Computer Engineering and Systems Group

Alex Sprintson
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. Jiang Hu
- Administrative assistant:
  - Carolyn Warzon, 333E WEB
- http://cesg.tamu.edu
- http://engineering.tamu.edu/electrical/
<table>
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<th>Faculty</th>
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<td>Pierce Cantrell</td>
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<td>Nick Duffield</td>
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<td>Gwan Choi</td>
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<td>Jiang Hu (group leader)</td>
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<td>P. R. Kumar</td>
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<td>Weiping Shi</td>
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<td>Srinivas Shakkottai</td>
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<td>Alex Sprintson</td>
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<td>Xi Zhang</td>
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Areas of Research

- VLSI circuits and systems
  - Electronic Design Automation (EDA)
  - Logic synthesis
  - System-on-Silicon (SoC)
  - Hardware acceleration
  - Biomedical applications
  - Low power/energy vlsi design
  - Radiation hardened vlsi design
  - Solid state radiation detectors
  - VLSI realization of machine learning algorithms
Areas of Research

- Computer Systems and Architecture
  - Multi-core processor design
  - Processor Microarchitecture
  - Memory Systems Hierarchies
  - System Designs for Emerging Non-volatile Memories
  - Storage Systems
  - Network Processors
Areas of Research

- Communication Networks
  - Wireless networks
  - Content distribution
  - P2P networks
  - Software-Defined networks
  - Network security
  - Real-time communication
  - Network coding
Areas of Research

- Cyber-Physical Systems
- Network and data science
  - Measurement and analysis of Internet Data
  - Big data analytics
Networking

- Prof. A. L. N. Reddy
- Research
  - Computer networks
  - Multimedia
  - Computer architecture
• Prof. Pierce Cantrel
• Research
  o Computer Networking

• Prof. Nick Duffield
• Research
  o Computer Networking
  o Measurement & Inference
  o Big Data & Algorithms
Prof. I-Hong Hou
Research
- Wireless networks
- Sensor networks
- Multimedia networking
- Queueing theory

Prof. P. R. Kumar
Research
- Wireless networks
- Cyber-physical systems
- Energy systems
- Automated transportation
- Control theory
- Information theory
- Etc.
• Prof. Srinivas Shakkottai
  • Research
    o Computer networks
    o Game theory
    o Content distribution.
    o Wireless networks.

• Prof. Alexander Sprintson
  • Research
    o Communication networks
    o Network algorithms
    o Network coding
    o Network survivability.
• Prof. Xi Zhang
• Research
  o Mobile Wireless Networks
  o Wireless Sensor Networks
  o QoS for Wireless Networks
  o Random Signal Processing for Wireless Comm. Systems
• Prof. Gwan Choi
• Research
  o High-Performance and Low-Power VLSI Design
  o Wireless Network Circuits
  o High-Performance and Low-Power VLSI Design
  o Wireless Network Circuits
  o System-on-Chip Solutions for Smartphones and Tablets
• Prof. Jiang Hu - Group leader
• 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 and ckt design
    o Low power, resilient, rad-hard ckt	s
    o Genomics
    o FPGA and GPU based algorithm acceleration
• 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 High performance multicore computer architectures
  o Memory systems
  o Reliability and Energy Efficiency in Computer systems
• Carolyn Warzon
  - Administrative Coordinator
  - 333E WEB
  - Phone: 862-1645
  - Email: c-warzon@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 a peer institution (6)
- Max undergraduate hours (6 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 (in combination) of ECEN 681, 684, and 685.
- Final defense of thesis is required for all MS students.
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
  - The Departments of Computer Science and Engineering (CSE) or Electrical and Computer Engineering (ECEN)
  - At least 13 of these 24 hours must be in 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 (6 hours/400 only)

- One hour of seminar is allowed (ECEN/CSCE 681) but is NOT required.

- No more than 3 hours (in combination) of ECEN 681, 684, and 685.
Ph.D. IN COMPUTER ENGINEERING Total number of hours (64 or 96)

- For students who already hold a Master’s Degree, 64 total hours are required.
- For “direct PhD” students, 96 hours are required. A minimum of 18 (or 42) classroom hours (excludes 681,684,685,691). 18 hours required for students with a previous Master’s Degree and 42 for direct PhD students. Classroom hours must be taken from courses within the College of Engineering and College of Science.

- Max undergraduate hours (8 hours / 2 courses 400 only)
- Three hours of seminar (ECEN/CSCE 681) are required.
  - At most 3 hours of ECEN 684
  - No more than 2 credit hours of Directed Studies (685) are allowed
  - Students working on a research project should enroll in Research (691) hours
  - A maximum of 6 transfer hours allowed from another institution. Transfer hours must be from a “peer institution”. Transfer hours are subject to the approval of the Graduate Studies Committee. Total number of hours (64 beyond the MS or 96 beyond the BS)
## 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
  - Data Science for Communications Networking

### 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
- ECEN 489 Smartphone Laboratory
- 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
  - ECEN 699 Adv. In VLSI Logic Synthesis
  - ECEN 752 Adv. In VLSI Circuit Design

- **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)*
ECEN 602: Computer Communication and Networking.

Offered in Fall 2015

• **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. Pierce Cantrell
- Offered in Fall 2015
- Objectives:
  Fundamental architectures, principle, modeling techniques, and applications for mobile and wireless networks. It’ll equip graduate students with not only solid foundation and emerging knowledge in a wide spectrum of wireless communications techniques and protocols from PHY-layer to higher Network-Layer, but also the rigorous analytical capabilities to evaluate performance of wireless networks. It addresses practical designing issues for hybrid wireless and wireline networks.
- Prerequisite:
  Graduate standing.
- Instructor:
  Prof. Xi Zhang
ECEN 651 Microprogrammed Control of Digital Systems.

Offered in Fall 2015

• 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
ECEN 676: Advanced Computer Architecture

• Offered in **Spring 2016**

• **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 architectures; multi-threaded architectures. Achieving performance under strict power constraints

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

• **Instructor:**
  Prof. Paul Gratz

Intel’s “Haswell”
i7 Die Photo
Offered in Fall 2015

- **Objectives:**
  - Statistical and computational methods for acquiring and analysing massive datasets, and their applications to operational data in communication networks.
  - Sampling, sketching, frequent itemset mining, network probing, network tomography, graph sampling.
- Prerequisite: Instructor approval
- Instructor: Prof. Nick Duffield
• Offered in Fall 2015

• Objectives:
  • Important applications in electrical and computer engineering require knowledge of linear/nonlinear/convex programming.
  • This course covers applications of importance to Electrical and Computer Engineering, including estimation of signals, routing and congestion control in communication networks, elastic flows in real-time wireless networks, wafer fabrication plants, and economic dispatch in electrical power systems.
  • Students will write their own code for several methods.

• Prerequisite:
  Math 304 or 309 or 311; and Math 251; and Graduate standing.

• Instructor:
  Prof. P. R. Kumar
ECEN 753: Theory and Applications of Network Coding

- Offered in Fall 2015

- Objectives:
  - Wireless network coding
  - Coding for reliability and security
  - Distributed storage/regenerating codes

- Prerequisite:
  Graduate standing

- Instructor:
  Prof. Alex Sprintson
• Offered in Spring 2016

• 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
Offered in **Fall 2015**

Solutions for mobile System-on-Chips SOCs

- **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

- **Instructor:**
  - Prof. Gwan Choi
• Offered in Spring 2016
• Objectives:
  The class covers several methods for logic representation, manipulation and optimization, for combinational as well as sequential logic. The course covers two-level as well as multi-level logic synthesis, and multi-valued synthesis as well. The focus is a sound understanding of the theory and practical implementation of logic techniques, which can be applied to a wide variety of fields.

• Prerequisite:
  Graduate standing, or instructor consent.

• Instructor:
  Prof. Khatri
ECEN 750: Design and Analysis of Comm. Networks

- **Offered in Spring 2016**
- **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
ECEN 755: Stochastic Systems

- Offered in Spring 2016
- Objectives:
  Important applications in electrical and computer engineering require knowledge of stochastic systems. This course deals with several models of stochastic systems and their analysis. It studies topics including performance evaluation, estimation, control, scheduling, identification and adaptation. It has applications in several fields such as computer engineering, communication networks and control.
- Prerequisite:
  Math 411; and Graduate standing.
- Instructor:
  Prof. P. R. Kumar
Seminars

- 681 seminar (Gratz)
- Fishbowl seminar
- Department seminar
CESG Graduate Merit Scholarship
The scholarship awardees will receive a one-time stipend of $1000 and be eligible for the in-state tuition.

Eligibility:
Newly admitted and current CESG Ph. D. and M. S. students who are currently not supported by a research, teaching assistantship or a fellowship. Note that scholarship recipients are required to complete a thesis and shall not transfer to the non-thesis M.E. program at a later time.

How to Apply:
Submit your application online by **11:59pm, August 30th**, at: 
https://records.ece.tamu.edu/TASchApp/ScholarshipApp/ScholarshipApp.php
You should specify your “Area” as “Computer Engineering”. You should not apply to multiple areas at the same time.