The Department of Electrical Engineering and Computer Science:
A Brief Overview (1970 – 2010)

by

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Foreword

The current Department of Electrical Engineering and Computer Science (EECS) grew out of several related programs and departments, including the Computer, Information and Control Engineering (CICE) program (established 1969), the Computer and Communication Sciences (CCS) Department (renamed in 1967 from the Communication Sciences Department, established 1964), and the oldest entity, the Electrical and Computer Engineering Department, originally named Electrical Engineering (established in 1905).

A history of the Department of Electrical Engineering (1895-1970) was written by Richard K. Brown in 1970. This was meant to coincide with the 75th anniversary of the founding of the Department, and celebratory lectures were given in April and May of that year. However, in 1994 when preparations began for the 100th anniversary, it was discovered that 1895 was not the date that the department was founded, but was instead the year that the first undergraduate degrees in electrical engineering were granted. The Regents' action in 1895 was to establish a Department of Engineering (later, College of Engineering). The Department of Electrical Engineering was actually created in 1905.

A forty-year history of the Department is offered here as a continuation of Richard K. Brown's work, and focuses primarily on the structure and administration of the Department as it resided in the College of Engineering. Several appendices capture additional information that was not previously available in summary form.

1970's: Department of EE Becomes ECE

In 1970, the Electrical Engineering Department was located in the East Engineering building (now East Hall) on Central Campus (Fig. 1). Its chair was Joseph E. Rowe who had been appointed in 1968, and he was assisted by Jack Cochran who had served as the Administrative Manager for the past 5 years and occupied an office next to that of the Chair. The Department had 33 full, 13 associate, and 9 assistant professors, as well as 6 lecturers.

Most faculty engaged in research, and were associated with one or more of the Departmental Research Laboratories. These were:

Fig. 1: East Engineering Building (now East Hall).

• Bioelectrical Sciences Laboratory (William J. Williams, Director) located on the roof of East Engineering

• Cooley Electronics Laboratory (Thomas W. Butler, Jr., Director) located in the Cooley Building on North Campus

• Electron Physics Laboratory (George I. Haddad, Director) located on the third floor of East Engineering

• Power Systems Laboratory (John J. Carey, Director) located in the basement of East Engineering

• Radiation Laboratory (Ralph E. Hiatt, Director) located in the Space Research Building on North Campus

• Systems Engineering Laboratory (rotating Director) located on the second floor of East Engineering

• Electro-optics Laboratory (Emmett N. Leith, Director) located in the IST building on North Campus.

Although research support, particularly from the Department of Defense, was becoming harder to obtain, the laboratories were reasonably stable.

By 1968, faculty and student interest in the theory and utilization of information processing systems had grown throughout the College of Engineering to the extent that an interdepartmental graduate program, the Computer, Information and Control Engineering (CICE) program, was initiated to cover this emerging discipline. In the next decade it grew to well over a hundred students with 43 affiliated faculty from five different departments, and a curriculum of almost seventy courses.

The existing undergraduate program in electrical engineering was in a state of almost constant change in order to adapt to new technological trends and serve the needs of the students. With the recent decrease in program length to 128 hours and the introduction of a 3-option program, many new junior level courses were being developed, with emphasis placed on computer engineering, communication systems and power systems. But even greater changes were about to occur.

Reflecting the growing importance of computers, in July 1971 the Regents created the new degree of Bachelor of Science in Engineering (Computer Engineering), i.e., B.S.E. (Comp.E), and changed the Department's name to Electrical and Computer Engineering. The Department was then charged with the responsibility for all computer-oriented faculty in the College. This presented our 50 or so faculty of Electrical Engineering with a choice. Most chose to remain Professors of Electrical Engineering, but 16 became Professors of Electrical and Computer Engineering and one became a Professor of Computer Engineering. The distinction lasted only 5 years and by 1976 all faculty were shown as Professors of Electrical and Computer Engineering in accordance with the name of the Department.

In the early 1970's, mainframe computers that required either direct card input at a small number of sites, or later, interaction over telephone lines using Teletype machines, dominated the scientific computing environment of the University. The operating system for the IBM mainframe known as the Michigan Terminal System (MTS) was developed at the University of Michigan Computing Center in the 1960's with the help of Computer and Communication Science (CCS) faculty members such as Bernard A. Galler (who later joined EECS), Bruce W. Arden, and Frank Westervelt. It was very much ahead of its time and dominated not only Michigan computing but computing at many other locations worldwide. There was also a strong infrastructure of documentation and instruction to support it. The computer field as a whole was moving

fast, with mainframes still dominant, but minicomputers were starting to take hold, and in 1972 the Merit Computer Network, connecting Michigan, Michigan State, and Wayne State, went on-line (see Fig. 2).

The first B.S.E. (Comp.E) degrees were awarded in Spring 1973. Initially, the total number of bachelor degrees awarded per year was about the same as it had been, but by the end of the decade the number had almost doubled, with the computer degrees representing a third of the total. The increase was in spite of a drop in both the general fund allotment and the number of faculty members.

For the Fall 1972 semester, Lawrence L. Rauch served as Acting Chair while Rowe was on leave, and then in the summer of 1974 Rowe resigned to accept the position of Dean of Engineering and Vice Provost at Case Western Reserve University in Cleveland, Ohio. John A.M. Lyon was appointed Acting Chair for a 1-year term starting September 1974.

Fig. 2: Merit Network PDP-11 based Primary Communications Processor (PCP) with custom high speed communication and IBM I/O channel interfaces. This photograph was taken on the 2nd floor of the University of Michigan Computing Center Building, Ann Arbor, MI, circa 1975. Credit: Merit Network, Inc.

A little earlier, the Electro-optics Laboratory was moved from the IST building on North Campus to the East Engineering Building. The Laboratory was directed by Emmett N. Leith and was integrated with the Interferometry Laboratory directed by Charles M. Vest of the Mechanical Engineering Department. Technically they functioned as a single interdisciplinary laboratory. With Carey's retirement, Mark K. Enns was appointed Director of the Power Systems Laboratory, and Theodore G. Birdsall replaced Butler as Director of the Cooley Electronics Laboratory. Later the same year the Radiation Laboratory moved into space on the west side of the fourth floor of East Engineering, effectively trading places with the Atmospheric, Oceanic and Space Sciences department. It was the first time the Laboratory had been in the same building as the Department, and the increased visibility had an immediate effect on the number of graduate students it was able to attract.

On 1 July 1975, George I. Haddad was chosen to be the new ECE Department Chair with a 5-year term, and Nino Masnari replaced him as the Director of the Electron Physics Laboratory. In line with a suggestion made two years earlier, the Department was now organized as two Divisions – Electrical Engineering and Computer and Information Systems – with an Associate Chair for each, and John A.M. Lyon and Keki B. Irani were given these positions (see Fig. 3 for the organization). A Vehicular Electronics Laboratory was also established with an equipment grant of $250K from the Bendix Corporation. Its director was Dale M. Grimes (who was later replaced by William R. Ribbens) and it was located on the third floor of the East Engineering Building next to the Electron Physics Laboratory.
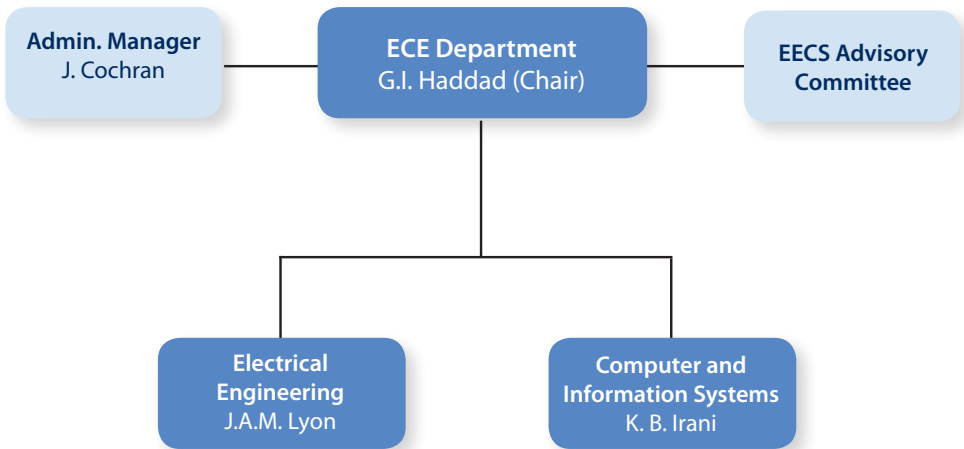

Fig. 3: ECE Department Organization - 1975.

In October 1975, Thomas B.A. Senior was appointed Director of the Radiation Laboratory. Two years later the University announced its intention to sell Willow Run Airport and the Laboratory was forced to vacate its experimental facilities there. Most of these, including a large anechoic chamber and a tapered one, were located in Hangar II at the airport. In the summer of 1977 many of the facilities were moved to the (very large) Room 525 in the basement of East Engineering. Using material salvaged from the anechoic chamber in Hangar II, a new and improved tapered chamber was built in part of Room 525. The construction was largely a student project, even to the decorative paneling on the outside of the chamber. The remaining facilities at Willow Run were transferred to the Beck Road side of the airport, and later expanded to include outdoor scattering and antenna ranges.

In 1977, Jack Cochran resigned his position as Administration Manager, and some of his duties were taken over by Richard A. Volz, who had earlier replaced Irani as Associate Chair. Two years later, Irani took over from Volz who had been appointed Associate Director of the Computing Center on North Campus, and Betty E. Cummings was appointed Administrative Manager of the Department, with fiscal responsibilities. By then the increasing enrollment was placing severe strains on the faculty whose numbers had not increased, and throughout the 70s our faculty count remained almost constant at about 36 full time equivalents (one full time equivalent (FTE) means an effort totaling 100% by any number of faculty. For example, two faculty members with 50% appointments would equal 1 FTE).

During the previous 5 years the undergraduate enrollment had gone up 50 percent, to 528 in EE and 240 in CE. The graduate enrollment had also risen to 176 in ECE and 127 in the Computer, Information and Control Engineering (CICE) program, and even with the higher graduate admission standards proposed for the next year, the enrollment was still expected to increase by 35 percent. The sponsored research support per annum was $2.5M, and most graduate students were financially supported through fellowships, research assistantships (RAs) or teaching assistantships (TAs). The average annual faculty salaries at about this time were $31K, $25K and $19K for full, associate and assistant professors.

During the 1970's, several senior faculty left the Department. Masnari was appointed Head of the Department of Electrical Engineering at N. Carolina State University, and he was replaced by Kensall D. Wise as Director of the Electron Physics Laboratory. Enns and Farhad Nozari also left. They were both faculty in the power systems area, and with their departure the Power Systems Laboratory ceased to exist. Our earlier efforts to build up the area had not been successful. Because of the failure of the power industry to provide research support and job opportunities for our graduates, these areas were becoming less popular and several courses were eliminated. Grimes left to become Department Chair at the University of Texas in El Paso, and Rauch left to join JPL. One bright spot was the award of the National Medal of Science to Emmett N. Leith in 1979 for his achievements in making holography a practical reality. This is the highest federal government honor for scientists and engineers and was presented by President Carter.

The seventies were a very difficult time for the State of Michigan. Because of the Middle East oil embargo, the auto industry plummeted and the State economy followed suit. The University felt the impact of the reduced State funding, and even though our enrollment at both the undergraduate and graduate

levels almost doubled, we were not able to add to (or even replace) our faculty. There were very few merit pay increases and, for a couple of years, none at all. But even with these hardships a good research program was maintained, with motivated faculty and excellent students. Towards the end of the decade the National Academies carried out a survey and ranking of university departments. We were rated 13th in the nation, and this did not sit well with us, the College or the University. Part of the problem was the way the statistics were gathered. Because those of our students who graduated through the CICE program were not credited to the Department, we were shown as graduating an average of only 5 PhD.'s per year. This was one of several factors that led to the re-organization of the Department in 1984.

1980's: The Move to North Campus and a New EECS Department

In 1980, Haddad was reappointed for an additional 5 year term. Lyon and Irani continued as Associate Chairs. Despite repeated requests to the College and the University Provost, the funds that the Department desperately needed were not forthcoming. The space that it occupied in East Engineering badly needed renovation and some of it was unsafe and demoralizing. For example, there was a "fifth floor" on the roof consisting of the biomedical engineering teaching laboratory and several faculty offices. These were reached through an outside door at the top of the staircase and elevator shaft, and required going across the open roof – unpleasant under all circumstances and dangerous in bad weather and winter. There was also not enough room for all of the classes to be taught, and some of the larger classes had to compete for rooms in buildings across Central Campus. Despite this, in 1981 there was a freeze on all faculty hiring throughout the College, and the Department's request for 8 new positions was put on hold.

Fortunately, things began to change in July of that year with the appointment of James J. Duderstadt as Dean of the College. Within a year the College's general fund allocation increased significantly, making possible the hiring of new faculty (all of the Department's 8 requests) and the implementation of a new salary structure. This included significant increases for assistant professors to improve the quality of new hires, and for the most productive senior faculty to discourage them from leaving. These were in addition to annual merit raises, and by 1983 the average faculty salaries in the Department were $48K, $38K and $35K for full, associate and assistant professors respectively.

A distraction in the early 80's was the opposition to so-called weapons research. A vocal minority of students and faculty was demanding an extension

to all university research of the "end-use" clause in the Regents' classified re-search guidelines, with the particular objective of banning research sponsored by the Department of Defense. Several College faculty came under attack for their work, and were forced to defend it before committees, in public forums and in the press. On 7 November 1983, 27 members of a group called the Progressive Student Network occupied the Radiation Laboratory's experimental facilities in the basement of East Engineering, seeking to end the "nuclear research" going on. The sit-in continued for two days and attracted considerable publicity, but not the support of other students and faculty that the demonstrators had hoped for. To avoid confrontation, the decision was made to give the demonstrators a reasonable time in which to leave, and they did so after 48 hours.

When a second group calling themselves the Nuclear Saints staged a sit-in a week later on 14 November, the decision was taken to evict them. At 2:30 am the next morning Senior read them the trespass law and gave them 10 minutes in which to leave. This they did in the face of a massive force of Ann Arbor police and security personnel, but only after being compelled to identify themselves and have their pictures taken. It turned out that most were not U-M students. An earlier sit-in at the Electron Physics Laboratory had led to the arrest of five students, but at a court hearing a few months later they were acquitted on promising not to repeat their act. There were no further demonstrations, but an interesting postscript came five years later when a half-dozen Nuclear Saints returned to the Radiation Laboratory (now on North Campus) for a reunion. One of them came from as far away as Boston. They handed out "twinkies" to those in the Laboratory, along with a flier that sought to justify their previous demonstration, but this time there was no confrontation – only smiles and handshakes.

Despite the targeting of the department by the protestors, there was, in fact, no nuclear research and no direct weapons research being conducted by the Department. The classified research that did exist in the Department was not of the nature presumed by the protestors.

In the summer of 1982 the University approved a plan to re-start the College's move to North Campus, involving all of the College except this Department, and thereby freeing up some of the space occupied in the West Engineering Building. As part of this, the Dean's suite of offices would be moved to a much smaller area in the Chrysler Center and all that would be left in West Engineering was the ship towing tank in the basement. The vacated space was needed to accommodate the Economics Department whose building adjacent to West Engineering had burned down on Christmas Eve 1981. The move started almost at once and though there was no immediate help for our Department,

the State provided $0.5M for planning the new Engineering Building I (EBI) that was to be our home on North Campus. Construction of the $30M building was later approved and ground breaking took place on 17 May 1984 (see Fig. 4). Major laboratories as well as computing facilities, classrooms and offices would

Fig. 4: Groundbreaking with Harold T. Shapiro (President of the University of Michigan), James Blanchard (Governor of Michigan), and James J. Duderstadt (Dean of the College of Engineering).

occupy 125,000 sq. ft. of the building, with an additional 12,000 sq. ft. for the Solid State Electronics Laboratory. Construction was scheduled for completion by May 1986, in time for us to move in that summer.

The Department structure also underwent a major change during this time. For several years it had been felt that the fractured nature of computing and information systems at the University was hindering enrollment and faculty recruiting, as well as our national ranking. This was stressed in the 1983 report of the CICE Review Committee, and after much discussion the Dean recommended that the CICE program be discontinued and merged into an ECE Department reorganized to have three divisions: Electrical Sciences, Systems Engineering, and Computer Engineering. It was also proposed that the Department of Computer and Communication Sciences (CCS) in LS&A be invited to join the College of Engineering either as a new department closely associated with the Computer Engineering Division of ECE, or as a Computer Science Division of the restructured ECE Department. Those ideas were discussed throughout 1983 and in a Memorandum of Understanding dated 18 February 1984 between the Deans of Engineering and LS&A it was recommended that the CCS Department be incorporated in a Computer Science and Engineering (CSE) Division of a newly named Electrical Engineering and Computer Science (EECS) Department. These organizational changes were approved by the Regents at their February 1984 meeting to take effect July 1984.

The new EECS Department would offer three undergraduate degrees: Electrical Engineering (EE), Computer Engineering (CE) and Computer Science (CS), and though the Department would be fully responsible for the CS program, the degree would remain an LS&A degree. At the graduate level the number of degrees awarded by the Department also increased, with the Master of Science in Engineering (M.S.E), Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) available in three areas: Electrical Engineering (EE), Electrical Engineering:Systems (EE:S), and Computer Science and Engineering (CSE).

The CCS Department was well established by 1984, with much ground breaking research done in the 1950's and 1960's, including the programming language Michigan Algorithm Decoder (MAD), the Merit Network, and the Michigan Terminal System (MTS). MTS came out of a joint development with IBM for a seminal time-sharing system initially developed for the IBM 360/67 mainframe computer system. The first Ph.D. in the computer science field at Michigan was awarded to John H. Holland in 1959, and CCS was founded in 1967 as an outgrowth of Communication Sciences. The industry was moving quickly to the personal computer with the development of the Apple II in 1977, the IBM PC in 1981, and the Apple Macintosh in 1984. In 1983 the Computer-Aided Engineering Network (CAEN) was founded to bring the College of Engineering into the new age of distributed computing, allowing personal computers and mainframes to begin to talk to one another, and establishing the early email systems, long before the Internet.

The summer of 1984 was a very busy one. To integrate the ECE, CCS and CICE courses into a new program, it was necessary to change their numbers and pre-requisites. The following numbering system was adopted to better group the courses:

EECS	X00-X09	Mathematics and Numerical Analysis
	X10-X19	Circuits and Plasmas
	X20-X29	Electronic Design and Materials
	X30-X39	Fields, Optics and Acoustics
	X40-X49	Power and Energy Conversion
	X50-X59	Communications and Signal Processing
	X60-X69	Control and Robotics
	X70-X79	Computer Organization and Formal Systems
	X80-X89	Computer Software Systems
	X90-X99	Intelligent Systems

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┌──────────────────────┐      │      ECE Department          │
│   Admin. Manager     │──────│ 1800 Students   69 Faculty   │
│  Betty E. Cummings   │      │  George I. Haddad (Chair)    │
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ECE Department

1800 Students   69 Faculty

George I. Haddad (Chair)

Admin. Manager

Betty E. Cummings

Electrical Engineering

45 Faculty

George I. Haddad (Chair)

Computer Science and Engineering

24 Faculty

Gideon Frieder (Chair)

Electrical Science

27 Faculty

Thomas B.A. Senior
(Assoc. Chair)

Systems Science

18 Faculty

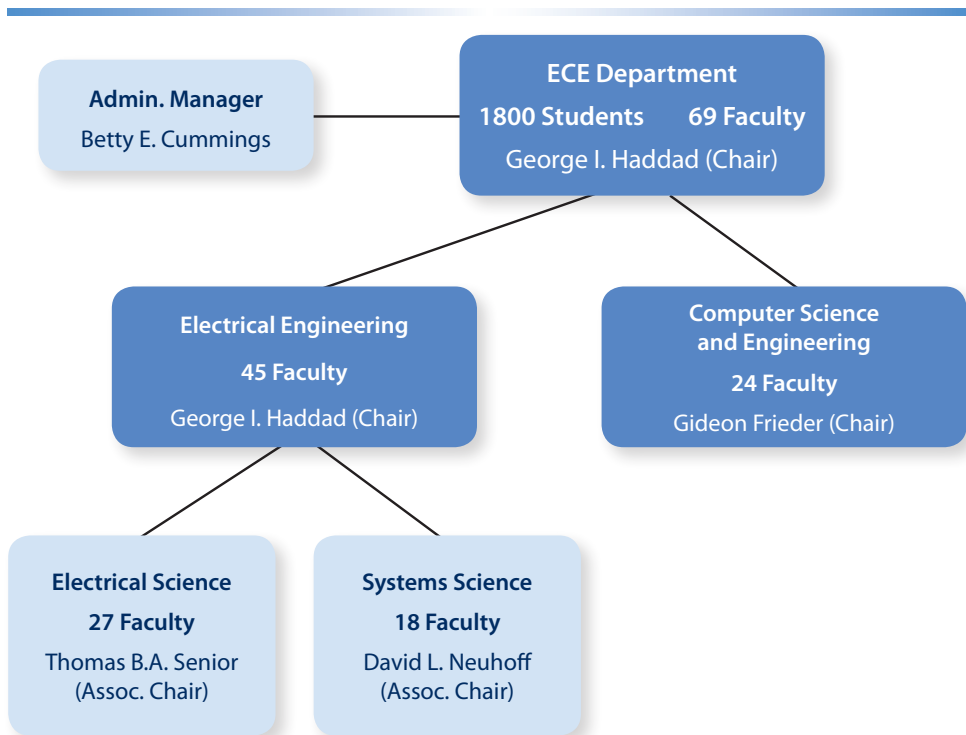David L. Neuhoff
(Assoc. Chair)

Fig. 5: EECS Department Organization - 1984.

Revision of the courses themselves was an on-going task, particularly through 1984, and creating the new graduate program was also a major job. The CCS and (most of) the CICE faculty took appointments in the new Department and as of Fall 1984 the organization was as shown in Fig. 5. The two parts of the Department were officially referred to as Divisions and the Division Chairs were Regental appointments. One of the Division Chairs would be the Department Chair, in this case Haddad. The other Chair was Gideon Frieder who had chaired the CCS Department in LS&A for the previous three years. Aside from responsibilities for their Divisions, the Associate Chairs had additional responsibilities – Senior for course and teaching assignments and Neuhoff for graduate affairs. We were by far the largest department in the College, and with the new building on North Campus little more than a hole in the ground, we already exceeded its planned capacity.

Meanwhile we had to get by in the cramped space of East Engineering. Our enrollment continued to grow particularly at the undergraduate level, and in a 1980 survey of incoming College freshmen, 75 percent indicated ECE as their preferred major. After several requests from the Department, the College agreed to limit the number of undergraduate admissions to the Department

in April 1984. However, soon after the restrictions were put in effect, they were no longer necessary, and enrollments (particularly in EE) decreased of their own accord. The restrictions were then eliminated.

In July 1985 Haddad was re-appointed Chair for an additional 12 months, and his term was later extended to the end of 1986 to cover the move to North Campus. Frieder, Senior and Neuhoff retained their positions. In the December 1985 Report of the Department Review Committee it was recommended that the Department be organized as 3 Divisions, and when Frieder was replaced by Irani in September 1986, the Department was shown as having the following three Divisions: Electrical Science and Engineering (ESE), Systems Science and Engineering (SSE), and Computer Science and Engineering (CSE), each headed by an Associate Chair, as shown in Fig. 6. This continued for the next 15 years. The Report also proposed the phasing out of the power systems and acoustics areas, and this did occur.
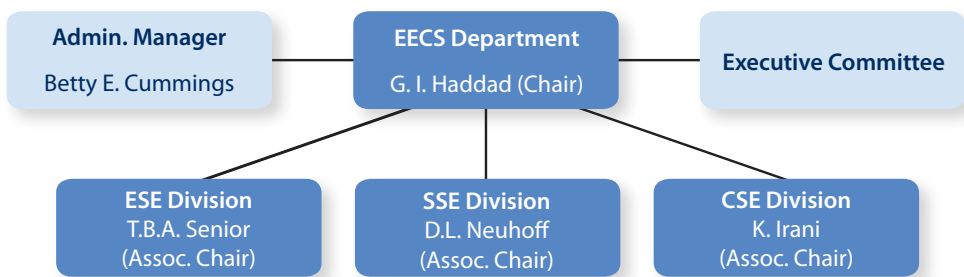
Admin. Manager Betty E. Cummings	EECS Department G. I. Haddad (Chair)	Executive Committee

ESE Division T.B.A. Senior (Assoc. Chair)	SSE Division D.L. Neuhoff (Assoc. Chair)	CSE Division K. Irani (Assoc. Chair)

Fig. 6: EECS Department Organization - 1986.

The five year period starting in 1982 was a very critical and exciting period for the Department. Approximately fifty new faculty members were hired in all three divisions and they formed a tremendous base for the Department to excel in the future. These faculty members went on to make the department among the top five in the nation. Haddad, in his last year, headed a proposal activity with 12 other faculty which resulted in the Center for High Frequency Microelectronics. This center, which came about from a Department of Defense University Research Initiative (URI), was the largest research program in the University at the time and amounted to $15 million from the Army and $5 million from the State's Research Excellence Fund. This major center was the first of several others in the Department in the following years.

On the computing side, several new organizations were started during this period. In 1985 the NCUBE computer was purchased, starting large-scale parallel computing research and development on campus. In 1986, the Center for Information Technology Integration (CITI) was founded by Daniel E. Atkins and

Richard L. Phillips to start sponsored research with industrial partners to make distributed computing part of the Michigan computing culture. In 1987, the NSFNet was established at Michigan to build and manage a national computer network. This was also an important period for the entire CSE Division, with the establishment of the Advanced Computer Architecture Laboratory (ACAL) in 1985 with John P. Hayes as Director; the Real-Time Computing Laboratory (RTCL) in 1985 with Kang G. Shin as Director; the

Fig. 7: Dedication of the EECS Building in 1986 with George Haddad at the podium.

Artificial Intelligence (AI) Laboratory in 1988 with Ramesh Jain as Director; and the Software Systems Laboratory (SSL) in 1989 with Galler as Director. Galler also founded the Software Patent Institute in 1990. The Theory Group was established in 1996 with Yuri Gurevich as the first Director. A disadvantage was the geographical split in the CSE faculty, with the AI and ACAL groups joining Robotics in the ATL Building, CITI located off campus, and only Software and Theory housed with the rest of the Department in the EECS Building.

The move to the new EECS Building (formerly Engineering Building I) on North Campus took place in the late summer of 1986 (see Figs. 7 and 8 for photos of the dedication and the new EECS Building) . It was not a simple matter. We now had 91 faculty, and though all of the faculty offices had new furniture, each required different things in the way of bookcases, filing cabinets and shelves. The Dean moved into a suite of offices on the west side of the second floor, and the Chair into a (smaller) suite on the floor above. All of the laboratories also had to be transferred. The space allocated for optics on the ground floor needed to be altered, and until that was done, most of the optics activity remained in the basement of East Engineering. Robotics also remained there until its move into the Advanced Technology Laboratory (old ITE Building) on North Campus in May 1987.

Having been in East Engineering for 39 years during which the nature of engineering had changed completely, there was an enormous amount of dis-

Fig. 8: The new EECS Building with the new walkway through North Campus.

carded equipment and material stored in the basement and elsewhere. Some of this was quite valuable from an historical perspective. All of it was sorted through by Ken McGrath (the Equipment Manager) and others, and what was worth keeping was put in storage in the basement of the Observatory. Over the years it was moved several times until, in early 2010, it was finally discarded by the College, just weeks before the Department sought to retrieve some of it for an historical exhibit.

Haddad's first period as Chair ended in December 1986, after 11 ½ years. With the recent faculty hires and the new emphasis on research, sponsored research had blossomed to over $10M per year. He had started out with a relatively small traditional engineering department and ended with a much larger one whose faculty had different approaches to academic life, particularly in how administrative decisions were made and how often meetings were to be held. Haddad and his administration worked effectively with these differing perspectives and was able to achieve a relatively harmonious atmosphere.

While the search for a new Chair took place, Senior was appointed Acting Chair for 6 months starting 1 January 1987, and when the search became prolonged, his term was extended to the end of 1987. Fawwaz T. Ulaby was appointed Radiation Laboratory Director, and Neuhoff and Irani remained as Associate Chairs. In the belief that a new Chair would soon be found, Senior remained as Associate Chair for the ESE Division. The year was primarily a waiting period, but one important change that was made during this year was to improve the undergraduate counseling. Prior to 1987, we had just a professional Academic Counselor and a Chief (faculty) Program Advisor for each undergraduate program (EE, CE, and CS). We now added 3 more faculty positions for the EE and

CE programs and 2 for the CS program. The positions would be held by junior faculty on a rotating basis, and this had the advantage of familiarizing them with our programs.

Edward S. Davidson was named Chair of the Department at the end of 1987, and his appointment began 1 January 1988. He had been the Associate Director of the Center for Supercomputing Research and Development at the University of Illinois, and had for several years chaired the Computer Engineering Area Committee there. Davidson retained the three Associate Chairs who were in place.

By the Fall of 1988, the number of faculty had increased another 16% to 101, and this, combined with a slow but steady decrease in undergraduate enrollment (about 25% over 4 years), meant fewer over-sized classes and more reasonable SCH/faculty ratios. Davidson made faculty recruiting his first priority, with the aim of putting Michigan on the map as a serious contender in CSE. Sponsored research was also increasing and several new research centers were started, including: the NASA Center for Terahertz Technology, directed by Ulaby as part of the Radiation Laboratory and established in 1988; and the NSF Center for Ultrafast Optical Science (CUOS), directed by Gérard A. Mourou, and started in 1990. CUOS was part of the Ultrafast Science Laboratory that was established when Mourou and his colleagues came here from the University of Rochester, and was housed in the bay area of the IST building (now Engineering Research Building I, or ERB I).

In April 1989, Virginia R. Wait was hired as Administrative Manager to replace Cummings who became the Research Administrator for what was now called the Solid-State Electronics Laboratory. When Haddad stepped down from the Chair position, he returned to that Laboratory as Director. Wise, the previous Director, established the Center for Integrated Sensors and Circuits, focusing on what began to be referred to as microelectromechanical systems (MEMS). The Solid-State Electronics Fabrication Facility, a full processing laboratory for sensors, devices and circuits, was now in operation. It was equipped using funding obtained through the State of Michigan Research Excellence Program and the U.S. Army's Center for High Frequency Microelectronics, and included a separate instructional laboratory for two undergraduate courses. The Department was soon to realize a disadvantage in having an advanced fabrication facility as part of the building, and the all-too-frequent fire alarms that resulted from any small spill or mishap, no matter how minor, were quite disruptive.

In an effort to better show our appreciation to all our students it was decided to treat them to a buffet lunch at the end of the Winter term. The last day of classes is always a Tuesday and because of the other activities generally held

on that day, we chose the previous day (Monday) and called it "The St. George's Day Feast." It was rumored that the name was chosen by someone of English origin who wanted to balance the attention given to St. Patrick's Day, but the choice was not inappropriate since St. George's Day (April 23) is always close in time. The name influenced what was done. Barbara Toma, the ESE/SSE Academic Counselor, sewed aprons and purchased toy medieval equipment for the 15 or so faculty who took part in the opening parade and in manning the food tables. It was extremely popular and enjoyed by all, including students from departments other than ours. Apart from a gap of a few years, the feast has been held every year since then.

1990's: Growth and Changes

Davidson stepped down as Chair at the end of 1990. Haddad was appointed Chair for a 3-year term starting 1 January 1991. Pallab K. Bhattacharya replaced him as Director of the Solid-State Electronics Laboratory. To make the Chair's task less burdensome, Haddad added the position of Associate Chair for Academic Affairs to the departmental organization, as shown in Fig. 9. The Associate Chair for Academic Affairs was responsible for all matters relating to courses, teaching assignments, etc. Senior took on this position for the entire department, though later each Associate Chair for the different divisions would take responsibility for academic affairs in their own area. David J. Anderson had replaced Neuhoff as the Associate Chair for the SSE Division in April 1990, and Kang G. Shin was appointed as Associate Chair for CSE.
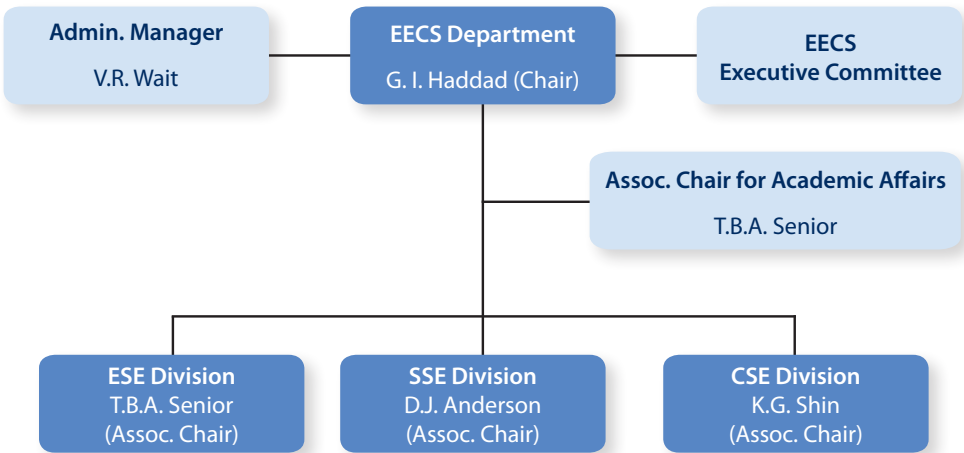

Fig. 9: EECS Department Organization - 1991.

One of the first tasks confronting Haddad was to get the finances in order. The Department had accumulated a debt of over $1.5M, and at a time when the College (and University) were subject to budget constraints, it would take careful planning over several years to eliminate it. It was hoped to do so without major impact on our academic and research programs, and among the steps that were taken were a more equitable assignment of teaching responsibilities, bearing in mind the administrative loads and research offsets of the faculty (this would lead to a reduction in the use of adjunct faculty), delays in filling faculty slots, and a request to faculty to contribute half of the departmental cost-sharing on proposals. With help from the College, it took three years to eliminate the debt.

In 1991, the Department was, by almost all measures, at least a third of the College. We had 99 faculty and $21M of external research support of which 82 percent was federal, with more in the form of grants, fellowships, scholarships and equipment. The research volume had increased considerably in recent years, as had the number of Ph.D. degrees awarded, and the total of undergraduate degrees awarded had been maintained. Indeed, our research productivity as measured by research dollars per faculty FTE led the College, and our instructional productivity, measured by student credit hours per faculty FTE, was also high, though declining relative to other departments. The average faculty salaries were now $86K, $66K, and $52K for full, associate, and assistant professors respectively.

In 1995, CSE started holding annual retreats for their faculty off-campus. Topics of interest included research, faculty search, new courses, and special topics of general interest to the faculty and students. The Associate Chair took a number of steps to give our CSE program more national visibility and get into the national rankings. Prior to this our CS program was not ranked. In 1996 our graduate program in computer science was ranked 18th by U.S. News & World Report; it was 13th in 2010. Computer Engineering, which was already ranked, was 9th by *U.S. News & World Report*. The Computer Research Association ranked our faculty quality as 21st (it was 13th in 2010).

In the other Divisions, research continued to increase in variety and dollar amount. On the systems side, the Cooley Electronics Laboratory had evolved into the Communication and Signal Processing Laboratory, and when Birdsall stepped down as Director in April 1994, Neuhoff replaced him. In addition, a Control Laboratory was established, as well as a Biosystems Laboratory. The optics and solid-state research were also increasing, and in FY 1995 the total research expenditure for the department exceeded $33M. The 1995-96 Departmental Review Report listed 7 Research Centers. They were:

- ARPA Center for Optoelectronic Science and Technology
- NASA Center for Space Terahertz Technology
- NIH Center for Neural Communications
- NSF-STC Center for Ultrafast Science
- SRC Center for Automated Semiconductor Manufacturing
- State of Michigan Center for Display Technology and Manufacturing
- URI-ARO Center for High-Efficiency Microelectronics

The organization of the Department had also changed, and a chart taken from that Report is shown in Fig. 10. Toby J. Teorey had replaced Shin as the Associate Chair for CSE in 1994, and as had become customary, the Departmental Computing Organization (DCO), located on the 4th floor of the EECS Building, reported to that Chair. Pramod P. Khargonekar had replaced Anderson as the Associate Chair for SSE, and he was also responsible for graduate affairs.

In 1996, the existing graduate program in Biomedical Engineering, which began in 1962 as part of the Department of Electrical Engineering, became part of the newly-established Department of Biomedical Engineering (BME). Charles A. Cain, a member of the EE Department, was the first Chair of the new Department. David J. Anderson took a partial appointment with BME, and Matthew O'Donnell became the second Chair of BME in 1999, a position he held until 2006.

The National Advisory Committee (NAC) was established in 1996 to provide advice and counsel to the Chair. It had 10 members from industry and academia, and its first Chair was Joseph E. Rowe, our former Department Chair. The role of the NAC was to provide feedback on departmental issues. The committee met annually as a general rule, though there were gaps as different Chairs took office. The final meeting of the committee was in 2007, and one of their last roles was to provide their input when the Department was again considering a new structure.

During the summer of 1996, the College administrative offices were moved from the EECS Building to the newly completed Robert H. Lurie Engineering Center Building. Construction of the adjacent car park had required the reconfiguration of Beal Avenue, thereby eliminating the long straight downhill road that had once been the site of the annual soap box derby (or go cart) races. That summer when the college administration vacated the EECS Building, the faculty offices for the CSE Division and the Solid-State Electronics Laboratory were consolidated in that space, thereby improving faculty interaction.

EECS National Advisory Committee

EECS Department Chair
Haddad

EECS Executive Committee

Admin. Manager
Wait

EECS Assoc. Chair for Academic Affairs
Senior

Flexible Staff and TA's

Graduate Affairs

SSE Division
Khargonekar
(Assoc. Chair)
25 Faculty
4 Res. Sci.

ESE Division
Senior
(Assoc. Chair)
33 Faculty
22 Res. Sci.

CSE Division
Teorey
(Assoc. Chair)
29 Faculty
5 Res. Sci.

DCO

ITS
White
0 Fac
2 R.S.

Biosystems
Williams
7 Fac.
1 R.S.

Control
Grizzle
7 Fac.
1 R.S.

SP
Hero
6 Fac.
1 R.S.

Comm.
Neuhoff
5 Fac.
1 R.S.

EM
Ulaby
8 Fac.
3 R.S.

SS
Bhattacharya
16 Fac.
10 R.S.

Optics
Steel
9 Fac.
7 R.S.

HS
Mudge
9 Fac.
0 R.S.

AI
Laird
6 Fac.
4 R.S.

Software
Stout
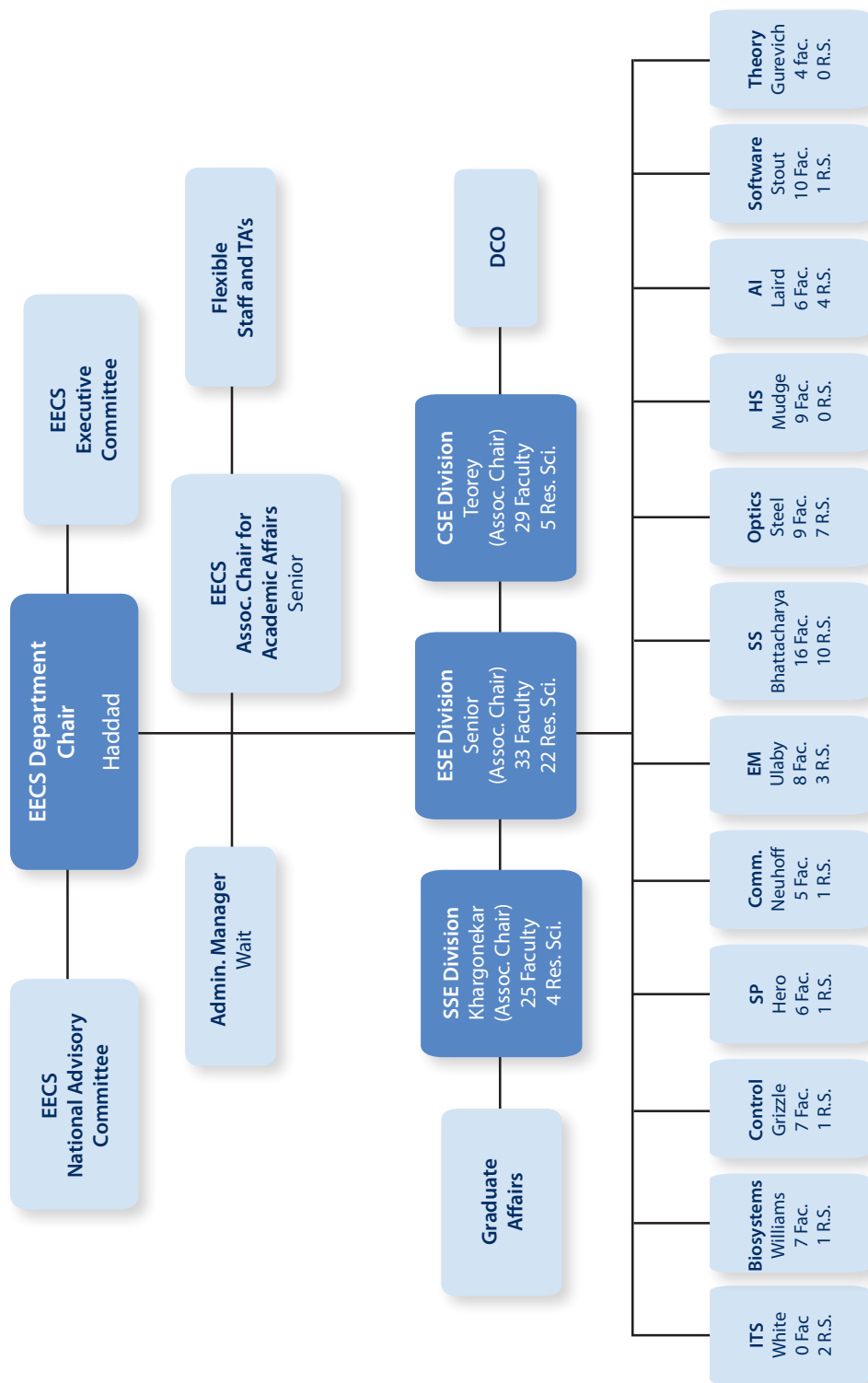10 Fac.
1 R.S.

Theory
Gurevich
4 fac.
0 R.S.

Fig. 10: EECS Department Organization - 1996.

When Prof. Haddad stepped down for the last time as Chair of the Department in 1997, he had served for nearly 20 years in that position, beginning in 1975. During those 22 years, research funding went from $2M to $35.8M per year, the faculty count doubled from 44 to 89, PhD's graduated went from 7 to 66, and the number of graduate students went from 212 to 650. He left an indelible mark on EECS.

In October 1997 Khargonekar was named the new EECS Department Chair with a 5-year appointment, though he would leave in 2001 to take the position of Dean of the College of Engineering at the University of Florida at Gainesville. The position of Associate Chair for Academic Affairs was eliminated (Senior had retired the previous June) and its duties were divided up among the three Associate Chairs. Richard B. Brown took over as Associate Chair for the ESE Division, Wayne E. Stark for the SSE Division, and Davidson for the CSE Division. Two years later Stéphane Lafortune replaced Stark as Associate Chair.

In preparation for the search for a new Chair, the College appointed a committee chaired by Khargonekar to develop "A Strategic Plan for the EECS Department," and its report was submitted in April 1998. It noted, for example, that the Department's student credit hours and research funding were both 36 percent of those for the College as a whole, whereas our faculty size was only 29 percent and the space allocated 26 percent. The undergraduate enrollment in the EE program appeared to have stabilized, albeit at a reduced level compared with a few years earlier, but the CE and CS enrollments were continuing to grow, placing a large burden on the CSE faculty and staff resources. The Report suggested that the Department (and College) aim to reduce our class sizes, particularly in the undergraduate courses, and a key recommendation that affected the search for a new Chair was that the 3-Division structure of the Department be retained.

2000's: One Department – Two Divisions, Two Chairs

In March 2000 Dean Stephen W. Director formed the EECS Futures Committee. This was charged with looking into the organization of the Department, with a focus on how to do better in CS. The final report was issued the following October and listed the pros and cons of a variety of possibilities ranging from the present organization to two entirely separate departments. Five specific plans were presented. These were widely discussed over the following year and in October 2001 a new organization was approved by a majority of the EECS faculty.

EECS would remain one department with one chair, but would now have two divisions: Electrical and Computer Engineering (ECE) consisting of the former ESE and SSE Divisions, and Computer Science and Engineering (CSE). Faculty could align themselves with one or both, but their tenure would be with the Department. Each Division would have an Associate Chair and an Executive Committee composed of 4 tenure-level faculty and one Associate Chair, with the Department Chair as an ex-officio member. For the Division to which the Chair did not belong, the Associate Chair would have direct input to the College and substantial autonomy in matters such as faculty hiring. The organization is shown in Fig.11.
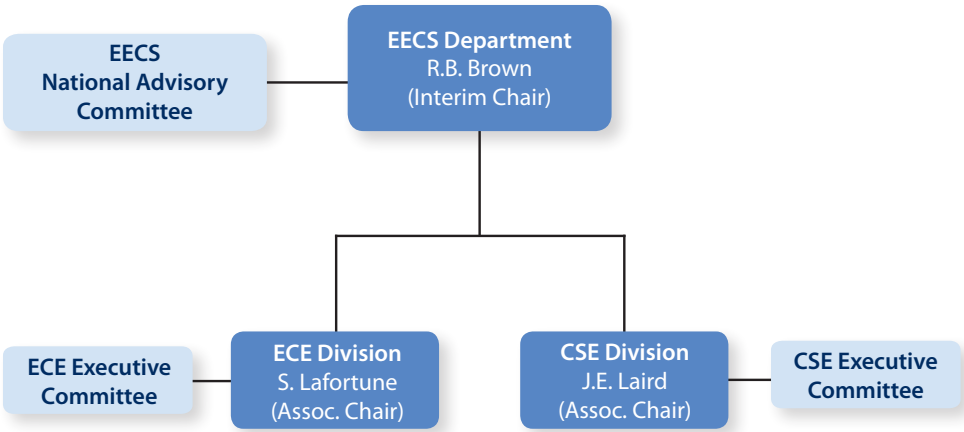

Fig.11: EECS Department Organization - 2001.

Meanwhile, there were other changes taking place. In the summer of 2001 authorization was given for a new CSE Building on North Campus, and planning began immediately. That same year saw the creation of a CS undergraduate degree in engineering: the Bachelor of Science in Engineering (Computer Science), i.e. B.S.E. (Comp. S.). Prior to that, the only CS undergraduate degree available was in LS&A, and though we had had the B.S.E. (Comp.E.) since 1971, there were problems with this arrangement. In 2000, the EECS National Advisory Committee said that because of the considerable overlap in the curricula of the CS and CE degrees, there was too much "brand" confusion, and as a result of this, we were losing out in the recruitment of students. The CSE Division faculty had been debating this for several years, but now they had some clout to add a CS degree in engineering in which Computer Science meant a strong emphasis on software, in contrast to the CE degree where the emphasis was on computer hardware.

The new CS degree in engineering was to have the same core computer courses as the degree in LS&A, including one required course in computer hardware, but there were also the differences necessary to satisfy the different College requirements. In addition, the CE degree was modified to have only one required course in software (programming), with the rest in hardware design. Students who wanted more of a balance between hardware and software could achieve this with either degree by choosing the appropriate elective courses. The first CS degree in engineering was awarded in December 2001.

In order to obtain ABET accreditation for the two CS degrees (ABET required that both programs be accredited since they had the same title), it was necessary to add five more credits in physics to the LS&A degree. This was to prove a major deterrent to students in LS&A who wished to study Computer Science, and enrollments decreased over the next decade, as they were doing nationally after the .com bubble burst in 2000. At the same time, however, enrollments in Michigan's CS degree in engineering increased dramatically.

CS-LSA was accredited by ABET from 2003 to 2012, but it rapidly became obvious that the two CS programs, CS-ENG and CS-LSA, served two very different populations of students. In 2012 the CSE faculty, in consultation with LSA students, the LSA and CoE administrations, and industry advisors, voted not to apply for re-accreditation for the CS-LSA degree.

Meanwhile, concern was being expressed about the atmosphere in the Department and the impression that it created on those outside. A "Climate Audit" was conducted in early 2001 and the May 2001 Executive Summary made it clear that there were several areas in which the climate in EECS could be improved. Over the next few years, steps were taken by the student societies and others to make the Department a more welcoming place, and a decade later, faculty, staff and student groups remain committed to fostering and maintaining a friendly and supportive environment in EECS.

In July 2001 Khargonekar was granted personal leave for the following academic year, and since he had been announced as the new Dean of Engineering at the University of Florida, it was evident that he had to be replaced as EECS Chair. Brown was appointed Interim Chair for a one year term. In June 2000 Davidson had retired and he had been replaced by John E. Laird as Associate Chair for the CSE Division. He continued in that post, and with the re-organization of the Department, Lafortune became the Associate Chair for ECE. Because of all the changes that were taking place, it is not surprising that there was some confusion and uncertainty in the air. This had an effect on the search for a new Chair, resulting in several of the potential candidates opting not to be considered. The net result was that the committee was disbanded and a

new committee was appointed in the fall of 2002. Brown's appointment as Interim Chair was now continued for another year.

2001 saw the first William Gould Dow Distinguished Lecture. The Lectureship was established by friends and family of William Gould Dow, who had died on 17 October 1999 at the age of 104. His 38 years on the faculty, including 6 as Department Chair, had an enormous influence on the evolution and growth of the Department. The first lecture was by Robert W. Lucky, corporate vice-president of Telcordia Technologies, on 9 November 2001, a date chosen to coincide with the dedication of the statue of Claude E. Shannon (BSE EE and Eng. Math 1936; ScD hon. 1961) outside the west door of the EECS Building (see Fig. 12).

Fig. 12: Bust of Claude E. Shannon outside the West entrance to the EECS Building.

Prof. Brown organized the first departmental Alumni Society during the 2002 Homecoming Weekend. Several individuals at the meeting were asked to become board members, and Bill Becher (MSE PhD EE '61 '68) agreed to serve as the first President of the Society. Brown also revived the EECS newsletter, which had ceased to be published in the mid 1990's. It was published in 2003, and has continued since that time.

In the Spring of 2003 the Carl A. Gerstacker Building adjacent to ERB1 was completed, and some of the optical research activities were moved in, along with the Advanced Technology Laboratory. A more auspicious occasion was the groundbreaking for the CSE Building on November 21, 2013 (see Fig. 13).

In June 2003, David C. Munson, Jr. was appointed as the new Chair of EECS with a 5-year term. Munson's previous appointment was at the University of Illinois, where his primary research interests were image and signal processing. Brown took a sabbatical leave and later accepted the position of Dean of Engineering at the University of Utah. Laird continued as the Associate Chair for the CSE Division and Anthony W. (Tony) England replaced Lafortune as the Associate Chair for the ESE Division.

Fig. 13: Groundbreaking for the new Computer Science and Engineering Building.

L: Donald Schmitt (architect), Stephen Director (Dean, College of Engineering), Kevin O'Connor (BSE EE '83; Progress & Promise fundraising campaign co-chair), Jerry Levin (BSE EE, Math '66 '67; Progress & Promise fundraising campaign co-chair), Mary Sue Coleman (President, University of Michigan), Prof. John Laird.

A key focus of the Department under Munson's leadership was the undergraduate program. For the past decade and more, the focus had been on research and its associated graduate program. This was necessary to increase the visibility and reputation of the Department, and also to bring the number of Ph.D.'s awarded up to the level that was felt desirable. In large measure, these goals had been achieved.

But now, most of the introductory undergraduate courses needed to be revised. Since changes here affected many of the later courses, all faculty rapidly became involved. Within a year both Divisions were holding faculty meetings once a month, with Department-wide meetings slotted in between. A driving force behind all of this was the ABET accreditation scheduled for the Fall of 2005.

An internal review of the department was carried out in 2004, and its report, published in August 2004, was generally favorable. Surveys of faculty and students revealed no major problems, though some students (particularly undergraduates) felt that the environment should be more friendly, with more opportunities (and places) for interaction and socializing. These needs

influenced the planned renovation of the EECS Building, which included an expansion of the existing cleanroom facility.

In September 2004, England was appointed Associate Dean for Academic Affairs in the College, and Brian E. Gilchrist replaced him as Associate Chair for the ECE Division. Martha E. Pollack replaced Laird as Associate Chair for the CSE Division. This same year, the Solid-State Electronics Laboratory was selected as a member of the National Nanotechnology Infrastructure Network (NNIN) funded by NSF. Ground breaking for the new Nanofabrication Facility took place on 15 April 2005 (see Fig. 14), and in September a day-long symposium on High Frequency Microelectronics was held to honor the contributions of George Haddad to this university and the research community on the occasion of his retirement. Haddad retired that September.

Over the past few years several senior faculty had either left or retired, and one result of this was a decrease in the amount of external research support. By 2006 it had decreased to the level it was ten years earlier, but it would soon start to increase again.

Fig. 14: Groundbreaking ceremony for the Lurie Nanofabrication Facility.

L: Warren Welch (PhD candidate in electrical engineering), Khalil Najafi,(SSEL Lab Director), Ann Lurie, Stephen Director (Dean, College of Engineering), Mary Sue Coleman (President, University of Michigan), Jerry Levin (BSE EE, Math '66 '67; Progress & Promise fundraising campaign co-chair), Donald C. Graham, David C. Munson, Jr. (Chair, EECS).

2006 was a year of significant changes with renovations to the EECS Building, the completion of the CSE Building, another change in Chairs, and another look at the structure of EECS. Renovation of the ground floor of the EECS Building began in April and shortly thereafter the new CSE Building was completed (see Fig. 15). When the CSE faculty moved in that summer, it brought them all together for the first time in one building. The portion of the ENIAC (Electronic Numerical Integrator and Computer) that Arthur W. Burks had brought to Michigan was again displayed, this time in the entrance to the new building (see Fig 16). Burks was a key member of the ENIAC design team, and also helped establish the Communication Science Graduate Program, and later the Department of Computer and Communication Sciences, in LS&A. When the new EECS Department was formed, he became an EECS faculty member until his retirement in 1986.

During the summer of 2006 Munson was named Dean of the College of Engineering, after three years as EECS Chair. When he took the position on 1 July he became the third Dean in succession to have an EECS faculty appointment. Gilchrist was appointed Interim Chair of the Department and Jeffrey A. Fessler replaced him as the Associate Chair for the ECE Division. Pollack continued as the CSE Associate Chair.

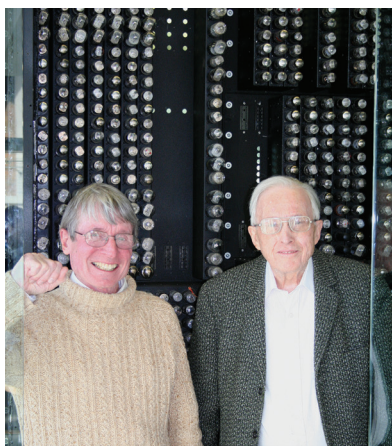**Fig. 15: Interior and exterior of CSE Building.**

Fig. 16: John Holland and Arthur Burks in front of the ENIAC in 2006.

The question of how the Department should be organized came up again, and the CSE Division began discussing various possibilities, including the splitting off of CSE to form a new engineering department. In Spring 2006 the CSE and ECE executive committees met to consider the ramifications of such a change. Discussions on the topic expanded to include the entire EECS faculty, and several scenarios were voted upon during the year. The final vote on a variety of organizational scenarios occurred January 2007, with the outcome being the retention of one EECS Department, but with several key changes.

EECS would remain one Department, but with two largely autonomous Divisions, each headed by a Chair. There was no longer a single Chair of EECS. Each division was given its own budget, sole responsibility for hiring and tenure decisions, and equal representation in College matters. The CSE Division was given responsibility for the CSE graduate program and the CS/ENG undergraduate program. The ECE Division was given responsibility for the EE and EE:Systems graduate programs and the EE undergraduate program. The CE undergraduate program would be jointly administered by both Divisions. The new structure was agreed to by the Dean, and upon Regental approval went into effect 1 May 2008.

In July 2007 Pollack resigned her position as Associate Chair of CSE to become the Dean of the School of Information and Farnam Jahanian took over as Associate Chair of the CSE Division. Gilchrist was re-appointed Interim Chair of the Department for an additional year. Much of this time would be spent on developing the plans for the new organization, showing how funds would be allocated, how administrative duties would be shared or split up, and so on. The new EECS Bylaws were approved by the CSE and ECE faculties on 18 April and 28 May 2008, respectively.

Meanwhile, there were other things going on. Reflecting a growing emphasis on globalization, the EECS Department had signed a research partnership agreement with Seoul National University in South Korea to facilitate graduate research involving both institutions, and the first took place on 21 February 2007. Improvements to our undergraduate advising procedures continued, and as approved in April 2007, all undergraduate students were paired with faculty for advising and career counseling, and were expected to meet with an advisor prior to registration.

The renovation of the ground floor of the EECS Building was completed in the fall of 2007. It included a lounge and socializing areas, the dB Café (operated by the HKN and IEEE student societies), a Showcase Laboratory for elementary circuits courses, and improvements to the classrooms (see Fig. 17). New display cabinets were also installed in the atrium. Changes to the rest of the building continued and by early 2008 new faculty and staff lounges (the former including an expensive coffee-making machine) had been completed on the third floor, followed by an adjacent conference room dedicated to George I. Haddad (see Fig. 18). The new Lurie Nanofabrication Facility (LNF) (see Fig. 19) was dedicated on 11 April 2008. The expansion cost, including that of the building and new equipment, was over $60M. It now offers 12,000 sq. ft. of clean room supported by over 60,000 sq. ft. of infrastructure, and is a world-class resource for solid-state devices, microsystems and nanotechnology.

Fig. 17: dB Cafe, CAEN Lab, Open Area.

2007 marked the 50th anniversary of the first graduate program in computing. Initially called Communication Sciences, it was renamed Computer and Communication Sciences (CCS) when it became a department in 1967. The CSE Division commemorated this event by organizing a symposium called CSE@50, which was held May 7-9, 2008.

Fig. 18: George I. Haddad Conference Room.

Fig. 19: Lurie Nanofabrication Facility.

Shortly thereafter, on 1 July 2008, the new departmental organization took effect. After national searches in both divisions, Khalil Najafi was appointed as the ECE Division Chair and Farnam Jahanian as the CSE Division Chair, both with 5 year terms. Jahanian's term began July 1, 2008, while Najafi's term began September 1, 2008. Many details as to how the Department would operate had still to be worked out, but to most students the change that had taken place was almost invisible, and this was intended.

In the new structure, each Division had an Associate Chair, and in ECE that person had to be from the area (ESE or SSE) not represented by the Chair. Neuhoff was given the position with the added responsibility for graduate affairs. A similar policy was followed by CSE, and since the Chair was in the software area, an AI person was appointed Associate Chair. He was Michael P. Wellman, and he was also responsible for academic affairs in the Division. The new organizational chart is shown in Fig. 20. In 2010 Karem A. Sakallah replaced Wellman as Associate Chair for the Division. By January 2009, both Divisions had dedicated staff in the area of marketing and communications, allowing them to give greater attention to publicity, recruitment, and alumni.
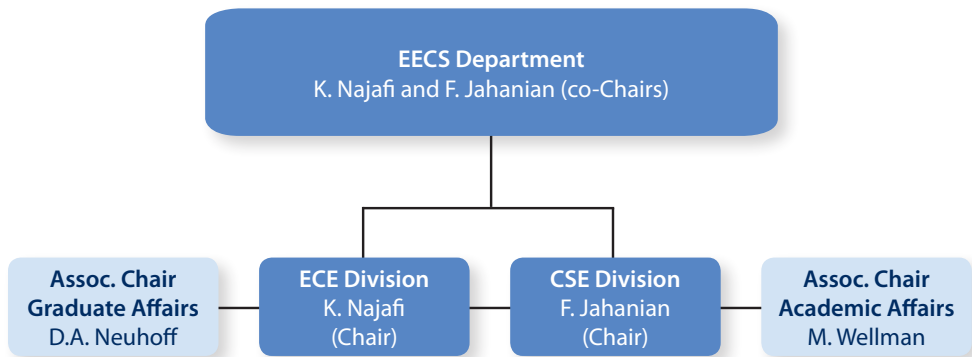
Fig. 20: EECS Department Organization - 2008.

Several faculty hired in the 21st century helped open new areas of research. Global concerns with energy and sustainability prompted the ECE Division to focus hiring in the area of Power and Energy. The hiring of new faculty enabled courses in this area to be offered in 2009, and in the summer of 2010, a new power systems laboratory was established in the EECS Building. Plasma Science also received more emphasis, and in 2009, the Michigan Institute for Plasma Science and Engineering (MIPSE) was established, funded in part by a grant from the HP Labs Innovative Research Program. Mark Kushner served as founder and first director of MIPSE. Computer vision and big data were expanding research areas in both divisions, and achievements in robotics by new and existing faculty brought this field into greater light.

Both divisions grew their outreach activities in the first decade of the 21st century. The WIMS Center and the NNIN provided the support for most outreach in the ECE Division, including workshops and activities for K12 students as well as professionals. The popular Nanocamp gave middle and high school students access to the Lurie Nanofabrication Facility, showing them how things like their iPods are made. In the CSE Division, K-12 outreach activities were strengthened, and a website called CS Connections was launched to highlight the CS outreach to K-12 students and educators. Both Divisions regularly participate in College of Engineering programs that bring high school students to campus for special programs during the summer.

2010: The State of EECS

Over the past 40 years the Department has changed from a traditional and more narrowly-focused group into a broad-based intellectual endeavor spanning a wide range of old and newly-emerging areas. The research areas defined for each Division as of 2010 were as follows:

Computer Science and Engineering:

- Artificial Intelligence
- Computer Architecture
- Computer-Aided Design and VLSI
- Interactive Systems
- Quantum Science and Engineering
- Robotics and Computer Vision
- Software Systems
- Theory of Computation

Electrical and Computer Engineering:

- Applied Electromagnetics
- Communications
- Control Systems
- Integrated Circuit Design and VLSI
- MEMS and Microsystems
- Optics and Photonics
- Plasma Science and Engineering
- Power and Energy
- Quantum Science and Engineering
- Robotics and Computer Vision
- Signal and Image Processing
- Solid-State Devices and Nanotechnology

The research laboratories were:

Computer Science and Engineering

- Advanced Computer Architecture Laboratory (ACAL)
- Artificial Intelligence Laboratory (AI)
- Software Systems Laboratory
- Theory of Computation

Electrical and Computer Engineering

- Michigan Integrated Circuits Laboratory (MICL)
- Optics and Photonics Laboratory
- Radiation Laboratory (RADLAB)
- Solid-State Electronics Laboratory (SSEL)
- Systems Laboratory

The major centers were:

- NSF Center for Wireless Integrated Microsystems (WIMS), established in 2000 for a 10-year term with Kensall D. Wise as Director;

- ARL Micro Autonomous Systems and Technology (MAST) Center for Objective Microelectronics and Biomimetic Advanced Technology, established in 2008 for an initial 5-year term with Kamal Sarabandi as Director;

- NSF Sensing Sensors: Compressed Sampling with Co-design of Hardware and Algorithms across Multiple Layers in Wireless Sensor Networks, established in 2009 for an initial 5-year term with Michael P. Flynn as Director; and

- DoE Center for Predictive Control of Plasma Kinetics: Multi-phase and Bounded Systems, established in 2009 for an initial 5-year term with Mark J. Kushner as Director.

As of 2010, the Department had 61 full, 18 associate, and 23 assistant professors, as well as 8 lecturers, with about 60 percent in the ECE Division. The total is almost double that in 1970. The FTE count has also increased (to 98 from 36) and the average faculty salaries have climbed to $149K, $108K and $93K for full, associate and assistant professors, respectively. The number of named professorships, awarded to senior professors for outstanding contributions to research, teaching and leadership, now stands at 24 in the Department thanks to an effort at the College level to recognize more deserving faculty in this way.

The new departmental structure had been successful, allowing each division to focus on its own priorities while remaining a single unit. Managing the undergraduate computer engineering degree is the area of greatest overlap between the two divisions. Each division is now able to respond more quickly to changing areas of research and other activities. One of those activities is serving the 20,000+ EECS alumni living throughout the world.

While students have always been at the heart of the Department, faculty focused even more attention on them in the first decade of the 21st century. The Department began to financially support interdisciplinary teams in greater numbers, an activity that continues to expand. EECS began to sponsor departmental awards for undergraduate students to reward extraordinary efforts in research, academics, service, and entrepreneurship. The Department initiated a career mentorship program for undergraduate students. Faculty committees were formed with the sole purpose of improving student life for both undergraduate and graduate students. All of these activities have made a positive impact on EECS students, and efforts targeting student life are expected to increase.

By all numerical measures the output in terms of students and research has increased significantly since 1970: the number of undergraduate degrees awarded by a factor 2, the number of Ph.D. degrees by a factor 3, and the sponsored research support by a factor 19 (a factor 3 when adjusted for inflation). The Department's academic programs are nearly all ranked in the top seven in the country.

The 21st century promises to be an era of exciting technological changes, with EECS at the heart of most of them. With the entire University of Michigan community preparing for its bicentennial celebration in 2017, we look forward to blazing new trails, while reflecting on where we have been.

Acknowledgements and Additional Resources

There are two documents relating to the earlier history of the Department:

(i) *History of the Department of Electrical Engineering*, by Melville B. Stout and Alfred H. Lovell. [note: this is a 30 page, typed informal history that provides information about the department from its earliest years through 1952.]

(ii) *The Department of Electrical Engineering: A 75-Year History (1895-1970)*, by Richard K. Brown.

Both are available from the Bentley Historical Library, 1150 Beal Avenue, Ann Arbor, MI 48109.

Additional historical documents that provide information about the department include:

(i) *Radlab History*, by Thomas B.A. Senior, revised May 2011.

(ii) *Computing at the University of Michigan: The Early Years through the 1960's*, by Norman R. Scott. Supplement by Toby J. Teorey. Compiled for the CSE@50 celebration, May 7-9, 2008.

(iii) Bernard A. Galler provided an aural history of his life at U-M and of computing at U-M in 1991. Galler came to U-M in 1955. The document is in the Bentley Historical Library.

(iv) *A Century of Connectivity at the University of Michigan*, edited by Nancy Bartlett, Nancy Deromedi, Alice Goff, Christa Lemelin, Brian Williams, 2007.

(v) *Fantastic Voyage: History of Microsystems development at the University of Michigan 1975-2000,* and *Fantastic Voyage 2: History of Microsystems development at the University of Michigan 2000-2010.*
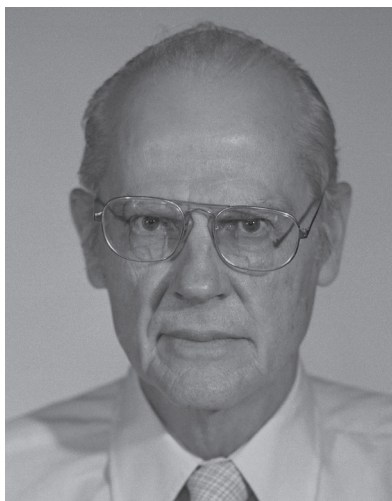
Appendix 1: Department Chairs (1970 – 2010)

Joseph E. Rowe
Chair
Jul 1968 – Aug 1972;
Jan 1973 – Aug 1974

Lawrence L. Rauch
Acting Chair
Sept 1972 – Dec 1972

John A.M. Lyon
Acting Chair
Sept 1974 – Jun 1975
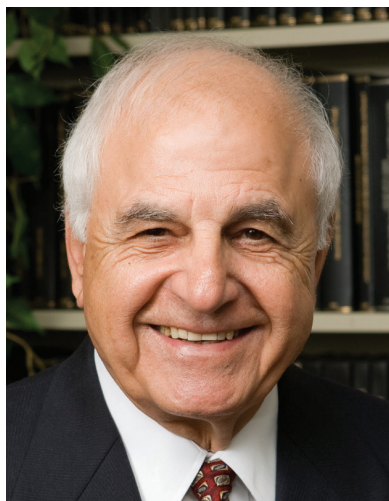
George I. Haddad
Chair
Jul 1975 – Dec 1986;
Jan 1991 – Sept 1997

Appendix 1: Department Chairs (1970 – 2010)

Thomas B. A. Senior
Acting Chair
Jan 1987 – Dec 1987

Edward S. Davidson
Chair
Jan 1988 – Dec 1990

Pramod P. Khargonekar
Chair
Oct 1997 – Jun 2001

Richard B. Brown
Interim Chair
Jul 2001 – May 2003

Appendix 1: Department Chairs (1970 – 2010)

David C. Munson, Jr.
Chair
Jun 2003 – Jun 2006

Brian E. Gilchrist
Interim Chair
Jul 2006 – Jun 2008

Khalil Najafi
ECE Chair
Jul 2008 –

Farnam Jahanian
CSE Chair
Jul 2008 – (2011)

Appendix 2: Faculty (AY 1970 – AY 2010)

Abraham, Santosh, G.	1987-1994		Dick, Robert	2008-
Ackerman, Mark S.	2001-		Drummond, Timothy J.	1987-1990
Anastasopoulos, Achilleas	1999-		Durfee, Edmund H.	1988-
Anderson, David J.	1970-2005		Dutta, Prabal	2010-
Atkins lll, Daniel E.	1972-		Ebbini, Emad S.	1990-1998
Austin, Todd M.	1999-		England, Anthony W.	1988-
Barton, Ben F.	1958-1993		Enns, Mark K.	1969-1978
Baru, Chaitanya	1985-1992		Essl, Georg	2009-
Baveja, Satinder S.	2002-		Farris, Hansford W.	1953-1982
Bement, Spencer L.	1960-2000		Feak, Glen A B.	1987-1993
Bertacco, Valeria M.	2003-		Fessler, Jeffrey A.	1990-
Beutler, Frederick J.	1957-1989		Finerman, Aaron	1984-1989
Bhattacharya, Pallab K.	1984-		Flanigan, Larry K.	1963-1999
Birdsall, Theodore G.	1950-1996		Flinn, Jason N.	2002-
Birmingham, William P.	1988-1994		Flynn, Michael	2001-
Biss, Kenneth O.	1973-1974		Freudenberg, James S.	1984-
Blaauw , David	2001-		Frieder, Gideon	1986-1989
Blakey, Peter A.	1978-1983		Galiana, Francisco D.	1974-1976
Boyapati, Chandrasekhar	2004-		Galler, Bernard A.	1984-1994
Breitenbach, Jerome R.	1983-1986		Galvanauskas, Almantas	2001-
Brown, William M.	1958-1972		Ganapathy, Sundaram	1976-1982
Brown, April S.	1985-1986		Gelenbe, Sumi E.	1972-1973
Brown, Richard K.	1947-1987		Getty , Ward D.	1966-1999
Brown, Richard B.	1985-2003		Gianchandani, Yogesh B.	2002-
Butler Jr., Thomas W.	1962-1974		Gilchrist, Brian E.	1991-
Cafarella, Michael J.	2009-		Giles, Martin D.	1990-1994
Cain, Charles A.	1989-2003		Grbic, Anthony	2006-
Calahan, Donald A.	1966-1999		Green, Daniel G.	1966- 2002
Carey, John J.	1946-1972		Grimes, Dale M.	1956- 1976
Carmon, Tal E.	2007-		Grizzle, Jessy W.	1987-
Chen, Kan	1971-1995		Guo , Lingjie J.	1999-
Chen, Peter M.	1993-		Gurevich, Yuri	1984- 2000
Chu, Chiao M.	1952-1989		Haddad, George I.	1957- 2004
Chuang, Kuei	1959-1995		Halderman, Alex J.	2009-
Coffey, John T.	1989-2001		Hall , Cordelia V.	1988- 1990
Compton, Kevin J.	1984-		Hansell, Gregory L.	1982- 1984
Conway, Lynn	1985-1998		Hayes, John P.	1982-
Curtice, Walter R.	1969-1972		Hellwarth, Arlen R.	1958- 1974
Davidson, Edward S.	1988-2000		Hero lll, Alfred O	1984-
Del Vecchio, Domitilla	2005-2009		Hiatt, Ralph E.	1958-1980
Delp (lll), Edward J.	1980-1984		Hiskens, Ian	2008-

Appendix 2: Faculty (AY 1970 – AY 2010)

|			
Hofmann, Heath	2009-	Lytinen, Steven L.	1986-1993
Hok, Gunnar	1953- 1970	Macnee, Alan B.	1950-1989
Holland, John H.	1961-	Mahlke, Scott	2001-
Honeyman, Peter	1986-	Majewski, Marian L.	1985-1985
Irani, Keki B.	1962- 1998	Mao, Zhuoqing	2004-
Islam, Mohammed N.	1992-	Markov, Igor L.	2000-
Jagadish, Hosagrahar V.	1999-	Martin , Edward A.	1953-1985
Jahanian, Farnam	1993-	Masnari, Nino A.	1957-1979
Jain, Ramesh C.	1982-1994	Mastrangelo, Carlos H.	1993-2002
Jamin, Sugih	1996-	Mattes, Brenton L.	1977-1984
Jarrahi, Mona	2008-	Mazumder, Pinaki	1987-
Jenkins, Janice M.	1980-2002	McAfee Jr, Leo C.	1969-2010
Jha, Niraj K.	1985-1987	McMahon , Lawrence E.	1959-1993
Kanicki, Jerzy	1994-	McMullen, Charles W.	1960-1986
Kaplan, Stephen	1958-	Meerkov, Semyon M.	1984-
Kapteyn, Henry C.	1996-1999	Meyer, John F.	1967-1986
Katehi, Linda P B.	1984-2001	Michielssen, Eric	2005-
Kazda, Louis F.	1946-1984	Mishra, Umesh K.	1985-1986
Khan, Peter J.	1967-1976	Moghaddam, Mahta	2003-
Khargonekar, Pramod P.	1989-2002	Momcilovic, Petar	2004-2010
Kieras , David E.	1984-	Mortazawi, Amir	2001-
Knoblock, Todd B.	1988-1992	Mosher, Raymond F.	1957-1976
Koditschek, Daniel E.	1993-2004	Mourou, Gerard A.	1988-2004
Ku, PC	2005-	Mouzon, James C.	1957-1971
Kuga, Yasuo	1988-1991	Mudge, Trevor N.	1977-
Kuipers, Benjamin	2008-	Murnane, Margaret M.	1996-1999
Kushner, Mark	2008-	Nadakuditi, Rajesh R.	2009-
Lafortune, Stephane	1986-	Nadel, Bernard A.	1984-1987
LaFrieda, James R.	1972-1973	Nagy, Andrew F.	1962-2009
Laird, John E.	1986-	Najafi, Khalil	1980-
Lawler, Eugene L.	1962-1971	Narasimhamurthi,	
Lee, George C.	1979-1985	Natarajan	1988-1987
Lee, Yung-Chia	1984-1990	Narayanasamy, Satish	2007-
Lee, Sang W.	1994-2000	Naylor, Arch W.	1956-1994
Lee, Honglak	2010-	Nelson, Thomas J.	1968-1974
Lefevre, Kristen R.	2008-	Neuhoff, David L.	1974-
Leith, Emmett N.	1952-2005	Nguyen, Clark T C.	1995-2006
Liu, Mingyan	2000-	Noble, Brian D.	1998-
Lomax , Ronald J.	1961-2000	Norris, Theodore B.	1991-
Lu, Wei	2005-	Nourani, Farshid	1979-1980
Lyon, John A M.	1959-1983	Nozari , Farhad	1977-1978

Appendix 2: Faculty (AY 1970 – AY 2010)

O'Donnell, Matthew	1990-2002	Shin, Kang G.	1982-
Olson, Edwin	2008-	Singh, Jasprit	1985-
Olte, Andre	1959-1995	Smith, Newbern	1959-1973
Owings, Clyde L.	1961-2000	Smith, Douglas B.	1982-1986
Pang, Stella W.	1990-	Soloway, Elliot	1988-
Papaefthymiou, Marios C.	1996-	Soparkar, Nandit R.	1994-2001
Patel, Jignesh M.	1999-2002	Stark, Wayne E.	1982-
Patt, Yale N.	1988-1999	Steel, Duncan G.	1985-
Pavlidis, Dimitris	1986-2004	Stout, Quentin F.	1984-
Peterson, Dean F.	1976-1983	Strauss, Martin J.	2003-
Pettie, Seth	2006-	Syed, Zeeshan	2009-
Phillips, Jamie D.	2002-	Sylvester, Dennis M.	2000-
Pollack, Martha E.	2000-	Tai, Chen T.	1964-1985
Porter, William A.	1961-1977	Teneketzis, Demosthenis	1984-
Prakash, Atul	1989-	Teorey, Toby J.	1972-2005
Radev, Dragomir R.	2000-	Terry Jr., Fred L.	1985-
Raieszadeh, Mina	2009-	Thatte, Satish R.	1982-1988
Rand, Stephen C.	1987-	Thomas, Spencer W.	1988-1991
Rauch, Lawrence L.	1969-1979	Thomason, Richmond H.	1998-2001
Ravishankar, C. V.	1986-1999	Tyson, Gary S.	1997-2003
Rebeiz, Gabriel M.	1988-2004	Ulaby, Fawwaz T.	1984-
Reinhardt, Steven K.	1997-2003	Volakis, John L.	1984-2003
Ribbens, William B.	1962-1999	Volz, Richard A.	1964-1989
Robinson, Andrew L.	1986-1993	Wakefield, Gregory H.	1986-
Rounds, William C.	1973-2008	Walker, Michael W.	1986-1992
Rowe, Joseph E.	1955-1973	Wasserman, Kimberly M.	1995-2002
Rundensteiner, Elke A.	1992-1998	Weil, Herschel	1952-1986
Sadanandarao, Sandeep P.	2002-	Weinberger, Doreen A.	1984-1991
Sakallah, Karem A.	1988-	Wellman , Michael P.	1992-
Sarabandi, Kamal	1985-	Wenisch, Thomas F.	2007-
Savarese, Silvio	2008-	Wentzloff, David D.	2007-
Schotland, John C.	2010-	Williams, William J.	1964-2001
Schunck, Brian G.	1986-1993	Winful, Herbert G.	1987-
Scott, Norman R.	1951-1987	Winick , Kim A.	1988-
Scott, Paul D.	1980-1987	Wise, Kensall D.	1974-
Scott, Clayton D.	2006-	Yagle, Andrew E.	1985-
Sechrest, Stuart	1989-1996	Yeh , Chai	1956-1981
Senior, Thomas B A.	1969-1998	Yoon , Euisik	2009-
Sharpe, Charles B.	1955-1988	Zhang, Zhengya	2009-
Sherlekar, Deepak	1987-1991	Zhong, Zhaohui	2008-
Shi, Yaoyun	2002-		

# Appendix 3: External Sponsored Research Support
(FY 1970 – FY 2010)
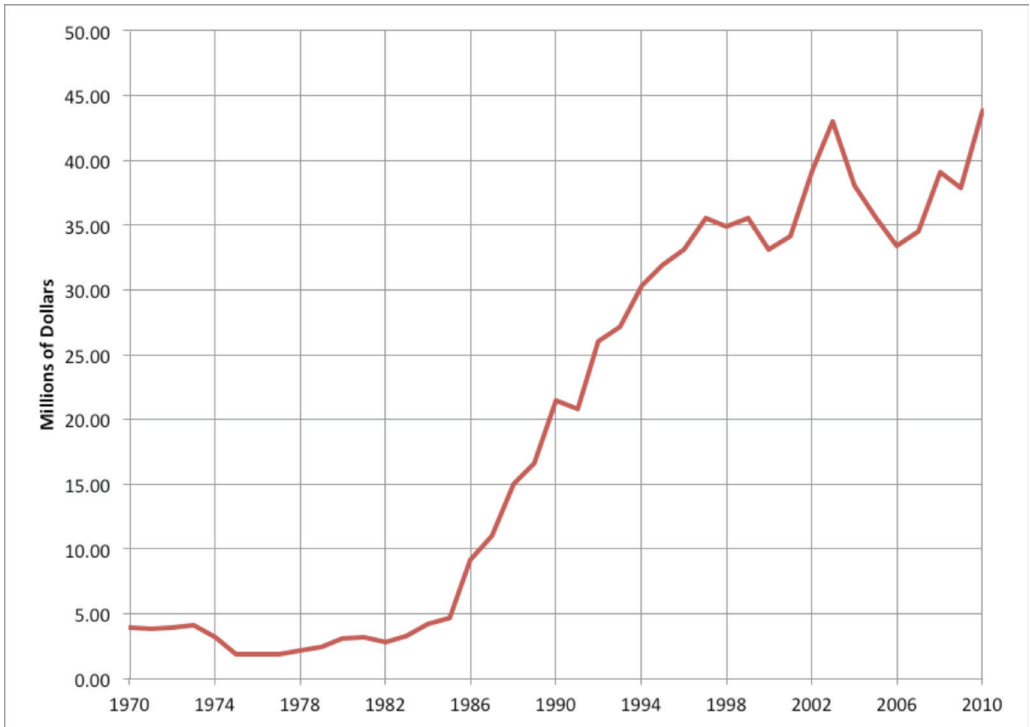
Notes: (i) The fiscal year runs from July of the previous year through June of the given year.

(ii) The data through 1974 include approximately $1.5M for the Space Physics Laboratory which was transferred to the AOSS Department in 1974.

# Appendix 4a: Bachelor's Degrees (AY 1970 – AY 1990)
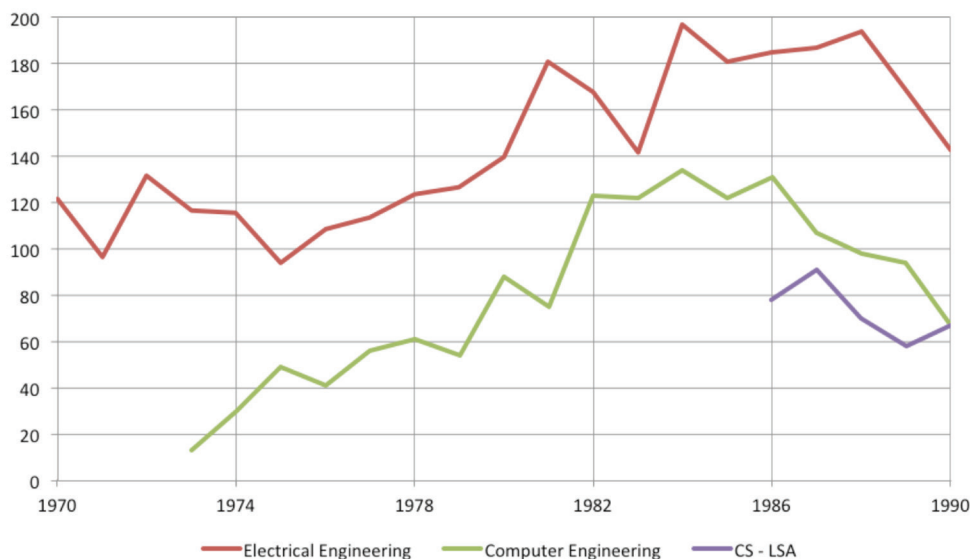
Notes: The academic year (AY) starts with the summer term of the previous
year and ends with the winter term of the given year. It includes the
summer and winter graduation of the previous year and the spring
graduation of the given year.

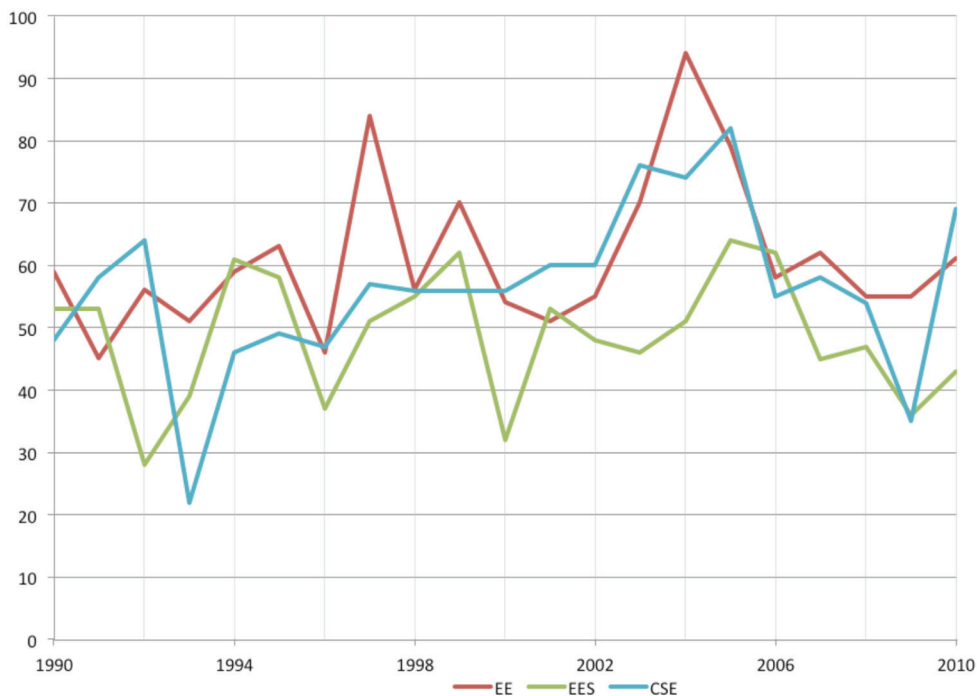# Appendix 4b: Bachelor's Degrees (AY 1990 – AY 2010)
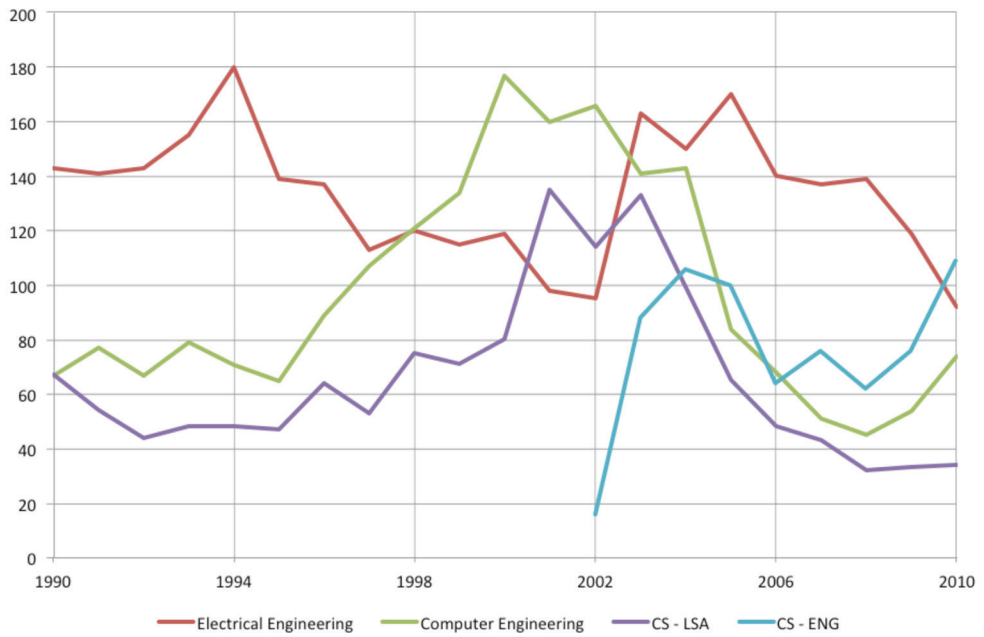
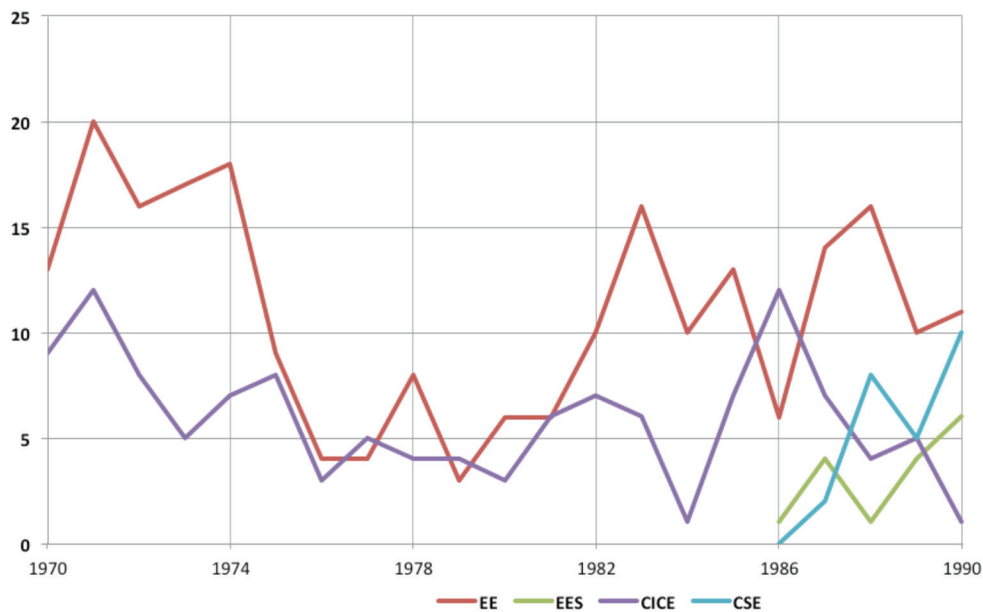## Appendix 5a: Master's Degrees (AY 1970 – AY 1990)
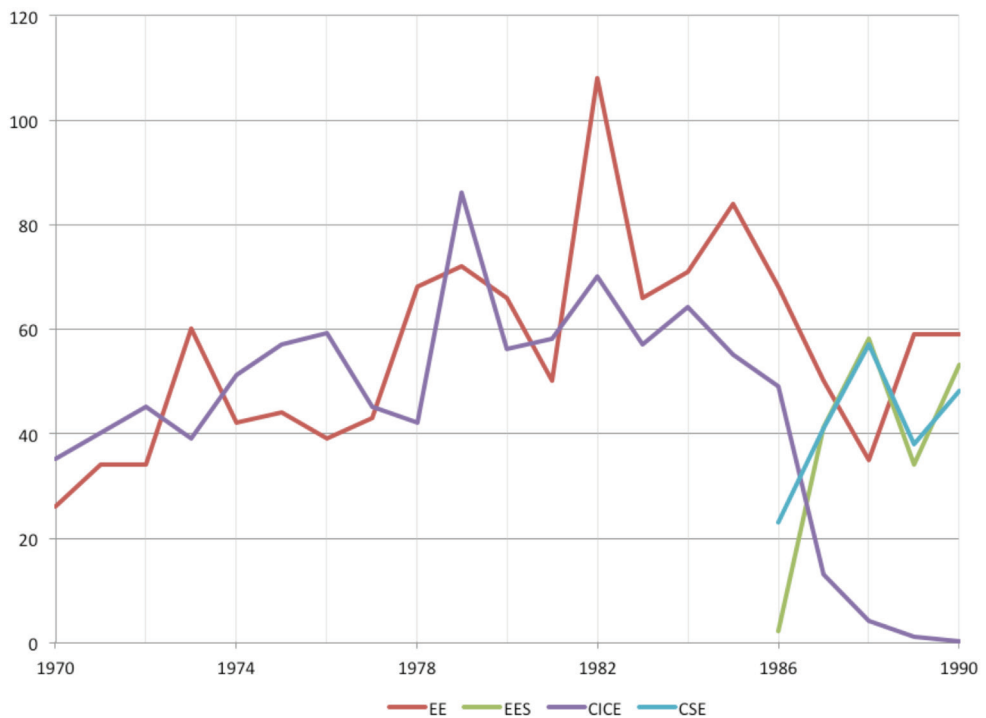
Notes: (i): The degrees Electrical Engineering Systems (EES) and Computer
Science And Engineering (CSE) were created in 1986, the same year
that the CICE program was eliminated
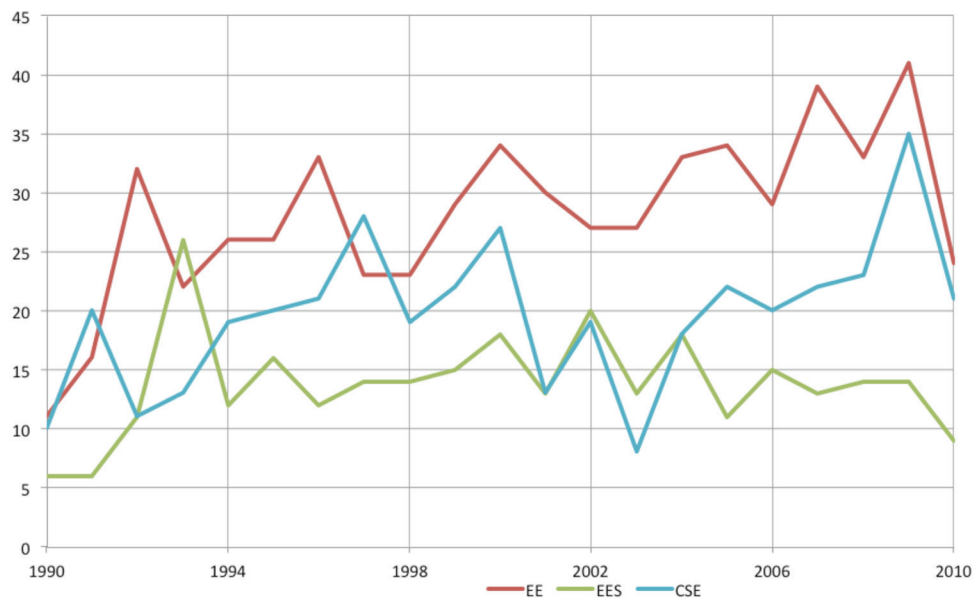(ii): The numbers are for M.S.E and M.S. degrees

Appendix 5b: Master's Degrees (AY 1990 – AY 2010)

Appendix 6a: Ph.D. Degrees (AY 1970 – AY 1990)

Appendix 6b: Ph.D. Degrees (AY 1990 – AY 2010)

Appendix 7: Degree Totals (AY 1970 – AY 2010)

Year	Bachelor's	Master's	PhDs
1970	97	34	13
1971	132	34	20
1972	130	60	16
1973	146	42	18
1974	143	44	9
1975	150	39	4
1976	170	43	4
1977	185	68	8
1978	181	72	3
1979	228	66	6
1980	256	50	6
1981	291	108	10
1982	264	66	16
1983	331	71	10
1984	303	84	13
1985	394	93	7
1986	385	132	20
1987	362	150	25
1988	321	131	19
1989	276	160	27
1990	272	163	42
1991	254	159	54
1992	282	151	61
1993	299	115	57

Appendix 7: Degree Totals (AY 1970 – AY 2010)

Year	Bachelor's	Master's	PhDs
1994	251	170	62
1995	260	173	63
1996	290	130	67
1997	272	192	68
1998	317	168	57
1999	323	188	68
2000	364	142	81
2001	391	164	54
2002	387	163	66
2003	514	192	49
2004	493	219	69
2005	415	225	66
2006	324	175	64
2007	308	165	75
2008	278	156	71
2009	283	126	91
2010	308	176	54

Note: Excludes CICE degrees and the CS-LSA degrees prior to 1986.