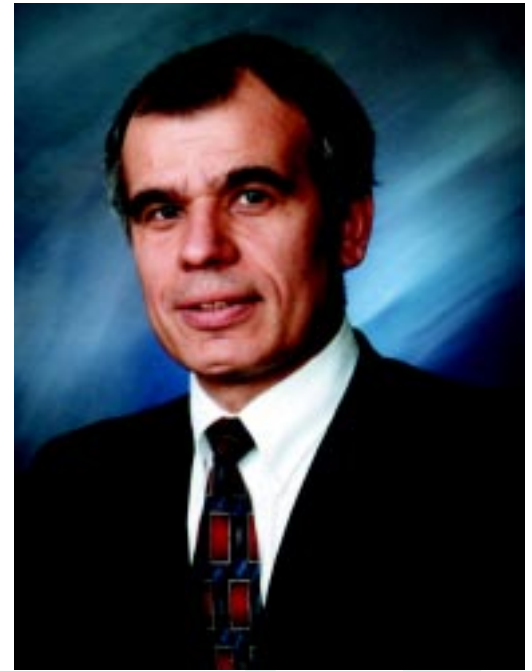
2000 Annual Report



**W**elcome to the Electrical and Computer Engineering Department (EECE) at the University of New Mexico! This report will acquaint you with our program and some of our accomplishments during the past year.

The University of New Mexico's School of Engineering is ranked among the top 50 engineering schools in the country. The EECE Department, being the largest in the School of Engineering, played a major role in achieving this ranking. Looking through this report you will see that EECE faculty continue to be pioneers in several areas of research, such as nanotechnology, micro-electronics, high power microwaves, high performance computing, and signal processing. During the year 2000 we received over \$12 million in external funding.

Our outstanding faculty continues to win awards for excellence in teaching, research and service. Recent faculty awards include 6 IEEE Millennium Medals received by Drs. Peter Dorato, Thomas Sigmon, Steve Brueck, Chaouki Abdallah, Shlomo Karni, and Martin Bradshaw. This Medal is awarded to only one percent of IEEE's membership worldwide. Also, Dr. Mohammad Jamshidi was selected for the Regents Professorship Award, the University's most prestigious faculty award.



While continuing our efforts to upgrade our existing instructional and research laboratories, 3 new instructional laboratories were established last year: The Embedded Systems Laboratory, the Software Engineering Laboratory, and the Antennas Laboratory. These new laboratories were established with the help of generous donations from industry. Also, 3 new research laboratories were established: the High Performance Computing Laboratory, the Robotics, Artificial Intelligence, and Vision Laboratory, and the Optical Spectroscopy Laboratory.

Our graduate enrollment has increased to over 200 students. The EECE website remains one of the most frequented Electrical and Computer Engineering websites in the world. Since all graduate program application materials and general information about the EECE Department are now available through the Internet, hundreds of prospective graduate students have applied to the EECE graduate program from all over the world through our website. Currently, we receive over 500 graduate student applications each semester. We have increased the number of Teaching Assistants (25) and Research Assistants (75) to attract outstanding graduate student talent to our Department. The graduate student seminar series, established in January 1999, continues to be very successful, attracting several distinguished scholars from all over the world. Also, for the first time in four years our undergraduate enrollment has shown some slight increase as well.

The EECE monthly newsletter, *Wired*, continues being published throughout the year. An on-line edition is accessible from our website and has already increased the number of visits to our website, many of which originate in foreign countries. The newsletter continues to serve as an important and effective tool to introduce new tenure-track and research faculty, as well as our technical and administrative staff to the UNM community and beyond.

Finally, 3 new faculty joined the EECE Department last year: Drs. Anna Scaglione, Marios Pattichis, and Christopher Smith.

Thank you for taking the time to learn more about our Department. If you would like to find more information regarding the Department and its activities, please visit our website at [www.eece.unm.edu](http://www.eece.unm.edu).

Best Regards,

A handwritten signature in black ink, appearing to read "Christos Christodoulou". The signature is fluid and cursive, written on a white background.

Dr. Christos Christodoulou, Chair

# LABORATORIES

## Teaching Laboratories

Networked Multimedia and Parallel Computing Laboratory  
High-Performance Computing Laboratory  
Wireless Communications Laboratory  
Advanced Microprocessor Laboratory  
Software Engineering Laboratory  
Microwave/Antennas Laboratory  
Embedded Systems Laboratory  
Computer Design Laboratory  
Microprocessor Laboratory  
Digital Logic Laboratory  
Electronics Laboratory

High Performance Algorithms & Applications Research Group (HPAA)

## Research Laboratories

CHTM Clean Rooms  
Crystal Growth Facility  
NASA ACE Center Laboratories  
Antenna & Computational EM Laboratory  
High-Performance Computing Laboratory  
PURSUE Research Program Laboratories  
Pulsed Power and Plasma Science Laboratory  
Microelectronics Research Center Laboratories

Networked Multimedia and Parallel Computing Laboratory  
Robotics, Artificial Intelligence & Vision Laboratory (RAIV)

## Faculty Awards

### Degrees Awarded

B.S. Electrical Engineering - 32  
B.S. Computer Engineering - 15  
M.S. - 18  
Ph.D. - 9

### Scholarly Activities

72 Refereed Journal Papers  
114 Conference Papers  
7 Patents  
11 Books (2 Translations)

### Sponsored Research

Total research funding:  
\$12,568,119

### Corporate & Private Donations

Total donations: \$1,476,177

### IEEE Millennium Awards:

Drs. Chaouki Abdallah,  
Martin Bradshaw, Steve Brueck,  
Peter Dorato, Shlomo Karni, Tom Sigmon

### UNM Regents Professorship:

Dr. Mohammad Jamshidi

### Sigma Xi/IEEE Young Outstanding Engineer Award:

Dr. David Bader

### Gardner-Zemke Professorships:

Drs. Edl Schamiloglu, Peter Dorato

### Lawton-Ellis Award:

Dr. Chaouki Abdallah

### International Excellence Award:

Dr. Ramiro Jordan

## *Graduate Seminar Series*

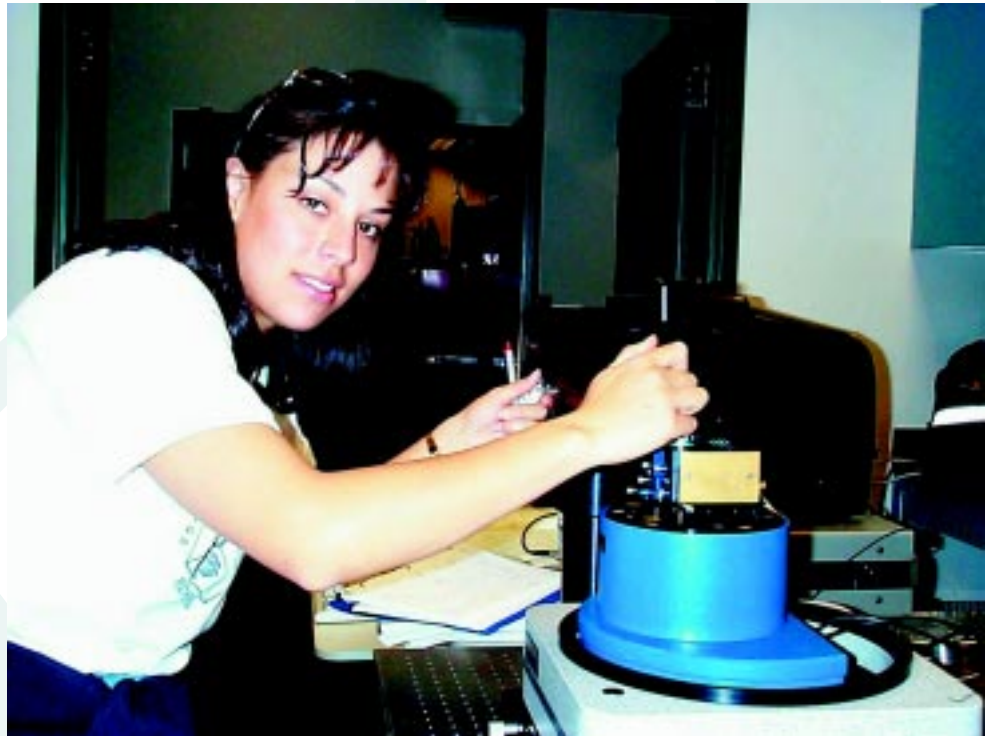
Over 35 presentations by international lecturers from various universities and industries around the world.

DEPARTMENT INFORMATION

# UNDERGRADUATE PROGRAM

The Electrical and Computer Engineering (EECE) Department continues to be recognized locally and nationally for the quality of its undergraduate programs. Locally, alliances have been forged with industry and the national laboratories to provide projects and mentoring opportunities for students working on senior design projects. Student teams in the EECE 419/420 classes are assigned to projects sponsored by local companies, such as BF Goodrich Aerospace, Sumitomo Sitix, Silmax, and Sandia National Laboratories. 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. Industry response to this program has been overwhelming, and the EECE Department has received more requests for student projects than it has student teams!

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,



*Shannon Delgado (UNM BSEE 2000, now at SNL) prepares to take an atomic force microscope image of quantum dots.*

Honeywell, and others have sponsored recruiting fairs, and have conducted interviews with students in the EECE building. 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 or are accepted into graduate schools nationwide.

EECE is committed to making EECE undergraduate programs as “user-friendly” as possible. This spring, for example, undergraduate students have been polled to see what courses they would like to have offered during the summer session. We hope this will help speed up gradua-

tion for our students. In addition, as part of an ongoing Outcomes Assessment program, a survey will be sent to EECE alumni, seeking their thoughts regarding 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 contact:**

***Dr. Charles B. Fleddermann***  
Professor & Associate Chair  
Director of Undergraduate Studies  
*E-mail: [cbf@eece.unm.edu](mailto:cbf@eece.unm.edu)*

# GRADUATE PROGRAM

The Department of Electrical and Computer Engineering (EECE) 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, passed the top 50 barrier for three years in a row in the U.S. News and World Report's Annual Survey. In the latest ranking issued on April 2, 2001, UNM is listed as number 48. Based on Fall 2000 statistics the only regional universities ranking higher than UNM in engineering were the University of Texas-Austin, Texas A&M, Rice University, 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, and was the only university ranked in the state of New Mexico.

The year 2000 was a busy year for curriculum development in EECE. The Graduate Program revamped its curriculum and introduced many new courses which 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 & Plasma Science, Computational Electromagnetics, and Antenna Theory); the Controls Systems Laboratory is designed to provide hands-on experience at the upper division undergraduate level; the microelectronics fabrication course entitled Device-Level Semiconductor Simulation TCAD Tools; and the course in Computer Engineering

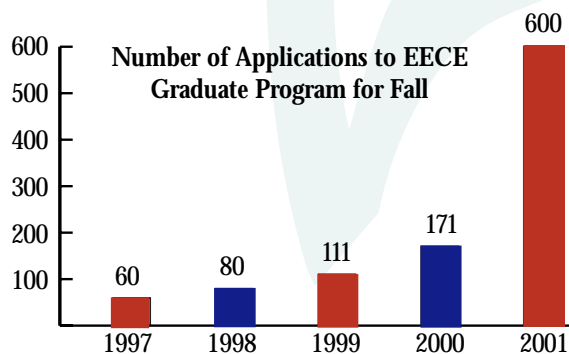
entitled Embedded Systems.

The EECE Department continues its investment in Graduate Assistantships. Each semester the Department funds over 25 Teaching Assistantships to support professors teaching undergraduate courses. Sponsored research obtained by EECE faculty, including those affiliated with the Centers, has provided funding for over 75 Research Assistantships. Furthermore, in addition to the tuition waiver that accompanies each Assistantship the Department now provides health care coverage for graduate students.

In order to accommodate the increasing number of graduate students in EECE and to facilitate their progress through the program, the Ph.D. qualifying exam is now administered twice a year. The average GRE scores of new graduate students entering the EECE program were higher than they have been in the past 5 years, and the number of new applications has exceeded 500 for Fall 2001 admission. This represents a tremendous increase over the past few years.

The EECE faculty recently approved a new M.S. degree in Optical Sciences and Engineering. This is a joint program with the Physics Department which ties into the Ph.D. in Optical Science, and is jointly administered by the two departments. The EECE Department is currently working on introducing a new professional degree program, the Master of Engineering in Electrical and Computer Engineering.

The University of New Mexico's School of Engineering is one of "America's Best Graduate Schools" (U.S. News and World Report).



Electrical & Computer Engineering Department

**For more information contact:**

*Dr. Chaouki Abdallah*

Professor

Director of Graduate Studies

E-mail: [chaouki@eece.unm.edu](mailto:chaouki@eece.unm.edu)

# FACULTY MEMBERS AND THEIR AREAS OF SPECIALIZATION

## PHYSICAL ELECTRONICS AND PHOTONICS GROUP

APPLIED ELECTROMAGNETICS    MICROELECTRONICS (FABRICATION)    PHOTONICS

### *STEVEN R. J. BRUECK*

Professor & Director of CHTM  
Ph.D. Massachusetts Institute of  
Technology

**Interests** Laser-material interactions,  
electro-optic devices, laser spectro-  
scopy.

### *CHARLES B. FLEDDERMANN*

Professor & Associate Chair  
Director, Undergraduate Program  
Ph.D. University of Illinois at  
Urbana-Champaign

**Interests** Plasma processing, physical  
electronics, photovoltaics.

### *STANLEY HUMPHRIES*

Professor  
Ph.D. University of California at Berkeley

**Interests** Numerical electromagne-  
tism, accelerator technology, plasma  
physics.

### *LUKE F. LESTER*

Associate Professor  
Ph.D. Cornell University

**Interests** High speed and high power  
semiconductor lasers, high tempera-  
ture electronics, microwave devices,  
turnable lasers, III-V semiconductor  
devices.

### *MAREK OSINSKI*

Professor  
Ph.D. Institute of Physics, Polish Academy  
of Sciences

**Interests** Semiconductor lasers,  
optoelectronic devices and materials,  
group-III nitrides, degradation  
mechanisms and reliability, computer  
simulation.

### *J. SCOTT TYO*

Assistant Professor  
Ph.D. University of Pennsylvania.

**Interests** Electromagnetics, hyper-  
spectral imaging, ultrawideband  
antennas.

### *JULIAN CHENG*

Professor  
Ph.D. Harvard University

**Interests** Optoelectronics, optical  
switching networks, optical  
communication systems.

### *CHARLES F. HAWKINS*

Professor  
Ph.D. University of Michigan

**Interests** VLSI design and testability,  
IC failure analysis, IC reliability.

### *RAVINDER K. JAIN*

Professor  
Ph.D. University of California at Berkeley

**Interests** Quantum electronics,  
optoelectronics, electro-optics,  
experimental solid-state physics.

### *KEVIN J. MALLOY*

Professor & Associate Director of CHTM  
Ph.D. Stanford University

**Interests** Semiconductor physics,  
device physics.

### *EDL SCHAMILOGLU*

Professor  
Ph.D. Cornell University

**Interests** Physics and technology of  
charged particle beam generation and  
propagation, high power narrow band  
and ultra wideband microwave  
sources, plasma physics and  
diagnostics, and electromagnetic  
wave propagation.

### *CHRISTOS CHRISTODOULOU*

Professor & Department Chair  
Ph.D. North Carolina State University

**Interests** Modeling of electromagnetic  
systems, phased array antennas,  
antennas for wireless communica-  
tions, microwave systems and  
applications of neural networks in  
electromagnetics.

### *STEPHEN D. HERSEE*

Professor  
Ph.D. Brighton Polytechnic, England

**Interests** Semiconductor materials,  
microelectronics and optoelectronic  
devices.

### *KENNETH C. JUNGLING*

Professor  
Ph.D. University of Illinois at Urbana-  
Champaign

**Interests** Laser and thin films, micro-  
analytical thin-film diagnostics, optical  
detection, high-power laser damage  
testing.

### *DONALD A. NEAMEN*

Professor  
Ph.D. University of New Mexico

**Interests** Semiconductor materials  
and devices, and electronics.

### *THOMAS W. SIGMON*

Professor  
Ph.D. Stanford University

**Interests** Semiconductor physics,  
device physics and process technol-  
ogy; pulsed laser processing of  
electronic materials, fabrication of  
polysilicon thin film devices on flexible  
plastic substrates and metals, devel-  
opment of spin polarized injection and  
transport in semiconductor materials.

## COMPUTER ENGINEERING GROUP

ALGORITHMS AND COMPUTING THEORY

COMPUTER ARCHITECTURE DATA COMMUNICATIONS

HIGH-PERFORMANCE COMPUTING VLSI DESIGN

### *THOMAS P. CAUDELL*

Associate Professor  
Ph.D. University of Arizona

**Interests** Neural networks, virtual reality, machine vision, robotics and genetic algorithms.

### *MARIOS PATTICHIS*

Assistant Professor  
Ph.D. University of Texas-Austin

**Interests** Digital image and video processing and communication, telemedicine, digital signal processing.

### *CHRISTOPHER E. SMITH*

Assistant Professor  
Ph.D. University of Minnesota.

**Interests** Robotics, computer vision, medical image processing, intelligent transportation systems, virtual collaborative environments.

### *GREGORY L. HEILEMAN*

Associate Professor  
Ph.D. University of Central Florida

**Interests** Data structures and algorithmic analysis, theory of information and computing, machine learning and pattern recognition.

### *L. HOWARD POLLARD*

Assistant Professor  
Ph.D. University of Illinois at Urbana-Champaign

**Interests** Computer architecture, digital design, fault tolerance, microprocessors.

### *JOHN S. SOBOLEWSKI*

Associate Professor  
Associate Vice President of CIRT  
Ph.D. University of Washington

**Interests** Data communications, networking, computer architecture, system information and design, medical application of computers.

### *DAVID A. BADER*

Assistant Professor  
Ph.D. University of Maryland

**Interests** High performance computing, parallel computation, computational biology and bioinformatics, remote sensing and image processing.

### *GARY K. MAKI*

Professor & Director of MRC  
Ph.D. University of Missouri at Rolla

**Interests** Digital design, fault-tolerant digital design, error correction codes, VLSI design and architectures.

### *WEI WENNIE SHU*

Associate Professor  
Ph.D. University of Illinois at Urbana-Champaign

**Interests** Operating systems and resource scheduling, system support for parallel computing, multimedia networking.

### *MIN-YOU WU*

Associate Professor  
Ph.D. Santa Clara University

**Interests** Parallel programming systems, multimedia systems, parallel and real-time OS, computer architecture.

## SIGNALS AND SYSTEMS GROUP

CIRCUITS AND CONTROL SYSTEMS

SIGNAL PROCESSING AND COMMUNICATIONS

### *CHAOUKI T. ABDALLAH*

Professor & Associate Chair  
Director, Graduate Program  
Ph.D. Georgia Institute of Technology

**Interests** Control systems and wireless communications.

### *PETER DORATO*

Professor  
D.E.E., Polytechnic Institute of Brooklyn

**Interests** Optimal control, robust design in feedback control systems.

### *MOHAMMAD JAMSHIDI*

Professor & Director of ACE Center  
Ph.D. University of Illinois at Urbana-Champaign

**Interests** Large-scale system theory and applications, computer-aided system design, energy and resource systems analysis, robotics.

### *RAMIRO JORDAN*

Associate Professor  
Ph.D. Kansas State University

**Interests** Data communications, multidimensional signal processors and software engineering.

### *BALU SANTHANAM*

Assistant Professor  
Ph.D. Georgia Institute of Technology

**Interests** Statistical signal processing, statistical communications, digital signal processing, time-frequency analysis, adaptive signal processing, and general signal processing.

### *ANNA SCAGLIONE*

Assistant Professor  
Ph.D. University of Rome

**Interests** Wireless and multiuser communication systems design, signal processing for communication, radar systems.

# DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING RESEARCH FACULTY

## CENTER FOR AUTONOMOUS CONTROL ENGINEERING (ACE)

<i>DAWSON, LARRY RALPH</i>	<i>PROFESSOR</i>
<i>DEVINE, RODERICK A.B.</i>	<i>PROFESSOR</i>
<i>EL-EMAWY, ABDEL-RAHMAN A.</i>	<i>ASSISTANT PROFESSOR</i>
<i>ELISEEV, PETR</i>	<i>PROFESSOR</i>
<i>GUENTHER, ARTHUR H.</i>	<i>PROFESSOR</i>
<i>KASPI, RON</i>	<i>ASSOCIATE PROFESSOR</i>
<i>LAUER, ROBERT B.</i>	<i>PROFESSOR</i>
<i>MOJAHEDI, MOHAMMAD</i>	<i>ASSISTANT PROFESSOR</i>
<i>NAKWASKI, WLODZIMIERZ</i>	<i>ASSOCIATE PROFESSOR</i>
<i>NEWELL, CHARLES TIMOTHY</i>	<i>ASSISTANT PROFESSOR</i>
<i>SHAY, THOMAS M.</i>	<i>PROFESSOR</i>
<i>TAYLOR, EDWARD W.</i>	<i>SCHOLAR</i>
<i>VARANGIS, PETROS M.</i>	<i>ASSISTANT PROFESSOR</i>
<i>ZUBIA, DAVID</i>	<i>ASSISTANT PROFESSOR</i>

<i>ETEZADI-AMOLI, MEHDI</i>	<i>PROFESSOR</i>
<i>FATHI-TORBAGHAN, MADJID</i>	<i>PROFESSOR</i>
<i>MACIEJEWSKI, ANTHONY A.</i>	<i>PROFESSOR</i>
<i>VADIEE, NADER</i>	<i>ASSISTANT PROFESSOR</i>
<i>ZRILIC, DJURO G.</i>	<i>PROFESSOR</i>

## CENTER FOR HIGHT TECHNOLOGY MATERIALS (CHTM)

<i>EDWARDS, ARTHUR H.</i>	<i>ADJUNCT ASSOCIATE PROFESSOR</i>
<i>FUKS, MIKHAIL ISAAKOVICH</i>	<i>PROFESSOR</i>
<i>ISLAM, NAZ</i>	<i>ASSOCIATE PROFESSOR</i>
<i>KOVANIS, VASSILIOS</i>	<i>ASSOCIATE PROFESSOR</i>
<i>KUCK, INARA</i>	<i>PROFESSOR</i>
<i>MANASREH, OMAR</i>	<i>PROFESSOR</i>
<i>MCCAULEY BELL, PAMELA</i>	<i>ASSOCIATE PROFESSOR</i>
<i>MINER, NADINE E.</i>	<i>ASSISTANT PROFESSOR</i>
<i>PATTICHIS, CONSTANTINOS</i>	<i>ASSISTANT PROFESSOR</i>
<i>SOBEL, ANNETTE LOUISE</i>	<i>PROFESSOR</i>
<i>SODEN, JERRY M.</i>	<i>SCHOLAR</i>
<i>STEARNS, SAMUEL D.</i>	<i>PROFESSOR</i>
<i>WEAVER, HARRY T.</i>	<i>PROFESSOR</i>

## ELECTRICAL ENGINEERING & COMPUTER ENGINEERING (EECE)

<i>CMERON, KELLY</i>	<i>ASSISTANT PROFESSOR</i>
<i>COX, DAVID F.</i>	<i>ASSISTANT PROFESSOR</i>
<i>DONOHUE, GREGORY W.</i>	<i>ASSISTANT PROFESSOR</i>
<i>GAMBLES, JODY W.</i>	<i>ASSISTANT PROFESSOR</i>
<i>WHITAKER, STERLING R.</i>	<i>PROFESSOR</i>

## MICROELECTRONICS RESEARCH CENTER (MRC)

<i>LUKE, JAMES R.</i>	<i>ASSISTANT PROFESSOR</i>
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## NEW MEXICO ENGINEERING RESEARCH INSTITUTE (NMERI)

**For more information check our website:**  
<http://www.eece.unm.edu/professors/professors-research.html>

# APPLIED ELECTROMAGNETICS

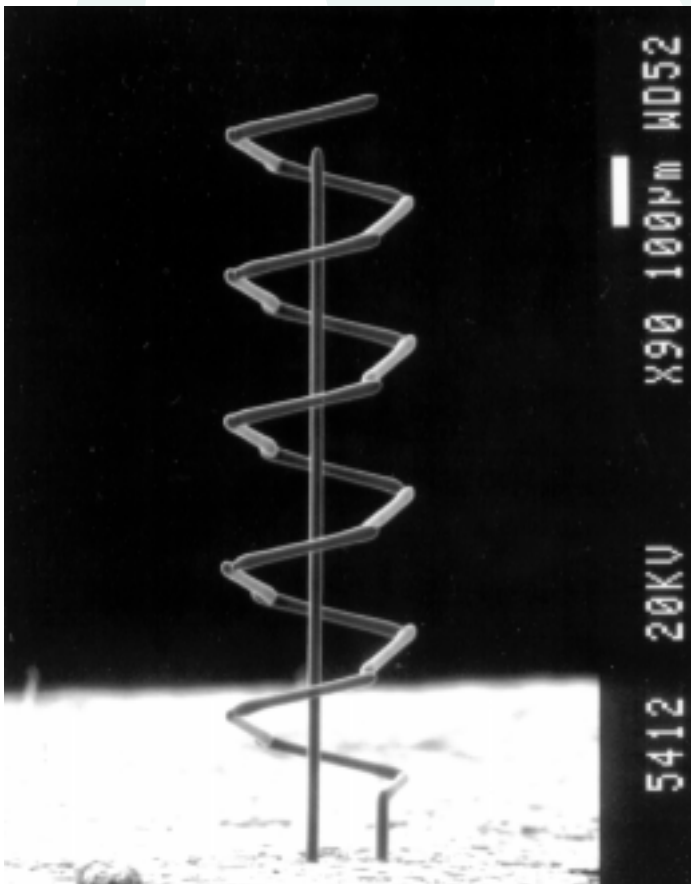
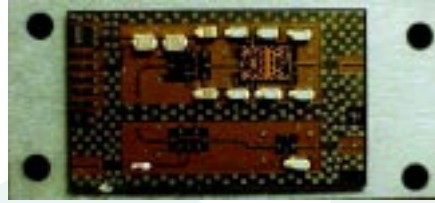
The Applied Electromagnetics area in the EECE Department was formed in 1999. It comprises the Computational Electromagnetics Laboratory led by Dr. Christos Christodoulou and the Pulsed Power & Plasma Science Laboratory led by Dr. Edl Schamiloglu. Other faculty in this area are Dr. Stanley Humphries and research professors Drs. Naz Islam and Vassilios Kovanis. We are also pleased to announce the hire of Dr. J. Scott Tyo who will join the EECE Department as an Assistant Professor in Fall 2001. Dr. Tyo received his Ph.D. from the University of Pennsylvania in 1997 and his areas of expertise include Ultra-Wideband (UWB) Electromagnetics and Polarimetric and Hyper-spectral Imaging with Visible and Near IR Light.

The Applied Electromagnetics area has added several new courses to its curriculum. In the

undergraduate area this includes a lecture and “hands-on” laboratory course entitled Microwave Engineering. In addition, beginning in Fall 2001, we will start to transition from a two-semester sequence in undergraduate Fields & Waves to a one-semester course in Electromagnetics. Finally, we offer a revised and updated course in Antenna Theory.

In addition to offering a graduate level version of the two new undergraduate courses listed above, we have also introduced a course in Computational Electromagnetics, reintroduced a course in Experimental Plasma Physics and Pulsed Power, and developed a new 600-level course entitled Advanced Topics in Applied Electromagnetics. Two of our faculty have just released books: Dr. Christodoulou co-authored a book entitled “Applications of Neural Networks in Electromagnetics” and Dr. Schamiloglu co-edited a book entitled “High Power Microwave Sources and Technologies.”

In terms of research, the Applied Electromagnetics area is involved in several ongoing research projects. These include Dr. Christodoulou’s research on THz antennas using chalcogenide materials for antennas, radiation effects on T/R modules and neural network applications, and Dr. Schamiloglu’s research on high power microwaves and a study of ultra-fast rise time photoconductive semiconductor switches (funded by AFOSR), and a new JPL-funded initiative on using high power microwaves to propel ultra-light carbon fiber-based sails for interstellar missions. The Applied Electromagnetics group was also just awarded a 5-year \$5 million MURI grant to perform basic research leading to compact, portable pulsed power.



*Spiral Antenna at THz*

# COMPUTER ENGINEERING

The Computer Engineering group, one of the EECE department's largest divisions, supports an ABET-accredited Bachelor of Science degree, along with M.S. and Ph.D. 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, virtual reality, and biomedical computation.

Our new Software Engineering Laboratory allows undergraduate students to develop projects that often lead to externally-sponsored research contracts. The High-Performance Computing Laboratory advances our understanding of the

main factors required for designing practical parallel algorithms for scientific applications and to develop techniques for

experimentally validating the results. The Networked Multimedia Laboratory performs research in the area of parallel and distributed computing for distributing digital media content over networks to distributed users.

## Computer Engineering Highlights and Accomplishments:

- Dr. Bader received a National Science Foundation Information Technology Research (ITR) award to investigate shared-memory parallel algorithms for problems in computational biology.
- Dr. Bader was awarded the National Science Foundation Faculty Early Career Development (CAREER) Award.
- The Department received significant donations of state-of-the-art software from industrial partners, Microsoft Corporation and Rational Rose.
- Collaborations were established with Sun Microsystems HPC Division and IBM Advanced Computing Technologies Center for early access during the design phase of next-generation high-performance computers.
- Several million dollars of externally-funded interdisciplinary research projects were received from NSF, DARPA, DOE, and NIH, in the areas of high-performance computing, visualization, next generation internet, telemedicine, functional brain imaging, and distance education.
- Our faculty hold several editorship positions on 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.



*A Vision-guided robotic tested  
in the RAIV Laboratory*

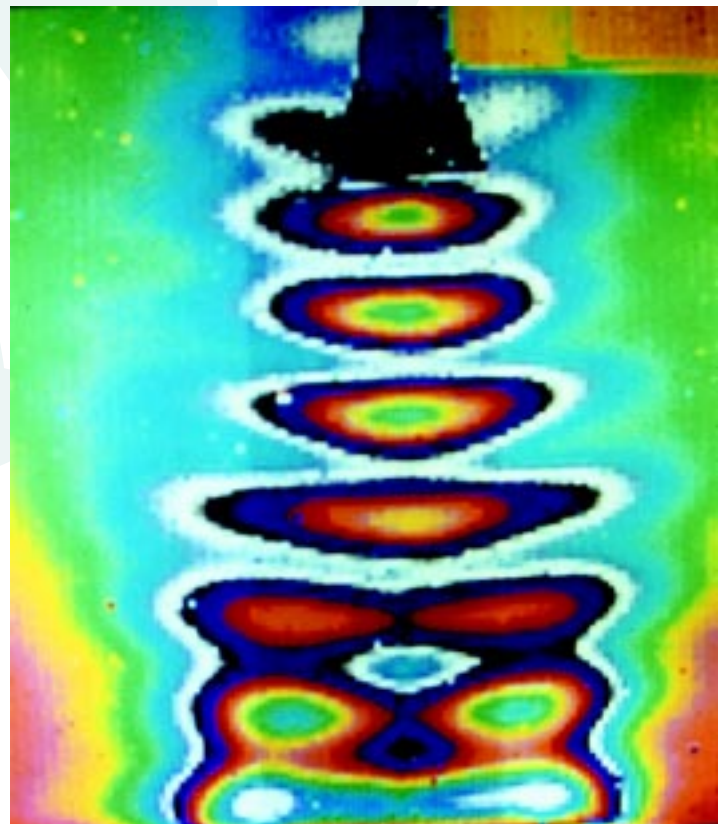
# SIGNALS AND SYSTEMS GROUP

The Signals and Systems group is one of the oldest and most vibrant groups of the EECE department. It comprises faculty in the areas of systems and controls (Drs. Dorato, Jamshidi, and Abdallah), Signal Processing (Drs. Santhanam and Pattichis), and Communications (Drs. Scaglione, Santhanam, Pattichis, and Abdallah). The faculty is engaged in research dealing with digital signal processing, image processing, communication theory, wireless communications, autonomous control systems, fuzzy logic control, and robust control.

Topics of current research interest within this group include: design of optimal space-time modulation schemes, design of digital communication systems, design of wireless communication systems, spread-spectrum modulation techniques, co-channel signal separation, time-frequency signal separation, medical image analysis, AM-FM transforms, multidimensional discrete Fourier transforms, design of digital filters, application of soft computing to the design of autonomous systems, fuzzy logic feedback systems, robust feedback system design via quantified multivariate polynomial inequalities, feedback systems design via statistical learning, feedback design for time-delay systems, coordinated control of satellite arrays, cooperative robotics, simulation and control of bone healing, image enhancement via fuzzy logic, and power control of wireless systems.

In order to accommodate the growing needs of students and companies, new courses have been introduced in the communications and signal processing arena, including EECE-442, Wireless Communications (Fall 2001), EECE-543 Spread-Spectrum Communications (Spring 2001), EECE-595 Digital Communication Theory (Fall 2000), and EECE-495 Signal Processing Exercises in MATLAB (Spring 2001). Two new faculty members (Drs. Scaglione and Pattichis) joined the group this year along with various visiting scholars and researchers.

The group has also been recognized at the local, national and international level, with Dr. Scaglione winning the prestigious 2001 *Best Paper Award* from the IEEE Transactions on Signal Processing, with Drs. Dorato and Abdallah receiving the IEEE Millennium Medal, with Dr. Dorato being awarded the senior Gardner-Zemke Professorship, and Dr. Jamshidi being nominated a UNM Regents Professor. Dr. Jamshidi's NASA Autonomous Control Engineering (ACE) center has been renewed for another 5-year funding cycle. Graduate student enrollments continue to grow within the group, with the largest increase occurring in the area of communications. The faculty members have also been active in various conferences and scholarly activities with a second printing of the graduate textbook in controls authored by Drs. Dorato and Abdallah, with Dr. Jamshidi co-authoring several textbooks and monographs, and Dr. Dorato publishing an undergraduate controls systems textbook.



*Image of a radiating electromagnetic wave*

# AUTONOMOUS CONTROL ENGINEERING CENTER



A · C · E

In the year 2000, the ACE Center at the University of New Mexico (UNM) reached a very important plateau for its total accumulated M.S. and Ph.D. graduates. Since 1995, the Center has supported 45 M.S. and 12 Ph.D. graduates, most of them ethnic minorities.

At UNM the ACE Center's VI-P (Vertically Integrated Project) model for research and education of ethnic minorities has been praised by many national and international organizations, such as the NSF, IEEE, NASA, Northeastern University (Boston), National University of China (Taiwan), Sheffield University (UK), among others.

Current major research trusts at ACE center are: Satellite Array Formations Coordinated Control; Wireless Cellular Systems Optimal Power Control; Cooperative Robotic Agents; Distributed Modeling

and Simulation of Robotic Colonies; Modeling, Simulation, and Control of Bone Fracture Healing Process; Autonomous Industrial Process Control Systems; Analog and Digital Image Enhancement through Fuzzy Logic; and Water Treatment Modeling and Control.

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## PREPARATION FOR UNIVERSITY RESEARCH OF STUDENTS IN UNDERGRADUATE EDUCATION

The Preparation for University Research of Students in Undergraduate Education (PURSUE) program, funded by the NASA MURED (Minority University Research and Education Division) PAIR program, is in its third year at the University of New Mexico. The program strives to increase the production of U.S. students in the fields of Mathematics, Science, Engineering, and Technology (MSET). One of the program's objectives is to integrate cutting-edge science and technology concepts and practices into relevant areas of the undergraduate curriculum. The PURSUE Program promotes increased participation of faculty and students in projects that foster both collaborative inquiry and promote broad and significant improvements to undergraduate teaching and learning.

The PURSUE program uses an integrated team structure headed by a faculty member and provides hands-on research in a peer-and-mentor supported environment. The teams include high school students and undergraduate students under the

mentorship of selected graduate students. Team leaders report directly to Dr. Nader Vadiiee, the PURSUE Program Director. Some teams accomplish their goals within a few months while others may remain in existence for several years. Each project team has an advisory committee composed of professionals from NASA, the University and industry. To date, a total of 112 different projects have been funded, 48 of which were research projects and 64 educational projects. Dr. Ronald DeVries, Professor Emeritus in EECE, led a team that developed a web-based course recently introduced into the EECE curriculum. 257 undergraduates and 63 graduate students have been directly involved with the PURSUE program, and students have presented more than 20 technical papers at regional and national conferences. (<http://pursue.unm.edu>)

## For more information contact:

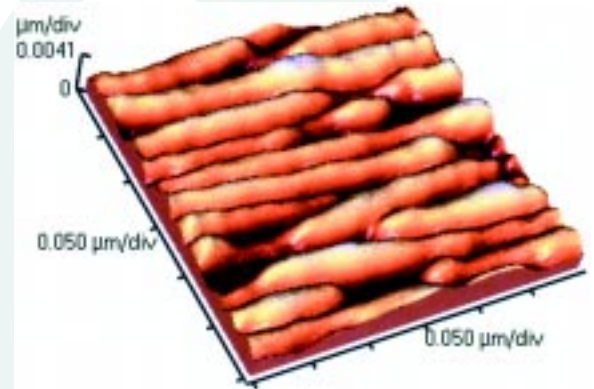
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# CENTER FOR HIGH TECHNOLOGY MATERIALS



The Center for High Technology Materials (CHTM) provides a research environment for graduate and undergraduate students in photonics and optoelectronics. The Center complements the academic program of the Department of Electrical and Computer Engineering (EECE). This past year 6 EECE students received their Ph.D. through CHTM and 6 more received their M.S. degree in Electrical

Engineering. Currently there are over 60 graduate students conducting research at CHTM, of which more than half are pursuing advanced degrees through the Department. In addition, 9 EECE faculty and 12 EECE research faculty conduct research through CHTM. In 2000, Professor Thomas Sigmon and Research Professor Thomas Shay joined EECE, and established research programs

in nanotechnology and optical communications at CHTM, respectively. Nanotechnology continues to figure prominently at CHTM. Several breakthroughs have occurred in quantum dot lasers, and interferometric nanolithography as well as in optical fiber-based devices. Major new research support was received in 2000, including funding for a multi-university DARPA Optoelectronics Center led by a University of New Mexico (UNM) and Department of Defense (DoD) MURI award on lithography. Finally, several CHTM/EECE students won a Best Paper Award at the SPIE Photonics West conference, and were one of the five winners of the Collegiate Inventors Competition.



*Guangtian Liu (now at Coherent Laser), Hua Li (now at New Focus) and Tim Newell (EECE Research Assistant Professor) examine a quantum dot laser.*

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# TENTH GENERAL ASSEMBLY OF THE IBEROAMERICAN SCIENCE AND TECHNOLOGY EDUCATION CONSORTIUM

The Iberoamerican Science and Technology Education Consortium (ISTEC) recently celebrated its Tenth General Assembly during November of 2000 in Cuernavaca, Mexico. The event was hosted by Tecnológico de Monterrey Campus Cuernavaca under the theme of "Transforming ISTEC". The main objective of this transformation was to evaluate the Consortium's experiences in promoting Information Technologies during the past decade, analyze its current situation, and plan for the future. As a result of the fruitful interactions at this General Assembly, ISTEC hopes to create a new model to better serve its membership. The goal is to be more efficient, productive, innovative and creative in its renewed mission, which includes the following objectives:

- 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
- Develop a common agenda under the well-conceived initiatives to develop human resources, exchange information for cooperation, and mobilize alternative resources
- Promote the adoption of a legal framework in science and technology in the region using relevant policy tools, such as economic policy, regulatory standards, procurement, and intellectual property
- Create public-private-international agencies partnerships with cost-sharing policies
- Identify gaps in the innovation and research schemes to expand educational and training opportunities
- Ensure the adequate and appropriate transfer of technology

In this opportunity, ISTEC members joined business leaders, government representatives, Iberoamerican universities' decision-makers, and science and technology investors with the objective of discussing and creating a cooperative scheme that will allow the Consortium to grow and develop programs more efficiently on a long term basis. Companies like Motorola, Microsoft, EBSCO and Sun Microsystems presented strategic working proposals to ISTEC members, and were present to discuss working strategies and license new technologies. During this encounter in Cuernavaca, Consortium members and invited guests exchanged ideas, programs and information. Another important issue was the election of a Board of Directors, Officers, and a President.

Comprised of over 120 academic, industrial, government agencies, and international organizations in the region, the Iberoamerican Science and Technology Education Consortium (ISTEC) is a non-profit 501 c (3) entity registered in the United States to foster scientific and technological education and joint international efforts in research and development. Its Executive Offices are currently located at UNM, and it forms an active branch of the Latin American and Iberian Institute (LAI).



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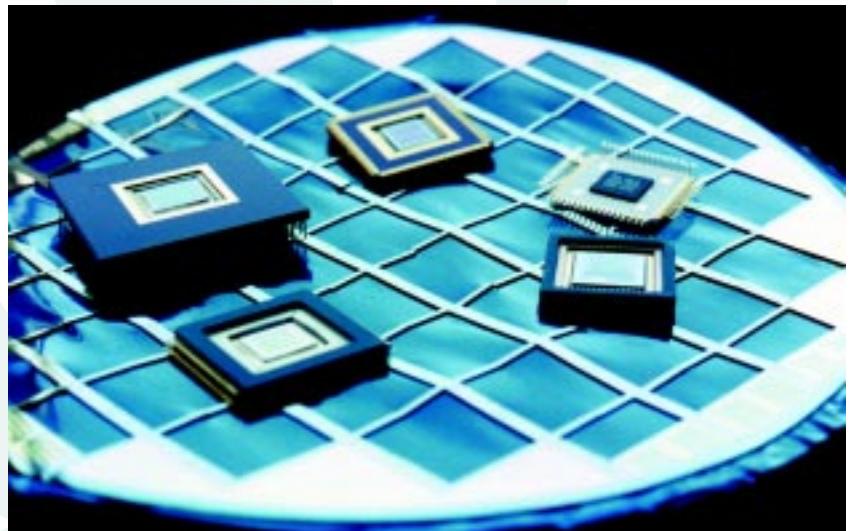
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## MICROELECTRONICS RESEARCH CENTER

The goal of the Microelectronics Research Center (MRC) is to advance Very Large Scale Integrated (VLSI) electronics through state-of-the-art electronic research and development of special purpose computer chips that benefit the electronics industry and the nation. Industrial needs are addressed through close interaction with major electronic companies and national needs through involvement with national research laboratories in NASA, DoD and DoE. The MRC expects to produce functional chips that meet commercial, military or space flight performance specifications and success is defined not only in terms of quality technical papers and excellently trained students, but also in chips that are manufacturable and ready for production. The MRC staff believes that fundamental ideas are more fully explored and developed when a project is demonstrated in working hardware. PicoDyne Inc., a new Albuquerque startup company that has licensed MRC technology through the Science & Technology Corporation, has had sales in excess of \$2 million.

Recent chip deliveries include a CCSDS standard data decompressor (the ground station companion for an earlier space flight compressor), the first installation of a higher performance lossy data compression chip set and a telemetry channel coder for a classified mission.

Projects currently underway include the second high performance data compression chip set member, a high speed cross correlator for microwave radiometry, a highly programmable Reed Solomon EEC engine, and an Ultra Low Power Radiation Tolerant single chip microcontroller. Under DoD and NASA sponsorship of our CULPRIT (CMOS Ultra Low Power Radiation Tolerant) program, we have demonstrated a special purpose processor capable of performing 1.28 GigaOperations/sec while consuming only 2.1 milliwatts of power.



NASA's third Hubble Space Telescope servicing mission in December of 1999 saw our second chip to be installed on board HST inside a Solid State Recorder that replaced an exiting reel-to-reel tape recorder. Other recent launches have also carried MRC chips into outer space on board such space-

craft as LandSat 7, Chandra X-Ray Observatory, TERRA, KOMPSAT, Multi-Spectral Thermal Imager, and EO-1. Upcoming launches carrying some of our hardware include 2001 Mars Odyssey, TIMED, and the Vegetation Canopy Lidar. In addition to these launches, a MRC chip recently participated in a very exciting landing – the telemetry that continued to successfully reach Earth following the NEAR spacecraft's soft landing on the asteroid Eros was protected against transmission corruption by one MRC's Reed Solomon coder chips.

*MRC's chips improve the world and our view of the Universe beyond*

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Alumni Memorial Chapel



Duck Pond



Student Service Center



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