Computer Systems and Networks

Foundation of the IT revolution!

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Outline

- CSN faculty members
- Undergraduate courses in CSN
- Jobs prospects after graduation
- Graduate courses in CSN
- Research labs in CSN
CSN Faculty Members

- Dr. Michael Fang
- Dr. Renato Figueiredo
- Dr. José Fortes
- Dr. Alan George
- Dr. Karl Gugel
- Dr. Michel Lynch
- Dr. Janise McNair

Undergraduate Courses in CSN

What are my options?
EEL 3701C
Digital Logic & Computer Systems

- Coreq: CGS 2425 or CIS 3020. An overview of logic design, algorithms, computer organization and assembly language programming and computer engineering technology. Laboratory.

- Topics
  - Elementary manipulations of Boolean algebraic equations and simplification of logic expressions
  - Design of combinational and sequential circuits
  - Design with a digital design and simulation package
  - Hardware description language (HDL)
  - Fundamental logic concepts in processor design and programming
EEL 4744C
Microprocessor Applications

- Prereq: EEL 3701C. Elements of microprocessor-based systems; hardware interfacing and software design for their application. Laboratory.

- Topics
  - General background
  - Basic microprocessor and microcomputer architecture
  - Programming model and addressing modes
  - Assembly language
  - M68HC12 instruction set
  - Software design concepts
  - M68HC12 assembly-language programming
  - Computer buses and parallel I/O
  - Interrupts and interrupt service routines
  - Memory concepts and interfacing
  - Timers
  - Serial input/output
  - Analog input and output
  - Supplemental topics (e.g. IA-32 family)

EEL 4712C
Digital Design

- Prereq: EEL 3701C. Advanced modular logic design, design languages, "finite" state machines and binary logic. Laboratory.

- Topics
  - Introduction
  - Design and physical implementation of commonly-used combinational networks
    - Design equations for MUXes, Decoders, Adders
    - The Look-Ahead Carry and the Multi-Bit Full Adder
    - Multi-bit Combinatorial Multiplier and the Carry-Save Adder
  - Review of clocked networks
    - Flip-Flops - in particular edge-triggered D flip-flops
    - Counters and Shift registers
    - Memories - RWM and ROM
  - Design methods for synchronous Finite State Machines (FSM)
    - The ASM diagram
    - Implementation methods - traditional, MUX, ROM/Latch
    - Implementation method - CPLD's and FPGA's
  - FSM design examples
    - Synchronous and Asynchronous Serial Input/Output, Video Display Generator, Video Display Memory, DRAM Controller, 8-bit Computer
EEL 4713C
Digital Computer Architecture


- Course goals
  - Study principles of computer architecture using VHDL simulations of real machines.
  - Show elements of a development system for solutions to problems in this field. These include the host computer along with software such as assemblers and simulators. The student is shown how to build and adapt these tools.
  - Introduce VHSIC Hardware Description Language (VHDL) as a tool for design and synthesis of complex digital systems.
  - Study implementation of a Complex Instruction Set Computer (CISC) using a microprogrammed state machine platform. Through this mechanism, various aspects of digital computer architecture will be introduced.
  - Study implementation of a Reduced Instruction Set Computer (RISC). In particular, the integer pipeline will be simulated to understand its strengths and weaknesses.
  - Study memory architectures, in particular, caches. Cache behavior will be simulated.

EEL 4930
Computer Networks

- This special-topics course introduces basic principles and practice of computer networking, emphasizing data and computer communication within the framework of the lower layers of the OSI and TCP/IP protocol architectures.

- Topics
  - Introduction
  - Protocols and architecture
  - Data communication interface
  - Data link control
  - Circuit switching
  - Packet switching
  - LAN technology
  - LAN systems
  - Internet protocols
  - Special class features
**Job Prospects After Graduation**

What do I do with my diploma?

**Employers**

- Students with CSN specialization are among the most highly recruited in ECE
- Wide variety of companies across a vast marketplace, such as
  - Intel
  - Motorola
  - Texas Instruments
  - IBM
  - Cisco Systems
  - Nortel Networks
  - Sun Microsystems
  - Lockheed Martin
  - Boeing
  - Lucent
  - Microsoft
  - Apple
  - HP
  - Honeywell
  - Harris
  - Paradyne
  - Raytheon
  - Sprint
- Also government (e.g. NUWC, CSS, etc.) and academia
Job Types

- Although neither a formal nor exhaustive list, here are some of the many job types offered to CSN graduates
  - Computer system design and test
  - Embedded system design and test
  - CPU design and test
  - Memory design and test
  - Peripheral component design and test
  - ASIC design and test
  - Network switch design and test
  - Network protocol and component design and test
  - Network and system management
  - System and applications software
  - Board and VLSI chip development
  - Field applications

Graduate Courses in CSN

Should I stay for an advanced degree?
If I do, what are my options?
Graduate Courses

• Thesis-option master’s degree
• Non-thesis-option master’s degree
• Graduate minor in CISE
• Doctoral degree

EEL 5764
Computer Architecture

This course focuses on fundamentals in design and quantitative analysis of modern computer architecture and systems, including instruction set architecture, basic and advanced pipelining, superscalar and VLIW instruction-level parallelism, memory hierarchy, storage, and interconnects.

Topics
- Fundamentals of computer design
- Instruction set principles, examples, and measurements
- Basic and advanced pipelining
- Memory-hierarchy design
- Storage systems
- Superscalar and VLIW processing
- Interconnection networks
- Future directions
**EEL 6763**
Parallel Computer Architecture

- This course focuses on advanced architecture emphasizing design and quantitative analysis of parallel architecture and systems, including theory, hardware technologies, parallel and scalable architectures, and software constructs.

- Topics
  - Basic Concepts in PCA
  - Parallel Programs
  - Programming for Performance
  - Workload-Driven Evaluation
  - Shared-Memory Multiprocessors
  - Scalable Multiprocessors
  - Directory-Based Cache Coherence
  - Interconnection Network Design
  - Future Directions

**EEL 6706**
Fault-Tolerant Computer Arch.

- This course focuses on design and quantitative analysis of fault-tolerant architectures and dependable systems including fundamental issues, redundancy techniques, evaluation methods, design methodology, and applications.

- Topics
  - Intro. to fault-tolerant computing
  - Fault-tolerant computer architectures
  - Fault-tolerant multiprocessor and distributed systems
  - Fault-tolerant system case studies
  - Experimental dependability analysis
  - Reliability estimation
  - Fault-tolerant software
  - System diagnosis
EEL 5718
Computer Communication

- This course focuses on design of data communication networks: modems, terminals, error control, multiplexing, message switching, and data concentration.

- Topics
  - Overview of communications networks and services
  - Layering architectures
  - Physical layer fundamentals: data transmission, coding/decoding, and modulation/demodulation
  - Multiplexing and switching
  - Data link control: error control and ARQ protocols
  - Multiple access control (MAC) protocols
  - Routing algorithms and protocols
  - Transport protocols
  - Congestion controls
  - LAN Technologies
  - Selected advanced topics

EEL 6785
High-Perf. Computer Networks

- This course focuses on design and quantitative analysis of high-speed networks and interconnects including protocols, hardware and software interfaces, switching, light-weight communication layers, flow and error control, and quality of service.

- Topics
  - Quality of Service (QoS) Protocols and Performance in HPNs
  - Lightweight Communication Interfaces for HPNs
  - Deterministic and Adaptive Routing for HPNs
  - Collective Communications in HPNs
  - Scalable Network Services for HPDC
  - Fault Tolerance in HPNs
  - Switch Architectures for HPNs
  - NIC Architectures for HPNs
  - Interface Architectures and Interconnects
  - HPN Topologies
EEL 6935
Wireless Networks

- This special-topics course introduces the fundamentals of cellular networks and next-generation wireless system design, using current and developing standards as examples.

- Topics
  - Overview of Wireless Networks
  - Physical layer fundamentals (radio propagation, wireless transmission techniques)
  - Multiple Access Control (wireless medium access alternatives)
  - Wireless Network Planning and Traffic Engineering
  - Wireless Network Management (mobility and resource management, security)
  - Wireless WANs (GSM, CDMA, GPRS)
  - Wireless LANs (802.11, ad hoc networks)
  - Wireless MANs (HAAPS)
  - Next generation wireless systems (Next G)

EEL 6935
Distributed Computing

- This special-topics course introduces key concepts and techniques underlying design and engineering of distributed computing systems.

- Topics
  - Distributed system characterization and models
  - Networking and internetworking
  - Interprocess communication
  - Distributed objects
  - Security
  - Name services
  - Operating system support
  - Distributed file systems
  - Introduction to grid computing
  - Advanced topics
EEL 6935
Nanocomputing

- This special-topics course introduces key concepts and techniques underlying design and engineering of computing systems that use nanoscale components.

- Topics
  - Introduction to digital and analog computation
  - Molecular electronics
  - Quantum cellular automata
  - Nanowires
  - Nanoelectronics building blocks
  - Memory-based systems
  - Reconfigurable computing systems
  - Bio-inspired computing systems
  - Computing models and computational complexity
  - Advanced topics

Research Labs in CSN

Should I get involved in research?
If I do, what are my options?
Wireless Network Lab (WINET)

Dr. Michael Fang

- **Research foci**
  - Wireless networks and mobile computing
    - Mobility management and resource management
    - IP mobility
  - Wireless mobile ad hoc networks
    - QoS routing, secure routing, power aware routing
    - Medium access control with QoS support
- **Personnel**
  - One faculty member
  - 11 Ph.D students
  - One MS student
- **Sponsorship**
  - National Science Foundation
  - Office of Naval Research
  - Air Force Research Lab
- **More information**
  - [http://www.fang.ece.ufl.edu/winet.html](http://www.fang.ece.ufl.edu/winet.html)

Wireless & Mobile Systems Laboratory

Dr. Janise McNair ([http://www.wam.ece.ufl.edu](http://www.wam.ece.ufl.edu))

Research Focus: **Mobility Management and System Inter-operability for Next Generation (Next G) Wireless Networks**

Projects:

  - Design and analysis of new protocols for signaling, resource allocation, and detection for multi-network (WLAN, Cellular) environments.
  - PhD Students: Yuan Guo, Fang Zhu
  - MS Students: Sitaram Penumetsa

- "Quality of Service and Security Issues for Mobile IP Networks."
  - Design and analysis of new packet-based handoff techniques that support quality of service (QoS) for multimedia traffic and secure mobility for inter-system roaming.
  - MS Students: Aarti Bharathan
HCS Research Laboratory
Dr. Alan D. George

- Research Focus Areas
  - High-perf. computer networks
  - High-perf. computer architectures
  - Parallel and distributed computing
  - Fault-tolerant computing
- Research Sponsors
  - National Security Agency
  - Sandia National Labs
  - Office of Naval Research
  - National Institute of Health
  - National Science Foundation
  - Rockwell Collins, Honeywell
- Other Sponsors
  - Nortel Networks, HP/Compaq
  - Intel, AMD
- Facilities
  - Cluster supercomputer (376 CPUs)
  - Networking testbed (>5.3 Gbps)
  - Embedded systems testbed (SHARC)

ACIS Research Laboratory
Drs. José Fortes and Renato Figueiredo

- Mission: To conduct fundamental and applied research on all aspects of systems that integrate computing and information processing.
  - Nanosystems research investigates biologically-inspired computing architectures that use novel nanoscale devices and self-assembled nanostructures.
  - Microsystems research focuses on decoupled microarchitectures that are capable of computing in memory.
  - Multiprocessor research considers hierarchical organizations of integrated processors and memory, or processors and storage.
  - Internet-scale systems research studies next-generation information grids for scientific and engineering applications, access to specialized resources and document management.
  - Global systems research addresses unique problems that arise in transnational digital government.
Conclusions

- Being strictly objective, CSN is the most exciting area in ECE! 😊
- Wide spectrum of courses, career opportunities, graduate courses, research labs, etc. here at UF
- For more info., feel free to contact me:
  
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