Research Activities in Computer Engineering at the Coordinated Science Laboratory

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Computer Engineering ...

Computer Engineering provides the fundamental knowledge, practical skills, professional attitude, and experience necessary to design, implement, and deploy computer hardware, software, and networks.

> "Computer engineer Mark Haas ... has the the best career in America ... The career's horizons figure to expand at something close to the speed of light. Over the next 10 years, computer engineers handiwork will be felt in every corner of the economy. The pay's not bad, either."
>
> —"The Fifty Hottest Jobs in America," *Money*, March 1995.

Computer Engineering at the University of Illinois

- Computer Engineering specialization in ECE
- faculty members

Narendra Ahuja	Steve Lumetta
Donna J. Brown	Janak H. Patel
Nick Carter	Sanjay J. Patel
Seth Hutchinson	Constantine Polychronopoulos
Wen-Mei Hwu	Elizabeth Rudnick
Tom Huang	William H. Sanders
Ravi Iyer	BharghavanVaduvur
Michael C. Loui	Benjamin Wah

- ranked 2nd among U.S. Computer Engineering programs!

Computer Engineering Course Areas

- three sub-specializations
  - Computer Systems (11 faculty)
  - Analysis and Design of Algorithms (2 faculty)
  - Computer Vision, Robotics and Artificial Intelligence (3 faculty)
- two levels of courses
  - 300-level: open to graduates and undergraduates
  - 400-level: open only to graduate students
- course caveat: **no graduate credit** for courses required for CompE undergraduate degrees
  - ECE 312: Computer Organization and Design
  - ECE 340: Solid State Electronic Devices
  - ECE 313: Probability with Engineering Applications (same as Stat 310/Math 363)

Recommended Courses: Computer Systems

Bharghavan, Carter, Hwu, Iyer, Lumetta, J. Patel, S. Patel, Polychronopoulos, Rudnick, Sanders, Wah

- **Computer Architecture** - ECE 412, ECE 411
- **Testing** - ECE 443
- **Analysis** - ECE 441
- **Fault-Tolerant Computing** - ECE 442
- **VLSI Design** - ECE 325
- **Logic Design** - ECE 362
- **Algorithms** - CS 373
- **Computer Networks and Distributed Systems** - ECE 338, ECE 328, ECE 371BW
- **Computer Systems Seminar** - ECE 490-X

Recommended Courses:
Analysis and Design of Algorithms

Brown, Loui

- **Combinatorial Algorithms** - CS 373
- **Automata, Formal Languages, Computational Complexity** - CS 375
- **Topics in the Analysis of Algorithms** - CS 473
- **Methods of Combinatorics** - CS 475
- **Linear Programming and Combinatorial Optimization** - Math 382
- **Topics in Graph and Geometric Algorithms** - ECE 474
- **Computational Complexity** - ECE 479
- **Combinational Algorithms Seminar**

Recommended Courses:
Computer Vision, Robotics and Artificial Intelligence

Ahuja, Huang, Hutchinson

- **Introduction to Artificial Intelligence -** ECE 348
- **Image Processing -** ECE 447
- **Computer Vision** - ECE 449
- **Computer Models of Cognitive Processes** - ECE 448
- **Computer Graphics** - CS 318
- **Combinatorial Algorithms** - CS 373

Computer Engineering Research Areas

VLSI, Computer-Aided Design
(Brown, Carter, J. Patel, Wah)

Computer Architecture, Parallel Processing
(Carter, Hwu, Lumetta, S. Patel, Polychronopoulos, Wah)

Compilers, Code Generation
(Hwu, S. Patel, Polychronopoulos)

Operating Systems, Runtime
(Bharghavan, Lumetta, Polychronopoulos)

Performance/Reliability Analysis, Modeling, & Measurement
(Iyer, Sanders)

Computer Engineering Research Areas

Fault-Tolerant Computing
(Iyer, J. Patel, Rudnick, Sanders)

Digital System Testing
(J. Patel, Rudnick)

Computer Networks, Distributed Systems
(Bharghavan, Loui, Lumetta, Sanders, Wah)

Algorithms, Complexity Theory
(Brown, Loui)

Computer Vision, Robotics
(Ahuja, Huang, Huchinson)

Finding a Thesis Advisor

- Talk to several people; there are many exciting projects.
- Interview a potential thesis advisor:
  - What are the advisor's expectations for the thesis?
  - What will your responsibilities be?
  - Will you be expected to formulate the research problem?
  - How much direction will the advisor give?
  - How frequently will individual and group meetings occur?
- Ask for copies of grant proposals.
- Talk to other students in the research group.
- Take a course with a potential thesis advisor (*e.g.*, ECE 498).

Incomplete List of Research Positions Available

- Reliable Distributed Systems - contact Prof. W. Sanders, whs@crhc.uiuc.edu (talk later by Prof. M. Cukier)
- VLSI Test - contact Prof. J. H. Patel, patel@crhc.uiuc.edu
- Computer Architecture - contact Prof. N. Carter, npcarter@crhc.uiuc.edu
- Adaptive Infrastructure for Clusters - contact Prof. S. Lumetta, lumetta@crhc.uiuc.edu

What Should You Get Out of Graduate School?

- Post-graduate evaluation metrics
  - GPA and standardized tests
    - plays little (MS) or no (Ph.D.) direct role
    - may impress potential advisors
    - may improve fellowship chances
  - publications
    - important contributions to the field (quality, not quantity)
    - measure communication ability
  - references
    - get to know more than one faculty member
    - pick challenging class projects, turn them into papers
    - talk to people at conferences
    - do an internship

Hamming Quotes

"When I first started, I got practically physically ill while giving a speech, and I was very, very nervous. I realized I either had to learn to give speeches smoothly or I would essentially partially cripple my whole career."

—Richard Hamming

"…if you have the door to your office closed, you get more work done today and tomorrow, and you are more productive than most. But ten years later somehow you don't quite know what problems are worth working on; all the hard work you do is sort of tangential in importance. He who works with the door open gets all kinds of interruptions, but he also occasionally gets clues as to what the world is and what might be important."

—Richard Hamming

If you don’t like what you’re doing, you’re in the wrong place.

—Jim Gray, recipient of the 1999 ACM Turing Award,
on graduate school (paraphrased from memory)