

### Fall 2007

Joe Noonan collaborates with Harvard	2
Eric Miller joins the ECE Department	3
High Tech Innovation and Project Fellows Program	3
Afsar's Labs Find New Applications for Terahertz Spectroscopy	4
Tufts faculty awarded seed grant for soft-bodied robotics research	4-5
Biomedical Implants	5
Tufts Wireless Lab (TWL)	5
Summer Interns Work on Renewable Energy	5
Best Poster Award at National Capstone Conference	6
Dr. Panetta Awarded \$500k to Develop Her Patent	6
SimLab News	6
Senior Projects Apply Knowledge of DSP	7

## From the Chair

This is an exciting period of growth for the Electrical and Computer Engineering department. We are increasing the size of the faculty again this year by adding expertise in the area of sustainable energy. The faculty are also developing new and stronger ties with industry through a number of new initiatives including a partnership between Tufts and a start-up company co-founded by Professor Panetta (see the article on page 6). Innovation and entrepreneurship are the themes of Professor Lasser's new program that gives our students direct contact with industrial leaders (page 3). Please take a moment to browse this newsletter and discover some of our many new educational and research initiatives.

Tufts alums have once again been generous to the department. These donations support nationally recognized programs such as the Nerd Girls and many other student-centered research and design projects. We are very proud to announce the M. Leighton Greenough Endowed Fellowship in Electrical Engineering. Leighton Greenough (E'40) has generously created this endowed fellowship to support the work of promising new graduate students in EE.

Our goal in ECE is to provide students with the educational setting necessary to hone both engineering expertise and a broader view of our society. One of the pressing engineering challenges faced by this and future generations is the development of sustainable energy technology.



Professor Jeff Hopwood

This year ECE hosted a public lecture on sustainable energy by Dr. Hermann Scheer, a prominent scientist in alternative energy and a member of the German Parliament. In addition, two of our undergraduate engineering students interned with ECE alum Frank Pao's company to investigate photovoltaic efficiency this summer. The Nerd Girls also completed the installation of a solar power system for an isolated lighthouse off the coast of Rockport, MA. This spring, we will offer a new course on sustainable energy systems. To continue to build on this theme, the department

(Continued on page 3)



Professor Denis Fermental

## A Career in Teaching

Professor Fermental entered Tufts as a Freshman in 1951, a commuter of modest means like most engineering students of the time. He left to join the Army in 1953 with the aim of completing his education with money from the GI Bill. The Army sent him to the Signal School at Fort Monmouth, New Jersey and then transferred him to Ansbach, Germany where he taught radar for two years. He returned to Tufts in 1956 and graduated in 1958.

In those days the Chair, Alvin (DOC) Howell, managed a balloon project dedicated to developing instrumentation for balloons that flew spy missions over the USSR. Upon graduation, Fermental joined the Electrical Engineering Department as an Instructor and Research Assistant assigned to the project. Shortly after Fermental began his apprenticeship, the aim of the project switched to creating a balloon borne telescope designed to obtain spectral data from the moon in preparation for the moon flights at the end of the 1960's. The hope was that the

(Continued on page 7)

**Congratulations to our graduate students who recently completed their Ph.D. dissertations, M.S. theses, and M.S. projects in 2007!**

**Ph.D. Dissertation**

Prabahan Basu                      Advisor: Joseph Noonan  
"Estimation and System Modeling Using Information Theoretic Measures"

Ethan E. Danahy                  Advisor: Karen Panetta  
"Logical Transforms and Their Use in Non-Linear Algorithms for Digital Signal Processing"

Brian Gregory Swahn             Advisor: Soha Hassoun  
"FinFETs: Thermal Modeling, Analysis, and Circuit Design"

**M.S. Theses**

Jon Wei Chow                      Advisor: Sameer Sonkusale  
"A Multipass Spatial and Temporal Image Filtering APS CMOS Image Sensor with Pixel Level ADC"

Joseph Charles Hachadorian    Advisor: Van Toi Vo  
"Electronic Cervical Range of Motion Measurement System: The Axial Rotation Measurement"

Elana Rui Lian                     Advisor: Van Toi Vo  
"Electronic Cervical Range of Motion Measurement System: Sagittal flexion and extension, lateral flexion and extension"

Zhenying Luo                      Advisor: Sameer Sonkusale  
"Implementation of a Wireless Telemetry System using a High Data rate low power BPSK demodulator"

George Saveriades                Advisor: Joseph Noonan  
"Effects of low-intensity magnetic fields (2.7 micro T, 30-60 Hz and 44-48 Hz) on Ca<sup>2+</sup> ions and catecholamine release from adrenal chromaffin cells"

Cedric Alexander Vigil          Advisor: Joseph Noonan  
"Image Transmission in Severe Data Dropout Cases Using Chaotic Mapping"

**M.S. Projects**

Clifton Bernard Bradley III      Advisor: C. Hwa Chang  
"Low Power, Low Cost Wireless Show Case Monitoring System"

David Crane                        Advisor: Joseph Noonan  
"FPGA and PCB Design Considerations"

Milan Daphtary                  Advisor: Sameer Sonkusale  
"Broadband Dielectric Spectroscopy on 0.18u CMOS Technology for Molecular Sensing and Detection"

Kyle David Doran                 Advisor: C. Hwa Chang  
"Medication Scheduling and Reminder Service for Wireless Home Healthcare Networks"

Eric Mitchell Evans                Advisor: Sameer Sonkusale  
"A Physiological Monitoring System For Fast Response"

Joseph Michael Ferrara          Advisor: Joseph Noonan  
"Surface Acoustic Wave Oscillator Open/Closed Loop Tuning"

Scott A. Harris                     Advisor: Valencia Joyner  
"CMOS Transimpedance Amplifier Design with Self-Biased Automatic Gain Control for Wireless LOS Optical

## Joe Noonan collaborates with Harvard



**Professor Joe Noonan**

Professor Joe Noonan has thirty-five years experience in the area of digital signal processing probabilistic modeling, and statistical communication theory. His general research activities concern optimal detection and estimation of signals in noise. Specific applications include; channel modeling, spectral and image estimation, time varying systems, and medical applications.

Professor Noonan stepped down as Department Chair in September 2007 and will return to a more active research and teaching role. His recent Ph.D. student Prabahan Basu has been awarded a joint post doc research position with Tufts and Harvard. Prof. Noonan and Dr. Basu will be working with Prof. Patrick Wolff of Harvard on improved estimation techniques using information theory with particular applications to speech modeling. Additionally, we have developed an improved algorithm for restoring low resolution images such as those from cell phones. This work continues and is presently being published. Finally, work is moving forward on epilepsy prediction for patients showing no EEG indication of the onset of a seizure.



**Halligan Hall, home of the ECE Department**

## Dr. Eric Miller Joins ECE Department



Dr. Eric Miller

Since arriving in January 2007, Professor Miller has been busy establishing a research program and developing a number of new classes for the ECE curriculum. With six proposals pending at agencies including the National Science Foundation, National Institute of Health, the Department of Homeland Security, and the Strategic Environmental Research and Development Program, Professor Miller is looking forward to the growth of a vibrant and interdisciplinary research program in image formation, inverse problems, and image processing. Industrial collaboration is always welcome so please feel free to contact Professor Miller if you are looking for an academic partner in these areas.

In the area of course work, Professor Miller offered a well received class in fundamentals of digital image processing in the Spring of 2007. A freshman version of this material, as well as a new class in probability and statistics, are on tap for the Fall semester.

Finally, Professor Miller has been active outside of Tufts. He is serving as the General Co-Chair for the 2008 IEEE International Geoscience and Remote Sensing Symposium to be held in Boston in July 2008. See [www.igarss08.org](http://www.igarss08.org) for the full story. He is also the local arrangements chair for the 2009 IEEE International Symposium on Biomedical Imaging. Finally, this past July, the Army Research Office funded the Workshop on Signal and Image Processing. The goals of the workshop were to evaluate the current state of the art in Automatic Target Recognition. Professor Miller led a discussion concerning the role of physics-based modeling and processing for addressing problems of target recognition using non-imaging sensors in highly cluttered environments.

## High Tech Innovation and Project Fellows Program

The *High Tech Innovation and Project Fellows Program*, for students to acquire practical engineering skills, learn project-based methods, and be mentored by working engineers, was initiated this past January by Ron Lasser, Professor of the Practice. The program is intended to *Create opportunities* for engineering students work on research and development projects sponsored and funded by high technology companies, *Interact with industry* engineers and professors to solve existing and challenging problems, *Build a web-based center of excellence* to document the pedagogy, experience, and interactions between students and industry. This year

two students were funded by Frank Pao and Atlantis Energy Systems, Inc. to determine the efficiency of photovoltaic solar cells. The program held three interactive question and answer sessions about engineering, industry and entrepreneurship, each with a guest speaker. The speakers were: Jon Hirschtick, Chairmen of Solid Works, Inc; Elliot Katzman, General Partner of Commonwealth Capital Ventures; and David Birnbach, President of Vaultus Mobile Technologies. The program is planning to have six sessions this year. If anyone has ideas for a speaker, please contact Professor Lasser.

## M.S. Projects (continued)

Brian Adam Kessler	Advisor: C. Hwa Chang
"Wireless Home Health and Safety Monitoring Systems"	
Wonjae Kim	Advisor: Karen Panetta
"Design of a Radio Frequency Identification (RFID) System for electronic Passports Using Commerical Off-the-Shelf Parts"	
Matthew C. Law	Advisor: Joseph Noonan
"Teradyne UltraFLEX Good Neighbor Noise Testing With the Very High Frequency AC Instrument Board"	
Scott A. Liporto	Advisor: Mohammed Afsar
"Fractal Antenna Investigation Project"	
Michael J. Matranga	Advisor: C. Hwa Chang
"Mobile Wireless Sensor Networks for the Health Care Industry"	
Ariel de Jesus Perez Sanchez	Advisor: Joseph Noonan
"A Study of the Gaussian Multiple Access Channel with Feedback"	
Mark Edgard Robinton	Advisor: C. Hwa Chang
"Interfacing a Subscriber Identity Module, Mobile Equipment, and Auxiliary Smart Card"	
Eric A. Silva	Advisor: Karen Paentta
"Quantifying Image Similarity"	
Wing Yun Siu	Advisor: Sameer Sonkusale
"VERILOG—A Modeling of CMOS Camera-On-Chip"	
Ramy Michael Souri	Advisor: Joseph Noonan
"Sensor Magnetic Coupling and Output Voltage Measurement"	
Gregory Allen Truhlar	Advisor: C. Hwa Chang
"Electronic Pillbox"	
Marc T. Weintraub	Advisor: C. Hwa Chang
"A Sensor Network for Museum Environment Monitoring"	
Vincent K. Yu	Advisor: C. Hwa Chang
"A Server for Wireless Golf Course Management System"	

(*From the Chair...* Continued from page 1)

is currently searching for a new faculty member to add to our expertise in sustainable energy. Simultaneously with this new ECE faculty position, the mechanical and chemical engineering departments are also adding new faculty in areas of alternative energy. These additions to the faculty will allow us to enhance the entire School of Engineering's educational and research programs in this important and exciting field.

This is my first year as chair of the department. I hope you share my enthusiasm for developing an even stronger and more vibrant intellectual community here at Tufts. In closing, on behalf of the entire ECE family I would like to express a sincere thank you to Professor Noonan for his leadership of the department over the last several years. The accomplishments described in this newsletter were fostered by Professor Noonan during his service as department chair, and we owe him a debt of gratitude for the department's upward trajectory.

# DEPARTMENT RESEARCH

## Afsar's Labs Find New Applications for Terahertz Spectroscopy

Professor Afsar, director of the High Frequency Materials Measurement and Information Center, received a five year contract from the US Army in September 2006

to study radar absorbing and radar altering materials. The program investigates the direct measurement of transmission, reflection and real and imaginary



Professor Mohammed Afsar

parts of the complex dielectric permittivity and the complex magnetic permeability from 1 GHz to 120 GHz. The total amount awarded is \$1.6M. The US Army has supported this research program since 1987. The research team includes Professor Afsar, Dr. Konstantin Korolev, Dr. Mahmut Obol, Ph.D. students Usman Khan, Nawaf Almoayed and Shu Chen, master's student Mi Lin, undergraduate students Nick Nguyen, Kim Nguyen, Sean McCooey and Baris Piyade, and technical consultant Paul Dee.

Afsar's lab is now proposing to extend their precise experimental methodology to include millimeter wave and terahertz spectroscopy of pollutant gases and the development of novel instrumentation, including a portable device for detecting gas molecules to better than one part per trillion. Another application is the measurement and spectroscopy of common household powders and pesticide powders. It is believed that such materials have similar electromagnetic characteristics as anthrax and are commonly used in envelopes as hoax material. The team has found that each household powder has a specific permittivity value (when resolved to one part in 10,000) and a unique absorption signature. Once

these values are known, it is relatively easy to identify the material inside sealed envelopes. The program was initiated by DARPA via the Naval Surface Warfare Center.

The High Frequency Materials Measurement and Information Center joined with Tufts New England Medical Center (Department of Pathology) in a research program to diagnose breast cancer by employing unique spectroscopic instrumentation covering the frequency range from 45 MHz to 20 THz. The research program led to the acceptance of two papers in IEEE International Conferences and the acceptance of one long paper to IEEE Transactions on Microwave Theory and Techniques. Various tumorous and non-tumorous breast tissues were studied over extended frequencies using the diagnostics developed at Tufts. The major discovery shows that there is a significant change in absorption and dielectric properties between tumorous and non tumorous tissues. The measurement at millimeter waves with relatively high power sources exhibited a 40 fold change in the transmission properties of cancerous tissue. The laboratory envisions the potential of such measurement for millimeter wave mammography.

The team at High Frequency Materials Measurement and Information Center has submitted and presented about twenty technical papers at different IEEE international conferences. Most of these presentations either have already been published or will be published in conference digests. The team has also published six journal papers in IEEE Transactions in the last twelve months.

**Learn more about ECE research at:**  
<http://www.ece.tufts.edu/research/>

## ECE among Tufts faculty awarded seed grant for soft-bodied robotics research

A multidisciplinary consortium of Tufts faculty, including Prof. Joyner and Prof. Sonkusale from the ECE department, was awarded \$730,000 from the Keck Foundation to develop "Biomimetic Technologies for Soft Bodied Robots".



Professor Valencia Joyner

This work, at the interface of biology, bioengineering and micro/nano fabrication, is to be based at the new Advanced Technology Laboratory at 200 Boston Avenue which includes the Bioengineering and Science Collaborative and the Tufts Nanotechnology facility. The overall goal of the program is to carry out research into biologically-based technologies that use soft materials and to incorporate them into a new type of highly flexible robot. These machines will have applications in biomedical diagnosis and surgery, emergency rescue and exploration, and for monitoring or repairing space vehicles. Devices based on these technologies are also expected to improve the versatility and performance of conventional robots. In addition to this novel research, the program will recruit and train students from both Science and Engineering to work together in cross-disciplinary areas. The project is co-directed by Professors Barry Trimmer (Biology Department and Biomimetic Devices Laboratory) and David Kaplan (Biomedical Engineering). Professors Robert White (Mech. Eng.) and Sameer Sonkusale (Elect. & Comp. Eng.) will supervise projects in the Tufts Microfabrication Laboratory. Professors Luis Dorfmann (Civil/Envir. Eng.) and Gary Leisk (Mech. Eng.) will supervise the material testing and modeling parts of the project and Professors Valencia Joyner (Elect. & Comp. Eng.) and Sameer Sonkusale will direct the design and production of soft material inte-

(Continued on page 5)

# DEPARTMENT RESEARCH

(Continued from page 4)

grated circuits. The Keck grant will provide specialized equipment for use with soft materials and biomechanics experiments. Please contact Prof. Joyner (vjoyner@ece.tufts.edu) for further details on this research initiative.



Flexible robot material

## Wireless Power & Data Telemetry for Biomedical Implants

Prof. Sonkusale's research group is working on novel technologies for wireless data communication for biomedical implants. Examples include pacemakers for heart patients, deep brain stimulator for patients with brain and cognitive disorders, cochlear implants for the deaf and retinal implants for the blind. A key requirement for the biomedical implant is the ability to last a lifetime without need for repeated surgical replacements. This puts a stringent requirement on the power supply for the implants. Wouldn't it be nice if we could implement the electronics side of the implant without any built-in power source?

It is in this regard that Dr. Sonkusale and his student Zhenying Luo have made a significant development. They have developed transceivers that can run without any external power source. The power needed for sensing and communication is delivered

remotely through wireless inductive links. A prototype of a battery-less biological implant system is implemented, which demonstrates both wireless power delivery and duplex wireless data communication. BPSK (Binary Phase Shift Keying) modulation is used for the data transmission to the implant devices for forward data transmission and LSK (Load Shift Keying) modulation is used for the reverse data transmission. The novelty of this system is the architecture and the circuit implementation of a new BPSK demodulator, which provides considerable power savings compared to prior art. Chip measurement results validate the design's feasibility. This transceiver could reduce power consumption by 60%. If you are interested in more about biomedical implant design, please go to <http://nanolab.ece.tufts.edu>

## Tufts Wireless Lab (TWL)

Professor C. Hwa Chang has developed a new graduate program in Wireless Networks. Tufts Wireless Lab (TWL) will attract students and outside collaborators conducting innovative wireless education and research. TWL strengthens our connections with industry by offering new approaches to cutting-edge applications. Our students benefit by gaining practical exposure to wireless networking problems in both the lab and the classroom.



Professor Hwa Chang

nodes and networks, localization, location management, wireless security, chip design for wireless applications, and system integration in life science applications including healthcare. Another research area that TWL is pursuing is seamless secure wireless storage. Seamless secure wireless storage is an area of great interest for research as it would enable large amounts of data to be transferred wirelessly rather than by using expensive underground cable equipment. Research fields range from security and reliability of such networks to fast, bandwidth rich, faultless data transmission over longer distances.

In 2007, TWL graduated seven undergraduates, four master's students, and published several papers. Special recognition goes to Jason Waterman's design, "Real-time Traffic Monitoring and Reporting," which won the bronze prize in the Open Source Software Foundry Competition.

The areas of TWL's wireless communications research are mainly in wireless ad hoc networks including the routing protocols, power conservation of wireless

## Summer Interns Work on Renewable Energy

Olusola Akapo, a graduate student in Electrical and Computer Engineering, and Jeremy Arak, an undergraduate beginning his senior year in Mechanical Engineering, worked with Atlantis Energy Systems, Inc. (AES), to measure the thermal and electrical efficiency of Sunslate, a solar roof tile, which is a BIPV (Building Integrated Photovoltaic) product. The alumni sponsor for this project is Frank Pao, Chairman of AES who provided the funding and equipment to build a test bed at an experimental station near Plaistow, NH. The overall results demonstrated that the Sunslate is more efficient when combined with an insulating and energy transfer layer hidden under the solar roof tiles. Ron Lasser, Professor of the Practice, assisted the students in their experimental work.

## SIMLAB NEWS

## Best Poster Award at National Capstone Conference

Ron Lasser and Joe Noonan presented *Raising the Bar: Taking Senior Design from Student Projects to Academic, Industrial, and Entrepreneurial Contributions*, a paper and a poster at the National Capstone Design Course Conference at the University of Colorado at Boulder in June, 2007. The poster was awarded Best Poster at the banquet, which wrapped up the conference. The paper discusses the metamorphosis of ECE's department-centric capstone design program for senior electrical and computer engineering students to a student-centric, multi-disciplinary, individual and team projects, and variable sponsorship environment. Establishing and communi-

ating the vision, developing the curriculum, and teaching the skills to students is described in an historical context as the course was expanded from a single semester to a full academic year and beyond.



Joe Noonan and Ron Lasser

New technology from Tufts SIMLAB focuses on *bit level* image processing. Currently, most multimedia processing systems focus on macroscopic level image processing, dealing with images at the pixel level or higher. Bit level image processing, however, gives substantial gains in image clarity, recognition, processing time, compression, and also reduces memory requirements. SIMLAB researchers have demonstrated the uses for these bit level methods, including interpolation, resizing, denoising and compression. As this technique is particularly well suited for edge detection, the research now focuses this new technology on problems of detection and recognition. SIMLAB researchers Barghavi Govindarajan and Sadaf Qazi lead the way with direct research into use of these bit level methods for edge detection. Shahan Nercessian is developing advanced methods for processing the output of these methods to get more refined results. Finally, Eric Wharton, the longest standing member of the SIMLAB team, is currently investigating a number of new image processing techniques, with a concentration on image enhancement.

## Dr. Panetta Awarded \$500k to Develop Her Patent



Professor Karen Panetta

Allied Minds Inc. and Tufts University are teaming together to commercialize novel algorithms that accelerate and enhance a wide class of signal and image processing applications. The new venture is called BA Logix Inc. Allied Minds has awarded a contract to Dr. Karen Panetta of the ECE department. Students in Dr. Panetta's SIMLAB will work on implementing these novel algo-

rithms. In addition, Dr. Panetta has assumed the role of BA Logix Chief Research Scientist. The new joint venture aims to develop robust and computationally efficient algorithms for digital systems, which can be applied to imaging and compression technologies, resulting in fast and efficient implementations in either hardware or software.

"Our approach works on bit level image processing, which lends itself better to solving certain data processing and transmission problems, such as those found in medical, text, audio, and video applications"

states Dr. Panetta who co-founded BA Logix along with Dr. Sos Agaian of the University of Texas at San Antonio. "A broad set of end users can be supported and their wireless, security, video and signal processing needs will be optimized by our technology."

## Faculty Contact Information

Jeffrey Hopwood	Professor/Chair	Halligan 101A	617-627-4358	hopwood@ece.tufts.edu
Mohammed Afsar	Professor	Halligan 218	617-627-3129	mohammed.afsar@tufts.edu
C. Hwa Chang	Associate Professor	Halligan 131	617-627-5178	hchang@ece.tufts.edu
Denis Fermental	Associate Professor	Halligan 242/225	617-627-5250	dferment@ece.tufts.edu
Valencia Joyner	Assistant Professor	Halligan 210	617-627-2291	vjoyner@ece.tufts.edu
Ronald Lasser	Professor of Practice	Halligan Ext. 011	617-627-4977	rlasser@ece.tufts.edu
Eric Miller	Professor	Halligan 216	617-627-0835	elmiller@ece.tufts.edu
Joseph Noonan	Professor	Halligan 114	617-627-2490	jnoonan@ece.tufts.edu
Karen Panetta	Associate Professor	Halligan 236	617-627-5976	karen@ece.tufts.edu
Douglas Preis	Professor	Halligan 222	617-627-2492	dpreis@ece.tufts.edu
Sameer Sonkusale	Assistant Professor	Halligan 231A	617-627-5113	sameer@ece.tufts.edu

(Continued from page 1)

data would provide clues as to the composition of the moon's surface. The effort, which continued until 1970, provided Fermental the opportunity to do independent design work.

In 1963, Fermental was promoted to Assistant Professor and on receiving his Ph.D. degree from Northeastern, became an Associate Professor in 1967. During the 60's and 70's, the department teaching faculty never exceeded seven full-time members and Fermental was given a wide variety of teaching assignments. He started a course in computer circuitry in 1961 and a course in switching circuits, the forerunner of ES4, in 1963. He also taught Communication Theory for a number of years. Around 1977, Fermental introduced a course in Information Theory and began a microprocessor course in 1979 that eventually became EE14. The 1980 catalog lists him as being in charge of:

EE11-EE12: Courses in analog electronics

EE14: Microprocessors

EE105-EE106: Courses in feedback control systems

EE115: Analog circuit design

EE116: Digital circuit design

EE206: Nonlinear systems

EE227: Information theory

(Consolidation of course material and an increase in faculty size reduced the list considerably in the 80's)

Fermental became a consultant with the United Electric Controls Company designing electronic temperature controllers in 1965 and remained with the company until 1989. The association, along with offering various design problems, gave him insights into the procedures of a small manufacturing company. He began consulting with the C.S. Draper Laboratory in 1980 spending his summers there from 1983 to 1999. This work, dedicated to the control of the inertial measurement unit for the Mark 6 Trident missile, involved circuit reviews, electromechanical simulation, and control code verification. It provided him with practical lessons in the control of a large complex system.

Professor Fermental became Department Chair in 1988 and served until 1996, one year after Electrical Engineering merged with Computer Science. In 2001, at the behest of Dr. Howell, he joined the board of Doble Engineering, an instrumentation company for the power industry, serving until 2006.

## 2006 Tufts Graduate Research Fair Presentations

Prabahan Basu - *Estimation and System Modeling Using Information Theoretic Measures*

Zhenying Luo - *Low Power Biomedical Implants*

Sungkil Hwang and Vinay Agarwal - *CMOS Microelectrode Arrays*

Jon Chow - *CMOS Camera on Chip*

Mike Trakimas - *0.5 V Analog and Mixed Signal Circuit Design*

Ethan Danahy - *Directional Edge Detection Using the Logical Transformation for Binary and Grayscale Images*

Eric Wharton - *Human Visual System Based Image Enhancement*

Nawaf Almoayed - *High Resolution Fourier Transform Spectroscopy of Pollutant Gases*

Na Wang - *Probabilistic-based energy aware routing for network lifetime and source level fairness in wireless sensor networks*

Scott Harris - *CMOS Receivers for Optical Wireless Communication Networks*

## Senior Design Projects Apply Knowledge of DSP

Seniors in the Class of 2007 applied the knowledge and skills learned in Digital Signal Processing (EE-125 and E-145, taught by **Professor Doug Preis**) to their senior design projects (EE-97). One group used digital filters they designed in the courses to filter a wide variety of audio signals, subjectively improving the sound quality. Another group worked with musician/guitarist Shahan Nercessian, who plans to do his graduate studies in ECE at Tufts, on mathematical methods and algorithms for audio source extraction, removal and separation. A third group investigated the feasibility of conformal radio frequency anti-theft tags. The photos show these seniors at the final poster presentations and demonstrations of their projects in Halligan Hall last Spring.

Professor Preis continues independent research on a variety of un-

solved and outstanding problems in his fields of expertise (signal analysis, audio engineering, acoustics and electromagnetic theory) and has frequently collaborated with colleagues outside of Tufts as well as undergraduate and graduate students at Tufts. For senior undergraduates the senior design project can be a great way to learn about and initiate interesting research in ECE, guided by a member of the faculty.



# Department of Electrical and Computer Engineering Mission Statement

*The mission of the Department of Electrical and Computer Engineering is to provide our students with educational experiences which give them a sound basis for professional practice, advanced education, and lifelong learning. At its core is the goal that students learn the fundamental principles of electrical and computer engineering and master engineering methods to solve challenging and diverse problems. Further, the department strives to have each student develop the leadership and communications skills necessary to relate these solutions to both technical and non-technical communities. The faculty is dedicated to accomplishing this mission through the integration of teaching and research.*

TUFTS UNIVERSITY  
DEPARTMENT OF ELECTRICAL  
AND  
COMPUTER ENGINEERING



**Tufts**  
UNIVERSITY

School of  
Engineering

---

Department Office:  
Halligan Hall, Room 101  
161 College Avenue  
Medford, MA 02155

Phone: 617-627-3217  
Fax: 617-627-3220  
E-mail: [ylandry@ece.tufts.edu](mailto:ylandry@ece.tufts.edu)

---

[WWW.ECE.TUFTS.EDU](http://WWW.ECE.TUFTS.EDU)

Interested in pursuing a Tufts Graduate Degree? Discover more about the graduate degree program at <http://gradstudy.tufts.edu/>

The department is always seeking industry relationships. If your company is looking to sponsor graduate fellowships, interested in internships, or career opportunities please contact Jeff Hopwood at [hopwood@ece.tufts.edu](mailto:hopwood@ece.tufts.edu).