

Computer Engineering Annual Report, 2003-2004

Computer Engineering focuses on the design, analysis and application of computers and on their applications as components of systems. The UCSC Department of Computer Engineering sustains and strengthens its teaching and research program to provide students with inspiration and quality education in the theory and practice of computer engineering.

Departmental Mission Statement

Achievements

The past year has seen many achievements within the Department of Computer Engineering.

- We hired our two top Assistant Professor candidates, Jose Renau in computer architecture, and William Dunbar in robotics. We appointed NASA/Ames robotics and engineering education leader Illah Nourbakhsh as an Adjunct.
- We spun off our ground-breaking BS in Bioinformatics program.
- We organized a highly successful ABET re-accreditation visit.
- We instituted a new two-quarter senior design project course.
- We designed a new undergraduate concentration in multimedia systems.
- We received grant and gift income of \$2.2M, and have already received large grants for 2004-5.
- We formed an industrial and academic computer engineering advisory board.
- We established a new student organization, the UCSC Engineering Honor Society.
- We educated 138 majors and pre-majors and 76 graduate students.
- We graduated 50 BS, 24 MS, and 5 PhD students.
- We earned a rank of 45 for our graduate program from US News and World Report.

Computer Engineering is among the most productive departments in the School. Based on the 2002-3 data used in the CLP process, CE has the highest level of research activity and is tied at second highest in teaching workload. As a result of our excellence and efficiency, CE has the highest workload in the School (using the School's 1/3 research and 2/3 teaching weighting), and per-capita is 35% above the SOE average.

Goals and objectives

The Department's focus areas are computer system design, design technologies, digital media and sensor technology, computer networks, and embedded and autonomous systems (robotics). It is always our goal to sustain and strengthen our teaching and research in these areas.

In addition to continuing and extending our excellence in research, service, and education, we will also be working on four administrative goals:

- Completing the MSNE program's move to campus direction and increasing enrollments.
- Graduate student outreach and coordination with other SOE programs.
- Expanding our advisory board.
- Increasing contact with alumni and donors beyond our annual letter.

Opportunities for the near future

The Department has identified four exciting opportunities for the near future.

- An invigoration of our central areas of computer system design and design technologies. Because of the loss of Professors Karplus and Dai and service load of Professors Ferguson and Larrabee, we have had to turn away many highly qualified applications in the VLSI/CAD area. Indeed, we have difficulty placing the small number of students accepted in this area. Computer Engineering was originally renowned in this area, but the static period of no new recruitments from 1991 to 2000 resulted in a languishing of this area. We must rebuild our core strength with 2-3 hires to ensure and enable undergraduate and graduate education, training, and research of the highest quality.
- A cluster hire in assistive technologies. This area is of extreme importance to the aging population. A group of 3-6 faculty and the creation of a research center could propel us to excellence. The group would have strong collaborations with faculty in digital media and sensor technology, embedded and autonomous systems, and Electrical Engineering. This could form a nucleus, with other SOE programs, for launching academic and research programs in bioengineering. Between 1999 and 2002, the number of Bioengineering BS degrees granted increased by 50%, MS by 78%, and PhD by 30%. In the System, bioengineering programs have been or are being created at every campus, and UCSC will host the 2005 Systemwide Symposium on Bioengineering.
- Programs in robotics. With the recent appointments of William Dunbar, Gabriel Elkaim, and Illah Nourbakhsh, and affiliated interests of Luca de Alfaro, Pak Chan, and Roberto Manduchi in CE, and control theorist Jorge Cortes in AMS, we are poised to launch exceptional robotics research and degree programs.
- An industrial affiliates program in network engineering. The Department will work with renowned networks researcher Professor J.J Garcia-Luna to establish an affiliates group for networking researchers in Computer Engineering, Computer Science, Electrical Engineering, and Information Systems and Technology Management.

Participation in the broader campus community

The Department has continued its tradition of an exceptionally high level of service.

- Professor Ferguson served as Provost of Crown College and SOE Associate Dean. Due to his campus leadership, he has been elected 2004-5 Chair of the Council of Provosts.
- In the Academic Senate, Professor Manduchi served on Academic Freedom, Professor Varma on Academic Personnel, Professor Mantey on Admissions and Financial Aid, Professor Hughey on Educational Policy (chairing for 2004-5), and Professor Obraczka on Faculty Welfare.
- Professor Hughey served on the Strategic Futures Committee, which planned for academic program growth to the year 2020.
- Within the SOE, Professor Varma directed the Korea Telcom program, Professor Mantey chaired the Information Systems and Technology Management advisory committee, Professor Hughey participated in the AMS Committee, and faculty members Cyrus Bazeghi and Stephen Petersen redesigned the capstone course for CE and EE majors.
- Professor Larrabee and Manger Guevara's Herculean efforts toward our and EE's ABET accreditation visit enabled a seamless review that is expected to result in a six-year continuation for CE and a 6-year initial accreditation for EE (<http://www.soe.ucsc.edu/~larrabee/abet>).
- Professors Tau and Hughey and students established the Engineering Honor Society.
- Professors de Alfaro led writing of one of the six chapters of the UARC proposal.
- Long Marine Lab Director Gary Griggs and Professor Hughey held a collaboration workshop between the Monterey Bay marine sciences community and the SOE.

- Computer Engineering sponsored an off-site retreat of the NASA Robotics Group, led by our new Adjunct Associate Professor Illah Nourbakhsh. We look forward to continuing collaborations with Professor Nourbakhsh and NASA
- Professors Hughey led the NIH Training Grant in Bioinformatics proposal with BME Professors Rohl and Lowe, and serves on the Bioengineering MRU Steering Committee.
- Professor Mantey has been involved in STEPS, IGPP, UARC, and CITRIS.
- Professor de Alfaro organized the first workshop on “Games in Design and Verification.”

Advancing diversity

Engineering as a profession and academic discipline suffers from an absence of diversity. The Computer Engineering Department is working to address this problem.

- Instructor Guy Cox and Professor Hughey lead an NSF Research Experiences for Undergraduates Site SURF-IT, a summer research program with a focus on increasing the number of women and underrepresented minorities in engineering. The program is hosting ten women and two men from institutions such as Swarthmore College, Georgia Tech, and our Berkeley campus.
- Professor Ferguson has leadership roles in the Multicultural Engineering Participation (MEP) program and the NSF Developing Effective Engineering Pathways (DEEP) program with De Anza and Foothill Colleges.
- Professor Hughey was selected as faculty advisor by our Society of Women Engineers chapter. During the current year, discussions with members led to the incorporation of gender issues into our required CE80E: Engineering Ethics, and also a new emphasis on the placement of female faculty members in early courses. The Department and SWE are continuing to work together on this ongoing and at times troublesome issue.
- Professor Manduchi is advisor to our Society of Hispanic Professional Engineers chapter.

2003-4 Graduate Degrees Granted by Computer Engineering

| Student | Degree | Advisor | Title |
|------------------------|---------------|----------------|--|
| Anand, Manju | MS | Hughey | Kompiler: A Compiler for the Kestrel Parallel Processor |
| Ananthateerta, Ashwini | MS | de Alfaro | Early Error Detection |
| Bakshi, Joyopriya | MS | Dai | Custom-cell Based Domain-specific Macro Degeneration for Digital Signal Processing Applications |
| Balakrishnan, Ramesh | MS | Garcia-Luna | |
| Balasubramanian, C. | MS | Garcia-Luna | Shortest Multipath Routing Using Labeled Distances for Mobile Ad-Hoc Networks |
| Bao, Ye | MS | Schlag | A History-based Scheduling Medium Access Protocol for Ad-Hoc Networks |
| Barangan, Alex | MS | Kang (EE) | High-Speed Low-Power Adder Design Using Parallel-Dynamic Logic |
| Bhandari, Vaibhav | MS (CS) | de Alfaro | Chai-A Tool for Synchronous Interfaces |
| Chinthalapati, Eswara | MS | Brandwajn | Networks Project Course (Distance Learning MS) |
| Desai, Chintan | MS | Varma | Multifield Packet Classification Using Partitioned TCAMS |
| Dong, Lihua | MS | Chan | Design of a PCI Communication System Between an FPGA Board and a PC |
| Flynn, Lori | Ph.D (CS) | Garcia-Luna | Qualified Multicast Distribution Tree Creation and Repair |
| Frank, Ajoy | MS (CS) | Manduchi | A Real-time Motion Segmentation and Video Compression System for Surveillance |
| Garcia, Rita | MS (CS) | Madhyastha | Skyline Computer Assisted Programming: A Supplemental Tool for Introductory Programming Courses |
| Ghosh, Rumi | MS | Brandwajn | Networks Project (Distance Learning MS) |
| Gupta, Puneet | MS | Brandwajn | Networks Project (Distance Learning MS) |
| Kaushik, Yogesh | MS | Brandwajn | Networks Project (Distance Learning MS) |
| Kumar, Ashwani | MS | de Alfaro | FLEXI: A Tool for Interface Automata |
| Liu, Kai | MS | Dai | System-in-Package Design in RF Application |
| Luo, Fangyi | MS | Dai | Layout Wiring Generation |
| McKenna, Paul | MS (CS) | Karplus | Computational Analysis of Conserved Intronic ReF 03gions Associated with Alternative Splicing Events |
| Mosko, Marc | Ph.D | Garcia-Luna | Routing in Mobile Ad Hoc Networks |
| Poonawala, Aryn | MS | Milanfar (EE) | Reconstructing Shapes from Support and Brightness Functions |
| Potireddy, Sireesh | MS | Mantey | Floor Control for IP Video Collaboration |
| Sankaran, Krishna | MS | Brandwajn | Networks Project (Distance Learning MS) |
| Shakih, Aman | Ph.D | Varma | Management of Routing Protocols in IP Networks |
| Sun, Jiannhwa | Ph.D | Langdon | The NEO Binary Entropy Coding Method and System |
| Wang, Yu | Ph.D | Garcia-Luna | Medium Access Control in Ad Hoc Networks with Omni-Directional and Directional Antennas |
| Zhou, Chuxiao | MS | Tao | Dynamic Depth Recovery from Unsynchronized Video Streams |

2003-4 Research and Training Funding Received

| Amount | Researcher(s) | Agency | Grant or Gift Title |
|---------------|--------------------------|---------------|--|
| \$45,000 | Larrabee, Ferguson | Intel | Realistic Defect Modeling and Test Generation |
| \$12,000 | Hughey, Karplus | NSF | The UCSC Kestrel Server (supplement for undergraduate research) |
| \$133,404 | Garcia-Luna | UCSB | MURI: Protocols to Support Wireless and Mobility |
| \$86,047 | de Alfaro | NSF | CAREER: Structured Design of Embedded Software |
| \$45,000 | de Alfaro | UCB | Rich Interfaces for component-Based Design |
| \$25,990 | Manduchi | CMU | Dynamic Maps: Mixed Initiative Robotic Perception in Dynamic Environments |
| \$96,840 | Manduchi | NSF | Randomized Invariant Features for Recognition |
| \$99,467 | Manduchi | NSF | Randomized Invariant Features for Recognition |
| \$34,339 | Mantey, Garcia-Luna, Tao | UC DIMI | TeleEducation/TeleCollaboration and Streaming Multimedia |
| \$96,482 | Hughey, Madhyastha | NSF | Summer Undergraduate Research Fellowship in Information Technology |
| \$35,000 | de Alfaro | UCB | Rich Interfaces for component-Based Design |
| \$7,200 | Chan, Schlag | UC/MICRO | Multi-Threaded Multiprocessing vs Multicast Multiprocessing for Parallel Placement and Routing |
| \$10,000 | Chan, Schlag | Xilinx | Multi-Threaded Multiprocessing vs Multicast Multiprocessing for Parallel Placement and Routing |
| \$30,649 | Ferguson | UCOP MESA | MESA Engineering Program (MEP) Center (2003-2004 budget) |
| \$75,000 | Garcia-Luna | Raytheon | Netfires, UCSC Network Protocol Research |
| \$1,800 | Chan, Schlag | UC/MICRO | Multi-Threaded Multiprocessing vs Multicast Multiprocessing for Parallel Placement and Routing |
| \$150,000 | Larrabee | NSF | Fault Diagnosis for Yield Improvement and Silicon Debug |
| \$179,877 | Obraczka | NSF | A Hybrid Systems Framework for Scalable Analysis and Design of Communication Networks |
| \$23,850 | Tao | UC DIMI | Real-Time Image-Based Rendering Using Sparsely Placed Video Cameras (renewal) |
| \$34,164 | Tao | Honda | Real-Time Image-Based Rendering Using Sparsely Placed Video Cameras (renewal) |
| \$145,000 | Dai | UCB | MARCO Design and Test Focus Center |
| \$102,690 | Varma | Altera | Gift, FPGA systems for digital logic and FPGA design courses |
| \$21,000 | Tao | NEC | Gift, the research of Professor Hai Tao |
| \$200,000 | Varma | Lucent | Optical Data Router (ODR) Architecture Design and Evaluation |
| \$12,000 | Obraczka, Brandwajn | NSF | Design and Evaluation of Protocols for Wireless Multi-Hop Ad Hoc Networks |
| \$100,000 | Tao | NSF | CAREER: Elements in Solving the Multiple Object Tracking Problem |
| \$80,000 | de Alfaro | NASA/Ames | Interfaces and Model Checking for Software |
| \$21,000 | Garcia-Luna | Anyang U. | Joint Project with Anyang University (Korea) |
| \$104,450 | Hughey | NIH/NIGMS | Predoctoral Bioinformatics Training at UCSC |
| \$202,333 | Karplus, Hughey | NIH/NIGMS | Combined Methods for Protein-Structure Prediction |