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 42 full time professors (as of December 2014), 18 professional staff members, 1061 undergraduate students, 346 graduate students and 33 post-doctoral fellows. At present, it offers four distinct CEAB-accredited undergraduate degree programs, a PhD and a Masters program. Since October 2008, Department has been hosting 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 2014, ECE members published a combined total of 115 refereed journal papers and 292 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 8.2 graduate students).

> Research productivity: 9.7 papers per professor in 2014

ECE professors continue to obtain impressive levels of competitive research funding. In 2014 a total of $14.88 M of *new* operating and infrastructure funding was awarded[2], which is 28% higher than the level of new funding reported the previous year. On average each ECE professor brought in over $200,000 in new operating funding and approximately $150,000 in infractructure funding, up more than double last year's level. Most notably NSERC operating funding has more than doubled in the past year.

> NSERC operating funding doubled since previous year

The table on the next page gives a more detailed breakdown of sources and types of funding, all amounts pertaining to calendar year 2014 installments. Note that all industrial contracts fall under the "Other Sources" category, and that the "Internal

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[1] A full list of publications is available at: http://www.mcgill.ca/ece/department/publications
[2] Funding data is derived from annual reports submitted by academic staff in the department.

funds" category comprises start-up grants and James McGill Professor/William Dawson Scholar research awards.

Table 1: Breakdown of new research funding for 2014, by type and source.

Source	Operating Grants	Infrastructure	Grand Total[3]
NSERC	$5,372,463	$293,610	$5,666,073
FRQNT	$799,722	$19,839	$819,561
CFI	$2,200	5,989,057	$5,991,257
CRC	$235,000		$235,000
Internal funds	$263,714	$2,475	$266,189
Other Sources	$1,817,897	$82,974	$1,900,871
Grand Total	**$8,490,996.00**	**$6,387,955**	**$14,878,951**

The new research funding also included more than $1M 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, co-sponsored by Hydro-Québec. In order to increase the level of industrial collaboration a new 'Industrial Liaison Committee' was struck in 2014, with the mandate to develop closers ties to local industry.

> Industrial Connection:
> $1M in new industrial contracts in 2014

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.

ECE's graduate student population is made up of 346 individuals, of which 216 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.

The department faculty is highly research intensive, with an average of 5.1 PhD students per full time tenured or tenure track faculty member (this is number significantly higher than any of our Canadian competitors based on available data). The

> Research intensity:
> 5.1 PhD students per professor

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[3] As previously noted, funding data is derived from annual reports submitted by academic staff in the department.

graduate student population is very much international, with 53% coming to McGill on a student visa. In 2014, 44 MEng (out of which 4 in the non-thesis option) and 31 PhD students graduated from ECE graduate programs.
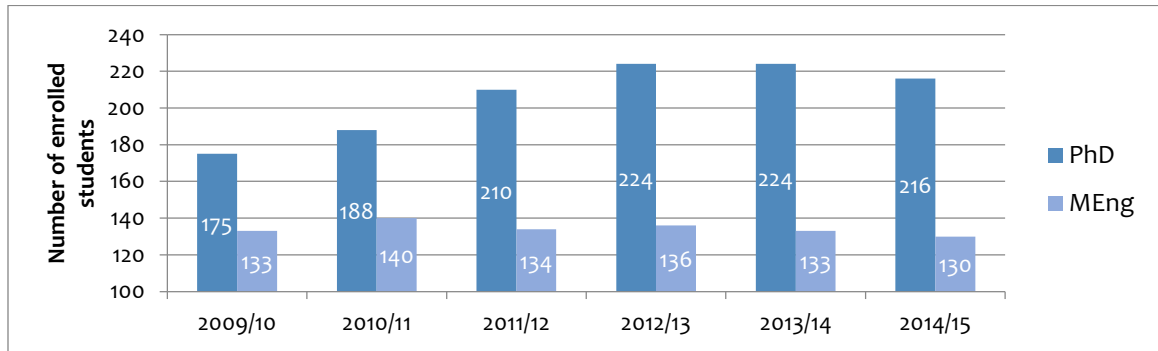

Figure 1: Enrolment trends in ECE's graduate program (Master's thesis and non-thesis options are lumped under "MEng").

An MEng non-thesis telecommunications concentration is currently being piloted in collaboration with industry partners; students in this concentration are able to take advantage of specifically designed industry internships, which constitutes a portion of their Masters research experience. The first round of internships took place in 2014 and were deemed to be very successful by industry partners and students alike.

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 1061 enrolled students, all four programs are successful and continue to be attractive to a large population. There was a very significant increase in admissions to ECE programs. New admissions grew from 217 in 2012/13 to 278 this year, while slighty down
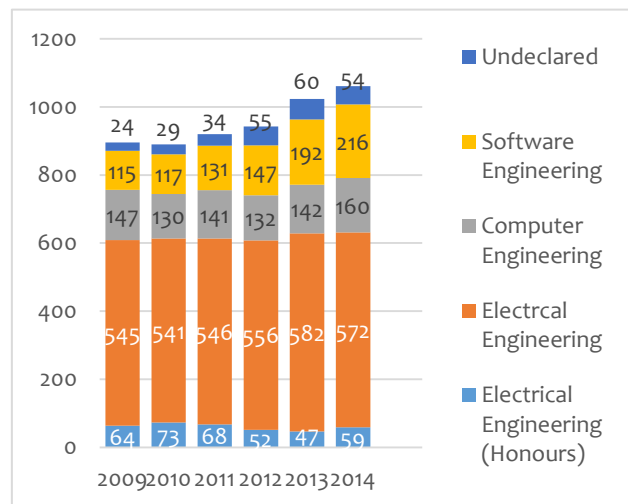

Figure 2: Undergraduate enrolment trends within the department's 4 programs. "Undeclared" students are those who have not picked their final program yet.

from 290 last year, still an overall growth of 28%, resulting in a 10% increase in total enrollment. In 2014, a cohort of 206 students graduated from ECE undergraduate programs. Software Engineering continues to increase in popularity.

A major review of the undergraduate curriculum was started in 2012, and during 2014 multiple consultations were held inside and outside the department. The goal is for the curricula to be formally approved in Spring 2015 in order to be made available to incoming U0 students in September 2015 and to incoming CEGEP students in September 2016. As part of the process the Department requested and obtained $270,000 from the University Laboratory Working Group in order to purchase new equipment for the revised laboratory courses. Our goal is to create new modular workstations that can be used by multiple courses.

> 28% increase in new enrollment over 2 years, with significant growth in CEGEP

For several years the department has sought to increase enrollment in students from local CEGEPs and in 2014 it engaged in a major effort to encourage qualified CEGEP applicants to accept our offer of admission. This action has resulted in a significant increase in CEGEP admissions this year. The department recognizes that it must still undertake further effort to increase the percentage of female undergraduate students (who currently represent 15% of the total undergraduate body) and is developing an improved recruitment strategy for female students.

INVOLVEMENT IN THE COMMUNITY

ECE faculty members remain strongly involved in the scientific community, where a lot of them have developed a strong international visibility and reputation. In 2014, ECE members participated in the Technical Program or Organizing Committees of more than 40 international conferences. ECE professors are active in more than 60 committees of scholarly societies or advisory boards, including acting as President or Vice-President of several IEEE societies. They collectively occupy 18 positions on editorial boards of international scholarly journals.

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.

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

In summer 2014 we said goodbye to Professor Haibo Zheng as he left McGill to take up a new 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 2014.

Professor Fabrice Labeau was elected as President of the IEEE Vehicular Technology Society.

Professor Jim Clark received the Canadian Image Processing and Pattern Recognition Society (CIPPRS/ACTIRF) Award for Research Excellence, awarded May 2014, recognizing leadership and outstanding performance in research related to computer vision and/or robotics.

Professor Jeremy Cooperstock was recognized with the US Ignite Best App in Education Award (Training Tools for First Responders)

Professor Andrew Kirk received the William and Rhea Seath Award for Engineering Innovation, awarded by Faculty of Engineering, January 2014, in recognition of his research on photonic biosensors.

Professor Zetian Mi was selected as one of the finalists of the Grand Challenges program by the Climate Change and Emissions Management Corporation, a $35-million competition to seek innovative uses for carbon and to transform carbon from a liability into an asset

Professor David Plant received the Christophe Pierre Award for Research Excellence (awarded by the Faculty of Engineering)

The Montreal Section of the joint IEEE Photonics Society, Antennas and Propagation Society and Microwave Society was recognized by the IEEE with a 'Best Chapter Award'. The Montreal Chapter of the Photonics Society is Chaired by Professor Odile Liboiron-Ladouceur. ECE researchers attracted in 2014 six best paper awards from international conferences and journals.

> 6 best paper awards in 2014

Appendix I (submitted separately): Consulting Activities