Department of Electrical and Computer Engineering

Annual Report 2006-07

American University of Beirut

http://www.aub.edu.lb/ece
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I. Introduction
Message from the Chair

During the period July 1, 2006 – June 30, 2007, the Department of Electrical and Computer Engineering offered several new undergraduate and graduate programs, continued developing its laboratories, addressed the issues of collaboration and academic advising, and witnessed exciting developments in its faculty and staff ranks.

At the undergraduate level, the Department offered the new ECE and existing CCE degrees according to the new curricula that were approved in 2006. Entering undergraduate students took the new course on Introduction to Electrical and Computer Engineering during their first semester. This course introduces students to the engineering profession and to the various areas of electrical and computer engineering. At the graduate level, the Master of Engineering program enrolled the first group of students working towards the Information and Communications Technology option, as well as students following the non-thesis option. The PhD in ECE program was approved by the State of New York Department of Education. The PhD program was advertised, and applications to the program were received during the spring of 2007. A select group of students were accepted for enrollment starting September 2007 (see article on PhD program in this report.)

Two new laboratories were equipped, furnished, and started operation during the period covered by this annual report: The Mobile and Distributed Computing Lab and the Wireless Communications Lab. The labs are located on the second floor of the Raymond Ghosn Building. Most of the equipment was financed by the CITPER project (EC Tempus grant JP 31074-2003). The departmental laboratories in Wing B moved to the new CCC Scientific Research Building (SRB) where they will remain until the Iran/Oxy Building is completed.

The Department initiated discussions with the Department of Computer Science at AUB to collaborate on several fronts. Cross-listing of courses and joint supervision of graduate research are among the areas identified as beneficial to both departments.

Student advising was seriously considered this year as an area that needed improvement in the Department. Feedback from students and faculty members was obtained by holding several meetings during which issues pertaining to the quality of academic advising were discussed. Recommendations were developed to remove the PIN requirement, to appoint an administrative advisor in the Department, and to allow students to switch advisors. The recommendations are currently in the process of being implemented.

There were several developments in the faculty and staff of the Department. Dr. Imad Elhajj joined the Department in September 2007 as an assistant professor. Dr. Elhajj is a 1997 graduate of AUB with a BE in CCE. He received his MS and a PhD in electrical engineering from Michigan State University. New faculty positions were advertised, and two applicants were offered positions in the Department: Dr. Mariette Awwad, from IBM and Dr. Hazem Haji, from Intel. Dr. Awwad received her BE in EE from AUB in 1997, and her PhD in EE from the University of Vermont in 2007. Dr. Hazem Haji received his BE in EE (with Distinction) from AUB in 1987, and his PhD in EE from the University of Wisconsin, Madison in 1996. Both faculty members will join the Department in February 2008. In June 2007, Prof. Ali Chehab received the University Award for Excellence in Teaching. Prof. Hassan Diab was appointed as Vice President for Regional External Programs. Prof. Fouad Mrad’s book on Applied Mechatronics was published in March 2007. Mr. Ghassan Deeb was offered a position in the ECE laboratories as Lab Engineer, and will start in August 2007.

I hope you find the information in this annual report useful and enjoyable.

Best regards,

Ayman Kayssi
Chairman
On the following Tuesday, the war in Lebanon started. Filled the front page of Wisconsin’s newspaper, The Capital Times. It did several TV, newspaper and radio interviews. Twice I was on abroad what is really happening in Lebanon. And so it was. I was an awareness campaign, in which we can tell people from the inside, but not from the outside. What was needed undoable was done. I knew that money would help Lebanon other supporters who were motivated by my enthusiasm, the Association, the Muslim Students’ Organization, and many with the help of the American Red Cross, the Arab Students’ I organized three fundraisers, at which 10,108 USD were raised. when my country needed me, I was there to do my duty. something; something to make me feel that I am useful and that when my country needed me, I was there to do my duty.

It was a Sunday July 9, 2006. Two major events happened on that day, Italy defeated France in the World Cup, and I left Lebanon for the US to do my internship at the University of Wisconsin, Madison. I was excited to begin my first experience in the real world of an engineering professional. On the following Tuesday, the war in Lebanon started. Filled with misery, sadness, fear, and hope, I was determined to do something; something to make me feel that I am useful and that when my country needed me, I was there to do my duty.

I organized three fundraisers, at which 10,108 USD were raised. With the help of the American Red Cross, the Arab Students’ Association, the Muslim Students’ Organization, and many other supporters who were motivated by my enthusiasm, the undoable was done. I knew that money would help Lebanon from the inside, but not from the outside. What was needed was an awareness campaign, in which we can tell people abroad what is really happening in Lebanon. And so it was. I did several TV, newspaper and radio interviews. Twice I was on the front page of Wisconsin’s newspaper, The Capital Times. It astonished the people in Madison that I was able to do so many things in a very short period of time, but that did not surprise me. Why? The answer is simple: I am an engineer.

When I was accepted in the faculty of Engineering and Architecture, I felt proud. Throughout the past four years, studying Engineering was not a tough task, but rather, living up to the expectations was the hard thing. We are known to be smart, attentive, and nerdy. We surprise the other students at AUB who are not in engineering that we are sometimes funny, and still smart. Little do they know that there is a difference between acting smart, and being smart in reality. We know the key to getting great grades in whatever courses we take outside of FEA (there is no need to talk about the courses inside FEA). What we are studying is not how to make complex calculations. Engineering is more than a field of study, or a career, it is a way of thinking and a method of application. We learned the numerous ingenious engineering theories, but know that there is more than just formulating a theory. We developed life-long skills that hopefully will make the gates of success open to us. Throughout the past years, my faith has increased. Now I have faith in engineering, and I have more faith in Lebanon. I can declare open-heartedly that our support will always be to our Lebanon, to this vast, confused beauty. And, now I can say with all the needed confidence, “Fellow engineers, make space for me in the engineering world!”

The American University of Beirut (AUB) is a private, independent, nonsectarian institution of higher learning, founded in 1866. It functions under a charter from the State of New York and is governed by a private, autonomous Board of Trustees. Degrees awarded by the American University of Beirut are officially registered with the Ministry of Higher Education in Lebanon and with the Board of Education in the State of New York. AUB was granted institutional accreditation in June 2004 by the Commission on Higher Education of the Middle States Association of Colleges and Schools.

As early as 1913, the American University of Beirut recognized the need for engineering education and training in the Middle East, and courses in this field were offered in the School of Arts and Sciences. In 1951, a separate School of Engineering was established and curricula were initiated in Architectural Engineering, Civil Engineering, Electrical Engineering, and Mechanical Engineering. In 1966, the School was renamed the Faculty of Engineering and Architecture (FEA) that comprised, among others, the Department of Electrical Engineering, which was renamed later to Department of Electrical and Computer Engineering (ECE).
The Department of Electrical and Computer Engineering (ECE) is the largest department in the Faculty of Engineering and Architecture. It has 22 full-time faculty members and is home to more than 600 undergraduate students and more than 70 graduate students. The total number of ECE alumni now exceeds 2500. The ECE Department maintains several specialized teaching and research laboratories. The laboratories are used for research purposes as well as to enhance teaching through hands-on experience in the various fields of electrical and computer engineering.

**ECE Mission**

The mission of the Department of Electrical and Computer Engineering is to prepare its students in a challenging environment for leading roles in their major fields of study. It also prepares them for life-long learning, and fosters critical and independent thinking, innovation, ethical conduct, and effective communication. The Department promotes excellence in education and research, and provides services to the community at large.

**ECE Undergraduate Programs**

The ECE department offers the degree of Bachelor of Engineering in two majors: Computer and Communications Engineering (CCE) and Electrical and Computer Engineering (ECE). The department also offers two minors: Minor in Information Technology and Minor in Biomedical Engineering.

**ECE Graduate Programs**

The ECE department offers the degree of Master of Engineering (ME) in Electrical and Computer Engineering, and the degree of Doctor of Philosophy (PhD) in Electrical and Computer Engineering.

The department offers the following graduate programs, all leading to the Master of Engineering in Electrical and Computer Engineering (ME in ECE) degree: ECE Thesis Program, ECE Non-thesis Program, and Information and Communications Technology Program.

The objectives of the ECE Department are the following:

- **Excellence in education**: The Department strives for excellence in education at the undergraduate and graduate levels. Students receive high-quality basic and advanced technical education in electrical and computer engineering, with emphasis placed on critical thinking, communication skills, creativity, ethical and professional behavior, leadership, and creating life-long learners.
- **Excellence in research**: The Department strives for excellence in research, by providing students and faculty members with a quality research environment and adequate laboratory facilities. Faculty members in the Department attract funding and contribute to state-of-the-art research in electrical and computer engineering. Ties with researchers at renowned industrial and academic institutions and with professional organizations are maintained to advance the professional development of faculty members and students.
- **Excellence in service**: The Department strives for excellence in the services it provides to the university, to local and international professional organizations, and to the community at large, with special consideration given to the needs of Lebanon and the region.
- **Outstanding faculty and students**: The Department attracts excellent students to its programs, and attracts and retains outstanding faculty members. The Department provides a supportive environment for the development of both faculty members and students, and encourages student-faculty interactions through curricular and extra-curricular activities.

**II. Personnel**
Faculty

Full Time Faculty

Professors

Al-Alaoui, M. Adnan: PhD, Georgia Institute of Technology; Areas of interest: Analog and digital signal processing with applications to filters, communications, controls, and biomedical engineering; pattern recognition and neural networks with applications to character, speech, and image recognition. Email: adnan@aub.edu.lb

Chaaban, Farid: PhD, University of North Carolina, Berkeley; Areas of interest: Design and verification of VLSI circuits and systems; design for reliability and optimization; design automation; mixed-mode simulation; fault simulation and testing. Email: ihajj@aub.edu.lb

Kabalan, Karim: PhD, Syracuse University; Areas of interest: Antenna theory; electromagnetic field computations; software development; telecommunication applications. Email: kabalani@aub.edu.lb

Karaki, Sami: PhD, University of Manchester; Areas of interest: Renewable energy systems modeling; generation expansion planning and production costing; application of neural networks, fuzzy systems, and genetic algorithms in energy systems. Email: skarakii@aub.edu.lb

Keysi, Ayman: PhD, University of Michigan, Ann Arbor; Areas of interest: Internet technologies; wireless applications; computer networks and data communications; VLSI design, modeling and simulation; digital system testing. Email: ayman@aub.edu.lb

Kassab, Fuad: PhD, Purdue University; Areas of interest: Control; robotics; industrial automation; instrumentation. Email: fuad@aub.edu.lb

Saade, Jean: PhD, Syracuse University; Areas of interest: Communication systems; fuzzy sets and logic; design of intelligent systems using fuzzy logic and other tools; optimization techniques for intelligent and decision-making systems. Email: jaade@aub.edu.lb

Saliba, Nassir: PhD, State University of New York at Buffalo; Areas of interest: Electrophysiology of nerve and muscle; modeling of the electrical behavior of nerve and muscle cells; modeling of the behavior of the human neuromuscular system. Email: nsalib8@aub.edu.lb

Hajj, Ibrahim: PhD, University of California, Berkeley; Areas of interest: Design and verification of VLSI circuits and systems; design for reliability and optimization; design automation; mixed-mode simulation; fault simulation and testing. Email: ihajj@aub.edu.lb

Chehab, Ali: PhD, University of North Carolina at Charlotte; Areas of interest: VLSI design and design for testability (DFT); dynamic power supply current (DQD); testing; development of automatic test pattern generation (ATPG). Email: chehabilities@aub.edu.lb

Dawy, Zaher: Dr.-Ing., Munich University of Technology; Areas of interest: Wireless communications (GSM/EDGE and UMTS); design of multiphase based cellular networks; multiple user information theory; multimedia transmission over IP networks; bioinformatics and computational biology. Email: zd03@aub.edu.lb

Elhajj, Imad: PhD, Michigan State University; Areas of interest: Computer & sensor networking, Internet security, medical & health informatics, robotics & automation, human machine interfacing. Email: ilef@aub.edu.lb

Karameh, Fadi: PhD, Massachusetts Institute of Technology; Areas of interest: System identification and control; biological systems; neural system modeling; gene expression arrays. Email: fk14@aub.edu.lb

Mansour, Mohammad: PhD, University of Illinois at Urbana Champaign; Areas of interest: Digital IC design, VLSI for communications, signal processing and general purpose computing systems; coding theory; code design on graphs; decoding algorithms and architectures; algorithm and architecture optimizations for VLSI using abstract algebra. Email: mmansour@aub.edu.lb

Saghir, Mazen: PhD, University of Toronto; Areas of interest: Computer architecture; optimizing compilers; configurable computing; embedded systems design. Email: mazen@aub.edu.lb

Abou Faisal, Ibrahim: PhD, Massachusetts Institute of Technology; Areas of interest: Information theory; digital communications; optical communication; stochastic systems. Email: iaf14@aub.edu.lb

Artail, Hassan: PhD, Wayne State University; Areas of interest: Distributed computing and clusters; high-availability, real-time software over networked systems; embedded systems and smart sensors; communication protocol design; software project management and rollout. Email: h2a27@aub.edu.lb

Associate Professors

Ali-Alhmad, Walid: PhD, University of Michigan, Ann Arbor; Areas of interest: Millimeter-wave 4G radio systems; multi-mode multi-band reconfigurable radio front-ends; digital radio transceivers for 3G systems; RF MEMS; applied EM applications. Email: wa29@aub.edu.lb

Artail, Hassan: PhD, Wayne State University; Areas of interest: Distributed computing and clusters; high-availability, real-time software over networked systems; embedded systems and smart sensors; communication protocol design; software project management and rollout. Email: h2a27@aub.edu.lb

Assistant Professors

Abou Faisal, Ibrahim: PhD, Massachusetts Institute of Technology; Areas of interest: Information theory; digital communications; optical communication; stochastic systems. Email: iaf14@aub.edu.lb

Bazzi, Louay: PhD, Massachusetts Institute of Technology; Areas of interest: Theory of error correcting codes; design and analysis of algorithms; cryptography; number theory. Email: lbz13@aub.edu.lb

Chehab, Ali: PhD, University of North Carolina at Charlotte; Areas of interest: VLSI design and design for testability (DFT); dynamic power supply current (DQD); testing; development of automatic test pattern generation (ATPG). Email: chehab@aub.edu.lb

Elhajj, Imad: PhD, Michigan State University; Areas of interest: Computer & sensor networking, Internet security, medical & health informatics, robotics & automation, human machine interfacing. Email: ilef@aub.edu.lb

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Saghir, Mazen: PhD, University of Toronto; Areas of interest: Computer architecture; optimizing compilers; configurable computing; embedded systems design. Email: mazen@aub.edu.lb
Part Time Faculty

Adjunct Professor

Khoury, Shahwan: PhD, Carnegie Institute of Technology

Senior Lecturers

Chahine, Hazem: Diploma, Loughborough College of Technology
Karshi, Walid: PhD, ENST Paris

Lecturers

Abdallah, Rima: PhD, Universite Paul Sabatier Toulouse
Abou Chahine, Souhbi: PhD, ENST Paris
Hamadi, Lamia: PhD, Ohio State University
Mehdi, Mahmoud: MS, Marquette University
Moghbal, Isam: PhD, Essex University
Mohtar, Tannir: MS, University of Prague
Othman, Ziad: PhD, University of Florida
Tannir, Marwan: PhD, Imperial College, London

Visiting Lecturer

Huijer, Ernst: PhD, University of Florida

Instructors

Barake, Taha: MSc, Virginia Polytechnic Institute
Droubi, Ghassan: ME, American University of Beirut
Ganouni, Mehran: ME, American University of Beirut
Husseini, Ahmad: ME, American University of Beirut
Hasbini, Haitham: MS, Boston University
Kanafani, Zaher: BE, American University of Beirut
Koamal, Ali: MS, Western Michigan University
Nahas, Nagi: BE, American University of Beirut
Slim, Basel: ME, American University of Beirut

Staff

ECE Secretaries

Ali Shaar, Rabab
Tannir, Samiha

ECE Labs

M. Khaled Joujou
Salam Abiad
Fuad Shihab

Members of the External Advisory Board

The External Advisory Board (EAB) plays an important role in advising, promoting, and supporting the ECE Department. The following is a list of the members of the EAB:

- Mr. Ghassan Boulbol, LibanCables
- Mr. Jalal Fawwaz, ACT
- Mr. Zuheir Haddad, CCC
- Mr. George Kadifa, IBM
- Mr. Kamal Kalot, Tamer Freres
- Dr. John Makhoul, BBN
- Mr. Youssef Matar, Dar Al-Hardassah (Chairman of the EAB)
- Mr. Abdel Raouf Rifai
- Mr. Hussein Rifai, MDC
- Dr. Gabriel Rebeiz, University of California, San Diego
Academic Programs

As of September 2006, the ECE department offers the degree of Bachelor of Engineering in two majors: Computer and Communications Engineering (CCE) and Electrical and Computer Engineering (ECE).

The mission of the undergraduate programs is to impart a basic understanding of electrical and computer engineering built on a foundation of mathematics, physical sciences, and technology; to expose students to practical and major design experiences; and to provide students with a global perspective and an awareness of their leadership role in regional development. This preparation is augmented by the liberal arts education offered to all undergraduates at the American University of Beirut.

The Electrical and Computer Engineering program provides the students with options to explore, and specialize in, one or more areas of electrical and computer engineering. The Computer and Communications Engineering program prepares its graduates for careers and higher studies in information and communication technologies. As educational objectives, graduates of the undergraduate programs:

- Possess skills and knowledge that qualify them for professional practice in electrical and computer engineering and for admission to reputable graduate programs.
- Are capable of applying fundamental knowledge, appropriate mathematical principles and computing tools, critical thinking, and best practices in electrical and computer engineering analysis and design.
- Are provided with an educational foundation that fosters creativity, team work, leadership, and communication skills, and prepares them for life-long learning along diverse career paths.
- Have an appreciation of technical, social, economic, environmental, ethical, and global aspects of engineering practice.

The Department also offers the following two undergraduate minors:

- Minor in Information Technology (IT): The IT Minor is open to all AUB students, except students majoring in Computer and Communications Engineering, Electrical and Computer Engineering, or Computer Science. The minor will be indicated on the transcript of the student who completes all the requirements. The IT minor program consists of six courses: three core courses and three electives.
- Minor in Biomedical Engineering: The Minor in Biomedical Engineering is open to all AUB students. The minor will be indicated on the transcript of the student who completes all the requirements. The minor requirements are divided into a set of core courses and a set of elective courses.

As of September 2006, three graduate programs are offered under the Master of Engineering in Electrical and Computer Engineering Degree: A research-oriented thesis program, a course-oriented non-thesis program, and a special program focused on information and communications technology (ICT). The ICT program is a special program in the sense that students following the ICT curriculum will have to complete all the requirements of a thesis program, in addition to taking business and management courses, graduate level lab courses, special courses given by visiting professors and industry specialists, and completing an industrial or research internship. Students enrolled in any of the graduate programs should have a major area and a minor area from the following eight ECE areas: Biomedical Engineering, Integrated Circuits and Computer Systems, Software Systems and Networks, Control and Intelligent Systems, Communications, Signal and Image Processing, Energy and Power Systems, and Applied Electromagnetics and RF Systems.

The objectives of the program are:
- to provide the student with the research opportunities to acquire a depth of knowledge in one specialization area of electrical and computer engineering, and familiarity with allied areas;
- to provide opportunities for the doctoral student to develop competence in performing independent research, communicating effectively, and learning independently;
- to advance the state of electrical and computer engineering research at AUB, in Lebanon, and the region;
- and to advance the state of the art in electrical and computer engineering.

Program Outcomes

Graduates of the program are expected to have:

- a breadth of knowledge in electrical and computer engineering, and a depth of knowledge in their specific area of research;
- an ability to identify and define research problems;
- experience in performing research and communicating the results effectively;
- experience in doing independent academic work;
- a published contribution to the existing knowledge in electrical and computer engineering.

Admission Requirements

Applicants to the PhD program must hold a master’s degree in electrical and computer engineering, or in a related discipline from AUB or another recognized institution of higher education, with a minimum cumulative average of 85.0 over 100 or its equivalent. Admission is determined by evaluating the following:

- Transcripts of academic record from the institution(s) of higher education attended by the applicant.
- Graduate Record Examination (GRE) general test scores.
- A written statement of purpose.
- Three letters of recommendations.
- A portfolio that includes a resume and samples of work.
- An interview, conducted either in person, by phone, or over the Internet.

All applicants must also satisfy the University requirements for admission to PhD programs.

The PhD Program in Electrical and Computer Engineering

AUB will be reviving PhD programs in eight areas of scholarship with the aim of stimulating much-needed scientific research in the Arab world. The PhD programs will be offered in the following fields: Arab and Middle Eastern history, Arabic language and literature, cell and molecular biology, theoretical physics, civil engineering, electrical and computer engineering, environmental and water resources engineering, and mechanical engineering.

The ECE department launched its PhD program in the spring of 2007, after all approvals were obtained, including registration by the New York State Department of Education. Seventeen applications were received for fall 2007-2008, of these eight applicants were recommended for admission. The ECE Graduate Committee based its admission recommendations on a combined score for applicants based on GPA, GRE scores, a research portfolio, interview results, and recommendations. The relative weights for the various components were 25%, 20%, 25%, 20%, and 10%, respectively. Five accepted applicants confirmed that they will join the PhD program in September 2007.

Detailed information about the PhD Program in ECE is given below.

Mission

The mission of the doctoral program is to provide high quality education in electrical and computer engineering which prepares students for employment and leadership roles in academic, industrial, or research positions.
## Course Offerings

### Summer 2006

<table>
<thead>
<tr>
<th>Course #</th>
<th>Undergraduate courses</th>
<th>Graduate courses</th>
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<tbody>
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<td><strong>Course #</strong></td>
<td><strong>Course Name</strong></td>
<td><strong>Course #</strong></td>
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<tr>
<td>ECE 210</td>
<td>Electric Circuits</td>
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<td>ECE 210C</td>
<td>Electric Circuits and Electronics</td>
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<td>ECE 230</td>
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<td>ECE 320</td>
<td>Digital Systems Design</td>
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<td>ECE 330</td>
<td>Data Structure and Algorithms</td>
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<td>ECE 430</td>
<td>Software Engineering</td>
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<td>ECE 440</td>
<td>Signals and Systems</td>
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<td>ECE 442</td>
<td>Communications Systems</td>
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### Fall 2006-07

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<th>Graduate courses</th>
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<td><strong>Course Name</strong></td>
<td><strong>Course #</strong></td>
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<tr>
<td>ECE 200</td>
<td>Introduction to ECE</td>
<td>ECE 601</td>
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<td>ECE 210</td>
<td>Electric Circuits</td>
<td>ECE 620</td>
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<td>ECE 230</td>
<td>Introduction to Programming</td>
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<td>ECE 310</td>
<td>Electronics I</td>
<td>ECE 632</td>
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<td>ECE 311</td>
<td>Electronics II</td>
<td>ECE 640</td>
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<td>ECE 320</td>
<td>Digital Systems Design</td>
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<td>ECE 330</td>
<td>Data Structures and Algorithms</td>
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<td>ECE 370</td>
<td>Electromechanical Systems</td>
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<td>ECE 421</td>
<td>Computer Architecture</td>
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<td>ECE 430</td>
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<td>Communications Systems</td>
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<td>ECE 450</td>
<td>Computer Networks</td>
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<td>ECE 460</td>
<td>Control Systems</td>
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<td>ECE 471</td>
<td>Fundamentals of Power System Analysis</td>
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<td>ECE 474</td>
<td>Electric Drives</td>
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<td>ECE 475</td>
<td>Industrial Electrification</td>
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<td>ECE 480</td>
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<td>ECE 499</td>
<td>Undergraduate Research</td>
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<td>ECE 501</td>
<td>Final Year Project</td>
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<td>ECE 501A</td>
<td>Audio Engineering</td>
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<tr>
<td>ECE 502</td>
<td>Artificial Intelligence</td>
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### ITEC courses

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<th>Course #</th>
<th>Undergraduate courses</th>
<th>Graduate courses</th>
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<tbody>
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<td><strong>Course #</strong></td>
<td><strong>Course Name</strong></td>
<td><strong>Course #</strong></td>
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<td>ECE 241</td>
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<td>ECE 311</td>
<td>Electronics Lab</td>
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<td>ECE 471L</td>
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<td>ECE 640L</td>
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<td>ECE 651L</td>
<td>Internetworking Lab</td>
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</table>
New ECE Graduate Courses

EECE 632  Cryptography and Computer Security
Prof. Ali Chehab

In this age of universal electronic connectivity, of viruses and hackers, of electronic eavesdropping and electronic fraud, security is becoming essential. In this course we introduce the students to the principles and practices of cryptography and computer security. We provide a tutorial and survey about classical encryption techniques, block ciphers and the data encryption standard, finite fields, advanced encryption standard, confidentiality using symmetric encryption, public-key cryptography, key management, hash and MAC algorithms, digital signatures, authentication applications, IP security and Web security.

EECE 653  Multimedia and Networking
Prof. Imad Elhajj

The last few years have witnessed the shift of the Internet from a pure data transfer medium to a network for multimedia applications. The new graduate course introduced covers topics in multimedia such as system requirements, performance requirements, representation and compression. Students are introduced to several compression and multimedia standards; such as, JPEG and MPEG. Multimedia networking is emphasized by discussing multicasting, streaming, multimedia networking protocols and quality of service based traffic management protocols. Networking topics covered include: MPLS, Diffserv, synchronization, VoIP, and Internet2. In addition, students in the course get to use the OPNET network simulator.

Teaching

This section includes the courses taught by the full-time faculty members in the department with the corresponding number of students in each course.

<table>
<thead>
<tr>
<th>Name</th>
<th>Teaching Courses</th>
<th>Summer 2006</th>
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<th>Spring 2006–07</th>
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### Statistics

#### Student Enrollment

**Undergraduate Students**

- Fall 2006-07
  - 1st year (Class of 2010): 91
  - 2nd year (Class of 2009): 93
  - 3rd year (Class of 2008): 89
  - 4th year (Class of 2007): 63

- Spring 2006-07
  - 1st year (Class of 2010): 89
  - 2nd year (Class of 2009): 63
  - 3rd year (Class of 2008): 70
  - 4th year (Class of 2007): 88

**Graduate Students**

- Fall 2006-07
  - CCE: 24
  - EE: 9
  - ECE: 21

- Spring 2006-07
  - CCE: 24
  - EE: 37
  - ECE: 21

A total of 600 undergraduate students were enrolled in the ECE department in both majors Computer and Communications Engineering (CCE) and Electrical and Computer Engineering (ECE) during academic year 2006-07.

#### Student Employment

The ECE department had 71 students registered in the student work scholarship program for the academic year 2006–07 (11 students in summer, 36 students in the fall term, and 24 students in the spring term). Student employment provides support to the faculty members in grading homework assignments, preparing course notes, course websites, laboratory operations, clerical work, etc. at the rate of three to six hours per week.

#### Graduate Assistants

Fellowships covering tuition and stipends are available for graduate students in return for assisting faculty members in teaching and/or research for a specified number of hours per week. Recipients are selected by the department on the basis of academic record and departmental need. The ECE department offered 97 graduate assistantships during the academic year 2006-07.

### Summer Training

ECE undergraduate students are required to do a technical internship during the summer of their third year. This experience consists of an eight-week internship with a professional organization that provides opportunities for training and exposure to the real engineering world. The following table presents a list of students with their internship positions during the summer of 2006.

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What no other place could offer…

Sara Ouwayda
(CCE Student, class of 2007)

Welcome to the AUB ECE department, I’d like you to meet my friend Sandra, a dabkeh dancer and a member of the AUB choir; our very own musicians, Fadi on the keyboard, and Faisal on the base; our resident Red Cross youths, Kamal, Hiba, and Salma; Nibal, the pass-par-tout student activities member; and myself, actress, director, and an environmentalist.

Many people consider the internship the highlight of their university years… I don’t buy it. If you ask me, every minute of the four years you spend in AUB is the highlight of your college years. Those were truly the best years of my life, and I am glad to say I enjoyed every minute of them.

So what has AUB given me? What AUB has given me is diversity; it offered me a polyvalence that few other options in the Middle East offer. I could study psychology, linguistics, cognitive science, and mathematics, while not compromising my path in engineering. I am not the graduate of one department, I am the graduate of the whole university, with all its departments, and this is something no other place could offer.

The long sleepless nights before an assignment was due are not easily forgotten, and I do not wish to forget them. Not because the suffering was too harsh, but because of the immense pleasure I experienced after the assignment was completed. As geeky as this may sound, there is no pleasure more significant, than to be up at 5 am, and look at your computer screen knowing you’ve shattered the doubts you had in your abilities, and “you solved it.”

In all the courses I’ve taken at AUB I’m proud to say I haven’t learned anything I plan on remembering. Instead, I gained the ability to learn: I learned how to think, and how to become a lifelong learner. At AUB, I learned how to find solutions to problems that resemble nothing I’ve ever encountered before. That is what engineering is all about, and that is what I learned here.

I must admit I didn’t stop complaining during my years at AUB, but I always knew deep down, that I was one lucky girl to be here, and so are my fellow classmates. We had the opportunity to be in a place that catered to our learning, our intellectual growth, our personal growth, and that allowed us to complain about the small things that were less than perfect.

So was it a hard trip? Yes, definitely, but it was one hell of a ride!
Final Year Projects

ECE undergraduate students are required to work in groups on final year projects (FYPs) during their fourth year. The FYP is a substantial piece of work that will require creative activity and original thinking. In general, the objectives of the final year project are to:

- Allow students to demonstrate a wide range of the skills learned at the FEA during their course of study by asking them to deliver a product that has passed through the design, analysis, testing, and evaluation stages.
- Encourage multidisciplinary research through the integration of material learned in a number of courses.
- Allow students to develop problem solving, analysis, synthesis and evaluation skills.
- Encourage teamwork.
- Improve students’ communication skills through writing two professional reports (at the end of the fall and spring term), producing a professional poster (only at the end of the spring term), and giving two presentations on their work (at the end of the fall and spring terms).

The following table presents the list of final year projects with corresponding groups of students and advisors during the academic year 2006–07.

<table>
<thead>
<tr>
<th>Final Year Project Title</th>
<th>Students</th>
<th>Supervisor(s)</th>
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<tbody>
<tr>
<td>Emotion Recognition</td>
<td>Zeid Abou Chahine, Mohammad Ammar Abou Faraj, Omar Al Bazzi</td>
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<tr>
<td>Teaching and Learning using Information Technology (TLTI)</td>
<td>Tarek Al-Nyra, Karim Jouini, Ahmad Mountada</td>
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<tr>
<td>Teaching and Learning using Information Technology (Signal Processing Team)</td>
<td>Sandra Al-Hattab, Ahmad El Haj, Youcef Yaacoub</td>
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<tr>
<td>Teaching and Learning Using Information Technology (Image Processing Team)</td>
<td>Ahmad Sidawi, Abdel Hamid Chandour, Ramaz Yuseis</td>
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<td>Heterogeneous Interface Card Simulated in NS-2</td>
<td>Hiba Alame, Adeeb Harb, Nermine Yahya</td>
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<td>Invoking Web Services over the Wireless Network from Mobile Devices</td>
<td>Rawia Abdel Samad, Omar Abou Faraj, Bessam Ezeddine</td>
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<td>Mobile Device Services for Pervasive Devices</td>
<td>Christian Basita, Mohammad Farhat, Selbou Meroshi Yeghiyan</td>
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<td>Clean Fuel</td>
<td>Maher Al-Hamadieh, Kunda Alameh, Rola Fakhour</td>
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<td>Energy Efficiency Planning in the Biology Agriculture and Physics Buildings</td>
<td>Rami Hilal, Ismaa Maarouf, Mariam Nasser</td>
<td>Chaaban</td>
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</tbody>
</table>

Final Year Project Title                          Students                                           Supervisor(s)
European Installation Bus                         Rami Bayram, Nizar Salmon, Sandra Sandakli           Chahine
Design of an Energy Management Unit/Controller for a Renewable Energy System | Joe El Khoury, Rami Hajer, Helal Jusheh            Chehab
The Potential of Gas-to-Liquid (GTL) Technology in Future Electric Power Plants | Hani Hmedan Al Samam, Ismail Ismail, Hussein Kassab | Chehab
DFNZ 07                                            | George Audi, Diana Fayed, Mark Haddad, Marwan Zeghbi | Chehab
DFNZ Defense Team                                  | Abdulrah Abou Chasal, Joanne Bou Jassaw, Rita Kettaneh | Chehab
Final Exam Scheduling                              | Nizar Bifiebe, Antoine Khadayfe                    Chehab
Infrastructure Controlled Peer-to-Peer Network: A System Implementation | Marwan Al Riff, Marwan Ramadan, Layla Zan         Dawiy
Multi-provisioning System for IP-based Telephony  | Gorges Deeb, Houssein El Sayed, Sander Solh        Dawiy
Performance Tools for IP-Based Telephony           | Nof Abu Zainab, Rony El Haddad, Bassam Fre          Dawiy
Autonomic Computing                                 | Mohamed Abdelhak, Hardar Haidar, Mustafa Ibrahim   El-Haj A
PHP Manager for VoIP                                 | Ahmad Awada, Amer Jbeihan, Ali Saad                El-Haj A
Visual Programming                                 | Fouad Arab, Riai Hallab, Nadim Restom              El-Haj A
Collaborative Intrusion Detection                  | Elie Bassi, Amer Farsov, Nabil Mukadam              El-Haj I
Simulation of a Wireless Communication System      | Mohammad Hajjar, Samah Ismail, Maria Khoury         El-Haj I
Advanced Traveler Information System                | Sara Mousa, Hassan Taran, Mazen Tlii               Kabalan
<table>
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<th>Final Year Project Title</th>
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<td>Energy Audit and Conservation Measures for the AUB Chemistry Building</td>
<td>Amer Hammoud</td>
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<td>Generation and Transmission System Planning in Lebanon from 2010 to 2025</td>
<td>Samer Fadel</td>
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<td>Malek Sulaiman Haidar</td>
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<td>Explorations in Biofeedback and Brain Computer Interface</td>
<td>Osama Eid</td>
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<td>Mobile Tourist Guide to Lebanon</td>
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<td>Live Drummer Emulation for use with MIDI Sampling</td>
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<td>Data Driven Design of Car Following Controller for Safe and Smooth Drive on Highways</td>
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<td>Computer Animation of IC Fabrication</td>
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<td>Marc Weir</td>
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</table>
Graduate Theses

Master of Engineering Thesis

Abdel Nahil, Ibrahim: Advanced Antenna Techniques for Multiphop Based Cellular Networks, February 2007, supervised by Professor Zaher Dawy


Al Kanj, Lina: Electronic Signal Predistortion for Compensation of Polarization Mode Dispersion in Optical Fibers, June 2007, supervised by Professor Zaher Dawy and Professor Norbert Hanik (TUM, Germany)

Asmar, Alain: Faces Detection Using Feature Based Approach, October 2006, supervised by Professor Adnan Al-Alaoui


Beainy, Amjad: Capacity Assignment for Multimedia over IP Networks with the Traffic Deviation, June 2007, supervised by Professor Zaher Dawy and Professor Samia Shareafeddine (LAU)

Bzeih, Amer: A New Broadband Microstrip Antenna Design for mobile communications, October 2006, supervised by Professor Karim Kabalan

Costantine, Joseph: A New Approach Design for Increasing for the Bandwidth of a Microstrip, October 2006, supervised by Professor Karim Kabalan

Hajj, Layal: An Information Theoretic Study of a Relay Channel, June 2007, supervised by Professor Ibrahim Abu Faycal

Hammeh, Hicham: Distributed Service Discovery Frameworks for Mobile ad hoc Wireless Networks, October 2006, supervised by Professor Hassan Artail

Hayek, Hossam: Adaptive Hierarchical Data Structure for Improving Search into Data, June 2007, supervised by Professor Hassan Artail

Husseini, Ahmad: Design of Experiments for Wireless Communications Laboratory, June 2007, supervised by Professor Hassan Artail

Husseini, Ahmed: Design of Experiments for Wireless Communications Laboratory, June 2007, supervised by Professor Hassan Artail

Husseini, Ahmad: Design of Experiments for Wireless Communications Laboratory, June 2007, supervised by Professor Hassan Artail

Jabour, Ravel: Optimizing Password Security through Key Pattern Analysis, June 2007, supervised by Professor Ali El Hajj

Jabara Alagha, Caroline: Speech Recognition Using Different Training Algorithms of Neural Networks, February 2007, supervised by Professor Adnan Al Alauii

Khaddaj, Sara: A General Approach for Analyzing Information Content in Neuronal Network Activity, June 2007, supervised by Professor Ibrahim Abu Faycal and Professor Fadi Karameh

Koulakizian, Mossine: Fossil Fuel related CO2 Emissions from Power Plants, Socio Economic Analysis, June 2007, supervised by Professor Farid Chaaban

Mahfoud El Zinnar, Rana: Abstracting Mobile Databases into a Single Database in Mobile Adhoc Networks, June 2007, supervised by Professor Hassan Artail

Mershad, Khalil: Semantic & Distributed Caching in MANET Systems, February 2007, supervised by Professor Hassan Artail

Meeinemeh, Suhai: Spreadsheet Simulation of Antenna Arrays, February 2007, supervised by Professor Karim Kabalan

Radwan, Zeen: XPRIDE Firewall: Policy-Driven Content-Based Web Services Firewall Committee Members, June 2007, supervised by Professor Ayman Kayssi

Saad, Saleh: Scalable Architecture for Caching Web Service Responses in Mobile Adhoc MANETs, June 2007, supervised by Professor Hassan Artail

Saad, Walid: Scheduling and Base Station Assignment in CDMA Networks with End-to-End QoS Guarantees, June 2007, supervised by Professor Zaher Dawy and Professor Samia Shareafeddine (LAU)

Shihah, Manal: Implementation of a Distributed Database System on Mobile Devices, June 2007, supervised by Professor Hassan Artail

Souf, Lara: Security, Personalization and Trust in Distributed File Sharing Networks & Centralized Search Engines, June 2007, supervised by Professor Ayman Kayssi

Toutayou, Fadi: ICT Frame Work for Large Scale Fully Digital Hospital (ICT-FDH), February 2007, supervised by Professor Toufic Medheber

Master of Engineering Thesis in Progress

Al Halabi, Alaa: Implementation of an Adhoc Network Utilizing the Triple Task Space Framework on Mobile Devices, supervised by Professor Hassan Artail

Al Kamal, Ismail: Reconfigurable Hardware System for Policy Based Web Security, supervised by Professor Adnan Al-Alauii

Al Kassem, Ibrahim: Blue HRT Hybrid Ring Tree Scatternet Formation in Bluetooth Networks, supervised by Professor Zaher Dawy

Al Rifai, Farah: Maximum Power Point Tracking of Photovoltaic Cells, supervised by Professor Rad Chedid

Alwani, Imad: Software Reliability in Web Development: A Feedback Control Approach, supervised by Professor Hassan Artail

Asmar, Samir: Various Current Distributions in Antenna Arrays: Linear, Beisel, Chebyshev & Modified Chebyshevs, supervised by Professor Karim Kabalan

Atallah, Adham: E-Manufacturing: A Predictive Maintenance Application, supervised by Professor Fuad Mad

Bazzi, Ali: Maximum Power Point Tracking of Multiple Photovoltaic Cells, supervised by Professor Sami Karaki

Chamoun, Youssif: Multi-level Application Layer Security Framework for Ad-Hoc Networks, supervised by Professor Ayman Kayssi

Eid, Rola: Iris Recognition Systems, supervised by Professor Adnan Al Alauii

El Halabi, Moustafa: Design of Digital Radio Broadcast Systems Based on Signal Quality Assessment in Different Geographical Reasons, supervised by Professor Jean Saade

Faddoul, Ronald: On the Relation of DNA Repair and the Genetic Code, supervised by Professor Zaher Dawy

Ghannour, Ali: Genetic Mapping Using Linear Least Square Estimation, supervised by Professor Zaher Dawy

Hamade, Halimah: Web Base Collaborative CAD, supervised by Professor Ali Chehab

Hamade, Samer: A Quantitative Evaluation of Reconfigurable Co-Processor Architectures for Soft CPU Cores, supervised by Professor Mazen Saghir

Kamaleddine, Isam: Adaptive Antennas for Wireless Communication, supervised by Professor Karim Kabalan

Khoury, Layla: Implementing and Evaluating an Authentication Mechanism and Key Agreement Protocol for SIP that Uses Identity-based Cryptography, supervised by Professor Ali Chehab

Krobroly, Mohammad: Design & Analysis of Energy Management Tool for Renewable Energy Conversion System, supervised by Professor Rjad Chedid

Salloum, Hussein: Design & Optimization of a Small Power Permanent Magnet Generator, supervised by Professor Farid Chaaban

Slam, Abbas: Speaker Recognition Using Neural Networks, supervised by Professor Adnan Al Alauii

Tabbarah, Tammam: Role of Burst Firing Cortical Cells in Neural Synchronization & Coding, supervised by Professor Fadi Karameh

Tawk, Yousef: A Modified Bowtie Antenna for Wi-Fi and Wi-Max Applications, supervised by Professor Karim Kabalan

Yazbeck, George: A Novel Reconfigurable Microstrip Antenna Based on Fractal Geometry, supervised by Professor Karim Kabalan

Youssef Al Cheikhani, Samer: Video Coding for Infrastructure Controlled P2P Networks, supervised by Professor Zaher Dawy

Graduate Non-Thesis Program

Bazzi, Donna: Major area: Control and Intelligent Systems, Minor area: Energy and Power Systems, June 2007, Chairman of Comprehensive Exam Committee: Professor Fuad Mad

Bou Akar, Amine: Major area: Energy and Power Systems, Minor area: Control and Intelligent Systems, June 2007, Chairman of Comprehensive Exam Committee: Professor Farid Chaaban

Chehab, Jana: Major area: Communications, Minor area: Software Systems and Networks, June 2007, Chairman of Comprehensive Exam Committee: Professor Ayman Kayssi

Zantout, Said: Major area: Communications, Minor area: Applied Electromagnetism and RF Systems, June 2007, Chairman of Comprehensive Exam Committee: Professor Ayman Kayssi
The AUB Experience

Zeen Radwan (ECE graduate student)

As an engineer I say, a person's life is made up of phases, you finish one phase to start a new one. I've spent two and a half years at AUB, and during this short phase of my life I have learned a lot from the wonderful people that I met and worked with. Learning is not only about academic knowledge it's also about what we go through in life that will shape our personalities and make us the people we become.

During my CCE masters program I took courses and also worked with a group of great professors. In addition, Dr. Kayss the chairperson gave me the opportunity to work as a member in the ECE Security Group which opened a new perspective for me that supported the preparation of my thesis topic.

My stay in Beirut happened to be at a time when Lebanon was going through a grave situation, but in spite of all the difficulties and critical circumstances, I will always and only remember the lovely memories and the warm faces of the dear people who will always remain in my heart.
A Universal Ultra-WideBand Data Modem Transmitter

Wael Y. Ali-Ahmad and Mohamed Nansour

Ultra-Wideband (UWB) technology is one of the emerging technologies required to push the design techniques in submicron CMOS forward to their edges, in order to achieve the highest performance possible with the best compromises. UWB systems use high-bandwidth signals to enable a new generation of ultra-high-data rate wireless applications. Implementation of a high-bandwidth RF system in the 3–10 GHz band presents challenges that can be solved by circuit and system techniques. One of the first challenging transceiver blocks to tackle is the UWB VCO circuit design, because it needs to cover fully or partially the UWB frequency spectrum while overcoming parasitics and tuning to the highest operating frequencies with a minimum of power consumption.

In recent years, the demand for high-data rate wireless communications has increased as consumer electronics have adopted more wireless peripherals. Shannon’s law shows that data rates are directly proportional to signal bandwidth and logarithmically proportional to the signal-to-noise ratio (SNR). A large increase in data rate can be achieved by increasing the bandwidth far beyond traditional narrowband systems, without requiring a significant increase in SNR which would require higher signal power. UWB increases the signal bandwidth by an order of magnitude over previous wireless data communication technologies such as 802.11 WiFi. The combination of high data rate and low output power makes UWB ideally situated for short-range in-home consumer electronics. Applications such as wireless video distribution require high data rates but have range limitations based on in-home environments. Wireless networks have to make implementation tradeoffs between reliability, range, high data rates, low power, and low cost. In 2002, the FCC approved the use of UWB in the 3.1–10.6 GHz range for output power densities below −41.25 dBm/MHz. The WiMedia standard allocates fourteen bands in six band groups across this spectrum (528MHz per sub-band). The standard supports over-the-air data rates up to 480 Mbps. To increase output power while remaining compliant with the −41.25 dBm/MHz FCC limit, fast frequency hopping is employed between sub-bands. This hopping requires the radio to switch bands between each symbol within a 9.5 ns guard interval. Given the low transmit power allowed by the FCC, the receiver must be designed to operate effectively at very low input power levels. The wideband nature of UWB provides frequency diversity, which helps to combat deep frequency fading. The WiMedia standard provides coding across carriers and across symbols and recovers portions of the UWB signal lost due to frequency fades. Two UWB standards are currently being considered: Multi-band Pulse-UWB and Multi-band OFDM-based UWB. Both systems result in the ability of the radio to cover the whole allocated 3–10 GHz frequency range. However, pulsed-based systems are typically simpler from an implementation point of view, requiring lower power, and lower cost, but require slower time-frequency hopping to improve energy capture. On the other hand, OFDM-based UWB systems are inherently more robust to multi-path but require accurate transmit to receive synchronization to allow faster frequency hopping. Hence, it is important to build a radio that supports multi-band operation across both modes (pulsed and OFDM).

We concentrate in this research project on the development of a Universal UWB transmitter (figure below) on the chip level with the following key features:

- Reconfigurability: Ability to access multi-mode capabilities using dedicated reconfigurable analog and baseband processing radio blocks.
- PowerEfficiency and Form Factor
- Scalability: Using new circuit topologies that exploit the latest digital deep submicron CMOS technology.

The first phase of this project was successfully completed with the design and implementation of a new quadrature digitally controlled ring oscillator (DCO) designed primarily for Impulse-Radio (IR) Ultra-Wide Band (UWB) applications. This DCO consists of a feedback system built with only two amplifier stages. Each stage uses a differential NMOS pair with a local positive feedback thus ensuring a negative resistance load. The frequency control is achieved via the control of the tail current in each stage. The DCO circuit was fabricated in a standard 0.13µm CMOS technology from UMC. It presents state-of-the-art performance under a 1.5V power supply with a frequency tuning range from 2.2GHz to 12.2GHz and a power consumption at maximum frequency, less than 8mW for the DCO core alone. Future work will extend this concept toward a more universal UWB solution, taking into account the additional OFDM-UWB phase noise requirements.

Efficient Policy-Based Web Security

Ayman Kayssi and Ali Chehab

The Secure Sockets Layer protocol (SSL) and the Transport Layer Security protocol (TLS) are seeing an increasing use on the web due to the rapid increase in the utilization of the Internet for critical transactions, lack of security in the basic Internet protocols (IP, TCP, UDP), and the rise in the number and frequency of attacks on network devices and traffic. Users are becoming more aware of security and privacy implications; for example, users expect to see a page secured by SSL when they fill in their credit card information or when they enter a username and password in a web form. HTTPS, which denotes using HTTP on top of SSL, is implemented in almost all web browsers. The main disadvantage of SSL, however, is the fact that SSL is a blind protocol. It encrypts all web data regardless of the different sensitivity levels of different parts of the traffic.

SSL imposes session establishment, key exchange, and encryption operation overhead. This overhead could reach unacceptable levels on limited clients, such as PDAs or mobile phones, and on heavily-loaded web servers. In order to overcome this shortcomings, administrators and webmasters tend to manually apply SSL on selected parts of their web sites. The main disadvantages of this approach are the following. Manual application of SSL does not impose any requirements on the client, any web browser with an SSL implementation will work well with SmallSSL. The main disadvantage than are needed. The SSL overhead will thus further sacrifice the limited resources of the clients, causing the users to suffer with low performance, reduced battery lifetime, and further load on the already heavily-loaded servers.

SmallSSL [1] is a content- and policy-based security solution that applies SSL dynamically on parts of the web traffic without requiring the administrator to manually inspect the content of the web site. Instead, SmallSSL requires the administrator to configure a policy to be applied upon request which secures web traffic leaving the web server. SmallSSL does not impose any requirements on the client, any web browser with an SSL implementation will work well with SmallSSL. Implementation results showed that, compared to bulk SSL, SmallSSL reduced the time overhead by 33% and increased data transfer speed by 17%.

As for enterprise applications, web services are becoming the most common way for enterprise applications to interoperate. Although this application-to-application structure significantly improves the interaction and development of the processes in the business world, it also raises many security concerns. Many methods are used to secure and encrypt the critical data exchanged among web services. The encryption can be performed at the application level. Encryption may also be performed on the transport layer security technologies, such as SSL. Security may also be performed at the message level by using XML security techniques such as XML Encryption and XML Digital Signature as in WS-Security. XPRIDE, an extension to PRIDE [2], is a SOAP security filter for securing the SOAP messages exchanged over the network between web services and their clients. XPRIDE is a policy-driven security architecture that employs content-based encryption to secure the SOAP messages based on their XML content. This system acts as a filter that performs security operations in a transparent manner to the sender and receiver, and hides the processing details thereby avoiding the application level security complexity. The advantage that this solution has over the existing content-based security provided by WS-Security, is that it supports the ability to secure specific pattern occurrences in the SOAP messages exchanged, while WS-Security enables only whole XML element encryption, although in many cases limited parts of the SOAP response need to be encrypted.

Literature

UMTS networks are currently widely deployed around the world in order to offer cellular subscribers, with high data rate, services such as interactive gaming and multimedia streaming. An essential component in launching a UMTS network is performing proper and cost-efficient radio network planning and optimization. Therefore, UMTS should benefit from GSM’s economies of scale and be deployed in a gradual manner while co-existing with GSM thus forming what is called a seamless network. The planning of such a seamless network should be done in a way that is cost efficient and network resource efficient, thereby assuring a better user experience.

A network operator has several options for deploying a UMTS network in a country that has existing GSM networks [1], [2]. Due to coordinated standardization, it is possible for a UMTS network and a GSM network to share basic core network elements, network sites, user terminals, etc. Sharing the core network elements is a major savings in terms of the initial cost, interconnection and building cost, as well as the maintenance cost. Sharing network sites, which is usually known as GSM/UMTS co-siting, also saves the operator major costs such as establishment costs, maintenance costs, site rental and site acquisition costs, etc. The only major parts of the network that cannot be shared due to technology difference are the radio access network elements.

Most professional radio network planning tools support co-siting of base stations which makes this option a viable one that could be planned and implemented. However, it should be noted that due to the added requirements of a UMTS network, simply reusing the GSM sites would probably not be satisfactory in terms of performance; thus requiring the addition of more UMTS sites. It is also worth mentioning that most professional radio network planning tools support live traffic profiles which allow the planner to take handovers between GSM and UMTS networks into account during the planning.

In addition to cost savings, GSM-UMTS co-existence provides the operator with greater flexibility in terms of service. An operator that has GSM/GPRS coverage all over the country can start by only deploying UMTS in main cities or in urban areas, in order to offer advanced data services while keeping voice calls served by the GSM network. The next phase for the operator would be to expand the UMTS network by offering more users and services in new areas. The trend would continue until after a few years, the UMTS network became capable of serving all network users. Knowing that on a seamless network multiple services exist that could be served by both systems, it is important to decide which system will use which service in each particular situation in a way that utilizes the network resources most efficiently while producing the best performance. In other words, one needs to balance the load in each network based on the service requirements and the status of the network.

The strategy that the operator decides to follow in terms of the UMTS network deployment depends on a number of factors such as: the level of competition in the market, the accepted amount of risk, the financial situation of the company and the subscriber, the level of market demand for a variety of advanced data services, the willingness of the users to switch to dual mode terminals, the operator’s willingness to release offers and incentives to encourage subscriptions, etc.

In this research, we mathematically model the problem of GSM/UMTS co-siting as an optimization problem which takes as input an area of interest with existing GSM sites and obtains as output the optimal number and locations of UMTS sites to be deployed (new and co-sited with GSM sites) in order to optimize a given cost function. Possible cost functions include minimization of UMTS deployment cost, maximization of network throughput by load balancing, or reduction of power consumption and electromagnetic radiation. An additional important constraint on the optimization problem is the given traffic demand in the area of interest and the forecasted traffic growth over a given number of years.

Several ongoing research projects are being conducted in this area. The first set of projects target improving the Quality of Service (QoS) of real-time multimedia applications both from the network perspective and the application perspective. These projects include:
- Real-time Adaptive Content-Based Synchronization of Multimedia Streams: In this research we propose a novel approach to synchronization based on the changes in the stream and not only based on time. Tests conducted over the Internet demonstrated the improvements in synchronization obtained using this approach.
- Adaptive VoIP and Real-time Video over IP: In this work we demonstrated that applications which adapt to the network conditions accomplish better performance.
- Starvation Avoidance for Priority Scheduling (SAF-PS): In priority queuing starvation occurs in the routers. A scheme was developed to improve the performance of low priority traffic by avoiding starvation. Tests conducted highlighted the improvements obtained using SAF-PS.

The second area of focus is security, which includes the following projects:
- Keyless Message Authentication by Verifying Position and Velocity for Mobile Ad Hoc Networks: Algorithms were developed to authenticate the position and velocity reported by a mobile node without encryption [1].
- Distributed and Collaborative Intrusion Detection (DaCID): In this project intrusion detection is improved by computers distributively sharing information.

The third area of focus is an emerging area in networking which includes sensor and mobile ad hoc networks. Numerous applications have been drivers for this technology ranging from environmental and military to disaster management and exploitation. Several projects are being conducted in this area including:
- Selective Querying in Sensor Networks: In order to extend the life of the power limited sensor networks, an algorithm was developed, which allows for selecting only a subset of the nodes available while maintaining the accuracy of the outcome [2].
- Data Centric Adaptive In-Network Aggregation: To resolve the issue of delayed data measurements, and their effect on the accuracy of aggregation, an adaptive content-based decision making process was developed. Simulations demonstrated the improvement in the accuracy obtained when compared to other methods [3].
- Sensor Network Assisted Telerobotics: The objective of this research was to design and implement hybrid networks consisting of sensor nodes and remotely operated vehicles or robots, where the network relays information about the environment in order to improve the safety and efficiency of navigation. To accomplish this, work has been done related to data fusion and aggregation, sensor localization and network, robot and human integration [4].

**Literature**

Fuzzy logic and inference, which emerge from the theory of fuzzy sets, have been used successfully in the design of intelligent machines. A methodology for the transfer of knowledge between robots has been established through the use of fuzzy inference systems. Fuzzy inference has also permitted the introduction of a methodology that allows airplanes to avoid being hit by targeted missiles. In addition, a systematic design for an intelligent fuzzy logic controller that adjusts the speed of a car on roads or highways to achieve a smooth and safe car following process has been published.

An important part of current technological developments are centered on the design of machines which are capable of performing tasks that require a high level of intelligence, such as that embedded in human thinking. Fuzzy logic, which emerges from the theory of fuzzy sets, has been used successfully in the design of intelligent machines. The aim of fuzzy logic is to provide a mathematical representation of the approximate nature of human reasoning, which is most often expressed in vague and imprecise linguistic statements. Fuzzy inference constitutes one of the most applied forms of fuzzy sets and logic. Fuzzy inference systems provide a methodology for the linguistic “if-then” representation of human knowledge or the manner by which human experts perform intelligence-requiring tasks.

Fuzzy logic and inference have been used in [1] to establish the concept and provide a methodology for the transfer of knowledge between robots. This makes robots or intelligent machines capable of learning from each other and then completing their knowledge using their own experience when performing intelligence-requiring tasks. This is very similar to human students when they acquire partial knowledge from a teacher and afterwards acquire the remaining knowledge necessary on their own based on self-identified experimental situations. What could be better than a machine with a level of intelligence that permits it to think and learn instead of needing to be totally programmed to perform a specific task?

Fuzzy logic has also been used to present a methodology that allows airplanes to avoid being hit by targeted missiles [2]. If the presented methodology is implemented it could prevent airplanes from colliding with static as well as moving obstacles. The September 11 tragedy could have been avoided had this methodology been implemented prior to the incident. The data-driven learning algorithm for the design of intelligent systems, which was published previously in [3] and applied to robot navigation among moving obstacles [5], has been applied here as well. Therefore the superority from the practical point of view is proven once more of the algorithm over the neuro-fuzzy ones. The theoretical superiority has been verified in other published papers.

Paper [6] provides a systematic and logically justified design for an intelligent fuzzy logic controller that can be used to adjust the speed of a car on roads or highways to achieve a smooth and safe car following process. The car following results in the study have been compared to those presented in papers published by other authors and have been shown superior from the point of view of safety and smoothness, which were considered the main design objectives. Car following is becoming increasingly important to smooth out traffic while guaranteeing safety on highways.

Characterizing Datapath Components for Configurable Soft Processors

Mazen A. R. Saghir

Growing interest in configurable computing and rising ASIC design and manufacturing costs have increased the proportion of field programmable gate arrays (FPGAs) used to implement computational platforms. The platform FPGAs are characterized by high logic densities and rich sets of embedded hardware components that include multiplier, memory blocks, DSP blocks, peripheral controllers, and hard processor cores. Using powerful FPGA CAD tools, FPGA components can be used quickly to implement highly-tuned systems that couple software-programmable processor cores with custom hardware blocks inside the logic fabric of an FPGA.

Today, many of these computational platforms are designed using soft processor cores that are specified in a hardware description language and implemented in the logic fabric of an FPGA. Unlike a hard processor core, the datapath of a soft processor can be easily configured to meet the requirements of a target application. Its instruction set architecture can also be extended to support user-defined instructions, which often result in significant improvements in the execution performance.

To overcome the inherent performance and area inefficiencies of implementing soft processors in FPGAs, the microarchitecture of these processors need to be optimized to make use of available on-chip resources. For example, most soft processors use embedded memory blocks to implement register files while others use embedded hardware multipliers to implement shift operations in arithmetic and logic units [1], such as microarchitectural optimizations often result in significant improvements in both performance and datapath area. However, designing datapath components using such hardware blocks are often the result of experimentation and designer insight because very little is known about the characteristics of these designs. Moreover, it is very difficult to perform a quantitative comparison of design alternatives because this requires the designs to be synthesized, implemented, and characterized using appropriate CAD tools. As the complexity of soft processor cores increases from simple RISC datapaths to more complex architectures, it is becoming increasingly important to develop accurate, parameterizable models of datapath elements implemented using the embedded hardware components. Such models will make it easier and faster to assess design trade-offs and compare design alternatives with regard to latency, FPGA resource utilization, and power consumption. Given the inherent routing overhead of FPGA architectures, such models can also provide insight into more efficient configurable platform architectures for implementing processor datapaths.

Since implementing processor datapaths in FPGAs is still a new research area, there is little work on modeling soft processor datapaths and components. In [1] the author describe SPREE, the Soft Processor Rapid Exploration Environment, which use to generate RTL code for various implementations of soft processor architectures. Although the results of this study provide accurate characterizations of performance, area, and power as well as several insights into the trade-offs involved in designing soft processors that issue and execute single instructions, SPREE still requires the time-consuming task of synthesizing and implementing the resulting RTL code using appropriate CAD tools. This makes it very difficult to explore a large architectural space particularly for datapaths with high architectural complexity. In [2], the authors provide a quantitative evaluation of the performance and area characteristics of a configurable, multi-ported register file for soft VLIW processors. The register file is configured according to design parameters that include data width, number of registers, and number of read/write ports, and is implemented using embedded memory blocks (BRAMs) found in high-density FPGAs. Although the results also provide an accurate characterization of configurable register file architectures, obtaining these results again requires the time-consuming task of using CAD tools to synthesize, implement, and characterize the register file components. The availability of accurate, parameterizable models of soft processor datapath components is therefore necessary to support the rapid exploration of architectural design alternatives, and can be used to augment more time-consuming analysis techniques.

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Literature


Infrastructure-Controlled Peer-to-Peer Network: A Prototype Implementation
Marwan Ramadan, Layla El Zein, and Marwan Al Elaiwi

Standing at the doorstep of 4G, one of the major challenges is to fulfill the foreseeable increase in power demand of future terminals. As technology evolves, services are getting more and more sophisticated and end users still expect their handheld batteries to last longer. A new and very promising approach to reduce power consumption is enabling cooperation among end users. In this project, we implement a test bed to evaluate the performance of a cooperative video streaming system.

A user requesting a real-time video from a server over a long-range wireless link will collaborate over a peer-to-peer short-range network with neighboring users in order to reduce power consumption and increase system throughput.

The deployment of 3G facilitated the integration of multiple high data rate services over the same network. Among these services, free video streaming is seen as one of the killer applications. With this evolution, pervasive computing is enabling cooperation among end users and, thus, these predictions remain to be verified.

In our project, we implement a test bed prototype for an infrastructure controlled peer-to-peer (P2P) network based on the design proposed in [1]. A cooperative P2P environment is setup for this purpose; a server streams real-time video in a distributed fashion among the peers which will exchange the received packets over a small-range high bit rate network. In a traditional system, the server streams the complete video version to each client requesting it. This is expensive in terms of reception power at the communication interface; not to mention the transmitted redundant traffic.

We established a P2P network between the users over a short-range wireless link that has different power efficiency than the long-range wireless link over which the users communicate with the server. For this, we have chosen Bluetooth for the short-range links and WLAN for the long-range links. The users will receive from the server only a subset of the data stream, as depicted in Figure 1. If N users are cooperating, then, each will be receiving one of N subsets from the server. This reduces the power consumed at the wireless-long range interface by N. To fill the gaps, each user will receive the other data subsets from its peers in the P2P network, while it forwards to each the data subsets it receives from the server. Being exchanged over a powerful efficient wireless link, the (N-1) subsets require less power at the communication interface than if they had been received directly from the server over the wireless-long range link.

We developed our own distributed algorithm at the server and at the clients. LSE2 was used to program the server to packetize the video MJPEG frames according to predefined criteria, and then to distribute them in a round robin fashion using UDP. Each client (user) algorithm is implemented in CP.Net and performs all critical functions in the system. The users first communicate over Bluetooth to discover each other, and recognize those neighbors that are willing to cooperate. When the streaming starts, each received packet is depacketized and buffered in the correct order into the video player. The player displays the frames in real-time according to quality of service considerations.

Extensive measurements were conducted and analyzed in a theoretical study that was used to calculate the aggregate power consumed in the system. The theoretical model was used to test the performance with a 64 Kbps CBR long-range link instead of a WLAN long-range link. Results show that a gain of 50% in terms of power consumption can be reached with only four collaborating peers. In addition to this notable power reduction, the infrastructure-controlled P2P network reduces the traffic in the network by a factor of N. This increases total throughput, minimizes service costs, and improves the overall QoS inside the network.

Microarchitectural Enhancements for Configurable Soft Processors

Roger Mousalli and Nabil Ghamas

Multithreading (MT) is an established technique for improving the throughput of microprocessors. We show that multithreading is particularly beneficial in configurable soft processors implemented in field Programmable Gate Arrays (FPGAs). We also introduce several microarchitectural enhancements to support multithreading. Our proposed approach results in a performance boost ranging from 1.10x to 5.13x.

FPGAs are emerging as new computational platforms for a large set of applications. They are easily reprogrammable, which makes them a cost efficient platform for custom computation. Although many platform FPGAs provide one or more hard processor cores, an increasing number of computational engines are designed using soft processor cores that are specified in a hardware description language (HDL) and implemented in the logic fabric of the FPGA. Unlike a hard processor, the datapath of a soft processor can be easily configured to meet the specific functional requirements or design constraints of a target application. Its instruction set architecture can also be extended to support user-defined machine instructions or custom instructions (CIs), which often yield significant improvements in execution performance. To overcome the performance and area inefficiencies of implementing soft processors in FPGAs, the microarchitectures of these processors are typically optimized to make use of available on-chip resources, which occupy less area and have lower latencies than logic implemented in the fabric of the FPGA.

In our project we implemented a multithreaded version of the Xilinx MicroBlaze, a widely-used, single-threaded, soft processor core. Recent research had demonstrated that a single n-way multithreaded soft processor occupies a smaller area than an n-way multiprocessor core while achieving lower levels of performance. Although somewhat intuitive, this was a good starting point for our work because soft processors need to be kept simple and small to achieve high levels of performance.

Our main contribution was the introduction of a novel multi-threading scheduling scheme that we call Hybrid Multithreading (HMT) that combines the benefits of both interleaved and block multithreading schedulers. HMT relies on a centralized thread scheduler that implements a dynamic form of fine-grained multithreading that changes only when busy threads are detected. Detection of busy threads is achieved using a Table of Operational Latencies (TOOL), a new hardware structure we propose that stores the latencies of all regular and custom instructions of the MicroBlaze instruction set architecture. Using TOOL, the HMT scheduler stores the latencies of issued instructions associated with each thread, and monitors the status (available or busy) of each thread.

Because we do not exploit instruction level parallelism (ILP) to maintain simplicity in our soft processor, we rely on thread-level parallelism (TLP) to hide latencies due to stalled instructions. In other words, we preserve architectural simplicity while exploiting a form of parallelism.

Best ECE Paper award at the 6th FEA Student Conference

Because our soft processor supports user-defined, custom instructions, TOOL can be configured at design time to include these CI latencies. Unlike previous work, our processor architecture imposes no restriction on these latencies. This was achieved by using a multi-ported register file that allows all threads to write back results simultaneously. Further support for Custom Computational Units (CCUs) is realized by embedding these CCUs within the datapath. Unlike the original MicroBlaze architecture, no dedicated communication channels are needed and no communication overhead is incurred.

Finally, we conducted a series of experiments to assess the benefits of our proposed architectures and to compare HMT with MT. Our experiments examined the effects of the scheduling scheme, the number of threads and the number of stall cycles. Our results show that, in general, the HMT scheduler achieves better performance than MT, and that multithreading becomes more effective with increased CPI. These enable our multithreaded processor to run 1.10 to 5.13 times faster than a single-threaded processor when executing a suite of synthetic benchmarks.

Literature


Best CCE Paper award at the 6th FEA Student Conference
Rethinking Technology and Research at AUB

Modeling the brain

Technology is not only changing how research is done, it is also expanding the possibilities in every field. Research to discover what motivates people to shop on-line or to model the human brain is relatively new both at AUB and at research centers worldwide. For scientists who have been working in laboratories for many years, however, the availability of technology may not have changed their research topics but it has certainly revolutionized the research experience and has led to some surprising results that directly impact the lives of those who live and work in the region.

It is hard to imagine anything more "high-tech" than modeling the human brain. It turns out, however, that this is something that scientists and researchers have been doing for some time. Fadi Karameh, an assistant professor in the Department of Electrical and Computer Engineering, is working with a modified EEG (electroencephalogram) machine that has been especially designed for research to increase his understanding of how the brain works. (EEGs, which measure electrical activity in the brain, have been routinely used in hospitals for many years for a wide range of purposes including detecting tumors.) Karameh explains that his approach is slightly different from that of many researchers who work in this field, in part because of his training as an engineer. “My work is integrative. I want to pull it all together, to look at the big picture, and identify common organizing principles.” By looking at different brain areas and finding similar neuronal “microcircuits,” he hopes to learn how information is shared in the brain and how higher cognitive centers in the brain, such as attention and planning, recruit lower cognitive areas, such as motor execution. Karameh explains that this is a “vast field” and that “experimentation occurs at several scales and spans the molecular level, cellular level, networks of neurons, all the way to the EEG scale, which is a signature activity recorded from the scalp.” His challenge is to find what he calls “simplified engineering models” of how components in this system work.

Both faculty and students have taken advantage of the EEG to expand their research. In 2005-06, Salam Akoum, Mariam Itani, and Rayan Jaber (who were all fourth-year students in electrical and computer engineering last year and have since graduated) designed a final-year project to explore “new techniques in brain-computer interface.” They were curious to see if the machine could detect when someone thought, for example, about moving a limb. When it came time to test their hypothesis, Jaber volunteered to be the “guinea pig.” (It turns out that he was a particularly good candidate because the machine works better on people with less hair.) With the cap firmly on his head and the electrodes hooked up to the EEG, Jaber places his hands on his knees. When his professor (Karameh) tells him to think of moving his right arm, the visual monitor registers this “movement”—except of course that there has been no movement, at least none that was visible to those of us in the room. Although Jaber did not move (his hands never left his knees), Karameh explains that it is possible to find an electrical signature from a bunch of electrodes hooked on to the cap over brain centers responsible for movement planning and execution. This type of research has biomedical applications and could, for example, make a huge difference in the lives of people who are fitted with artificial limbs. “Imagine if you could move your artificial arm or leg the way you wanted to just by thinking about it?” Karameh asks.

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**Publications**

**Journal Papers**


**Conference Papers**


A companion website offers great facilities for instructors and students, including lectures and a solution manual (www.oup.com/us/smali).
Research and Travel Grants

October 2006-September 2007

I. Abu Faycal
- An information theoretic approach to coding in cortical neuronal systems, Funding Source: University Research Board (URB), AUB, Duration: 2006-2007, amount $ 10,500 (with Prof Fadi Karameh)

M. A. Al-Alaoui
- Differentiator-Based Filters and Mixed Differentiator/Integrator Based Filters, Funding Source: University Research Board (URB), AUB, Period: 2006-2007 Amount: $5,200

L. Bazzi
- Paid research leave during Fall 06-07 semester under the auspices of the William and Flora Hewlett Foundation grant.

R. Chaaban
- Energy Audit in AUB, ERC project requested and funded by AUB President, since March 2006. (Amount $70,000)
- Integrated water, energy, and environment knowledge system using GIS technology, URB Grant, Beirut, September 2005 – September 2006. ($6000)

R. Chedid

A. Chehab
- Kadifa Research Fund: An Enterprise Policy-Based Security Architecture for Protecting Relational Database Network Objects ($8,000) (with Prof. Ayman Kayssi)
- Tempus, Structural and Complementary Measures: Quality Assurance for Higher Education in Lebanon, (150,000 Euro)

Z. Dawy
- LINCSR Grant (750,000 LL), "FP7-based Accelerator for Haplotype Inference with Application to Lebanese Genomic Data Sets," December 2006 – September 2007, joint proposal with Dr. M. Saghf (FEA) and Dr. R. Mahfouz (FM).
- Hewlett Foundation Junior Faculty Research Leave for Spring Semester 2007

A. El Hajj
- "Conception d'une plateforme informatique générique d'évaluation et de réhabilitation à distance des personnes handicapées" (A Generic Platform System for Remote Assistance and Evaluation of Handicapped), CIDERE Project, 20,000 €, January 2007-December 2008 (with Professor Imad Mougathar)
- IBM Faculty Award, Development of a Service Science Management and Engineering (SSME) track in the ECE graduate program, 15,000 USD, 2007. (with Professors Ayman Kayssi, and Fouad Mrad)

I. Elhajj

E. Kayssi

K. Kebelen
- Using Uniform Circular Arrays with Modified-Chebyshev and Bessel Patterns for Intercell Interference Reduction, Funding Source: University Research Board (URB), AUB, Period: 2006-2007, amount 5,500

M. Mansour
- Design and Implementation of a Low-Power Voltage Controlled Oscillator for UWB Radio Systems, joint work with another faculty member, Funding Agency: Rathman Foundation, Period: 2007, Amount: $10,000
- Project Title: High-Performance Decoder Architectures for Repeat-Accumulate Codes Principal Investigator: Mohammad M. Mansour, Funding Agency: Lebanese National Council for Scientific Research (LNCSR), Period: 9/1/06 – 9/1/07, Amount: 6,250,000 LL, — $4167
- Project Title: Hardware-Based Simulation Platforms for Sparse Parity-Check Matrix Codes, Principal Investigator: Mohammad M. Mansour, Funding Source: University Research Board (URB), AUB, Period: 2006-07, Amount: $5800
- Long-term faculty development grant, Hewlett Foundation Fellowship Award, Fall 2006-07, Grant: $3600

F. Mard
- Project title: Control Engineering for Economic Planning, Amount: 8,000,000.00 LL, Funding Agency: Lebanese National Council for Scientific Research (LNCSR), Period: 12/1/06 – 1/12/07.

F. Karameh
- An information theoretic approach to coding in cortical neuronal systems, Funding Source: University Research Board (URB), AUB, Period: 2006-2007, amount $ 10,500 (with Prof Abu Faycal)
- Long-term faculty development grant: Hewlett Foundation Grant Sep06- Jac07
Halfway through... the ICT Program

Marilise Makhoul (ECE graduate student, ICT program)

Spending almost all your time in the same room with the same group of individuals sounds very boring. But when this room is the Raymond Chiossion Building’s Multimedia Lab, and it’s filled with ICT graduates, it’s so much fun. Now I think that perhaps it was not the projects that made us—the ten ICT graduate students—spend all our time in the computer lab, but the fact that we enjoyed it.

In fact, ICT is a mixture of software courses, telecom courses, business courses, thesis, and an internship. This special graduate program also includes interesting seminars, modern lab courses, and special topic courses. That is why each semester is so varied and always exciting.

All through my academic life, I have been a lucky person (as the Proverb says). Wherever I will be a few years from now, I know I will remember AUB and be grateful. Thank you ICT committee and welcome new ICT students!

Manar Khattar (ECE graduate student, ICT program)

I remember the first time I stepped into this Faculty. I am sure enthusiasm and delight shone in my eyes! I was attracted by the idea that we are the first generation of the ICT program, established by the department as part of the CITPER program to develop a model for graduate ICT curricula in the Middle East, but I knew there was a big and challenging experience waiting for me; joining a new program and getting directly onto the track wasn’t easy!

The most interesting part about ICT is the unique curriculum that aims to close the gap between industry and academia through a mandatory industrial internship and special courses in engineering and business management. Thus an ICT student graduates with a strong engineering background along with practical industrial experience and fundamental business knowledge.

When I enrolled in the program, I didn’t expect that the journey of study, overnights, projects, stress and hard work would be that difficult. But in the end all these efforts were rewarded, after one year I have noticed a big improvement in my personality and my academic proficiency. Great opportunities began to show up! I saw that companies really are interested in graduate students, contrary to what I used to hear, and the special thing about ICT students is that they are well prepared to get into real-life work due to their thorough background of theoretical knowledge and practical competence.

By the time this article is published I will be in Sweden pursuing my training at Sting Networks, where I am going to have an opportunity to acquire professional skills and experience by working with people from different backgrounds and nationalities to experience how things work outside Lebanon and in real markets. At the same time I may have the chance to work on my thesis with the company.

All these opportunities in my life are thanks to ICT and the efforts made by the department to change the concept of graduate studies. From now on, a master’s degree is not only about research and papers; it’s also about applying research in real industrial situations.

To put it in a few words, ICT has been a breakthrough in my life! AUB is a short journey but a lifetime experience that I will never forget! I will always remember AUB and the beautiful moments I spent with my friends; our gatherings that were a mixture of fun, serious work and full of enthusiasm. I am thankful to my professors who made the biggest contribution to my success even when I felt they were too firm. I know now it was for my benefit.

Finally, I have a small message for the new incoming students: ICT is a place where there’s a will there’s a way!
The CITPER Project

Developing the Middle East’s Future Technical Elite

Bring the American University of Beirut, international businesses, and European Union partner institutions together, and they will introduce you to tomorrow’s technical elite. The Collaborative Information Technology Program for Education and Research (CITPER) is a joint European project funded by the European Commission’s TEMPUS program. The project is a collaborative effort between AUB’s Department of Electrical and Computer Engineering (ECE), Technische Universität München (Germany), the University of Southampton (United Kingdom), and Siemens AG (Germany). The project has already achieved one of its objectives—the establishment of a two-year Information and Communications Technology (ICT) graduate program at AUB, which began in fall 2006. Ayman Kayssi, member of CITPER and chair of the Electrical and Computer Engineering (ECE) Department, spoke at length to MainGate about the program and its prospects in the Middle East. Kayssi noted that since ICT (information and communication technology) is the region is still in its early stages, there is “a lot of potential [for it here]. If you look at the studies that are being conducted concerning what kinds of jobs or job sectors are growing the most around the world, you will see that ICT-related jobs are among the top jobs listed.” These jobs include data management, hardware/firmware engineering, network development, and project management. AUB’s ICT graduates will be well positioned to compete globally in this market.

Surveys distributed by CITPER to regional companies demonstrated that there is a lot of interest in ICT in the Middle East. The program was designed specifically to meet the needs of these regional companies. Member of CITPER and professor of electrical and computer engineering Hasan Artail explained that the survey revealed “that most companies have needs in software systems, management skills, and industrial liaisons.” The program is being designed not only to benefit the companies in the region: students will be rigorously prepared for the global market as well. According to Kayssi, graduates will be particularly valuable to future employers because of the international experience that CITPER’s links with universities and companies outside of Lebanon will give them. The initial, and so far strongest link, was established when Professor Zaher Dawy, who is now at AUB’s ECE Department, worked with Professor Joachim Hagenauer when he was a PhD student at Technische Universität München (TUM), 2000-04. Dawy now plays a pivotal role in the project at AUB, which is led by Professor Hagenauer. Project members have also started discussing exchange opportunities and project activities with a number of other European universities, including KTH (Kungliga Tekniska högskolan) in Sweden, UPC (Universitat Politècnica de Catalunya) in Spain, and TU Munich (Technische Universität) Delft in the Netherlands.

Student exchanges have already taken place: two AUB ECE master’s students, Ali Chandour and Joseph Constantine, spent the spring 2006 semester at TUM, while Johanna Weindl from TUM spent a semester at AUB. Constantine is currently at the High Frequency Institute in Germany conducting research on antenna modeling in Multiple-Input Multiple-Output (MIMO) channels and taking courses from professors who are renowned in the ICT field such as Professor Max Costa and Professor Peter Rasser. Constantine commented that it “is quite a rewarding experience scientifically and research-wise, and it also opens the horizons for future plans.” He noted that CITPER is the first program of its type in the Arab world and that it “will attract excellent students from many Arab countries to Lebanon instead of Europe.”

CITPER is also building strong ties with industry to promote applied research and to increase opportunities for students and faculty members to work with colleagues in industry. Faculty members affiliated with the program have already started discussions with companies such as Siemens, Ericsson, Nokia, IBM, and Microsoft. Such ties could lead to both internships and employment opportunities for AUB students in the future.

The program is rigorous: students have to take a demanding and diverse series of courses that range from Corporate Information Technology to Wireless Communications. The curriculum includes a business requirement that was prompted by Siemens’s involvement in the program. Siemens’s products are geared towards meeting the needs of industrial and infrastructure companies that use ICT, so the company has a good deal of ICT know-how. According to Kayssi, Siemens plays an important role in CITPER because it is “bringing its expertise and an industrial viewpoint… It identified the business requirement as an important aspect of the program.” Since the three other partners in the program are universities, it is up to Siemens to provide input from the world of industry.

“We want students to be exposed to an industrial environment so they have to complete an internship as well,” Kayssi said. “The students will definitely be in demand,” he added, referring to the industrial experience and exposure to Europe they will have earned by the time they graduate. Kayssi recounted the early days of the internet in Lebanon, when most of
The companies that started internet-related businesses were staffed by CCE (Computer and Communications Engineering) graduates. “We expect similar things to happen for [ICT] graduate students,” he said.

Another one of CITPER’s objectives is to help start a doctoral program at AUB. The PhD program is being developed in parallel with the master’s program, and is set to launch in 2007. According to Artaïl, the implementation of a PhD program will help “attract good students and funding to the program, because right now ICT is very popular. It’s a trend that’s really taken off.”

Whether or not this curriculum can be as easily implemented at other universities in the Middle East, however, remains uncertain. While one of the objectives of CITPER is to provide a curriculum that would serve as a model for universities in Lebanon and the region, Kayssi noted, “In Lebanon, this would not be easy because it really requires human resources and links with other universities. However, he added, other universities in Jordan, Egypt, and possibly Syria may eventually be able to adopt the model curriculum, although “it may take a year or two for them to study it, and they may need to adapt it to their environment and needs.”

In terms of publicizing the program, Artaïl commented that they are in the process of advertising the fact that the program itself was designed for the region: “We will show all the data and the analysis we have done, since we have looked at university programs, the needs of the industry, and we visited many trade fairs.” Artaïl even suggested the possibility of creating a local or regional ICT consortium to “keep up with technologies and to enable us to collaborate with each other…. This could hopefully stimulate student and faculty mobility between AUB and EU institutions.”

The ECE Department in collaboration with partners from the European Union (EU), has received a generous grant of 494,000 Euros from the European Commission within the TEMPUS framework, to establish a graduate program in information and communications technology (ICT). TEMPUS is one of a number of European Community programs designed to help the process of social and economic reform and it focuses on the development of higher education systems in partner countries. Its main objectives are the enhancement of mutual understanding, cooperation and higher education modernization. The EU partners are: Munich University of Technology (TUM), represented by Prof. Joachim Hagenauer (grant holder) and Prof. Eckhard Steinerbach; University of Southampton represented by Prof. Lica Dragulescu; Siemens AG, represented by Dr. Frank-Steven Becker and Prof. Ernst Feicht. The members of the ECE Department who co-wrote the project proposal and are implementing the project with the assistance of the EU partners are Prof. M. A. Al-Kaisi, H. Artaïl, A. Chehab, Z. Dayy, A. El-Hajj, K. Kabalan, A. Kayssi, and M. Saghir.

The CITPER Project, the project was launched in September 2004 during a workshop that was attended by all partners in Munich. The main objectives of CITPER are to start a new graduate program in ICT at the ECE Department that is customized to the ICT industry needs in the Middle East; to develop a model for graduate ICT curricula in the Middle East; to stimulate student and faculty mobility between AUB and EU universities; to forge strong ties with industry to promote applied research; and to support the starting of the PhD program at the ECE Department.

**Selected Projects**

**Tempus Structural and Complementary Measures (SCM)**

**Ali Chehab**

Project Title

Quality Assurance for Higher Education in Lebanon

**Partners**

- University of Sunderland (UK)
- Groupe ESA (France)
- Mectic (Lebanon)
- American University of Beirut (Lebanon)
- Hariri Canadian Academy (Lebanon)
- Beirut Arab University (Lebanon)
- Lebanese General Directorate of Higher Education

**Project Objectives**

Long-term objective: To make the Lebanese Higher education institutions aware of the European Quality assurance processes.

**Specific objectives**

- To encourage the Lebanese institutions of higher education to embrace a quality assurance philosophy.
- To disseminate good practices in quality assurance, identity areas for change, and assist in setting targets for improvement.
- To understand the importance of quality assurance as a self-improving tool.
- To develop four quality assurance centers in Lebanon.
- To develop three training courses in quality assurance.
- To develop Lebanese trainers to train on quality management.
- To help the Ministry in Lebanon draft a national document on quality assurance.


**Strategic objectives addressed**

R. Chedid: Principle Investigator
S. Karaki: Co-investigator

The overall strategic goal of this project is to co-ordinate R&D joint efforts to produce sustainable essential life-resources at minimum environment loads in Mediterranean Partner Countries (MPC) by introducing high technology and automation. The global objective is to develop a new model-based optimal system design approach to economically improve the overall performance, dependability, reliability and availability of co-generating water-electricity plants powered by renewable energy for remote arid areas using a high level of automation to meet specific cost requirements and to disseminate the new technology in MPC and MENA.

This project offers a solution to cost optimal co-production of energy and water using renewable energy besides diesel generators. Cost optimization is achieved through a high level of automation, which is necessary to adapt the working conditions to the strongly varying renewable energy supply, and remote maintenance. The approach is based on thorough modeling of the processes and offers a large degree of flexibility in the design to meet different production requirements.

The project will be led by the University of Mannheim, Germany, and will be executed by teams from six universities and research centers: NTUA (Greece), UVA (Spain), C.R.T.En (Tunisia), AUB (Lebanon), and NERC (Jordan).

The project overall cost is around 7,721,000 Euro fully financed by the EC. AUB through the Department of Electrical and Computer Engineering will be responsible for one work package out of eight. The grant given to AUB to accomplish its tasks is 160,885 Euro.
An Exchange Semester

From TUM to AUB

Sebastian Bück and Tobias Knappe

We arrived in Lebanon on February 1st, and because the semester was postponed for a week, we had extra time to explore Beirut and its nightlife. All the people we met and talked to asked the same question: “What the hell are you doing here in Lebanon?” The fact that we were spending an exchange semester in the Electrical and Computer Engineering Department at AUB surprised them a lot, not only because of the current political situation in Lebanon, but also because Germany is more famous for its technical universities than Lebanon.

We already knew Lebanon and AUB because we had taken part in the CITPER international seminar in 2006. But still we were surprised by how different studying at AUB is compared to studying at our home university, TUM (Munich University of Technology). The courses at the AUB with all their assignments and projects required a lot of work, much more than a course at TUM does. We were lucky, that we had registered for only two courses, so we had some time left for getting to know some people and the country.

Besides taking technical courses, we also registered for a Colloquial Lebanese Arabic class at AUB. We had a lot of fun learning all the terms and phrases which were useful in daily life. After a short time we became professional at bargaining with cab drivers and were able to give them directions when they were lost. It also simplified chatting with policemen and cab drivers and were able to give them directions when they were lost. It also simplified chatting with policemen and cab drivers and were able to give them directions when they were lost. It also simplified chatting with policemen and cab drivers and were able to give them directions when they were lost.

At AUB we experienced a campus life which is hardly comparable with studying at TUM. Sitting under a tree, chatting, and enjoying the beautiful view on the Mediterranean Sea really makes the AUB campus unique. Of course we also tried out AUB’s private beach. It’s a good feature to be able to jump into the sea between lectures. But as TUM students we really missed a cool beer from the university-owned brewery served on campus. The green oval with its surrounding palm trees would make such a nice beer garden!

Since we didn’t expect AUB to change their beach regulations for us, we had to look for another place to swim. After the end of the semester we spent a lot of time at Lebanon’s various beach clubs.

Tobias also went skiing in Faraya on the weekends. He left Beirut in the morning when it was still chilly outside, joining one of the many organized AUB student trips to Faraya. Living near the gorgeous Alps in Europe, he expected nothing but another skiing trip but he was soon amazed by the fusion of alpine and Mediterranean environment. He will always remember this experience because it was his first time skiing with a beautiful view of the sea.

As we had already visited nearly all of Lebanon’s sights, we decided to travel to Jordan during spring break. We did a lot of sightseeing there as well, but the best experience was to be invited by a member of parliament to have dinner with him. We spent the entire evening with him and his friends.

In our opinion an extraordinary exchange semester needed an extraordinary journey home. So we decided to travel overland instead of just flying home directly. On our way we visited Damascus and then took the train from Aleppo to Istanbul. We spent a whole week on the road with many stops in order to get used to Europe again step by step.

Among all the good memories we have of our exchange semester in Lebanon, the best ones are of great Lebanese hospitality and the delicious food.

RS. und der Trend ist ganz klar erkennbar!

From AUB to TUM

Joseph Costantine

After finishing my BE at the second branch of the Faculty of Engineering at Lebanese University, I looked forward to continuing into research work. I chose AUB over ENST in Paris to continue my master’s degree for personal reasons. My experience at AUB was fulfilling and completely intriguing, it was where I started research work on electromagnetic and antenna design domain with Prof. Karim Kabalan. At AUB I found myself encouraged to discover new limits of knowledge, to search for new and revolutionary concepts, to believe in my work, and to fight for it.

My peak experience at AUB was when I went as an exchange student to Munich University of Technology (TUM). Arriving to Munich resembled arriving on a new planet where life is very different. The transportation system is very sophisticated and accurate; people are very helpful and professional. As surprising as it sounds, language was not a problem even though I took an introductory German course in Beirut a lot of work needed to be done on my German language skill, but all Germans understand English and the majority speak it. The most important aspect of the culture is that Germans try to help as much as they can. That quality helped me a lot and helps all foreigners I know living there.

At TUM I took two courses and worked on a research project with the High Frequency Institute. The research project I worked on involved antenna configuration in MIMO channels. Interesting results were obtained which paved the way for further research in this domain.

My master’s thesis was titled: New Multi Wide Band Design for a Microstrip Patch Antenna; it was composed of a theoretical part and a practical part which required the antenna to be fabricated and tested. Because the antenna designed was sophisticated and could not be fabricated in Lebanon due to the lack of technology, the High Frequency Institute, upon our request, provided facilities for the fabrication and testing of the antenna. The fabrication and testing process took a month, during which trials were repeated and precisely examined in order to assure the results obtained were accurate. Finally the performance results of the fabricated and simulated antenna were almost identical. Because of the exchange program, we were able to fabricate our multi function antenna and I was more experienced and knowledgeable in this domain after working with professionals at the High Frequency Institute in TUM.

My five months spent in Munich were not only of scientific value but also a cultural experience that introduced me to Europe. I was offered the service package luxury with my dormitory by “Studentenwerk” where in addition to the room, I was invited to special introductory events, like tourism in certain German and Austrian cities, a weekend in the Alps where we went hiking, traditional breakfasts and barbecues. During this time I also visited Rome, Paris and Berlin on my own. I met a lot of international students and benefited from this cultural mix and made a lot of friends, in addition to those in the Lebanese community of AUB graduates who are quite active. This European experience was enriching; it opened my eyes to people with different cultures who carry a great history of technological advancement. In addition it gave me the maturing experience of living on my own in a foreign country.

Finally, I would like to thank the Tempus committee at AUB that chose me to go as an exchange student and enjoy these five unforgettable months that not only had a scientific and cultural benefit. I am currently being considered as a serious Ph.D. candidate at the High Frequency Institute. Without any doubt the exchange program extends horizons and gives AUB graduate students great opportunities to improve their research skills and receive excellent academic experiences especially at well funded research institutes like TUM.
V. Activities
Abou Faycal Ibrahim
Student advising (40 students); ECE Undergraduate Committee.

Al-Alaoui M. Adnan
Chair: IEEE Lebanon Section; Senate; Senate Governance Ad-Hoc Committee; Member of the ECE TEMPUS CITPER Committee.

Ali Ahmed Walid
Technical Program Committee Member (IEEE RFIC conference); Principal Consultant for MediaTek; supervising and leading the development of a HSUPA multi-band transmitter RFIC for 3G cellular applications.

Artail A. Hassan
Student advising (38 students); Graduate Studies Committee; Applicant Selection Committee; Strategic Planning Committee; Web Oversight Committee; Member of the ECE TEMPUS CITPER Committee.

Bazzi L. Louay
Student advising (38 students)

Chehab A. Ali
Student advising (35 students); Member, ad-hoc committee on ECE Undergraduate and ABET Committee; IEEE Power and Circuits Society, Lebanon section; Member of the ECE TEMPUS CITPER Committee.

Dawy Zaher
Student advising (28 students); Member of the ECE TEMPUS CITPER Committee; Member of the Ad-Hoc ECE Publicity Committee; Editor of the ECE Department Annual Report; Member of the FE A Student Affairs Committee; Member of the 6th FE A Student Conference Organization Committee; Member of the AUB President’s Taskforce on Tenure; Vice Chair, IEEE Lebanon Communication Society Chapter; Counselor of IEEE Student Branch at AUB; Member of the Organizing Committee for the International Graduate Workshop on Information Technology (between AUB, TLM, and University of Southampton); Member of the Organizing Committee for IEEE Lebanon Communications Workshop (IEEE LCW-2007); Leading Guest Editor, Special Issue on Multiprotocol based Cellular Networks, EURASIP Journal on Advances in Signal Processing; Technical Program Committee (TPC) Member: IEEE Globecom 2007 – Ad-Hoc and Sensor Networking Symposium, IEEE ICC 2007 – Wireless Communications Symposium, IEEE WCNC 2007 – Phy/MAC Track.

El Hajji A.
Student advising (30 students); Academic Development Committee; Fraud Complaint Committee (secretary); Member of the ECE TEMPUS CITPER Committee.

Elhajj I.
Secretariat for the ECE departmental meetings; Registration chair and program committee member at the 2006 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2006), Beijing, China; Program Committee member IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Switzerland, 2007; Program Committee member for the International Workshop on Networking Robotics organized in conjunction with the International Conference on Communications and Computer Networking ICCCN, Hawaii, 2007; Consultant for Info-Tech.

Kabalan K.
Student advising (28 students); Member, ECE Graduate Committee; Chairman, ECE 440 Course Committee; Member, ECE 380 Course Committee; Member, Graduate Studies Committee; Member, 6th FE A Students Conference; Member, University Graduate Studies Committee; Member, OSB Advisory promotion Committee; Member of the Organizing Committee, The 5th FE A Student Conference, May 27-28, 2007, Beirut, Lebanon; Organizer of the special session on Parallel and Distributed Simulation, 2007 International Conference on High Performance Computing and Simulation (HPCS’07) and in conjunction with the 21st European Conference on Modeling and Simulation (ECMS 2007), June 4-6, 2007, Prague, Czech Republic; Member of the ECE TEMPUS CITPER Committee.

Karaki S.
Student advising (33 Students); University Research Board, 2001 – 2006; Consultant for Energy Efficiency Planning at AUB; Principal Investigator, AUB, $189,000.

Karameh F.
Student advising (36 students); Biomedical Engineering Seminar; Teaching effectiveness Committee; Consultant Cambridge Energy Solutions, Cambridge MA USA.

Kaysiss A.
Chairman of the Department of Electrical and Computer Engineering; Chairman, ECE Graduate Committee; Chairman, ECE Undergraduate affairs and ABET Committee; Member, FE A Administrative Committee; Member, FE A Space Committee; Member, FE A Academic and Curriculum Committee; Member, University Admissions Committee; Member, University Strategic Planning Steering Committee; Member of the ECE TEMPUS CITPER Committee; Consultant to REP.

Mansour R.
Member of the ECE Graduate Committee; Chairman of the FE A SAC committee; Member of the Students’ Integrity Committee (part of IVPP); Member of the IEEE Signal Processing Technical Committee on ECE Undergraduate and ABET Committee; Member of the ECE TEMPUS CITPER Committee; IEEE Signal Processing Workshop, Oct. 2007, Shanghai, China.
ECE BUDGETS

Major Budget: $84,000
ASHA Budget: $105,000

MEETINGS

ECE Meetings

August 31, 2006: Announcements; Part-time roster in ECE; Syllabi of ECE 210 - Electric Circuits, and ECE 290 - Analog Signal Processing; ECE 200 - Introduction to Electrical and Computer Engineering; Definition of "major courses" in new curricula.

September 28, 2006: Election of new secretary; Announcements (agenda of meetings, start-of-semester forms, committee membership, GA's and student employment, equipment for laboratories, Final-Year Project).

October 19, 2006: Announcements; Advising workshop.

November 30, 2006: Distinguished alumni nominations; New courses ECE 290 (Analog Signal Processing), ECE 535 (Advanced Software Engineering), ECE 640 (Wireless Communications Lab), ECE 6311 (Same as ECE 4311); One-credit courses to teach programming languages; Regulation about attendance in graduate seminar.

December 21, 2006: Announcements; Ad-hoc recruiting committee; Syllabus of ECE 290; One-credit courses to teach programming languages.

January 18, 2007: Announcements; Special graduate courses; Course plan for 2007-2008.

February 15, 2007: Announcements; Mission, objectives, and outcomes of the PhD program; Ad-hoc committees to develop syllabi of ECE 340, 370, 380; Visiting faculty members.

March 22, 2007: Announcements (fall schedule, summer teaching, town meetings with students); PhD program outcomes; Syllabi of ECE 340, 370, 312, 321, ECE 380; Cross-listing CMP3 272 (Operating Systems) as ECE 432; Inviting short-listed faculty members.

April 26, 2007: Announcements; New courses (Internet Security, Synthesis in Design Automation); Options for electromagnetics courses; Grades in multi-section courses (common final exams); Weeding out books in FEA library.

May 11, 2007: Special Meeting: Vote on extending offers to the faculty candidates that completed the interviewing process; Vote on next steps to take concerning the remaining faculty candidates.

June 15, 2007: Announcements; New course; Courses in graduate major/minor areas and ICT program; Final-year projects - discussion of outcomes; Part-time titles (promotions from Lecturer to Senior Lecturer, and from Instructor to Lecturer); Weeding out old books in FEA library; Student awards.

June 25, 2007: Special Meeting: Voting of degrees

SEMINARS

The ECE Department routinely holds several seminars per semester to expose students to professional and research projects of interest to electrical and computer engineers. Speakers at these seminars include professional engineers and researchers. The ECE Department organized 18 technical seminars during the period July 1, 2006 – June 30, 2007.

- The Promise and Challenges of Secure Online Collaborations, Prof. M. Atallah, Purdue University, October 12, 2006
- CATV: Past, Present, and Future, Dr. W. Kamal, AUI, November 9, 2006
- Efficient Scalable Alternative to Reorder Buffers in Multicore Processors, Dr. H. Akkary, Intel Corporation, November 16, 2006
- HIIL Testing of Powertrain Controllers in Hybrid Electric Vehicles, Dr. B. Badreddine, Ford Motor Company, December 13, 2006
- Grid Computing, Dr. S. Maal, Trinity College Dublin, December 19, 2006
- DSP Architectures: Past, Present, and Future, Mr. R. Ferzli, Arizona State University, January 4, 2007
- Networked Robots, Senson, and Humans, Prof. I. Elhay, AUI, January 12, 2007
- From MSCORM (Multimedia SCORM) toward a MRA (Multimedia Reference Architecture) for LMS, Dr. R. Shamma, AUI, April 19, 2007
- Reconfigurable Computing: A New Supercomputing Paradigm, Professor W. Najjar, University of California-Riverside, April 26, 2007
- Automated Anesthesia, Professor T. Hemmerling, McGill University, April 30, 2007
- Medical Ultrasound, Dr. S. Hakim, Medtronic, May 8, 2007
- Medical Technology, Dr. B. Tabshouri, AUI Medical Center, May 22, 2007
- Computer Security, Professor M. Atallah, Purdue University, May 24, 2007
- Power Management for VLSI Circuits, Professor F. Najm, University of Toronto, May 26, 2007
- Medical Ultrasound, Dr. S. Hakim, Medtronic, May 8, 2007
- Medical Technology, Dr. B. Tabshouri, AUI Medical Center, May 22, 2007
- Computer Security, Professor M. Atallah, Purdue University, May 24, 2007
- Power Management for VLSI Circuits, Professor F. Najm, University of Toronto, May 26, 2007
Dr. Farid N. Najm

Dr. Farid N. Najm received the B.E. degree in Electrical and Computer Engineering (ECE) from the University of Beirut (AUB) in 1983, and the M.S. and Ph.D. degrees in Electrical and Computer Engineering (ECE) from the University of Illinois at Urbana-Champaign in 1986 and 1989, respectively. He worked with Texas Instruments in Dallas, TX, 1989-1992, then joined the ECE Department at UIUC as an Assistant Professor, becoming a tenured Associate Professor in 1997. In 1999, he joined the ECE Department at the University of Toronto, where he is now Professor and Vice-Chair of ECE. Dr. Najm is a Fellow of the IEEE, and is Associate Editor for the IEEE Transactions on CAD. He received the IEEE Transactions on CAD Best Paper Award in 1992, the NSF Research Initiation Award in 1993, the NSF CAREER Award in 1996, and was Associate Editor for the IEEE Transactions on VLSI 1997-2002. He served as General Chairman for the 1999 International Symposium on Low-Power Electronics and Design (ISLPED-99), and as Technical Program Co-Chairman for ISLPED-98. He has also served on the technical committees of ICCAD, DAC, ICCD, ISQED, and ISLPED. Dr. Najm has co-authored the text “Failure Mechanisms in Semiconductor Devices,” 2nd Ed., John Wiley and Sons, 1997. His research is on computer-aided design (CAD) for integrated circuits, with an emphasis on circuit level issues related to power dissipation, timing, and reliability.

Dean’s Award for Creative Achievement

The Dean’s Award for Creative Achievement has been initiated in the Faculty of Engineering and Architecture in December 1991. The objective of this award is to recognize and reward creatively among students of the faculty in their approach to academic work. The award consists of a certificate in testimony of creative achievement as well as inscription of the recipient’s name on a special board. Undergraduate students from all classes in the Faculty of Engineering and Architecture who have demonstrated creativity in their approach to academic work as applied to projects, problem solving, laboratory, shop work, etc. are eligible without restriction. If the work in question is a group activity, the award may be made to each member of the group. Selection of the candidate for each program shall be made by the Department and communicated to the Dean for voting by the faculty at the end of the academic year.

ECE: Claude Alou Diaher (ECE), Ali Hinnawi (ECE), Nasser Ghousseiny (ME), Asaad Tahhan (ME) class of 2007

CCE: Marwan Ramadan (CCE), Layla El Zein (CCE), and Marwan Al Rifai (CCE) class of 2007

Abdul Hadi Debs Award

Abdul Hadi Debs Foundation established a new award at the American University of Beirut which will be offered to graduating students who excel in their studies. This award will be made equally to three students in the Faculty of Arts & Sciences, Faculty of Agricultural and Food Sciences, and Faculty of Engineering and Architecture according to the following restrictions:

FEA Abdul Hadi Debs Award: Joseph Constantine

Other Awards

Other awards for best papers and posters are also presented during the FEA Student Conference. The FEA Student Conference is a yearly conference organized by the FEA, where students can exhibit their projects and present technical papers, which are published in the conference proceedings. The following are the awards given to ECE students during the 6th FEA Student Conference that took place in May 2007.

Best Paper by CCE Undergraduate Students

Marwan Ramadan, Layal El Zein, and Marwan Al-Rifai: Infrastructure Controlled Peer to Peer Network: A System Implementation

Best Paper by FEA Graduate Student

W ald Saad: An End-to-End Approach for Scheduling in CDMA Networks

Best Paper by ECE Undergraduate Students

Roger Moussali and Nabil Chamer: Micro architectural Enhancements Targeting Configurable Multi-Threaded Soft Processors
ECE Publicity Campaign

ECE Video

The ECE Department is in the process of producing a video that presents the various areas of electrical and computer engineering, the current research being done by faculty members, as well as the laboratories and facilities that are available in the department. The video was prepared by a professional producer during the period March – May 2007, and should be ready in the fall of 2007. The video will be shown and distributed to high school students interested in joining the undergraduate programs, and to university students interested in joining the graduate programs in ECE. The video production was financed by the CITPER project (EC Tempus grant JEP 31074-2003.)

The CITPER project also financed three visits by groups of faculty members to universities in Egypt, Jordan, and Syria.

Visit to Egypt

Professors Hassan Artail, Ali El-Hajj, and Karim Kabalan visited five leading universities in Egypt from March 10 - 14, 2007. The purpose of the visit was to inform administrators and faculty members at the Egyptian institutions about the AUB ECE Department, its programs, and specifically the ICT graduate program.

First, on their agenda was a seminar arranged at Alexandria University in the presence of Professor Hosam Ghanem, the Vice Dean for Graduate Studies and Research and Prof. Said El-Kharmy, the chairman of the IEEE section at the university, who agreed to pursue the idea of forming a regional ICT consortium. Next, the AUB ECE team members visited the Arab Academy for Science, Technology, and Maritime Transport, where they met Professor Sayed Badawi, the Dean of the Institute; Professor Mustapha Hussein, the Assistant Dean for Research; and Professor Rodolfo Abdel Rasoul, the Chairperson of the Department of Electronics and Communication Engineering. The AUB ECE team presented an overview of the ICT program and the possibility of student exchange between the two institutions.

A presentation was also given at the American University in Cairo, and attended by Professor Mikhal Mikhal, the Chairman of the Computer Science Department, who expressed readiness to start cooperation at all levels, beginning with faculty mobility. The AUB ECE team then visited Ain Shams University and met Professor Houssam Fahmy, the Chairperson of the Department of Computer Science, who discussed the possibility of offering the ICT program or a modified version at Ain Shams University. The group also visited Cairo University and met Professor Ay Fahmy, the Dean of Computer and Information Studies, in the presence of Prof. Reem Bahgat. The meeting focused on the ICT program, and possible collaboration between the two institutions.

Visit to Syria

Professors Hassan Artail, Ali El-Hajj, and Mazen Saghir visited three leading universities in Syria between May 18 and May 22, 2007 in order to introduce the CITPER project. In addition, the AUB team discussed with officials at the Syrian universities the possibility of adopting the ECE ICT program and having faculty mobility activities between the ECE Department and their departments.

The activities at the Arab European University (AEU) began with a long meeting between the Vice President of the University for Academic Affairs, Dr. Faye Kwan, and other top officials and faculty members. A seminar was then held for faculty members that was attended by more than forty students.

At the Al Kalamoon University, the AUB team met with the President of the university, Prof. Abdulrazaq Chisho has and with the Dean of Engineering, Dr. Shwedik Batal. As in the case of AEU, the administration was interested in learning about AUB’s experience in developing engineering programs and wanted to draw on the experience and skills of the faculty. A presentation on the graduate ICT program and the ECE department was given to a sizable audience that included faculty members and students.

The visit to Aleppo University began with a meeting between the AUB group and Dr. Ziad Salem, who gave a general description of Aleppo University, its programs, students, and faculty members. The AUB team then met with faculty members in the Electrical and Electronic Engineering Faculty where discussions about the engineering programs offered at both AUB and Aleppo University continued. The AUB team gave a presentation about the ICT program and the ECE Department to a large packed hall of students, several faculty members and personnel from the administration, which included the Vice President for Academic Affairs, Dr. Kusay Kayali. Later, Prof. Mazen Saghir gave a seminar entitled “FPGA: Architectures, Tools, and Applications” which was well-received by both students and faculty members.

In summary, the trip was very successful in giving information to administrators and faculty members at Syrian universities about AUB, ECE, and more specifically the ICT program. All officials that the AUB team met with showed enthusiasm for collaborating at all levels. More so, students showed a very high level of interest in continuing education at AUB and in working on projects that involve direct supervision or co-supervision by AUB faculty members.

Visit to Jordan

Professors Ali Chehab, Zaher Dawy, and Ayman Kayssi visited three leading universities in Jordan during the period of May 12 - 17, 2007. The purpose of the visits was to inform administrators, faculty members, and students at the Jordanian institutions about the AUB ECE Department, its programs, and especially the ICT and the PhD programs.

First, a seminar was arranged at the Jordan University of Science and Technology (JUST) in the presence of Professor Omar Al-Jarrah, Assistant President for ICT; and Professor Mozay Al-Sa’idi, Chairman of the Computer Engineering Department; and with other faculty members and students. Then, a presentation was made to students and faculty members of the Electrical Engineering Department at JUST in the presence of Professor Fahmi Abu Al-Rub, Vice Dean of the Faculty of Engineering; and Professor Mohammad Barat, Chairman of the EE Department.

Next a visit was made to Philadelphia University near Amman, where a presentation was made to faculty members and students at the Faculty of Engineering in the presence of Professor Kazim Al-Audhy, Vice Dean and Professor Mohamed Ali, Chairman of the Computer Engineering Department.

Finally, the AUB team visited the University of Jordan where a presentation was made to faculty members and students in the presence of Professor Daif Allah Dalabbeh, Dean of the Faculty of Engineering and Technology, Professor Ghazi Andanah, Chairman of the Computer Engineering Department; and Professor Sadek Hamed, Chairman of the Electrical Engineering Department.

The AUB ECE team also discussed with administrators and faculty members of the visited universities the possibility of student and faculty exchange between the ECE Department at AUB and the corresponding departments at the universities visited.
As soon as AUB opened its door on the first day of the Reine Heloue, and Counselor Prof. Zaher Dawy, Secretary Diana Fayad, Treasurer Jad El Mir, President Rabih Yazbeck, Vice President Hussein El Sayed, Zaher Dawy, announced a number of future events.

On November 28th, 2006, IEEE organized an “advising meeting”, during which, professors along with some students were invited to discuss issues related to advising at AUB. We pinpointed weaknesses and strengths in the advising procedures from both the professors’ and the students’ side. It was a very interactive discussion and students made use of the occasion to criticize and give voice to all their complaints! In fact, the same applied for professors.

On December 23rd, 2006, we organized a Wine & Cheese Christmas dinner at Shtroumpf in Jouissance. Karaoke and lots of laughing and drinking followed the dinner! Some professors were also present and they enjoyed this merry night with us! IDM and Le Voyager sponsored the event.

The 2006–07 executive board consists of:

President Rabih Yazbeck, Vice President Hussein El Sayed, Secretary Diana Fayad, Treasurer Jad El Mir, Net representative Reine Heloue, and Counselor Prof. Zaher Dawy.

Having decided upon the theme “Time to Lead the Way” the IEEE Student Branch at AUB has been organizing activities for all its members from 1st year to graduates!

The 2006-07 executive board consists of:

President Rabih Yazbeck, Vice President Hussein El Sayed, Secretary Diana Fayad, Treasurer Jad El Mir, Net representative Reine Heloue, and Counselor Prof. Zaher Dawy.

As soon as AUB opened its door on the first day of the semester, the IEEE team joined the orientation program of new students to help with the registration, selection of courses and all the procedures that sound complicated at first.

To enhance the educational experience and personal development of students by facilitating interaction and communication, a number of faculty members and staff at AUB and the IEEE AUB Student Branch hosted the annual iitar on 18 October 2006 at the Gefinor Rotana Hotel. More than 160 IEEE members attended. In speeches following the iitar, Rabih Yazbeck welcomed the guests. Dean Hajj talked about the holy month of Ramadan and how it teaches self-discipline, self-control, tolerance and care for others. And finally, Professor Zaher Dawy, announced a number of future events.

A logo competition took place encouraging students to participate in the creation of an official logo for the IEEE-AUB student branch. We received very interesting and creative logos, although only one has been selected they all deserved to be the IEEE SB logo.

The opening of the WIE (Women in Engineering) affiliation was a first for the 2006-07 IEEE SB. We organized several meetings to discuss the possible programs of such an affiliation and to interest students in joining. We celebrated the opening with free donuts donated by Dunkin Donuts. Unfortunately not only women were present at the event… men could not control their appetite for donuts! For the first time at AUB, a WIE chair position was created, that will begin in the academic year 2007-08!

The Spring Barbecue took place on campus on April 26th. IEEE members, non-members and the executive board were all busy preparing delicious hamburgers and chicken burgers…the engineering terrace was overcrowded during the entire event and not one slice of bread was leftover at the end!

IEEE invited Ericsson to the Engineering Board room where Mr Ramzi Sukkar gave a presentation titled “3G Evolution, High Speed Packet Access and Beyond.”

On the 19th of April, we gathered 4th year students and professors from the ECE department for a “Town meeting” to discuss issues related to students’ education, graduate programs, and general problems faced.

The IEEE-AUB Student Branch participated in the first IEEE Lebanon Section workshop that was organized by the IEEE Lebanon Communication Society and was held at Universite Saint Joseph (USJ).

IEEE SB! The event was sponsored by: Ericsson, National Instruments, CIS and FE-A-SRC.

Last but not least there the traditional ECE Gala was held. Due to the unfortunate situation in the country, a decision was made to organize a gala lunch rather than a gala dinner. The lunch was held on Tuesday June 19th in Le Meridien Commodore. We enjoyed funny sketches, interesting speeches and a very amusing ambience. The winner of the IEEE logo competition was announced, and it was Joe Gemayel. Many other awards were distributed to students and professors.

At the end of the year, we gathered 4th year students and the students’ side. It was a very interactive discussion and students made use of the occasion to criticize and give voice to all their complaints! In fact, the same applied for professors.

Finally, we would like to express our gratitude to Prof. Zaher Dawy, who assisted us throughout this year and participated in every event we organized. We would also like to applaud the relentless efforts of all the IEEE-AUB members, without forgetting all the help that we received from the ECE department and its friendly staff.

Believe in IEEE believe in your future!
Congratulations to Prof. Imad Elhajj on his marriage to Ms. Rita Marciulionyte, from Lithuania. The wedding ceremony took place at Our Lady of Tannir Church on October 28th, 2006 and the celebration was held in the Le Royal Hotel, Dbayeh. Rita was born on July 19, 2006 at the hospital in Beirut. Our similar ways of thinking, similar backgrounds and mutual ability for discussion and argument made our relationship seem likely to be successful.

As communications engineers, Samer and I were successful and lucky enough to get employment at world-class multinational telecom companies, namely Ericsson and Nokia Siemens Networks. Although we are both based in Lebanon, being a part of regional resource pools requires continuous traveling to different countries. Even though this is certainly not the best scenario for any engaged couple, Samer and I are convinced that this experience is necessary for our careers and we have decided to accept the challenge hoping that we will be up to it just as we were up to the four-year CCE challenge. Success in any team challenge has the same requirements: collaboration, mutual understanding, and well-distributed effort.

Our love and compassion for AUB and Engineering goes beyond memories and education. We are grateful to AUB because it gave us the opportunity to meet each other and saved us from the agony most people go through while searching for the right person. AUB is more than a learning place; it is a community where people meet, make friends and sometimes become eternal partners.

By: Mona Itani
(CCE 2006 with collaboration of Samer Sharefeddteen, CCE 2006)

June 15, 2007: Stepping into the most beautiful place in Beirut and heading towards the Bechtel Building after a year of being away from the university, I felt a rush of emotions in my blood. For this is the place where I had spent most of my time for four years, this is the path I ran everyday I was late for a class in the morning or for an exam, this is where I became an engineer and this is where I met my life partner.

Pasing by the engineering hallway we studied the hanging FYP posters on both sides, and we couldn’t help but remember that during our 4-year CCE challenge hoping that we will be up to it just as we were up to the four-year CCE challenge. Success in any team challenge has the same requirements: collaboration, mutual understanding, and well-distributed effort.

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AUB: Beyond Education

Congratulations to Prof. Ali Chehab, Ayman Kayssi, and Ernst Hujer for becoming Senior IEEE Members.

Congratulations to Ms. Samiha Tannir (ECE Secretary) on the birth of her son Omar Mohammad Itani. Omar was born on July 19, 2006 at AUBMC.

Congratulations to Prof. Hassan Artail for his promotion to Associate Professor rank.

Congratulations to Profs. Ali Chehab, Ayman Kayssi, and Ernst Hujer for winning AUB 2007 Teaching Excellence Award. In an event that has become an annual tradition at AUB, assistant professor of electrical and computer engineering Ali Chehab was awarded the Teaching Excellence Award 2007. The Teaching Excellence Award is comprised of a $5,000 grant to be spent on academic research.

Congratulations to Mr. Khaled Joujou (ECE Labs Manager) on his marriage to Natalie Mounzer Mahmassani on the 5th of October 2006 in Le Royal Hotel.

Congratulations to Prof. Ibrahim Abu Faycal on his marriage to Misa Sarah El-Sayad. They celebrated their wedding on the 22nd of June, 2007 in Meshrif Country Club.

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