

and Computer Science

UNIVERSITY OF CENTRAL FLORIDA

AY 2018-2019 ANNUAL REPORT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING COLLEGE OF ENGINEERING AND COMPUTER SCIENCE UNIVERSITY OF CENTRAL FLORIDA



FEATURED FACULTY - DR. AMRO AWAD

Dr. Awad currently leads the Secure and Advanced Computer Architecture (SACA) team. SACA currently has more than 10 PhD students and a few undergraduate research interns. One common thing about all SACA members, including Dr. Awad, is the passion to make next-generation computing systems and technologies more secure. With more than two million dollars funding, SACA collaborates closely with several defense agencies, national labs, and industry. One main research project we are currently involved with is a DARPA-funded project,

titled: Novel Hardware Support for Integrity-Protected and Encrypted Non-Volatile Memories. With this project, we are investigating novel approaches for supporting security primitives for emerging Non-Volatile Memories (NVMs). Emerging NVMs such as Intel's and Micron's 3D XPoint Technology are promising for replacing DRAM in future computing systems. NVMs promise terabytes of memory directly attached to the memory bus,



with ultra-low idle power, persistent data, and performance comparable to DRAM. On the other hand, emerging NVMs complicate the implementation of secure memories due to the long retention of data, recoverability of data, and the limited write endurance.

In this project, we explore how to implement secure memory while allowing recoverability, very fast recovery time, high performance, and low write overheads. Our project relies on FPGA technology to model architectural support and the proposed memory controller changes to enable secure architectures for emerging NVMs. The project is a three years project with abudget exceeding million dollars.

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GRADUATE CERTIFICATE

CONNECTIVITY, SENSING AND CONTROL FOR SMART COMMUNITIES

The large number of unprecedented cyber attacks on computing and cyber physical systems is alarming, and has already started new research directions towards systematically securing future systems. This new certificate serves as a response of the urgent needs of the defense industry, defense agencies, healthcare systems, cloud systems providers and processor vendors. Many new trends are making hardware security as a major role player in the feasibility of adopting such systems. Such trends include, autonomous systems, Internet-of-Things (IoT), cloud computing and edge computing. This program will be focused on providing a self-contained curriculum and set of courses that can uniquely provide a comprehensive understanding of hardware security. ECE department currently has multiple faculty members who are experts on secure processor architectures, secure cyber physical systems and hardware security, which makes ECE department the most natural home of this program.

SECURE COMPUTING AND CYBER PHYSICAL SYSTEMS

This certificate program aims at preparing the graduate students to undertake advanced engineering or research efforts in these interdisciplinary areas. The courses that are selected for the certificate are chosen such that the students will receive a broad exposure to all of the technologies that are utilized in smart communities. This curriculum is different from what is currently offered in other programs at UCF, in that it is inherently interdisciplinary and focuses on newly established fields such as cyber-physical systems, IoT, and smart grid, rather than the core traditional disciplines. A systems oriented view is one of the main traits of this program. It is expected that some of the courses offered through this certificate program are taught jointly by faculty from multiple departments

SUSTAINABLE AND RESILIENT ENERGY SYSTEMS

Energy systems and power grid, in particular, have been undergoing through dramatic and unprecedented changes in the 21st century. From large-scale penetration of distributed stochastic renewable sources, to introduction of energy storage systems and electric vehicles, all interfaced to the grid through power electronics-based converters. At the same time, increased adverse effects from weather-related phenomena create additional problems in system operation. The modern systems and the grid have become much more dynamic and uncertain. To meet the new challenges, a new class of cyber-physical energy systems have arisen, such as "smart grid" that combines power system infrastructure with communication systems and information technology. The program focuses upon holistic analysis, design, development and deployment of distributed renewable energy resources (including PV systems), advanced information, communication, control and optimization technologies, along with supporting economic and management policies.

UNDERGRADUATE TRACKS

POWER AND RENEWABLE ENERGY

Currently enrolled: 99 students

Power and Renewable Energy Track will provide students the fundamental knowledge in power system operation and control, renewable energy integration, machines, microgrid design and operation, power markets and data analytics. They will have an opportunity for hands-on training in smart grid technologies. Students can select from a large number of technical electives covering the areas of power and renewable energy. After graduation, they can decide to pursue a graduate degree or can find employment in companies such as Duke Energy, OUC, FPL, Siemens, ABB, Leidos, as well as many other regional, national, or international companies. Also, opportunities exist for employment in State and Federal Government agencies.

COMMUNICATIONS AND SIGNAL PROCESSING

Currently enrolled: 22 students

In the Communications and Signal Processing Track students will be trained to develop and apply theory and algorithms in the broad fields of communications, networked systems, and signal processing. Students have a wide range of technical electives to choose from including wireless communication, satellite communication, communication networks, smart grid networks, image processing. Students will graduate with more depth of knowledge in the area of Communications and Signal Processing. After graduation, they can decide to pursue a graduate degree or can find employment in companies such as Harris, Lockheed Martin, Qualcomm, Raytheon, L3 Communications, Texas Instrument, as well as many other regional, national, or international companies. Also, opportunities exist for employment in State and Federal Government agencies.

RF AND MICROWAVES

Currently enrolled: 6 students

The RF and Microwave Track provides students an opportunity to take technical elective courses covering a wide range of topics in applied electromagnetics such as antennas, computational electromagnetics, high-speed circuits and systems, bio-electromagnetics, radar, remote sensing and wireless sensors. Students will graduate with more depth of knowledge in the high frequency RF and Microwave field. After graduation, they can decide to pursue a graduate degree or can find employment in companies such as Harris, Qualcomm, Raytheon, Qorvo, Keysight, Skyworks, as well as many other regional, national, or international companies. Also, opportunities exist for employment in State and Federal Government agencies.

DIGITAL VLSI CIRCUITS

Currently enrolled: 32 students

Students interested in VLSI systems and digital design can pursue the Digital VLSI Circuits Track. Students can select from a wide range of technical elective courses such as embedded systems and hardware-software co-design, microarchitecture and memory design for performance, VLSI testing and fault tolerant computing, design of ultra-low power circuits and systems and the mechanisms for computing systems, and data acquisition. Students will graduate with more depth of knowledge in the area of VLSI systems and digital circuit design. After graduation, they can decide to pursue a graduate degree or can find employment in companies such as Lockheed-Martin, Intel, TI, Apple, as well as many other regional, national, or international companies. Also, opportunities exist for employment in State and Federal Government agencies.



EE & CPE UNDERGRAD: 1,129

EE MSc: 33 EE PHD: 116 CPE MSc: 31 CPE PHD: 52



BACHELOR'S: 244 EE MSc: 26 EE PHD: 14 CPE MSc: 20 CPE PHD: 9

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RANKINGS

U.S. NEWS AND WORLD REPORT TOP 100 RANKINGS

In the 2020 List of Best Graduate Schools released by U.S. News and World Report, the graduate programs in UCF's Department of Electrical and Computer Engineering received the following rankings:



GRADUATE PROGRAM RANKING:



MESSAGE FROM CHAIR

In academic year 2018-2019, ECE department went through a State-mandated review of our undergraduate and graduate programs. Positive outcomes were reported on our educational programs, research enterprise, our faculty, staff, and



programs, research enterprise, our faculty, staff, and students. The department and college were recommended to address both the support staff to faculty ratio and the student to faculty ratio, as the number of support staff relative to the program size is low and the student to faculty ratio is higher than the national average. These recommendations affirm our continuing focus on hiring faculty and staff, the top goal of our departmental strategic plan. Since 2010, the department recruited 22 new faculty members, and the resulting full-time faculty headcount (minus the loss due to retirements) reached above 40 for the first time last year and currently stands at 41. Among our faculty the 35 tenured/tenure-track faculty members, there are 8 NSF CAREER Awardees and 5 IEEE Fellows.

The increased faculty body allowed us to offer more degree options in our undergraduate and graduate curricula. Over the past two years, our EE BSc and CpE BSc programs have been enhanced from one curriculum each to curricula with multiple tracks. The traditional curricula are retained so students can take courses across all technical disciplines but of limited depth. Four additional tracks in Power and Renewable Energy, Communication and Signal Processing, RF and Microwave, and Digital and VLSI Circuits have already attracted healthy enrollments from our body (see the previous page for details), and they allow our students to focus their BSc study and pursue their career in a particular field. In the past year, three new graduate certification programs are developed for approval and implementation, and they cover such three cross-disciplinary fields: 1) connectivity, sensing and control for smart communities; 2) secure computing and cyber-physical systems; and 3) sustainable and resilient energy systems. Additionally, our faculty are looking into ways of enhancing our curricula in the areas of data analytics, artificial intelligence, and real-time learning. Industry-focused program such as navigation and control is also being investigated.

This edition of ECE annual report contains research of one featured junior faculty member, a summary of our new educational programs, and the statistics on standard metrics. With support from our alumni and friends, we will continue to strive for excellence and make ECE the best it can be.

Finances



FY19 EXPENDITURES \$16,188,328



Zhihua Qu Professor and Chair of ECE

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