**National Science Foundation Awards Grant to UAH / ECE Dept. With Support From MEMS Optical and AMCOM**

Dr. Jennifer English, an Assistant Professor in the Department of Electrical and Computer Engineering, is the Principal Investigator for a grant awarded to UAH/ECE Dept. from the National Science Foundation to develop laboratory-intensive courses in microelectronics and microelectromechanical systems (MEMS) technology. These courses present UAH engineering students with a unique opportunity to design and implement different micro-fabrication processes to create and then test microelectronic devices and MEMS devices. Local interest in the laboratory development from engineers at MEMS Optical and AMCOM as well as support from regional academic leaders helped make this award possible.

The design, fabrication and implementation of microelectronics and MEMS devices are having a major impact on UAH’s engineering curriculum programs and research programs. An undergraduate curriculum that addresses microelectronics and MEMS device technology concepts and techniques is extremely valuable in preparing students for careers in these fields. An ideal curriculum program teaches students theoretical concepts in the classroom and reinforces this information with practical laboratory experience by performing microfabrication experiments. The microelectronics and MEMS fabrication courses will provide students with this practical experience, which will advance their education and increase their career opportunities upon graduation.

Local and regional companies and government agencies will also benefit from the addition of these courses to the undergraduate engineering curriculum by having access to local engineers that possess the knowledge and practical experience in microfabritculation technology. This will reduce the need for extensive job training as well as employee recruiting from other areas of the United States.

Currently, two microfabrication courses are being developed, with each course requiring a weekly lecture period and a weekly laboratory period. The first course, “Microelectronics Fabrication Laboratory”, will offer students the opportunity to learn about the concepts, parameters and techniques for silicon-based MOS transistor fabrication (see process list below). Each step of the MOS transistor fabrication process will be addressed, and the mathematical models for determining the process parameters will be presented. Given a set of device specifications, the students will develop process parameters for each fabrication step and then implement the parameters in the laboratory.

The students will start by characterizing a bare silicon wafer and perform the fabrication steps to realize a wafer of MOS transistors. They will then test the transistors and determine a yield rate for the process run. The students will also be taught how to keep a laboratory manual to document their experiments as well as how to perform the experiments safely and responsibly.

The students in the photo are all members of the Laser Science and Engineering Group at UAH, directed by Dr. Richard Fork of the ECE Department. Walker and Cole, along with Professor Fork, made oral presentations at the conference, which is held in cooperation with the Office of the Secretary of Defense, US Army, US Air Force, US Navy and US Marine Corp. Professor Fork gave a presentation titled “Surface High Energy Laser.” Walker's presentation was “Thermal Analysis of the Surface High Energy Laser.” Cole's presentation was “Optical Design of Solar Pumped High Energy Space Based Lasers.”

During the annual banquet at the Huntsville Marriott, Walker was honored with $500 and a commemorative award, which he is holding in the photograph. The plaque has additional significance in that it is made from conformal glass from the Airborne Laser. The award is sponsored by Brashear LP, the company that makes the conformal glass for the Airborne Laser.
Introducing 
Dr. Sam Yoo
Associate Professor

Dr. Seong-Moo (Sam) Yoo joined the ECE Department Faculty in August 2001 as an Associate Professor of Computer Engineering.

Dr. Yoo received his M.S. and Ph.D. in Computer Science from the University of Texas at Arlington in 1989 and 1995, respectively. From January 1996 to August 1996, he was a Visiting Professor in the Department of Computer Science and Engineering, the University of Texas at Arlington. From September 1996 to August 2001, he was an Assistant Professor in the Department of Computer Science at Columbus State University, Columbus, Georgia.

He has been working in the fields of parallel architecture, wireless networks, and computer security. He has widely made research on multiprocessor scheduling based on mesh architecture, and the research has been published in the IEEE Transaction on Parallel and Distributed Systems and the Journal of Parallel and Distributed Computing. His recent research is focused on wireless network, especially the routing algorithms on wireless ad hoc network, handoff algorithms on wireless ATM network, security issues in wireless networks, and mobility management.

In his spare time, he likes jogging and watching baseball games.

Introducing 
Dr. Alek Milenkovic
Assistant Professor

Dr. Aleksandar Milenkovic joined the ECE Department in August 2001 as an Assistant Professor. He received his Ph.D., M.S., and B.S. degrees in Computer Engineering from the University of Belgrade in 1999, 1997, and 1994, respectively. His primary areas of research interests are in computer architecture, VLSI, embedded systems, parallel and distributed technology, and networks.

Before joining the UAH, Dr. Milenkovic was an Assistant Professor at the Dublin City University, Ireland, and the University of Belgrade, Yugoslavia. He has explored techniques for achieving high performance in shared memory multiprocessors, memory tolerating techniques, workload characterization, and performance evaluation.

Dr. Milenkovic is currently studying new architectural techniques for future generation systems, which will exploit current technology and application trends in order to maximize performance at minimal cost. Also, he is interested in developing tools for design automation using high-level hardware description languages that will cover the entire process, from formal specification to synthesis.

In his spare time, he likes to read, play basketball, and ride bicycles.

(Continued from page 1)

NSF Grant for UAH/ECE Micro-Fabrication Laboratory

The second course, “MEMS Fabrication Laboratory”, will continue to focus on the fabrication techniques presented in the “Microelectronics Fabrication Laboratory” and introduce some additional fabrication techniques to realize different MEMS sensors and actuators (see process list).

Students will learn about the basics of MEMS device design and fabrication and how they are created in the laboratory using silicon, polymer, and ceramic materials. The students will develop fabrication processes for basic MEMS devices and then perform the experiments in the laboratory to realize the devices. Testing of the devices will be performed and yield rates for the fabrication process will be determined. Students will document their experiments in a laboratory manual.

It is important to note that these courses are not intended for the ECE department students alone, but rather for all engineering students. Microfabrication is a multi-disciplinary technology that relies on advances in materials science and in all facets of engineering including chemical, systems, and mechanical engineering. Thus, all students in the college of engineering are encouraged to consider enrolling in these courses when they are added to the curriculum. The courses will both be three-hour semester courses. The “Microelectronics Fabrication Laboratory” will require a grade of C or better in EE 300 for enrollment and the “MEMS Fabrication Laboratory” will require a passing grade in the “Microelectronics Fabrication Laboratory”.

If you have any questions about the content of the two courses or would like more information, please contact Dr. English by email at english@ece.uah.edu.
Space Plasma Research in Electrical and Computer Engineering

In addition to the charged particles, space is also permeated by a variety of electromagnetic waves, which are generated by the electron and ion beams or by interactions between the ionized gases originating from the Earth and that impinging on the Earth’s magnetosphere coming from the Sun. The waves originating far from Earth are known as Alfvén waves and are a rich source of energy as they transport electromagnetic energy from far distances to the near-Earth space.

Our research involves theory and modeling of electrodynamic phenomena in space. We have a synergistic team consisting of expertise in theory as well as in computing. Since modeling of complex phenomena in space is like a grand challenge problem, we use massively parallel computing. The team consists of Dr. Nagendra Singh, Dr. Earl B. Wells and graduate students. One of the projects funded by the NSF deals with modeling of the nonlinear waves generated by electron beams permeating the polar region of the near-Earth space. The goal of this project is to better understand the mechanism for the dissipation of electron beam energy. Dr. Al-Sharaeih and Mr. S. M. Loo have played a crucial role in developing the parallel code for this project. Another project, funded by NASA, deals with the transfer of energy from Alfvén waves to the ambient plasma particles in the near-Earth space. Alfvén waves transport this energy from far distances.

A third project, also funded by NASA, is in the field of plasma propulsion of a spacecraft in deep space where the medium is the solar wind. Typically solar wind blows at a speed of ~500 km/s and proton density of $5 \times 10^{19}/m^3$. If the momentum in the wind could be efficiently intercepted by a spacecraft, it could possibly be propelled to large velocities drastically cutting the travel time from Earth to different planets. One such schemes involves blowing a large magnetic bubble from a spacecraft, providing it with a large capture area for the solar wind momentum. We are developing a rigorous model for the blowing of the magnetic bubble and its interaction with the solar wind. Mr. Saikat Saha and Dr. Nagendra Singh are developing the model.

Spacecraft-plasma interaction is yet another field of our active interest. Our recent involvement in this field has been the modeling of the Tether satellite and the Polar spacecraft. Space research is a combination of gas dynamics and Maxwell’s theory and provides a rich field for physicists and engineers alike.

Nano / Microfabrication Facility Under Construction

The first floor of the Optics Building is presently undergoing a $650,000 renovation to significantly expand available cleanroom space from 1,300 square feet to approximately 4,500 square feet. The new cleanroom will provide a home for UAH’s Nano/Microfabrication Facility (NMF), which is part of the Laboratory for Integrated Computing and Optoelectronic Systems (LICOS). Construction is expected to be completed by April 15, 2002.

The purpose of the Nano/Microfabrication Facility is to provide a broad suite of micro- and nanofabrication tools to university researchers to enable research in micro- and nanotechnologies, and to serve as a focal point for micro- and nanofabrication in the community. Examples of technologies that can be developed in the facility include microelectromechanical (MEMS) devices, nanophotonic and photonic bandgap elements, waveguide and integrated optic chips, and microcantilevers for chemical and biological sensing.

The tools that will be available in the NMF include capabilities for thin film deposition, plasma etching, photolithography, electron-beam lithography, holographic lithography, wet chemical processing, chemical-mechanical planarization, and various metrology techniques such as profilometry and scanning electron microscopy. In addition, there are tools for wafer dicing and wire bonding.

The Nano/Microfabrication facility represents the culmination of six years of funding from a variety of sources. These include the National Science Foundation through the EPSCoR program, university investments, and gifts from an anonymous private benefactor.
ECE Laboratory News...

Dennis Hite,
ECE Lab Manager

Recently I have noticed a lot of activity around the Engineering Building. In particular, I have noticed several students and professors working in the ECE labs at other than class times. I do not know all the details, but I do know it is a refreshing site. My hope is both the students and professors are benefiting from this interaction. The department will soon have a new addition to its list of instructional laboratories. The Virtual Controls Lab (VCL) will allow students to access and perform controls experiments remotely via the UAH LAN. More details as to when the VCL will be accessible and which courses will utilize it should be available in early 2002. I have posted a few rules in the instructional labs. Please take a moment to read them. They shouldn’t cause you too much heartache. In order to keep the equipment up and running and the labs clean a few rules are required.

In this report are just a few of the projects going on around the department. If any of them spark an interest, then I encourage you to contact the people involved to acquire more information or better yet get involved yourself.

Dr. Joiner has been working with Dr. Sheldon from the Physics Department and with the students from the UAH chapter of the Students for the Exploration and Development of Space (SEDS) to create a satellite ground station.

A Virginia company, AeroAstro, originally supported the project, and the ground station was to provide support for a small satellite called the Small Payload Access to Space Experiment (SPASE). The purpose of SPASE was to prove that a satellite could be built cheaply that would be adaptable to several different payloads. The payload for this experiment was a crystal growing experiment developed by NASA.

Although the SPASE spacecraft has been demanifested from its space shuttle mission and therefore will not be launched, the students gained considerable design experience. Also the equipment purchased for this contract will be used to establish a ground station at UAH for future space missions. The ground station will be used to command and retrieve data from small satellites operating in the S-band frequency range. If you would like to get involved or for more information please contact:

Dr. Laurie Joiner
Email: joiner@ece.uah.edu
Office: EB 217B

Visit the ECE web site:
http://www.ece.uah.edu/

Dr. Kulick, Gaede, and Wells have been working with students investigating hardware/software co-design and rapid prototyping of hardware/software systems.

Languages such as HandelC and SystemC are making the hardware design process much more accessible to C programmers. HandelC is a C-like hardware programming language that can be compiled into VHDL (Very high speed integrated circuit Hardware Description Language) and then translated into an FPGA design. Graduate students (below) are currently investigating it as a candidate for use as a specification language in hardware/software co-design. The main advantage of this language is that the designer doesn't have to know or learn VHDL.

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The Department of Electrical and Computer Engineering at the University of Alabama in Huntsville offers a new program, Master of Science in Software Engineering (MSSE), as a new degree program through the College of Engineering beginning January 2002. MSSE, computer science track, is offered through the Computer Science Department in the College of Science.

The Master of Science in Software Engineering in the Department of Electrical and Computer Engineering Department unconditional admission requirements are:

A Bachelor’s degree from ABET or CSAB approved programs with a minimum of 3.0 out of 4.0 scale, GRE Score of 1700, and TOEFL score of 600 (for international students).

Conditional admission may be granted to individuals who fail to meet one or more of the requirements for unconditional admission.

Prerequisites:
Coursework or demonstration of knowledge in:
Programming in C, C++ or Java (CPE 112)
Data Structures (CPE 212)
Discrete Structures (CS 214)
Algorithm Design and Analysis (CS 317)
Operating Systems (CPE 336)
Computer Architecture (CPE 431)

Experience in the development of a large scale, industrial strength software is highly desirable.

Program Structure
Program would be a 33 hour program
Program would include a significant controlled software development experience
Full Time students should allow two years to complete the program.

Planned Coursework for the Degree

I. Software Engineering Core
(4 courses; 12 credits total)

CS 650 – The Software Engineering Process
Plus one of following three course sequences:
CS 652 – System and Software Requirements Methods
CS 658 – Software Project Management and Quality Assurance
CS 654 – Software Design Techniques and Tools
CS 551 – Object Oriented Software Development

CS 552 – Object Oriented Design
CS 658 – Software Project Management and Quality Assurance

II. ECE Department Capstone Courses
(3 courses, 3 credits total)

CM 601 – Communication for Engineers, one credit hour.
EE 691 – Graduate Seminar I, one credit hour.
EE 692 – Graduate Seminar II, one credit hour.

III. CPE or CS Software Design Studio
(2 courses, 6 credits total)

Since the purpose of the design studio is to provide the student with opportunities to work on large scale software design projects with real world implications, at least one member of the student's committee should be chosen from outside the department with industrial expertise in the design and/or management of large scale software systems. The external committee member may also be chosen to provide domain expertise in an engineering discipline if such an experience is critical to a design studio project.

CPE 656 / CS 666 Software Studio I
CPE 658 / CS 668 Software Studio II

IV. CPE Core Courses
(4 courses, 12 credits total and may not take more than two at 500 level)

Four courses taken from the following list or approved by the supervisory committee:

CPE 538 – Real Time & Embedded Systems
CPE 536 – Computer Systems Software.
CPE 512 – Intro Parallel Programming
CPE 548 – Introduction to Computer Networks
CPE 551 – Software Design and Engineering
CPE 561 – Translation Systems
CPE 628 – Testing Hardware Systems
CPE 631 – Adv Computer Systems Architecture
CPE 633 – Fault Tolerant Systems Architecture
CPE 648 – Advanced Computer Networks
CPE 661 – Code Optimization
CPE 731 – Distributed Shared Memory Systems.
CPE 726 – Tools for VLSI Design
CPE 735 – Selected Topics in Operating Systems
CPE 760 – Selected Topics in Compilers and Translation Systems

For More Information:
Contact ECE Department
Dr. Ned. Audeh, ECE Graduate Director
256-824-6316 or audeh@ece.uah.edu
ECE Department Prepares for ABET Visit

The Electrical and Computer Engineering (ECE) Department, as well as the entire College of Engineering (COE), has been actively preparing for its next visit by the Accreditation Board for Engineering and Technology (ABET). ABET, a federation of 31 engineering technical and professional societies, is recognized as the sole agency responsible for the accreditation of U.S. educational programs that lead to engineering degrees. All undergraduate engineering programs at UAH were last visited by ABET in the Fall of 1997, at which time all programs received continuation of accreditation. All three programs in the ECE Department received continuation of accreditation: Computer Engineering, Electrical Engineering and Optical Engineering. At the time, the ECE Optical Engineering was the first ABET-accredited optical engineering program in the nation.

ABET next visit will be in the Fall of 2003. However, this next accreditation review by ABET will be under the new Engineering Criteria 2000 (EC2000). The most important difference between EC2000 and ABET's traditional accreditation process is the continuous improvement nature of the EC2000 implementation. Under ABET's EC2000, each undergraduate degree program must set educational objectives and have in place a system of ongoing evaluation that demonstrates achievement of these objectives. Program objectives are statements that describe the expected accomplishments of its graduates during the first few years after graduation. The program objectives should be consistent with the mission of the University and based on the needs of the program's constituencies, including students and employers. Furthermore, each program must have educational outcomes and an assessment process that both demonstrates the outcomes are achieved and that results of the process are applied to the further development and improvement of the program. Program outcomes describe what graduates of that program will be expected to know and be able to do after completing a curriculum.

To assist in the development and implementation of the assessment procedures associated with EC2000 the Chairman of the ECE Department, Dr. Adhami, has appointed an Program Assessment Coordinator for each of the Department’s three programs: Dr. Gaede is CPE Program Assessment Coordinator, and Dr. Corsetti is both the EE and OPE Program Coordinator. For the past two years, program assessment coordinators have been working with the ECE faculty to develop and implement the assessment procedure for each program. Students' inputs into the assessment process (shown in the figure on page 7) are through their graded course work, course surveys, Graduating Senior Exit Survey, Alumni Surveys. Alumni Surveys are currently being conducted at the two and five year point. Information obtained from these students' inputs is essential to the process, and enables the faculty to determine how well each program objectives and outcomes are being achieved, and whether changes to the program or its objectives and outcomes may be required. Below are the Objectives and Outcomes for each program, as well as the Mission of the ECE Department.

MISSION OF THE ECE DEPARTMENT

The mission of the ECE department is to develop and maintain high quality undergraduate and graduate programs in Electrical, Computer and Optical Engineering to meet the needs of its constituents, and to participate in scholarly and productive research that contributes to the economic well being and quality of life of the citizens of Huntsville, the State of Alabama and the United States of America.

ELECTRICAL ENGINEERING PROGRAM OBJECTIVES & OUTCOMES

The electrical engineering option offers a background that enables students to pursue careers in any of the many diverse facets of electrical engineering such as electronics, networks, power systems, instrumentation, communications, and controls. The student may also select advanced undergraduate courses to develop individual and specific interests.

OBJECTIVES

The objectives of the Electrical Engineering Program are to:

1. Provide the student with education in mathematics, science, and fundamental concepts in engineering.
2. Enable the student to function effectively in interdisciplinary environment in industry and government.
3. Give the student in-depth knowledge of electrical engineering through elective courses for different areas of specialization such as controls, computer hardware/software, communications, signal processing, electronics, electromagnetic fields, and optics.
4. Provide the student with an ability to apply electrical engineering knowledge in the analysis, design and testing of electrical engineering systems, processes and components. This includes the ability to use appropriate computer and software tools, competence with laboratory techniques, analysis and interpretation of data, and application of modern analysis tools in advanced courses for a better understanding of the subjects.
5. Enhance the student’s written and oral communication skills. The curriculum will require written and oral communications in several courses, introduce the student to engineering practice and to its ethical and societal aspects, and help make him/her proficient in articulating issues.
6. Provide the opportunity for in-depth study of social sciences and humanities outside of engineering.
7. Prepare students for graduate studies, lifelong learning and professional development.

Program strengths include an engineering design experience; use of contemporary engineering design and modeling tools throughout the curriculum; and advanced engineering design options in analysis/design. The electrical engineering faculty is committed to sustaining a vigorous academic environment that values quality and diversity in the educational experience.
Course Assessment Procedure

OUTCOMES

The Electrical Engineering Program must demonstrate that its graduates have:

1. An ability to apply knowledge of mathematics, science, and fundamental concepts in engineering to the analysis of electrical and computer engineering problems.

2. An ability to design a component, system, or process to meet desired needs.

3. An ability to function on multidisciplinary teams.

4. An ability to identify, formulate, and solve electrical engineering problems.

5. An understanding of professional and ethical responsibility.

6. An ability to convey technical material through written and oral presentation.

7. A recognition of the need for, and ability to engage in life-long learning.

8. An ability to use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design.

9. A knowledge of mathematics through differential and integral calculus and advanced topics in differential equations, linear algebra, and complex variables.

10. A broad education and knowledge of contemporary issues necessary to understand the impact of electrical engineering solutions in a global and societal context.

11. A knowledge of probability and statistics, including electrical engineering applications.

12. An ability to design systems that include hardware and software components.

13. An advising program that assists students in achieving their academic objectives.

14. An interaction with practicing engineers through the use of:
   (a) Adjunct faculty,
   (b) Programs and seminars sponsored by the department and local industry,
   (c) Local sections of professional societies,
   (d) Student branches of professional societies, and
   (e) Tours and field trips.

15. An effective laboratory instruction program in electrical engineering.
The Department of Electrical and Computer Engineering offers a four-year program leading to a Bachelor of Science in Engineering degree with specialization in computer engineering. The purpose of the program is to produce a broadly educated individual, who qualifies as a professional in the analysis, design and application of computer systems.

The Computer Engineering Program provides a background in non-engineering areas such as English, mathematics, basic science, humanities and social sciences. A broad background in engineering is developed through the engineering core curriculum and further courses from electrical engineering.

The program's focus on computer engineering is developed through a blend of courses in computer engineering and computer science. The graduate computer engineer will be professionally qualified in a number of technical specialties which include computer architecture, interface design, communications and networking, and software engineering. In professional life the computer engineer considers carefully the role of the engineer in dealing with a broad spectrum of commercial, legal, and ethical issues.

**OBJECTIVES**

The objectives of the Computer Engineering Program are to:

1. Provide graduate with background, knowledge, skills and hands-on experience to enter the practice of computer engineering.
2. Prepare graduates for graduate studies, life-long learning and professional development.
3. Emphasize problem-solving skills throughout the curriculum.
4. Integrate hardware/software and computer systems issues throughout the computer engineering curriculum, especially in the context of real-time, embedded, and networked systems.
5. Provide a broad-based undergraduate education in Computer Engineering with a thorough basis in mathematics, probability & statistics, physical sciences, engineering sciences, laboratory experiments and design experience.
6. Provide general education to identify the impact of engineering decision in the broader societal context.

The computer engineering faculty are committed to sustaining a vigorous academic environment that values quality and diversity in the educational experience. Program strengths include the major engineering design experience; integration of hardware/software and computer systems issues, especially in the context of real-time, embedded and networked systems; use of contemporary engineering design and modeling tools throughout the curriculum; and advanced engineering design options in hardware, software and networking.

The curriculum provides a thorough basis in mathematics, probability and statistics, physical sciences, engineering sciences, laboratory experience, and design experience. This background enables students to apply computer engineering principles to a variety of contemporary problems. Engineering approach is emphasized throughout computer related coursework.

**OUTCOMES**

This Computer Engineering Program integrates the knowledge and skills acquired in a diverse set of courses, the extracurricular experiences, and the faculty expertise and scholarship needed to enable the graduates of the program to:

- Understand, analyze and design hardware and software systems and components;
- Identify and solve computer engineering problems;
- Design and conduct laboratory experiments to investigate and test the characteristics and dynamics of systems and components;
- Be proficient in the use of modem computer engineering techniques and tools;
- Be proficient in the oral and written communication of their work and ideas;
- Learn and work independently;
- Participate effectively within and across disciplinary groups and understand the value of teaming;
- Understand the technical and professional qualities of an engineer that are valued in today’s workplace;
- Understand contemporary issues relevant to the practice of computer engineering;
- Understand the global and societal impact of engineering problems and solutions;
- Be prepared for a lifetime of continuing education;
- Conduct themselves in accordance with the highest professional and ethical standards.
**OPTICAL ENGINEERING PROGRAM OBJECTIVES & OUTCOME**

The Department of Electrical and Computer Engineering administers the accredited undergraduate degree option in optical engineering. This program prepares students for careers in opto-electronics, including the design and application of systems for optical fiber communications, optical instrumentation, holography, image forming and processing, lasers and optical detection, as well as areas such as optical testing.

**OBJECTIVES**

The objectives of the Optical Engineering Program are to:

1. Provide the student with education in mathematics, science, and fundamental concepts relevant to interface areas involving optical engineering.
2. Enable the student to function effectively in the interdisciplinary environment in industry and government with a special emphasis on interdisciplinary problems that involve optical engineering.
3. Give the student in-depth knowledge of optical engineering with an emphasis on areas involving optics through elective courses. These courses address areas such as controls, computer hardware/software, communications, signal processing, electronics, electromagnetic fields, and optics with an emphasis on building skills and knowledge relevant to tasks at the interface between optical engineering and electrical engineering.
4. Provide the student with an ability to apply optical engineering knowledge in the analysis, design, and testing of systems, processes, and components that involve either or both, optical and electrical engineering. This includes the ability to use appropriate computer and software tools, competence with laboratory techniques, analysis and interpretation of data, and application of modern analysis tools in advanced courses that relate to interface issues involving both optical engineering and electrical engineering.
5. Enhance the student's written and oral communication skills. The curriculum will require written and oral communications in several courses, introduce the student to optical and electrical engineering practice and to its ethical and societal aspects, and help make him/her proficient in articulating relevant issues.
6. Provide the opportunity for in-depth study of social sciences and humanities with an emphasis on areas that involve both optical and electrical engineering.
7. Prepare students for graduate studies, lifelong learning, and professional development with a special emphasis on the interface between optical engineering and electrical engineering.

Program strengths include a design experience requiring the use of both optical engineering and electrical engineering skills and knowledge; use of contemporary optical and electrical engineering design and modeling tools throughout the curriculum; and advanced optical and electrical engineering options in analysis/design. The optical and electrical engineering faculty is committed to sustaining a vigorous academic environment that values quality and diversity in the educational experience.

**OUTCOMES**

The Optical Engineering Program must demonstrate that its graduates have:

1. An ability to apply knowledge of mathematics, science, and fundamental concepts in engineering to the analysis of optical, electrical and computer engineering problems with an emphasis on material that involves all three areas of engineering.
2. An ability to design optical and electrical components, systems, and processes to meet desired needs.
3. An ability to function on multidisciplinary teams addressing tasks that involve both optical engineering and electrical engineering.
4. An ability to identify, formulate, and solve optical engineering and electrical engineering problems with an emphasis on problems involving both areas of engineering.
5. An understanding of professional and ethical responsibility with an emphasis on areas that involve both optical engineering and electrical engineering.
6. An ability to convey technical material through written and oral presentation, with an emphasis on areas that involve both optical engineering and electrical engineering.
7. A recognition of the need for, and ability to engage in lifetime learning with an emphasis on areas that involve both optical engineering and electrical engineering.
8. An ability to use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design learning with an emphasis on areas that involve both optical engineering and electrical engineering.
9. A knowledge of mathematics through differential and integral calculus and advanced topics in differential equations, linear algebra, and complex variables learning with an emphasis on areas that involve both optical engineering and electrical engineering.
10. A broad education and knowledge of contemporary issues necessary to understand the impact of optical engineering and electrical engineering solutions, with an emphasis on areas that involve both optical engineering and electrical engineering.
11. A knowledge of probability and statistics, including optical and electrical engineering applications with an emphasis on areas that involve both optical engineering and electrical engineering.
12. An ability to design systems that include hardware and software components relevant to optical and electrical engineering with an emphasis on areas that involve both optical engineering and electrical engineering.
13. An advising program that assists students in achieving their academic objectives with an emphasis on areas that involve both optical engineering and electrical engineering.
14. An interaction with practicing engineers through the use of:
   (a) Adjunct faculty,
   (b) Programs and seminars sponsored by the department and local industry,
   (c) Local sections of professional societies,
   (d) Student branches of professional societies,
   (e) Tours and field trips,
   (f) Involvement of both faculty and students in ongoing engineering efforts, and
   (g) Involvement of both faculty and students in national and international programs relevant to engineering tasks occurring at the interface of optical and electrical engineering.
15. An effective laboratory instruction program in optical and electrical engineering with an emphasis on areas that involve both optical engineering and electrical engineering.
Publications, Presentations and Awards

ELECTROMAGNETICS

Nagendra Singh, Professor

Journal Articles


Conference Papers


HARDWARE & SOFTWARE ENGINEERING

S. M. Yoo, Associate Professor

Journal Articles


Conference Papers


OPTICS

Gregory Nordin, Professor

Journal Articles


Conference Papers


Contracts

NASCAR/EPSCoR, Chemical and Biological Micromechanical "Smart" Sensor Arrays (PI: Mike George, Co-PIs: G. Nordin, C. Scholz, J. Ng), 8/1/01-7/31/04.

DARPA/Clemson, Laboratory for Advanced Photonics (PI: J. Dimmock, Co-PIs: G. Nordin, M. Abushagur), 7/19/01-7/18/02

Boeing, Modeling of Fine-Line Lithography Performance (PI: G. Nordin), 8/28/01-10/30/01.

SY Technology, Analysis of Lithography on Wafers (PI: G. Nordin), 8/29/01-10/15/01.

ELECTRON DEVICES

Fat Duen Ho, Professor

Conference Papers


CONTROL

Yuri Shtessel, Associate Professor

Contracts

"Integrated Guidance and Control Technology for RLV Risk and Cost Reduction," subcontract from Ohio University, contract with NASA, Marshall Flight Space Center, AL, 06/1/01-09/30/05.

"Smooth Sliding Mode Controller Design," U.S. Army Aviation and Missile Command, Huntsville, AL, 5/10/01 - 9/30/01.
**Publications, Presentations and Awards**

David Pollock, Assoc. Research Professor

**Presentation**


**SOLID STATE**

Timothy Boykin, Associate Professor

**Journal Articles**


**Summer 2002 ECE Course Listing**

**Electrical Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>EE100</td>
<td>Concepts/Digital Signals Sys</td>
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<tr>
<td>EE201</td>
<td>Digital Logic Design Lab</td>
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<td>EE202</td>
<td>Intro Digital Logic Design</td>
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<td>EE300</td>
<td>Electrical Circuit Anal I</td>
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<td>Electricity &amp; Magnetism</td>
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<td>Analy Meth Continu Time</td>
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<td>Laser Systems</td>
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<td>Sampled Data Cont Sys</td>
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<td>EE710</td>
<td>Selected Topics/ECE</td>
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**Computer Engineering**

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<td>Computer Org</td>
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<td>CPE422</td>
<td>Adv Logic Dsgn</td>
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**Optical Engineering**

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<td>OPE459</td>
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**Optical Science Engr**

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<td>OSE799</td>
<td>PhD Disserta</td>
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Ms. Barbara Robertson, ECE PhD Candidate, Gets Student Paper Award

Ms. Barbara Robertson, ECE doctoral candidate, received the student paper award for her presentation on Modeling of Radio Frequency Micro-Electro-Mechanical System (MEMS) Switches at the MEMS Components and Applications for Industry, Automobiles, Aerospace, and Communication Conference. This conference was part of the SPIE Micromachining and Microfabrication Conference held in San Francisco, CA, October 21-25, 2001. The paper was coauthored by Ms. Robertson's advisor, Dr. Fat D. Ho, ECE Department, UAH, and by Dr. Tracy Hudson, U.S. Army Aviation and Missile Command (AMCOM).

Ms. Robertson also presented a paper written with the same coauthors on Developing Models for the Analysis and Design of MEMS at the Microsystems Technology and Applications Workshop held at Redstone Arsenal, AL on 11-12 July 2001. This paper concentrated on modeling techniques for MEMS.

Ms. Robertson is developing generic MEMS switch models for use in electrical circuit modeling for her dissertation.

The MEMS switch offers many benefits in RF applications. These benefits include low insertion loss, high quality factor (Q), low power, RF isolation, and low cost. The ability to manufacture mechanical switches on a chip with electronics can lead to higher functionality, such as single-chip arrays, and smart switches. One RF system which may benefit from MEMS is the front end of a wireless transceiver. MEMS switches, and devices built from switches, could be used to replace existing devices in the exciter, the transmitter, the duplexer, the antenna, the RF receiver, and the IF receiver. Obviously, RF switches are basic building blocks for MEMS designs. The MEMS designer needs models of these basic elements in order to incorporate them into their applications.

The U.S. Army AMCOM plans to develop a suite of mixed-signal RF switch models using Tanner SPICE. The suite will include switches made from cantilever beams and fixed-fixed beams. The switches may be actuated by electrostatic, piezoelectric or electromagnetic forces. Ms. Robertson will develop lumped element models for switches actuated by electrostatic forces. The effects of materials and switch geometry are considered in the models. The lumped element models use a current-force electrical-mechanical analogy, that is a force is equivalent to a current, and a displacement is equivalent to a voltage. Finite element modeling and device testing will be used to verify the SPICE models.

We want to hear from you!

The ECE Department looks forward to hearing your views and your success stories. Contact us to share your news and comments about your career and interests. Your story should be sent to realtime@ece.uah.edu