Computer Engineering and Systems Group

Paul V. Gratz
Dept. of ECE
Texas A&M University
About Computer Engineering in ECE

- A joint program between ECE and CS
- CE degrees
  - M. S., M. E., Ph.D.
- Group leader:
  - Dr. A.L.N. Reddy
- Information:
  - Carolyn Warzon, 333E WERC
- http://cesg.ece.tamu.edu
- http://ece.tamu.edu
Areas of Research

- **Computer Systems**
  - Computer Architecture
  - Storage and I/O Systems
  - GPUs
  - Health Biomed
  - Parallel processing

- **Networking**
  - Control Systems
  - Game Theory

- **Multimedia systems**
- **Network Coding**
- **Protocols**
- **Wireless networks**
- **Cyber physical systems**

- **VLSI**
  - Computer Aided Design
  - VLSI synthesis and test
  - Interconnection Networks
  - Fault tolerant computing
Networking

- Prof. A. L. N. Reddy
  - CE Group leader
- Research
  - Computer networks
  - Multimedia
  - Computer architecture
• Prof. P. R. Kumar
• Research
  o Sensor networks
  o Cyber physical systems
  o Control theory
  o Information theory

• Prof. Srinivas Shakkottai
• Research
  o Computer networks
  o Game theory
  o Content distribution.
  o Wireless networks.
CESG Faculty

- Prof. Alexander Sprintson
- Research
  - Communication networks
  - Network algorithms
  - Network coding
  - Network survivability.

- Prof. Xi Zhang
- Research
  - Wired/Wireless networking
  - Communication systems
  - Network control and QoS
VLSI

- Prof. Gwan Choi
- Research
  - High-Performance and Low-Power VLSI Design
  - Wireless Network Circuits
  - High-Performance and Low-Power VLSI Design
  - Wireless Network Circuits
  - System-on-Chip Solutions for Smartphones and Tablets
• Prof. Jiang Hu
• Research
  o Physical design automation
  o Clock network synthesis
  o Design for manufacturability

• Prof. Weiping Shi
• Research
  o VLSI logic synthesis
  o VLSI circuit design
  o Low power, resilient circuits
  o VLSI testing
• Prof. Sunil Khatri
• Research
  o VLSI logic synthesis
  o VLSI circuit design
  o Low power, resilient circuits
  o VLSI testing

• Prof. Peng Li
• Research
  o VLSI interconnect modeling, timing
  o Signal/power integrity
  o Analog/Mixed-signal/RF CAD
  o Circuit simulation
Computer Systems

- Prof. A. L. N. Reddy
  - CE Group leader
- Research
  - Computer networks
  - Multimedia
  - Computer architecture
• Prof. Mi Lu
  • Research
    o Parallel computing
    o Distributed processing
    o Computer architectures
    o Computer networks

• Prof. Paul Gratz
  • Research
    o On-chip interconnection networks.
    o High performance multicore computer architectures.
    o Memory systems.
• Carolyn Warzon
  o Administrative Coordinator
  o 333E WERC
  o Phone: 862-1645
  o Email: carolyn@ece.tamu.edu
MASTER OF SCIENCE IN COMPUTER ENGINEERING (Thesis Option)

- Total number of hours (32)
  - A minimum of 24 classroom hours (Excludes 681, 684, 685, & 691).
  - A minimum of 21 classroom hours from the College of Engineering and College of Science
  - Transfer hours allowed from another institution (6)
    - Transfer hours must be from a peer institution
    - Transfer hours are subject to approval of the Graduate Studies Committee
  - Max undergraduate hours (9 hours/400 only)
  - Special problems, seminar, and research (681, 685, & 691)
    - 8 hours maximum of these courses
    - 4 hours minimum of 691
    - 1 hour of seminar (ECEN/CSCE 681) is required
    - No more than 3 hours of ECEN 681, 684, and 685.
  - Composition of committee (at least 3)
    - At least 2 within Computer Engineering Group from ECEN
    - At least 1 not in the student's department
Master of Engineering (Non-thesis option)

- **30 credit hours**
  - A minimum of 27 classroom hours (Excludes 681, 684, & 685) from
    - College of Engineering
    - College of Science
    - College of Business (at most one course, and only from the INFO Dept.)
  - A minimum of 24 classroom hours from
    - Computer Science
    - Electrical & Computer Engineering
    - >= 13 hours must be in Electrical Engineering for Computer Engineering students in the Electrical & Computer Engineering Department.
  - Transfer hours allowed from another institution (6)
    - Transfer hours must be from a peer institution
    - Transfer hours are subject to approval of the Graduate Studies Committee
  - Max undergraduate hours (9 hours/400 only)
  - One hour of seminar is allowed (ECEN/CSCE 681) but is NOT required.
  - No more than 3 hours of ECEN 681, 684, and 685.
  - A report is required in at least one of the ECE or CSE courses.**
  - Students may petition for exemption from final oral with the approval of the student’s Committee Chair.
  - Composition of committee - The Graduate Coordinator will be the chair of all MEN committees. No other committee members are needed.
Ph.D. IN COMPUTER ENGINEERING

- Total number of hours (64 beyond the MS or 96 beyond the BS)
  - A minimum of 42 classroom hours beyond the BS Degree (Excludes 681, 684, 685, & 691); a maximum of 24 of these hours can be from previous graduate work.
    - Max undergraduate hours (8 hours / 2 courses 400 only)
    - Three hours of seminar (ECEN/CSCE 681) is required.
    - At most 3 hours of ECEN 684

- Composition of committee (at least 4)
  - At least 2 within Computer Engineering Group from ECEN
  - At least 1 not in the student’s department
  - At least 1 not in CE Group, but in ECEN department

- All PHD students are required to pass the Departmental Qualifying Examination
  - Incoming PHD students are required to take the exam within one year of starting the program.
  - Students entering the program with a previous degree outside of Electrical or Computer Engineering are allowed, with the approval of their advisor, an extra year and will be required to take the exam by the end of the second year.
  - Those students that fail the examination are given a second opportunity to retake the exam which must be taken at the next opportunity in which the exam is offered.
  - Those that fail the examination twice will be removed from the PHD program.
Ph.D. IN COMPUTER ENGINEERING (cont)

- All PHD students are required to pass a preliminary examination.
  - PHD students are required to schedule their prelim exam by the end of their 4th semester (excluding summers) or 6th semester for direct PHDs. Students who have not scheduled their prelim by the appointed time will be blocked from further registration until they do so.
  - OGS must be officially notified of the exam schedule at least 2 weeks prior to the exam. This should be done through the graduate office.
  - Student must download the checklist and signature page from the OGS web site. The checklist must be signed by your advisor and Graduate Coordinator prior to the exam.

- The prelim exam consists of a written and an oral examination.
- For students who have passed the departmental Qualifying Exam, the written portion of the prelim exam can be waived subject to the approval of the student’s supervisory committee.
- Students who fail the prelim exam will have one opportunity to retake the exam within 6 months of the original exam date.
- Final defense of dissertation is required for all PHD students.
  - A dissertation proposal must be approved by the supervisory committee and submitted to the Graduate Office prior to the defense.
  - Typically this proposal is submitted in conjunction with the preliminary exam, but it can be submitted afterwards.
  - Date and location of the final defense must be scheduled through the Graduate Office so that official notification can be provided to OGS.
  - Dissertation must be submitted to committee members at least two weeks before defense.

More information:
http://www.ece.tamu.edu/Graduate/GradDegreeRequirements.php
Course List: Networking

**Networks and Architecture**
- ECEN 602 Computer Communication and Networking*
- ECEN 619 Internet Protocols and Modeling.
- ECEN 621 Mobile Wireless Networks*
- ECEN 627 Multimedia Systems and Networks
- ECEN 651 Microprogrammed Control of Digital Syst. (not CSCE 614)*
- ECEN 750 Design and Analysis of Communication Networks*
- ECEN 689 Special Topics Course*
  - Game Theory

**Communication and Control**
- ECEN 601 Linear Network Analysis*
- ECEN 604 Channel Coding for Communications
- ECEN 605 - Linear Control Systems*
- ECEN 606 - Nonlinear Control Systems*
- ECEN 646 Statistical Communication Theory*
- ECEN 647 Information Theory
- ECEN 662 Estimation and Detection Theory*
- ECEN 683 Wireless Communications*

**Systems and Software**
- CSCE 410 Operating Systems*
- CSCE 606 Software Engineering*
- CSCE 629 Analysis of Algorithms*
- CSCE 658 Randomized Algorithms*
- CSCE 665 Advanced Networking and Security
- CSCE 664 Wireless and Mobile Systems

**Math / Stat:**
- MATH 415 Modern Algebra I*
- MATH 416 Modern Algebra II
- MATH 446 Principles of Analysis I*
- MATH 447 Topics in Analysis II
- STAT 601 Statistical Analysis
- MATH 606 Theory of Probability I
- MATH 607 Real Variables I*
- MATH 608 Real Variables II
- MATH 619 - Applied Probability*
- MATH 625 - Applied SDEs
- MATH 630 - Combinatorics
- MATH 651 Optimization I*
- MATH 652 Optimization II

**English:**
- ENGL 301 Technical Writing (no grad credit)*
Course List: VLSI and Architecture

- **Hardware/VLSI**
  - ECEN 454 Digital Integrated Circuit Design*
  - ECEN 468 Advanced Logic Design
  - ECEN 652 Switching Theory
  - ECEN 654 VLSI Systems Design*
  - ECEN 680 Test and Diagnosis of Digital Systems
  - ECEN 687 VLSI Physical Design Automation*
  - ECEN 689 Special Topics Courses
    - OPT & VERIF OF VLSI SYS
  - CSCE 661 Integrated Systems Design Automation

- **Computer Architecture**
  - ECEN 623 Parallel Geometric Computing
  - ECEN 651 Microprogrammed Control of Digital Syst. (not CSCE 614)*
  - ECEN 653 Computer Arithmetic Unit Design
  - ECEN 676 Advanced Computer Architecture
  - CSCE 605 Compiler Design

- **Systems and Software**
  - CSCE 410 Operating Systems*
  - CSCE 606 Software Engineering*
  - CSCE 629 Analysis of Algorithms*
  - CSCE 658 Randomized Algorithms*
  - CSCE 662 Distributed Processing Systems

- **Math / Stat:**
  - MATH 415 Modern Algebra I*
  - MATH 416 Modern Algebra II
  - MATH 446 Principles of Analysis I*
  - MATH 447 Topics in Analysis II
  - STAT 601 Statistical Analysis
  - MATH 606 Theory of Probability I
  - MATH 607 Real Variables I*
  - MATH 608 Real Variables II
  - MATH 619 - Applied Probability*
  - MATH 625 - Applied SDEs
  - MATH 630 - Combinatorics
  - MATH 651 Optimization I*
  - MATH 652 Optimization II

- **English:**
  - ENGL 301 Technical Writing (no grad credit)*
Offered in Fall 2013

- **Objectives:**
  Computer communication and computer networks; use of the International Standards Organization (ISO) seven-layer Open Systems Interconnection model as basis for systematic approach; operational networks to be included in the study of each layer; homework assignments to make use of a campus computer network.

- **Prerequisite:**
  Statistical probability background.

- **Instructor:**
  Prof. A.L.N. Reddy
ECEN 651 Microprogrammed Control of Digital Systems.

Offered in Fall 2032

• Objectives:
  Hardware and software concepts involved in the design and construction of microprocessor-based digital systems; microprocessor architecture; bussing; interfacing; data input/output; memories; and software development for operation and testing; design projects with microprocessors and related components

• Prerequisite:
  ELEN 350 and 449 or approval of instructor.

• Instructor:
  Prof. Lu
Solutions for mobile System-on-Chips SOCs Fall 2013

• Topics Discussed:
  - Introduction to Design Automation Methods
  - Low-Power VLSI Design
  - Low-Power Multimedia Processing
  - Timing Design for Low-Power Applications
  - Baseband Processing
  - HW/SW Co-design Verification
  - Memory Subsystem Design

• What are SoCs?
  A6, Hummingbird, Tegra, OMAP, Snapdragon, etc. Chips that go on to cell phones, tablets, and eventually everything else

• What will the future SoCs have in common?
  Multi/many-core processors
  Multimedia units
  Baseband processing
  Sensors
  Memory
  Special ASIC modules

We will discuss emerging design methods and examples.

• Instructor:
  Prof. Gwan Choi
ECEN 653: Computer Arithmetic Unit Design

- Offered in Fall 2013
- Objectives:
  Design of digit computer arithmetic unit, control and memory. Focusing on microprocessor arithmetic logic unit (ALU) design; high-speed addition, subtraction, multiplication and division algorithms and implementations; design and simulation with integrated circuit components and VLSI circuits.

- Prerequisite:
  ECEN 651

- Instructor:
  Prof. Mi Lu
ECEN 689: Special Topics in Network Algorithms & Protocols

Offered in Spring 2013

• Objectives:
  • Network Algorithms - switching, packet classification, scheduling, buffer allocation, IP lookup, prefix matching, Bloom filters, flow control, accounting and measurement, intrusion detection
  • Network protocols - design, specification, optimization, analysis, verification, and implementation

• Prerequisite:
  ECEN 602 or instructor consent

• Instructor:
  Prof. Alex Sprintson
ECEN 676: Advanced Computer Architecture

- Offered in **Spring 2013**
- **Objectives:**
  This course explores design of high-performance computer architectures and their quantitative analysis. Microarchitectural details of modern superscalar processors. Emphasis on fine-grain and coarse-grain parallelism; interconnection networks; shared memory and message passing architectures; multi-threaded architectures.

- **Prerequisite:**
  ECEN 651 or CPSC 614 or approval of instructor.

- **Instructor:**
  Prof. Paul Gratz
• **Objectives:**
The class covers design techniques applicable in a custom VLSI design setting. We cover various CMOS circuit design styles, design and simulation techniques including 3-D parasitic extraction, leakage power reduction and exploitation, dynamic compensation of circuit behavior, design of semiconductor memories, packaging issues and transmission line analysis.

• **Prerequisite:**
Graduate standing, or instructor consent.

• **Instructor:**
Prof. Khatri
ECEN 689: Algorithms and Methodologies for VLSI

• Objectives:
This course will provide a top-down perspective of VLSI design flow with focus on architectural transformations and physical design. The architectural transformations will be illustrated through DSP circuits. The physical design part includes algorithms on floorplanning, cell placement, routing and circuit sizing. In addition, this course will cover other important aspects of VLSI design, such as functional verification, clocking, heat removal, signal integrity and package design.

• Prerequisite:
Basic knowledge on digital design, circuit theory, algorithms and C/C++ programming, or Col.

• Instructor:
Prof. Hu
Objectives:
In this class we take an analytical approach to understanding resource allocation on the Internet. We first study the system in a global sense, and use a deterministic approach to study congestion control protocols. We then study individual queues and routers, and use a stochastic approach to understanding system performance.

Prerequisite:
Some probability background.

Instructor:
Prof. Srinivas Shakkottai
Scholarships and Teaching Assistants

- A limited number of ECEN Department scholarships are available to CESG students in Fall 2013.
  - You are encouraged to contact faculty members you would like to work with before submitting.
  - To apply please fill out the electronic form found at: http://engineering.tamu.edu/electrical/academics/advising/graduate/funding
  - Application must be received by Aug. 23rd, 2013, 12:00 pm.

- Some limited TA positions may also be available.
  - TA application on same page above.
  - International students who wish to be TA’s must complete and pass ELPE prior to semester start.
  - Preference towards PhD students for TAships.
Thank you

Welcome to ECE!
Welcome to Computer Engineering!