ANNUAL REPORT

Department of
Electrical and Computer Engineering

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Submitted by:

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Chair

The Department of Electrical and Computer Engineering consists of 44 full time professors and 1 professor shared 50% with another Faculty (as of December 2016), 21 professional staff members, 1134 undergraduate students, 319 graduate students and 26 post-doctoral fellows. At present, it offers four distinct CEAB-accredited undergraduate degree programs, a PhD and a Masters program. The Department currently hosts the headquarters of the NSERC funded Strategic Research Network called Healthcare Support through Information Technology Enhancements (hSITE) and of FRQNT-funded SYTACom (a provincially funded center for telecommunications research). The Intelligent Systems group is part of the Center for Intelligent Machines – an interdisciplinary centre involving researchers from the Department as well Mechanical Engineering and Computer Science.

RESEARCH AND PUBLICATIONS

In 2016, ECE members published a combined total of 189 refereed journal papers and 240 refereed conference papers, for an impressive average production of 9.7 papers per tenured or tenure-track professor per year[1]. It must be noted that, in several sub-disciplines of Electrical and Computer Engineering, conference publications are a privileged means of fast dissemination, and are sometimes as well regarded as journal publications.

Most of those publications are done in collaboration with supervised graduate students, and professors in ECE maintain a level of funding that allows them to provide adequate funding to a research team that is large by any standards (on average, each tenured or tenure-track professor supervises 7.3 graduate students).

Research productivity: 9.7 papers per professor in 2016

ECE professors continue to obtain impressive levels of competitive research funding. In 2016 a total of $9.6 M of *new* operating and infrastructure funding was awarded. On average each ECE professor brought in around $193,000 in new operating funding and $29,400 in new infrastructure funding. These amounts are in line with last year's results, and with the addition of three new tenure-track academics in August 2016 we expect to see this grow as the new professors get established.

The table below gives a more detailed breakdown of sources and types of funding, all amounts pertaining to calendar year 2016 installments. Note that all industrial contracts fall under the "Other Sources" category, and that the "Internal funds" category comprises mainly start-up grants and James McGill Professor/William Dawson Scholar research awards.

[1] For a full list of publications, please go to http://www.mcgill.ca/ece/department/publications

Table 1: Breakdown of new research funding for 2016, by type and source.

Source	*Operating Grants*	*Infrastructure*	**Grand Total**[2]
NSERC	$ 4,624,302.00	$ 215,847.00	**$ 4,840,149.00**
FRQNT	$ 573,736.00	$ 24,693.00	**$ 598,429.00**
CFI	$ 2,975.00	$ 862,241.00	**$ 865,216.00**
CRC	$ 125,000.00	$ -	**$ 125,000.00**
Internal funds	$ 199,645.00	$ -	**$ 199,645.00**
Other Sources	$ 2,773,455.00	$ 161,888.00	**$ 2,935,343.00**
Grand Total	**$ 8,299,113.00**	$ 1,264,669.00	**$ 9,563,782.00**
	TOTALS ARE ON EXCEL SHEET		

The new research funding also included over $500,000 in new contracts with a wide range of domestic and international companies. Many other industry collaborations are supported through leveraged funding from NSERC. This includes two currently active NSERC Industrial Research Chairs, sponsored by Hydro-Québec.

TEACHING AND LEARNING

GRADUATE PROGRAMS

ECE has very strong graduate programs. At the graduate level, two Master's degree options, in addition to a Ph.D. program, are offered.

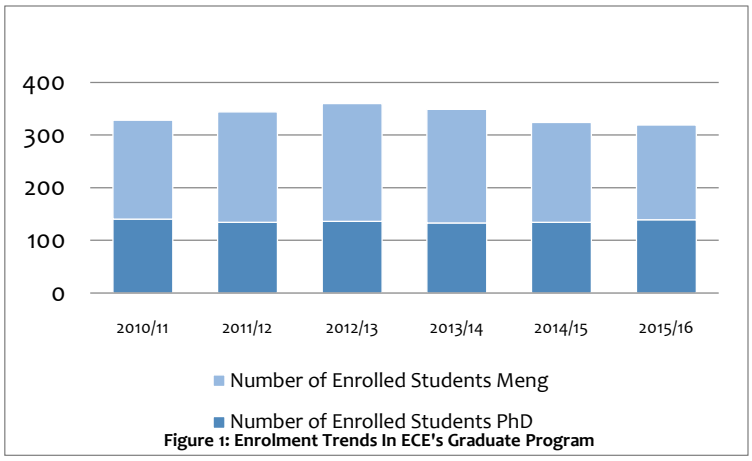

Figure 1: Enrolment Trends In ECE's Graduate Program

ECE's graduate student population is made up of 319 individuals, of which 180 are enrolled in the department's PhD program. The growth of the PhD program over the last few years is illustrated in the chart below, describing graduate enrolment trends over the last 5 years. According to available data, ECE operates the largest PhD program in the university.

The department faculty is highly research intensive, with an average of 4 PhD students per full-time tenured or tenure-track faculty member. Last year, 35 students graduated with their PhD, while 50 MEng students also graduated from ECE graduate

Research intensity: 4 PhD students per professor

[2] Funding data is derived from annual reports submitted by academic staff in the department.

programs (of which 14 were in the non-thesis option), an increase of almost 22% over the average of the last three years.

UNDERGRADUATE PROGRAMS

ECE offers four distinct programs at the undergraduate level, all accredited by the Canadian Engineering Accreditation Board (CEAB), namely the B.Eng. in Electrical Engineering, the B.Eng. in Computer Engineering, the B.S.E. in Software Engineering and the B.Eng.in Honours Electrical Engineering. With a total of 1091 enrolled students, all four programs are successful and continue to be attractive to a large population. New admissions remained steady this year for the first time in three years, but due to admission increases in previous years, total entrollment continues to grow and now stands at 23% over the 2010 level. In 2016, a cohort of 178 students graduated from ECE undergraduate programs.

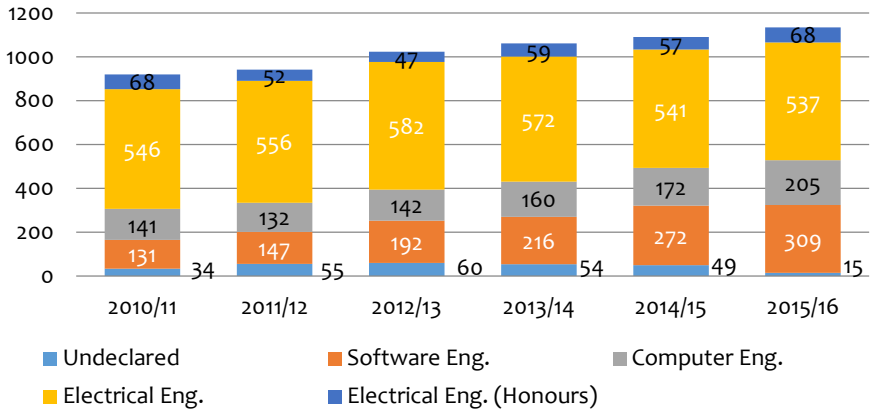

Figure 1: Undergraduate enrolment trends within the department's 4 programs. "Undeclared" students are those who have not picked their final program yet.

A major review of the undergraduate curriculum was started in 2012, with a formal set of revisions adopted in 2015 for introduction with the 2016 cohort. These revised programs include significantly increased levels of hands-on experiences for the undergraduate students, by incorporating laboratory exercises into large early-year lecture courses. Feedback from the first semester of the new programs has been positive, albeit with some teething problems associated with laboratory scheduling that have now been resolved. A further modification that we have recently proposed is to transform the Software Engineering program into a Co-op program. If this is accepted by the university we hope to make it available for students starting in the Fall 2018 semester. The demand by companies for interns in this field is strong, and consultation with our students has confirmed that this would be a welcome and popular program.

The ECE Department has also continued to focus efforts on increasing diversity in our undergraduate body. Whilst the percentage of female undergraduate students has increased by 27% over the last four years and now stands at 19% of the total undergraduate body

38% of new enrollment is from CEGEP admissions

(which is almost exactly equal to the Canadian average for all Engineering programs) we recognize that more needs to be done. The ECE Undergraduate Recruitment Committee has worked hard to develop outreach activities such as videos which are aimed at potential female recruits. For several years the department has also sought to increase enrollment in students from local CEGEPs and in 2013 it engaged in a major effort to encourage qualified CEGEP applicants to accept our offer of admission. This action has resulted in a significant percentage of CEGEP admissions again this year.

INVOLVEMENT IN THE COMMUNITY

ECE faculty members remain strongly involved in the scientific community, where many of them have developed a strong international visibility and reputation. In 2016, ECE members participated in the technical program or organizing committees of more than 60 international conferences and workshops, including occupying major leadership roles in over 20 of these. ECE professors are active in more than 30 committees of scholarly societies, advisory boards and standards bodies and Chair 7 of these. They collectively serve as editor or area editor for sixinternational scholarly journals. Of particular note: Professor Fabrice Labeau is President-Elect of the IEEE Sensors Council and Professor David Plant is Vice-President (Technical Activities) of the IEEE Photonics Society. ECE McGill professors Chair the local Montreal chapters of the IEEE Vehicular Technology Society, the IEEE Signal Processing Society and the IEEE Photonics Society.

It must be pointed out that ECE administrative and support staff are also heavily involved in the University community, through participation in change management committees and project steering committees.

Involvement in more than 60 conference committees

The connections that ECE establishes with the community are on several fronts: well-established collaborations with the Department of Physics or the School of Computer Science at McGill (through e.g., the McGill Institute for Advanced Materials – MIAM – and the Center for intelligent Machines – CIM); individual research collaborations with the Quebec and Canadian community, through active participation in Quebec *Regroupements Stratégiques* CREER, ResMiQ, RQMP (including representation on their boards) and hosting of *Regroupement Stratégique* SYTACom; and funded international research projects with India, China, France, Sweden, Brazil and USA.

MILESTONES

During 2016 the department welcomed four new professors. Assistant Professor Xiaozhe Wang joined us in January, becoming the newest member of the Power Systems Group. Professor Daniel Varro, who was previously appointed at the Budapest University of Technology and Economics and whose research is in software engineering joined us in August, together with Assistant Professor Sharmistha Badhra, who has joined the

Integrated Circuits and Systems Group. In September we recruited Associate Professor Derek Nowrouzezahrai, who was previously appointed at Université de Montreal and who undertakes research in computer graphics. Unfortunately Professor Zetian Mi left us in 2016 to continue his career in the US.

HONOURS, AWARDS AND PRIZES

We only list here a few rolled up numbers and highlights of the numerous awards garnered by ECE members in 2016.

Professor David Plant was elected as a *Fellow of the Royal Society of Canada* and was also awarded the *IEEE Montreal Chapter Gold Medal Achievement*.

The spin-off company launched by Professor Mourad El-Gamal to commercialize his MEMS technology inventions received the *Entrepreneurial Company of the Year Award* from Frost & Sullivan.

Professor Daniel Varro was recognized with the *Most Influential Paper* award from the IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC 2016) for work published in 2005.

Professor Fabrice Labeau received the 2016 *Outstanding Service Award* from the IEEE Vehicular Technology Society for outstanding and numerous service contributions to the VTS society, in particular in promoting VTS membership and Chapters activities development worldwide.

Professor Dennis Giannacopoulos received the *Samual and Ida Fromson Award* for Outstanding Teaching from the Faculty of Engineering.

Professor Aditya Mahajan received the *NSERC Discovery Accelerator Award*.

The recent work of Sharif Sadaf, a PhD student in our department, was picked up as an important advance by the magazine Semiconductor Today (FYI, Semiconductor Today highlights our Al-tunnel junction visible nanowire LED work.

Graduate Programs Administrator Caroline Brown received the *Award for Excellence in Service to Graduate and Postdoctoral Studies* for 2015-2016. This award, given out by the Faculty of Graduate and Postdoctoral Studies, in recognition of Caroline's dedication to graduate students in our department, the efficiency that she has brought to our operations and her visible devotion towards her work.

ECE professors and graduate students collectively won six Best Paper awards at a range of international conferences

ECE SCHOLARLY WORKS FOR THE PERIOD JANUARY 1ST, 2016 TO DECEMBER 31ST, 2016

(URL of publications : http://www.mcgill.ca/ece/department/publications)