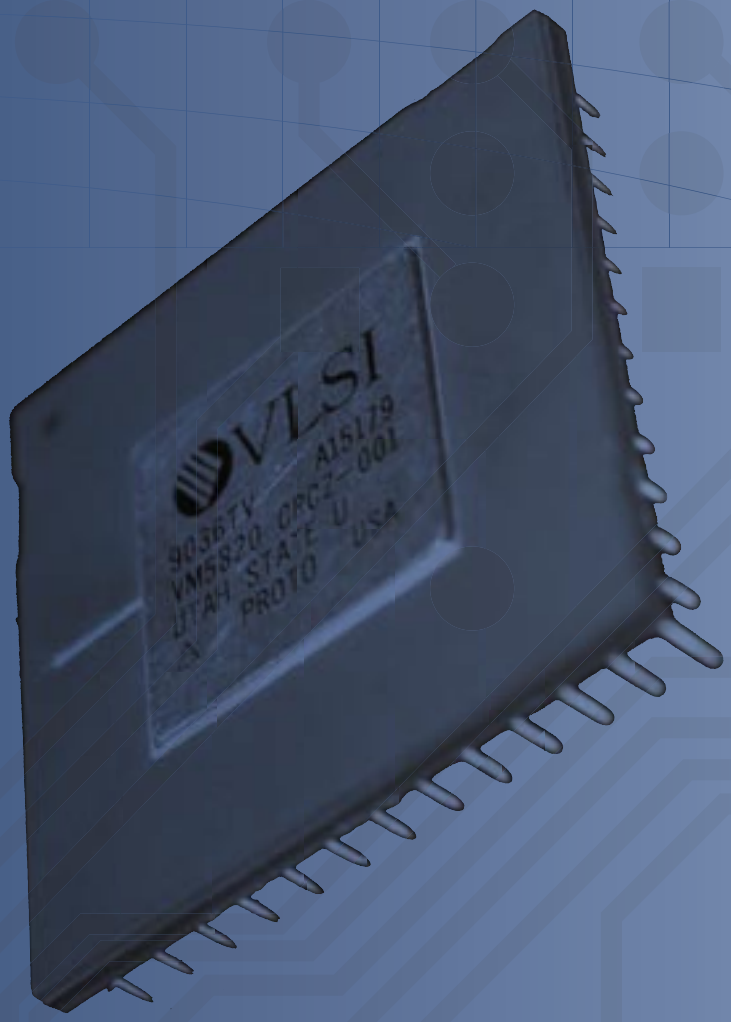

ECE 2004

ELECTRICAL AND COMPUTER ENGINEERING

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UtahState UNIVERSITY

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Message from the Dean

Scott Hinton

The College of Engineering continues to grow and improve! This past year we enrolled over 1700 undergraduate students and over 350 graduate students. We have moved into the new engineering building and have started the design phase of renovating the old engineering lab building. This past year we added six new faculty members which brings the college up to 82 tenure/tenure track faculty members in addition to 10 research professors. In research we published almost twice as many journal papers as we did the previous year, our research expenditures were over $11.3M, and we were recently awarded a new $10M NSF research center. It has been a good year!

The ECE department continues to be one of the most exciting departments in the college. Their faculty continues to push the boundaries of the ECE supported technologies with new patents and research papers. They also are very effective in bringing these new ideas into the classroom to prepare students to understand the leading edge of technology so they can be immediate contributors as they move into industry.

Finally, I am also pleased to announce that Dr. Tamal Bose has been appointed the new Department Head of the ECE department in November 2003. He is a strong and respected leader with a strong vision about the future of the ECE department. I am confident that he will lead the ECE department into the type of national prominence that will make you all proud to be ECE alumni.

Scott Hinton
Dean, College of Engineering

Message from the Department Head

Tamal Bose

It is my pleasure to write this message for our inaugural ECE magazine. This magazine is for the alumni and friends of the ECE department. It is also intended to serve as an annual report and to bring more visibility to our department and our programs.

We currently have a very strong ECE department with quality teaching and research programs. Our strengths lie in our talented faculty, bright and diligent students, and dedicated staff. Our strongest research programs are in the areas of space engineering, robotics, signal processing, electromagnetics, and bioengineering. We have nationally renowned centers and faculty in these programs. Largely due to these programs, we attract about $3.5M per year in external research funding.

The department has been growing steadily over the past few years. We currently have over 400 undergraduates and about 150 graduate students. This reflects over 50% growth in less than three years. We have 20 full-time faculty members and have recruited three additional Assistant Professors who will join us in the 2004-05 academic year. All of the new faculty members are in the area of computer engineering. This shows a departmental commitment to strengthen our computer engineering program.

Although we have a strong department, there is plenty of room for improvement. Our PhD student population is relatively small and about 15% of the total graduate students. Our goal is to increase it to 50% over the next five years. We also need named laboratories and endowed faculty positions. The reality is that all of these initiatives require funding. Therefore, I am working closely with the college development officers to increase private donations and endowments. With faculty growth and increasing emphasis on research, we expect our external research funding to grow significantly.

I solicit all of your support in my efforts towards bringing international recognition to this department. This is a great department and I am proud to have the opportunity to lead it.

Tamal Bose
Department Head
Electrical and Computer Engineering

2003-04
Department Information

RESEARCH CENTERS

Anderson Wireless Center
Interim Director: *Michael Tompkins*

Center for High-speed Information Processing (CHIP)
Director: *Tamal Bose*
Co-Director: *Jacob Gunther*

Center for Self-Organizing Intelligent Systems (CSOIS)
Interim Director: *YangQuan Chen*

National Center for Design of Molecular Function (NCDMF)
Director: *Linda Powers*

Utah Space Research Institute (USRI)
Co-Director(s): *Charles Swenson, Todd Mosher*

DEGREES AWARDED

BS Electrical Engineering	53
BS Computer Engineering	20
MS Electrical Engineering	31
ME Electrical Engineering	44
PhD Electrical Engineering	1

SPONSORED RESEARCH

Total Research Funding	$3.2M

CASH DONATIONS

Total Donations	$105,000

UNDERGRADUATE PROGRAM

Number of Courses	43
Number of Students Enrolled	408

GRADUATE PROGRAM

Number of Courses	39
Number of Students Enrolled	144

IEEE OFFICERS

Back: *Daniel Frei, Rustin Banks, Noah Sundberg*
Front: *Kenneth Reese, Scott Cornelson*

USU Robots in Iraq

A little bit of Logan crawls around the dusty streets of Baghdad these days. Actually, there are 10 little crawlers and, more specifically, they hail from the Center for Self-Organizing and Intelligent Systems (CSOIS) in the Department of Electrical and Computer Engineering.

These little crawlers are actually a new generation of intelligent and highly mobile robots that American soldiers can operate from a distance to inspect the undercarriages of vehicles wishing to pass through critical checkpoints around Iraq's capital city. They are superior to robots of an earlier ilk because of a key enabling technology concept created by researchers at the Center called the "Smart Wheel."

This is a self-contained wheel module with a steering motor, drive motor, and an innovative slip ring that allows data and power to pass from the chassis to the wheel without a wired connection. A Smart Wheel has independent control of its drive and steering axes. The slip ring allows infinite rotation in the steering degree of freedom.

Should the electronic sensors aboard the low-profile robot detect something suspicious, the semi-autonomous robot can quickly maneuver in any direction to make a closer inspection.

ODIS, as this hard-working electronic hound was named for its Omni-Directional Inspection System, traces its ancestry to the T-series of robots developed in a collaboration between CSIOS and the U.S. Army Tank-Automotive Command (TACOM). The TACOM project is a perfect example of the research cycle where theoretical ideas are proposed, explored, refined, and finally commercialized. Prototypes T1, T2, and T3 are the granddaddies of ODIS and were developed to demonstrate the feasibility and scalability of omni-directional vehicles.

ODIS is a man-portable robot that can be used for autonomous or semi-autonomous inspection under vehicles. Customers for such a system include military police and other law enforcement entities interested in searching under vehicles for bombs or contraband. Sensors carried by ODIS can be used to detect chemicals, biological agents, thermal signatures, radiation, or to simply send back video images to the operator.

One outcome of the TACOM project has been a licensing agreement with a manufacturing firm that will produce ODIS-T2 in volume. It was this manufacturer that filled the order for 10 ODIS-T2s to take up duties in Iraq.

While research continues to improve ODIS, CSOIS is pursuing challenges on two additional fronts. The first is a conceptual plan for multiple autonomous agents to detect threats in critical locations such as nuclear reactors, power plants, and military installations.

The second is a parking lot surveillance system that includes a golf-cart sized mother robot (T4) and a pizza-box sized child robot (ODIS). T4 can autonomously patrol a parking lot, using its ample vision capability with stereoscopic head cameras, a boom camera (on a robotic arm), and a real-time license plate recognition system. Should "Mom" detect a suspicious vehicle, it can deploy ODIS to autonomously investigate the undercarriage of the vehicle.

Front (left to right): Morgan Davidson, Kevin Moore, YangQuan Chen, Hui Fang Dou

The various activities at CSOIS have always involved graduate and undergraduate student engineers. ODIS and his ancestors have provided students with invaluable real-world experiences. Several students gathered the necessary skills, creativity, and incentive to start new ventures. Several thriving companies can trace their roots to CSOIS.

Work on these unique robotic workers was begun by Dr. Kevin Moore, under whose guidance CSOIS thrived for its last six years. Dr. Moore recently joined the Applied Physics Laboratory at Johns Hopkins University, leaving the Center in the capable hands of interim director YangQuan Chen. The Center was officially organized in 1992 with funding from the State of Utah Center of Excellence Program.

CSOIS robot in Iraq

Miniaturizing Communications & Signal Processing

Most of us already marvel at the power of the palm-sized hardware we use in our everyday lives. Phone, fax, email, calendar, computer, alarm clock, camera, and charge card are now packaged to take less room than a pack of playing cards. Nevertheless, "smaller, faster, cheaper, and more efficient" are the words driving researchers working with fast signal processing algorithms and their implementation in VLSI chips.

The Center for High-speed Information Processing (CHIP) at Utah State University is focused on research and education in fast algorithms capable of processing signals and images more efficiently and using less computational resources. With Tamal Bose as director and Jacob Gunther as co-director, CHIP Center researchers hope to design, prototype, and commercialize their work. CHIP is in its third year of funding from the State of Utah Centers of Excellence Program with matching funds from federal agencies and private companies.

"Chip area can be reduced by half to give us twice as much computing space that uses less power," says Dr. Bose. "When a signal is received on a cell phone, it has undergone a lot of operations such as noise removal, coding, modulation, averaging, and compresssion. A lot of computations—addition, substraction, and multiplication—are necessary.

"Multipliers are a bottleneck in computational speed of Integrated Circuits (IC) chips," he explains. "ICs, which are the brain of digital devices, implement complicated functions. The lesser the complication, the faster the IC will work and the less power and space it will need.

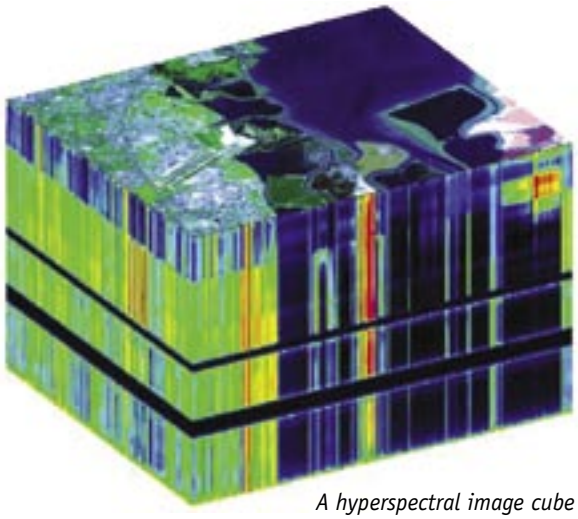
"To reduce the complexity of a function, different algorithms can be implemented that act as computational machines instructing the ICs how to implement the math. The goal of CHIP researchers is to invent algorithms that are multiplier-free," the director explains.

The Center will focus on creating smaller, faster chips via faster algorithms that will result in smaller, more powerful cell phones, computer modems, and digital radio and television. Using less power translates into fewer batteries for earth-bound digital consumer gadgets and less drain on solar collectors used to power machines in space.

"This is very beneficial as power budgeting in spacecraft applications is very important," Dr. Bose notes. "For example, it allows processing of streaming images from spacecraft. Presently, the images are downloaded only after the spacecraft returns and then it takes days and months of processing to discern the actual image."

Other research underway at the USU Center deals with echo cancellation in speaker phones, under the guidance of Dr. Gunther. "Echoes are

Dr. Jacob Gunther (right) with doctoral student Song Wang, working on the hearing aid project



A hyperspectral image cube

the most annoying artifacts when using hands-free communication devices such as speakerphones," he points out. "The echoes can be introduced either acoustically or electronically."

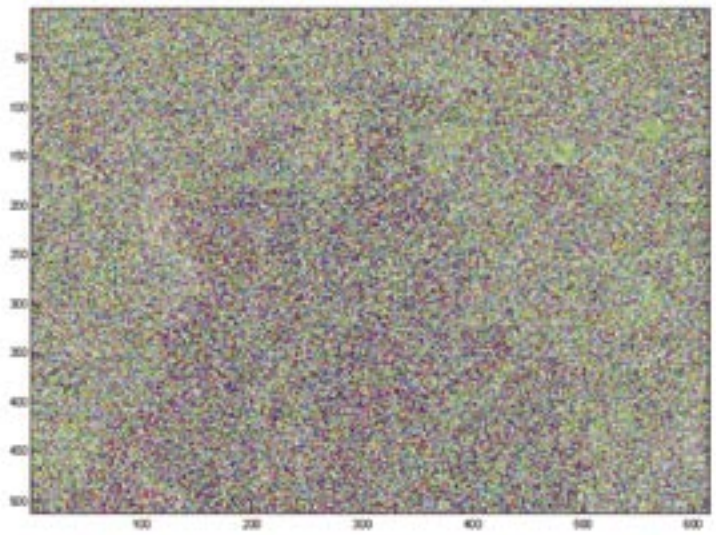
In a speakerphone, acoustic echoes arise when the signal emitted from the loud speaker finds its way back to the microphone. Line echoes are due to reflections at impedance mismatches in the telephone system. If the person at the far end of the call hears an echo, it is probably due to acoustic echo on your end. If you hear the echo, then it is probably line echo.

Echo cancelers were introduced to eliminate distracting echoes. Conventional echo cancelers work by synthesizing an echo signal that matches real echo. Then the echo may be canceled by subtraction. This technique has a drawback: communication can only be carried out in one direction at a time. So, when one person is speaking, the person on the other end must listen and vice versa. When sound is produced on both ends simultaneously, conventional echo cancelers fail. The new echo canceller processes the signals—one from near end, one from the far end, and a third one that it creates—in a way that takes into account their physically independent origins. Algorithms were developed based on the principle that the two signals are statistically independent as they arise from physically different sources. The algorithm has been incorporated into a prototype circuit and implemented on a programmable microprocessor chip.

The new echo canceler adapts itself a large number of times per second to adjust to the changes in the echo when two people are talking. This family of algorithms will be patented in the near future, according to Dr. Gunther.

Another active project at CHIP hopes to cancel acoustic feedback in hearing aids. Electronic hearing aids pick up environmental sounds using a tiny microphone and output an amplified version through a small loudspeaker. Acoustic feedback from speaker to microphone causes the hearing aid to ring.

Using advanced signal processing algorithms, CHIP researchers are investigating ways to cancel feedback so that higher ampliciation can be achieved in hearing aids. Drs. Gunther and Bose are collaborating with a Utah-based company that is a world leader in digital hearing aids.



Corrupted image of Moffet field

Processed image

Bioagent Sensors: Guarding Against Bioterrorism

Long before the infamous events of Fall 2001, researchers in Utah State University's National Center for the Design of Molecular Function (NCDMF) turned their energies to detecting and identifying biological pathogens that might be loosed on the world. Whether these pathogens are released intentionally by terrorists, accidentally, or even naturally, they can result in disease or death when inhaled, swallowed, or brought into contact with skin of humans and other living beings.

Accurate and quick knowledge of exposure is of paramount importance to limit further dissemination and exposure, as well as to quickly administer effective therapeutic and prophylactic strategies.

Working under the aegis of the National Institutes of Health (NIH) and other federal agencies since 1993, NCDMF researchers have developed a low-cost, continuous, automated, distributed system for the detection of bioagents at the infectious dose level. This system consists of disposable bioagent exposure identification technology and optical-based detection which immediately identifies the bioagents and the degree of exposure. This technology can be used in air, water/liquids, mail, foods, and on other surfaces, and has been extensively tested in real world conditions.

Established in 1988, the NCDMF is the brainchild of Professor Linda Powers. The Center's primary goal has been to establish "rules" for the design of biomolecular function which involves intimate relationship between molecular structure, function, and energy. The secondary goal is to develop instruments for biomolecular analysis applicable to environmental, biomedical, and homeland security/bioterrorism problems.

During its tenure as an NIH Research Resource, the Center developed a variety of novel spectroscopic and kinetic instruments. The research is both basic and applied, and the expertise of chemists, microbiologists, biochemists, physicists, and engineers is brought to bear on problems falling within three broad categories: 1) establishing the underlying basis for the design of biomolecular function, 2) the development of novel spectroscopic and kinetic instrumentation, and 3) engineering applications of biotechnology to environmental and biomedical problems.

The Center's photonics laboratory possesses a variety of capabilities, including photothermal, transient, and real-time time-resolved absorption/emission measurements. This facility includes a large, shielded laser enclosure containing two excimer lasers, a copper vapor laser (30 kW peak power), and three-dye lasers with more than 10 percent energy conversion efficiency. A broad selection of optical and diagnostic equipment is available.

Dr. Linda Powers with students

A nearby instrumentation room houses cell sorting instruments, a dual-wavelength double-beam spectrophotometer, a custom-built stopped-flow spectrophotometer, and a temperature-jump apparatus. Also included are several fluorenscence instruments.

With funding from the Eccles Foundation, NIH, Department of Defense, and the Department of Justice, NCDMF researchers have developed specifically designed molecules, called ligands, that are used to bind to specific microbes, and they've designed capture surfaces that selectively bind bacterial cells, spores, toxins, and viruses using molecular engineering methods.

These ligands can be chemically linked to a surface by long organic molecules as well as attached to fluorophores for ELISA-type methods. DNA can also be captured using ligands based on charge and surface technology.

While capture events can be detected using a number of methods, intrinsic fluorescence of the microbes, toxins, and DNA such as that from metabolites, amino acids, and other specific cell components provide highest sensitivity and require no sample contact.

Several multi-wavelength intrinsic fluorescence detection devices have been developed and tested with secure wireless communications that employ pattern recognition algorithms for detection and microbe identification. The optical reader technology using wireless data transmission has been demonstrated and is ideal for integration into a large-scale network.

Rocky Mountain Space Grant Consortium: Collaboration is the Name of the Game

Under the auspices of the Rocky Mountain NASA Space Grant Consortium, students at all levels of study at Utah State University are learning approaches to designing, fabricating, testing, and calibrating small rockets with atmosphere measuring capabilities. Equally important for students is the opportunity to learn to collaborate with students and professionals across the country.

Students from USU, University of Utah, Brigham Young University, and Weber State University have collaborated in the UNITY IV rocket design project, while similar consortia in Virginia, Colorado, and Alaska collaborate with the Rocky Mountain group on other small rocket projects.

Dr. Doran Baker works with students in his center

UNITY IV rockets use hybrid (solid + liquid) engines developed and tested by students. A flight this year exceeded 4,000 ft. altitude. USU and Hampton University (Virginia) students are collaborating to develop small rocket infrared radiometers to measure OH and O2 in the mesosphere. The sensor is a 2-channel radiometer called MINRAD, and prototype instruments have successfully passed through calibration.

Another important player in the collaboration is the Utah Rocket Club whose members work with university students to design, build, and launch small rockets. This affiliation is a great aid in recruiting students into engineering and technology as they and/or their parents participate in consortium activities.

A major player in all of these efforts is NASA and its Office of Space Science, Education, and Public Outreach. The Consortium maintains a mutually supportive working relationship with NASA Centers. Their overall aim is to assist teachers with space technology curricula and to help create hands-on experiences for high school-age and younger students. Ties are also forged to aerospace-related industries and commercial firms, and state and local government units, and the Consortium which helps with implementation and use of distance-learning systems.

The Rocky Mountain NASA Space Grant Consortium was founded in September 1989 by a group of organizations: USU, University of Utah, University of Denver, and Thiokol Corporation. From its Rocky Mountain roots, the Consortium has offered opportunity and experience in space science, often with accompanying fellowship dollars.

Launching Satellites

Eager engineering students from several of Utah State University's departments have their heads together designing what they hope is a most exceptional nanosatellite. They won the right, along with 13 other student design teams from universities across America, to compete in a NASA program to build the best nanosatellite.

In 2002, NASA awarded each of the 14 teams $100,000 as seed grants and gave them two years to design, build, and test their satellites which are about the size of a 19 inch television set. Jeff Ward, principal investigator for the team and doctoral candidate in electrical and computer engineering, said "Many satellites are so complex that things can go wrong. You can't send a mechanic into space to fix a problem, so we've chosen a safe and reliable design that will get the job done. We want to win this competition, and we believe we have a better chance by keeping it simple."

The students are part of a long and strong tradition of space exploration begun 45 years ago at Utah State by Professor Doran Baker. USU boasts the most student-designed, university-originated experiments ever to be carried into space. Carrying on that tradition falls onto the shoulders of, among others, Charles Swenson, associate professor and an internationally recognized leader in the measurement of ionospheric properties. Swenson guides the work of the student team and certainly had an influence on their choice of work they will ask their satellite to perform.

The students have until Jan 2005 to perfect their design and to make sure it performs to their specifications. It's interesting to think that this small research satellite may some day shed light on upper atmosphere goings-on above the homelands of such team members as Joel Quineieu of Switzerland, or Aroh Barjatya of India.

Dr. Swenson points out that "There was a time when the government and NASA recruited talented engineers and then trained them according to their requirements. But now," he says, "there is a need for engineers already trained for the job. There is an urgent need for new, highly trained people because many of the people from the Apollo era are retiring and very few people are ready to take their places."

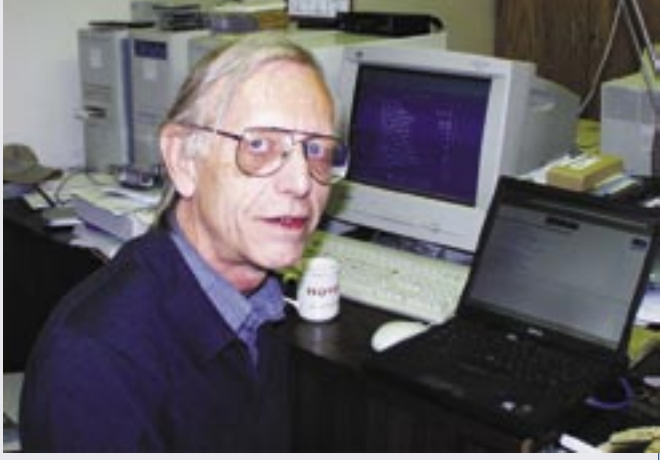
To that end, Dr. Swenson and many other research and teaching professors at USU encourage students to work with them in research and design. One of Swenson's projects, a NASA-funded effort to measure the time history of the nighttime E-region neutral winds, was launched just over one year ago from Wallops Flight Facility in Virginia.

Aroh Barjatya also works on this project. He explains that the band of ionosphere extending from 95-150 km is called the E-region. "Plasma impedance probes measure electrical properties of the ionosphere, an upper region of the atmosphere starting at about 80 km composed of electrons that have been stripped from atoms by the Sun's x- and UV rays. Information gathered during the flight tells scientists much about the formation, composition, and dynamics of this layer, including density, temperature, and plasma frequency of internal descending intermediate layers of the mid-latitude nighttime E-regions."

Another of Dr. Swenson's projects is the Floating Potential Measurement Unit which should be carried to the International Space Station on the next space shuttle flight. The cross-shaped instrument will monitor static charging on the space station so that a safer environment can be provided for astronauts when they must work outside the station.

Dr. Swenson (front center) and his team

Doupnik to Oxford



Dr. Joe Doupnik

Professor Joe Doupnik exchanges the open-neck sports shirt attire of a typical Utah State University engineering professor for the robes of Oxford University this fall as he begins a year-long sabbatical. Dr. Doupnik's ties to the United Kingdom (UK) networking community are vast; he has presented many seminars on behalf of Salford Computing both in the United States and abroad.

Teaching duties will include conducting seminars at Oxford University on real-time networking issues faced on a day-to-day basis. He will balance his teaching duties with research on enhancing the Service Location protocol (SLP). "SLP is an Internet standard which provides a scalable framework to find and select services offered by devices on the network," Doupnik explains. "SLP is a computer-to-computer protocol used on local networks only. DNS (Domain Name System) and DHCP (Dynamic Host Configuration Protocol) are helpful to some extent in obtaining the information about the services provided by the device. While SLP initially was designed for local networks and not for the Internet, it is now needed globally."

"There's a problem using broadcast and multicast in SLP on large networks," Doupnik says. To overcome these problems, he plans to enhance the SLP protocol and re-implement it for Internet application.

"Each university uses networking for its own needs," Doupnik continues. "But sometimes people are overwhelmed by the onslaught of new technologies. Pooling technical resources is a better way to overcome problems," he says of his plans to collaborate with academicians from various universities in the UK. By combining resources for testing and exploring new technologies, Doupnik and collaborators hope to remain well ahead of market time.

The 24-year veteran of the USU classroom and laboratory helped found a consortium of 100 major universities, with Novell as the industrial collaborator. The consortium is adding major UK universities to its ranks.

"We wish Joe a productive and exciting sabbatical in England and look forward to seeing him from time to time as he commutes back to the States for an occasional visit," says Department Head Tamal Bose.

Student National Awards

Kenneth B. Reese Receives National Tau Beta Pi Award

The Fellowship Board of Tau Beta Pi, the engineering honor society, announced the selection of 35 young engineering graduates from 306 applicants to receive graduate fellowships for 2004-05. Kenny Reese, a 2004 B.S. graduate in Electrical & Computer Engineering at USU, was chosen as one of the award recipients. All Tau Beta Pi Fellowships are awarded on the competitive criteria of high scholarship, campus leadership and service, and promise of future contributions to the engineering profession. All fellows are members of Tau Beta Pi and may do their graduate work at any institution they choose. Kenny plans to use the fellowship to pursue an M.S. degree in Electrical Engineering with an emphasis in Communications here at USU. "I feel very honored to have been awarded this fellowship from Tau Beta Pi. They are a well-respected society and really do have service to others as their number one goal," said Kenny.

Sid Henderson's student paper award

Sid Henderson received an "Outstanding Student Paper" award in December, 2003, from the Physics & Aeronomy Section of the American Geophysical Union. His work, entitled "Characterization of the Equatorial Anomaly and Automatic Detection of Equatorial Plasma Bubbles in GUVI Data," presented a new technique that uses ultraviolet images taken from NASA's earth orbiting TIMED spacecraft to study equatorial ionospheric physics. With his advisor Dr. Charles Swenson from the ECE department and Dr. Bela Fejer from the Physics department, he is studying physical phenomena that disrupt space based communication systems such as GPS.

Aroh Barajata Receives Award for Top Paper at conference

Aroh, an ECE graduate student, recently attended the 8th Spacecraft Charging Technology Conference in Huntsville, Alabama along with his major professor, Charles Swenson. He received an "Outstanding Student Paper Presentation" Award. The title of his paper is "Observations of vehicle surface charging in dusty plasma." The paper discusses a surface charging event that was seen on a sounding rocket flight in February 1998. The Sudden Atom Layer (SAL) rocket's main mission was to investigate the sporadic sodium layers that form at an altitude of 80-100 Km and to detect the presence of dust layers in the vicinity of the sodium layer. The rocket carried two instruments built here at Utah State University's Space Dynamics Lab: The Swept Impedance Probe and the DC Langmuir Probe. Aroh presented the data from the two probes and the development and application of a SPICE model to explain the anomalous features of the data.

Todd Bigelow First Prize Winner in Best Student Paper Award Competition

Todd Bigelow is a senior in the electrical engineering program and worked closely with Paul Wheeler and the FACT Center's Kevin Reeve to develop a multimedia CD-ROM for the science of sound class. He was invited to present his paper titled "Software Tools for Developing and Acoustics Multimedia CD-ROM," at the Acoustical Society of America (ASA) meeting in Austin, Texas. His paper won the Best Student Paper award, even though he was the conference's sole undergraduate.

ECE Dedicates the Micron Digital Design Laboratory

The first named laboratory was dedicated in the ECE department on November 7, 2003. Micron Foundation donated $100,000 to establish the Micron Digital Design Laboratory. This lab is used by a variety of courses on digital systems at the junior and senior levels. Denzil Rogers of Micron was honored at the ceremony. The dedication ceremony was addressed by Tamal Bose, ECE Department Head, and was attended by Scott Hinton, Dean of Engineering, Joyce Albrect, VP for Development, and many faculty members, students and staff. We sincerely thank Micron for this donation.

(left to right): Henry Coakley, Randy Haupt, Dean Scott Hinton, Denzil Rogers, and Joyce Albrecht

Electrical & Computer Engineering 2004 Awards

Outstanding Researcher

Professor Jacob H. Gunther received the BS, MS and PhD in Electrical Engineering from Brigham Young University in 1994, 1995 and 1998 respectively. After working for a couple of years at Merasoft, Inc. in Orem, he joined the ECE department in 2000 as an Assistant Professor. In his short time at USU, Dr. Gunther has established an active externally funded research program in signal processing and communications. Dr. Gunther has demonstrated remarkable creativity and breadth in his research. He has been publishing actively in the top rated journals and supervis-

ing a large number of graduate students. He is the inventor on 6 U.S. patents and has recently established a USU research partnership and royalty sharing agreement with a large Utah company for his echo cancellation work. He is a regular attendee and participant at world-wide conferences of signal processing community. Dr. Gunther is currently the vice-chair of the Utah section of the IEEE Signals & Communications Society. He is co-director of the Center for High-Speed Information Processing.

Outstanding Teacher

Professor Jacob Gunther received the award from Kenneth Reese, IEEE President. Dr. Gunther established himself as a very popular professor in a short time. In the last three years he has taught seven different courses representing a huge amount of preparation time; yet he received excellent student evaluations in all of them. Students love his classes and are always excited when they get him as an instructor. He is always enthusiastic about teaching. Dr. Gunther was selected for his ability to take a difficult topic and express it in a clear way. He takes the time to ensure that every student has a solid understanding of principles. To achieve this, he will go to the extra mile in holding additional study sessions outside of class and patiently accommodating students at his office.

Outstanding Advisor

Dr. Doran Baker received the award from Kenneth Reese, IEEE President. Dr. Doran Baker brings a long history of working with students as advisor and mentor. He works with both undergraduate and graduate students in the ECE department. In his work as Director of Rocky Mountain Space Grant Consortium, a NASA program, he has provided scholarships to students inside and outside the department. "He is always willing to give students valuable career advice and direction. He has helped numerous students gain full-time employment after graduation from USU and part-time employment at Space Dynamics Laboratory while they are still in school," according to IEEE students. Dr. Tamal Bose speaks of Dr. Baker's "unwavering dedication to our students."

Distinguished Alumnus

William I. Fletcher graduated in 1968 from USU. Bill Fletcher received his BS from Weber State University in 1965 and the MS degree in Electrical Engineering from Utah State University in 1968. Bill worked at the Lawrence Livermore Laboratory before joining Utah State University as faculty member. During his last 14 years at USU, Bill wrote his best selling text book An Engineering Approach to Digital Design, which now has been declared one of Prentice Hall's Eleven Classic Engineering Texts. Bill and two other faculty members at USU founded Design Analysis Associates, Inc. (DAA) in 1972. They developed software to analyze electronic systems for the purpose of fault detection in electronic systems. Although the initial direction of the company has changed, the company has achieved a significant growth each year since its beginning. Bill and his DAA team are also known for their wide temperature, rugged, precision, pressure measurement systems. He is presently the President and CEO of Design Analysis Associates, Inc.

Distinguished Service Award

Dr. Allan Steed received his BS, MS and PhD degrees in Electrical Engineering from Utah State University in 1963, 1964 and 1978 respectively. In 1964, he joined the staff of Electro Dynamics Laboratory (EDL), a predecessor of SDL, at Utah State University and later became the director of EDL in 1978 and then the director of SDL in 1982. As the head of SDL, Dr. Steed led a staff of more than 330 professional and technical experts, while managing an annual budget in excess of $50 million. During his career he has served on many ECE graduate committees, taught graduate classes in space engineering and electro-optical engineering. Dr. Steed said that one of the most important roles of SDL in education has been to provide financial support and exceptional experience to about 100 students per year. He has continually been a champion of student and faculty involvement at SDL's programs. In 1996, Dr. Steed was named the CEO of Utah State University Research Foundation. Some of his many honors include USU Leone Leadership Award, D. Wynne Thorne Research Award, and the Utah Governor's Medal for Science and Technology.

Outstanding Senior

Senior Bruce Christensen received the award from Tamal Bose, ECE Department Head. The Department of Electrical and Computer Engineering has chosen Bruce Christensen to represent them as their Outstanding senior for 2004. Bruce has been involved in many projects such as Water Fountain, Remote Robot, DLX processor Design and SumoBot. He has also set up systems and made programs to meet the needs of his family's construction company. He networked the computers, created an invoice program, a time clock program and other general maintenance. In Bruce's spare time he enjoys snow boarding, water skiing, camping, motor biking and spending time with his wife Valerie. Bruce graduated last December and now works for a growing digital signal processing company in Salt Lake City. Eventually he would like to own his business (a family tradition). He would like to invent something that his company would manufacture. Bruce has a 3.9 GPA.

Outstanding Junior

Michael Lillywhite Outstanding Junior 2003–2004. Michael Lillywhite represents Electrical and Computer Engineering as the Outstanding Junior for 2004. He is an active member of Engineering Council. He works very hard as an Electrical Engineering Research Assistant with Dr. Liang. He is writing a program to convert a vector graphics file to a different format to be input in a cell phone wave pattern simulator. In Michael's spare time he enjoys reading, playing the clarinet and playing games with his wife Lori. He is a very active member in his church and has served many callings. He served as his Bishop's secretary, and also likes to help people in need. Michael has a 3.9 GPA.

Outstanding Pre-Professional Student

Brian Parke received award from Tamal Bose, ECE Department Head. The Department of Electrical and Computer Engineering has chosen Brian Parke for the Outstanding Pre-Professional student award. Brian is planning on attending law school to become patent attorney. He enjoys all sports and participates whenever his schedule allows. Brian has two jobs: he referees for USU intra mural sports, and works as an electrician on weekends. Brian is also very active in his church. He enjoys spending time with his wife Stephanie. Brian has a 4.0 GPA.

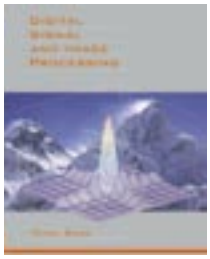
Outstanding Graduate Teaching Assistant

Broc Going received the award from Tamal Bose, ECE Department Head. Broc will be graduating Spring 2004 with an ME in Electrical Engineering and a BS in Computer Engineering. He has been studying at USU since 1997, except for two years spent in Chile doing church service. He is a member of IEEE and Tau Beta Pi and is currently serving as Corresponding Secretary of our chapter of Tau Beta Pi. Broc is from Richmond, Utah. He has a wonderful wife and two beautiful little girls and between family and school he keeps busy. Once he is finished with school, Broc and his family will move to Boise, Idaho, where he will work as a Software Engineer for Micron Technologies.

Outstanding Graduate Research Assistant

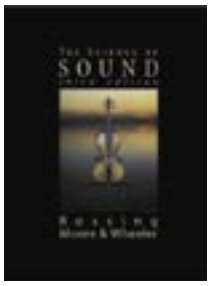
Lili Ma received the award from Tamal Bose, ECE Department Head. Lili received both her bachelor's and master's degrees in Electrical Engineering at Harbin University of Science and Technology in China majoring in Industrial Automation and Instrumentation. After getting her MS degree, she worked for a high-tech company for one year, doing programming for power supply monitor. After that she joined USU in Spring 2000 as a PhD student and has been working for CSOIS. Her research interests are in the areas of Control, Robotics and Computer Vision.

New Books by ECE Authors



Digital Signal and Image Processing
Tamal Bose
John Wiley, 706 pages, Nov. 2003
ISBN: 0-471-32727-1

Modeling, Sensing and Control of Gas Metal Arc Welding
Desineni Subbaram Naidu, Selahattin Ozcelik & Kevin L. Moore
Elsevier Science Ltd., 351 pages, Oxford, UK, 2003, ISBN: 0080440665



The Science of Sound (3rd Edition)
by Thomas D. Rossing, F. Richard Moore and Paul A. Wheeler
Pearson Addison Wesley, 680 pages,
3rd edition 2002, ISBN: 0805385657

System Simulation Techniques and Applications Based on MATLAB/Simulink
By Dingyu Xue and YangQuan Chen
Tsinghua University Press, Beijing, China, 2002 (in Chinese), 434 pages
ISBN: 7-302-05341-3/TP3137

Journal Publications 2003

Doran Baker

D.L. Wright, G.L. Ritchie, V.P. Rasmussen, R.D. Ramsey and D.J. Baker, "Managing Grain Protein Wheat Using Remote Sensing," Online Journal of Space Communication, Vol. 3, 2003.

Tamal Bose

M. Radenkovic, T. Bose, and Z. Zhang, "Self-Tuning Blind Identification and Equalization of IIR Channels," EURASIP Journal on Applied Signal Processing, pp. 930-937, Aug 2003.

Annette Bunker

Annette Bunker, Ganesh Gopalakrishnan and Konrad Slind, "Live Sequence Charts Applied to Hardware Requirements Specification and Verification: A VCI Bus Interface Example," Software Tools for Technology Transfer, 2003.

YangQuan Chen

1. J. Liang, Y.Q. Chen, "Optimization of a Fed-batch Fermentation Process Control Competition Problem Using NEOS," Proceedings of Inst. Of Mechanical Engineers, Part-1 (UK). Vol. 217, Part-1 pp.427-432.
2. YangQuan Chen, Kevin Moore and Vikas Bahl, "Learning Feedforward Control Using a Dilated B-Spline Network: Frequency Domain Analysis and Design," IEEE Transactions on Neural Networks, 2003.
3. Y.Q. Chen, B.M. Vinagre, "A New IIR-Type digital fractional order differentiator," Signal Processing. (Elsevier) Vol.83, no. 11, pp.2359-2365.
4. B.M. Vinagre, Y.Q. Chen, I. Petravs, "Two Direct Tustin Discretization Methods for Fractional-order Differentiator/Integrator," Journal of the Franklin Institute pp. 349-362, Vol. 340, Issue 5, August 2003.

Randy Haupt

1. R. Haupt, "Generating a plane wave in the near field with a planar array antenna," Microwave Journal, Aug 03.
2. D. Yang, Y.C. Chung, and R.L. Haupt, "Genetic Algorithm Optimization of a Multi-sectional Corrugated Conical Horn Antenna," Microwave and Optical Technology Letters, vol. 38, no. 5, Sep 5, 2003, pp. 352-356.
3. R. Haupt and Y.C. Chung, "Optimizing ,"Optimizing Backscattering from Arrays of Perfectly Conducting Strips," IEEE AP-S Magazine, Vol. 45, No. 5, Oct. 2003, pp. 26 – 33.

Kevin Moore

YangQuan Chen, Kevin Moore and Vikas Bahl, "Learning Feedforward Control Using a Dilated B-Spline Network: Frequency Domain Analysis and Design," IEEE Transactions on Neural Networks, 2003.

Linda Powers

1. C. Estes, A. Duncan, B. Wade, C. Lloyd, W. Ellis Jr., L. Powers, "Detection of Microorganisms by Intrinsic Fluorescence," Biosensors & Bioelectronics 18, 511-19, 2003.
2. H.Y. Mason, C. Lloyd, M. Dice, R. Sinclair, W. Ellis Jr., L. Powers, "Taxonomic Identification of Microorganisms by Capture and Intrinsic Fluorescence Detection," Biosensors & Bioelectronics 18, 521-27, 2003.
3. C. Lloyd, F. Cleary, H.Y. Mason, C. Estes, A. Duncan, B. Wade, W. Ellis, L. Powers, "Is What You Eat and Drink Safe? Detection and Identification of Microbial Contamination in Foods and Water," IEEE Special Proceedings on Chemical and Biological Microsensors, 91, 908-914, 2003.
4. C. Lloyd, H.Y. Mason, C. Estes, A. Duncan, B. Wade, W. Ellis Jr., L. Powers, "Detection and Identification of Biological Threats," Proceedings BTR 2003: Unified Science and Technology for Reducing Biological Threats and Countering Terrorism, 114, 2003.

Charles Swenson

A.B. Christensen, L. Paxton, S. Avery, J. Craven, G. Crowley, D. Humm, H. Kil, R. Meier, C. Meng, D. Morrison, B. Ogorzalek, P. Straus, D. Strickland, C. Swenson, R. Walterscheid, B. Wolven, Y. Zhang, "Initial Observations With the Global Ultraviolet Imager (GUVI) in the NASA Timed Satellite Mission," Journal of Geophysical Research, 108(A12):1451, December 2003.

Research Grants & Contracts 2003

Doran Baker

1. Doran Baker, PI, Dwayne Westenskow, Co-PI, "NASA Space Grant," NASA HQ, Feb 2004-Jan 2005, $431,250.
2. Doran Baker, PI, Douglas Ramsey, Co-PI, "NASA Affiliated Research Center," NASA Stennis, Apr 1999-Mar 2004, $200,000.
3. Doran Baker, PI, Dwayne Westenskow, Co-PI, "Workforce Development," NASA HQ, Feb 2004-Jan 2005, $60,000.
4. Doran Baker, PI, John Vanderford, Co-PI, "Workforce Development with Multiple State Consortia," NASA HQ, Feb 2004-Jan 2005, $25,000.
5. Doran Baker, PI, Jim Ulwick, Co-PI, "SABER," NASA Langley, Jan 2004-Jan 2005, $55,000.

Tamal Bose

1. Tamal Bose, PI, Jacob Gunther, Co-PI, Randy Haupt, Co-PI, "Center for High-speed Information Processing," State of Utah, 2003 – 2004, $145,000.
2. Tamal Bose, PI, "Multiplierless filters for real-time processing of hyperspectral images," NASA, 2003-2004, $73,000.
3. Tamal Bose, PI, "Novel Algorithms for image processing," NASA, 2003-2004, $27,000.
4. Jacob Gunther, PI, Tamal Bose, Co-PI, "Feedback Cancellation for hearing aids," A Utah based hearing aid company, 2003-2004, $93,000.

Scott Budge

1. Robert Pack, PI, Scott Budge, Co-PI, Reese Fullmer, Co-PI, Paul Israelsen, Co-PI, Christopher Neale, Co-PI, Tom Wilkerson, Co-PI, "Center for Advanced Imaging LIDAR," State of Utah, 2003-2004, $135,000.
2. Scott Budge, PI, "Real-Time Processing of Multi-Channel Imagery from a Confocal Microscope," Pacific Northwest National Laboratory, 2003-2004, $49,918.
3. Robert Pack, PI, Scott Budge, Co-PI, Reese Fullmer, Co-PI, "Tactical Laser Radar Seeker Technology Research," Naval Air Warfare Center, 2003-2005, $300,000.

YangQuan Chen

1. Kevin Moore, PI, Y.Q. Chen, Co-PI, Igor Podlubny, Co-PI, "Fractional calculus and its applications in engineering and control," NRC, 2003-2005, $16,000.
2. Y.Q. Chen, PI, Eddie Loo, Co-PI, "Development of Real-time tele-lab," USU FACT, 2003-2004, $12,000.
3. Y.Q. Chen, PI, "Relay Automatic Tuning of Fractional Order PI/D Controller," USU NFRG, 2003-2004, $10,100.
4. Y.Q. Chen, PI, "Computational Optimal Control - software development," Private Donation, 2003-2004, $3,000.
5. Kevin Moore, PI, Y.Q. Chen, Co-PI, "Coordination and Control of Distributed Sensor Actuator Networks – From Single System Missions to Multi-Agent Missions," SDL Skunk Works, 2003-2004, $15,000.

Jacob Gunther

1. Tamal Bose, PI, J. Gunther, Co-PI, "Center for High-speed Information Processing," State of Utah, 2003-2004, $145,000.
2. J. Gunther, PI, Tamal Bose, Co-PI, "Advanced Signal Processing for Hearing Aids," A Utah based hearing aid company, $93,000.
3. J. Gunther, PI, "Antenna Arrays for Wireless Communications," CURI, 2003-2004, $9,780.
4. J. Gunther, PI, "Independent Component Analysis for Hyperspectral Image Unmixing," 2003-2004, SDL Skunk Works, $15,000.

Randy Jost

1. R. Jost, PI, J.R. Dennison, Co-PI, "Investigation of Contamination, Charge Storage and Charge Enhanced Contamination of Spacecraft Optical Components," Space Dynamics Lab, 2003-2004, $25,000.
2. R. Jost, PI, "Development of SAR Processing Capability," Space Dynamics Lab, 2003-2004, $30,691.
3. R. Jost, PI, "Development of EO/IR Calibration and Characterization Program," Space Dynamics Lab, 2003-2004, $9,790.
4. R. Jost, PI, "Development of EMC Testing Capability," Space Dynamics Lab, 2003-2004, $9,790.

George Liang

1. G. Liang, "MOUT RF Propagation Model V & V," AMSAA, 2003, $80,000.

Kevin Moore

1. K.L. Moore, PI, Y.Q. Chen, Co-PI, "Coordination and Control of Distributed Sensor/Actuator Networks – From Single System Missions to Multi-Agent Missions," Space Dynamics Lab, 2003-2004, $15,000.
2. K.L. Moore, PI, "Mobile Robotics Research Support," PercepTek, 2003, $10,606.
3. K.L. Moore, PI, "Fractional Calculus and its Applications in Engineering and Control, New Investigators Twinning Program," National Research Council, 2003-2005, $16,000.
4. K.L. Moore, PI, Y.Q. Chen, Co-PI, "Year 5 Modification 11 to Agreement DAAE07-98-3-0023, TACOM Lightweight Robotic Semi-autonomous Ground Vehicle Mobility and Survivability Enhancements Program," U.S. Army Tank Automotive Command, 2003-2004, $801,954.
5. K.L. Moore, PI, Y.Q. Chen, Co-PI, "Year 5 Modification 10 to Agreement DAAE07-98-3-0023, TACOM Lightweight Robotic Semi-autonomous Ground Vehicle Mobility and Survivability Enhancements Program," U.S. Army Tank Automotive Command, 2003, $299,904.

Linda Powers

1. Linda Powers, "Arrays of Receptors for Infectious Disease Diagnosis," NIH, 2003-2006, $450,000.
2. Linda Powers, PI "Fluorometric Detection of Microorganisms on Sterile Surfaces," NASA, 2003-2004, $85,000.

Charles Swenson

1. Charles Swenson, PI, "A FDTD Study of impedance probe techniques," NASA, 2003-2006, $242,279.
2. Charles Swenson, PI, "FPMU Additions: Capacitor Changeout, Additional Decoder Card, Contamination Bagging," NASA, 2003, $83,388.
3. Charles Swenson, PI, "Quick to Orbit," AFOSR (USUSAT II), 2003-2005, $100,000.
4. Charles Swenson, PI, "Low Cost PCM Encoder," NSROC, 2003, $55,000.
5. Charles Swenson, PI, "Atomic Oxygen Instrumentation and Calibration," Space Dynamics Lab, 2003-2004, $50,000.
6. Charles Swenson, PI, "Simulation of collisionless Time-of Flight Mass Spectrometer Design for Upper Atmospheric Measurement of Density and Velocity-Distributions of Neutral Particles," Space Dynamics Lab, 2003-2004, $37,000.

ECE Faculty

Doran Baker, *Professor*
Ph.D., University of Utah
Research interests: Remote sensing, space-based measurements and imaging, infrared and radar sensors, electromagnetics.

Matthew Berkemeier, *Assistant Professor*
Ph.D, University of California, Berkeley
Research interests: Mobile robot locomotion, control of underactuated robots.

Tamal Bose, *Department Head & Professor*
Ph.D., Southern Illinois University
Research interests: Signal processing, communications, image processing.

Scott Budge, *Associate Professor*
Ph.D., Brigham Young University
Research interests: Data compression, digital signal processing.

Annette Bunker, *Assistant Professor*
Ph.D., University of Utah
Research interests: Computer security, hardware verification.

YangQuan Chen, *Assistant Professor*
Ph.D., Nanyang Technological University, Singapore
Research interests: Control systems.

Aravind Dasu, *Assistant Professor*
Ph.D., Arizona State University
Research interests: Reconfigurable computing, compiler, multimedia architectures.

Hui-Fang Dou, *Research Assistant Professor*
Ph.D., Tsinghua University, China
Research interests: Precision instruments, precision motion control, biomedical rehabilitation engineering, smart sensors and actuators.

Joe R. Doupnik, *Professor*
Ph.D., Pennsylvania State Univesity
Research interests: Networking, concurrent systems.

Jake Gunther, *Assistant Professor*
Ph.D., Brigham Young University
Research interests: Signal processing, communications.

Randy Haupt, Adjunct *Professor*
Ph.D., The University of Michigan
Research interests: Antennas, numerical methods, electromagnetics, scattering, chaos theory, signal processing. Left USU in 2004 for Applied Research Laboratory, Pennsylvania State University.

Scott Hinton, *Dean of Engineering*
M.S.E.E, Purdue University
Research interests: Photonic switching, optical interconnects, and technology enhanced learning environments.

Paul Israelsen, *Research Associate Professor*
M.S., Utah State University
Research interests: VLSI design.

Randy Jost, *Assistant Professor*
Ph.D., University of Missouri-Columbia
Research interests: Electromagnetic fields, solid state, microwaves.

George Liang, *Assistant Professor*
Ph.D., Polytechnic University – Brooklyn, NY
Research interests: Electromagnetic fields, microwaves.

Todd K. Moon, *Professor*
Ph.D., University of Utah
Research interests: Digital signal processing, communications.

Kevin Moore, Adjunct *Professor*
Ph.D., Texas A&M
Research interests: Control theory.
Left USU in 2004 for Applied Physics Lab at Johns Hopkins University.

Linda S. Powers, *Professor*
Ph.D., Harvard University
Research interests: Instrumentation, optics.

Alan W. Shaw, *Emeritus Professor*
Ph.D., Standford University
Research interests: Digital system design, computer engineering, VLSI.

G. S. Stiles, *Professor*
Ph.D., Stanford University
Research interests: Parallel processing, networks, concurrent systems.

Charles M. Swenson, *Associate Professor*
Ph.D., Cornell University
Research interests: Space science engineering.

Michael Tompkins, *Assistant Professor*
Ph.D., University of Illinois at Urbana-Champaign
Research interests: Electromagnetics, microwaves, wireless communications.

Paul Wheeler, *Associate Professor*
Ph.D., Brigham Young University
Research interests: Digital systems design, microprocessor applications, acoustics.

Chris Winstead, *Assistant Professor*
Ph.D, University of Alberta
Research interests: Analog VLSI and information theory

ECE Staff

Kathy Peacock, *Business Manager*
MS, Utah State University

Mary Lee Anderson, *Graduate Secretary*

Tricia Harrison, *Staff Assistant*
BS, Utah State University

Les Seeley, *Computer Specialist*
BS, Utah State University

Justin Hamm, *Technician*

Heidi Harper, *ECE Store Manager*

Industrial Advisory Committee

Wayne Barlow — Wescor, Inc.
Michael R. Bolam — L3 Communications
Brian Bone — Vista Computers Technology
Tamal Bose, Department Head – Utah State University
Dennis Briscoe – Wescor, Inc.
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