momentum

Alumni & Industry Magazine
Mechanical & Industrial Engineering
University of Toronto

Issue 3
Engineering Goes Global

UNIVERSITY OF TORONTO
MECHANICAL ENGINEERING
125 YEARS
1890-2015

“People come to learn from us in Toronto and we go around the world to teach other people.”

Issue 3
Engineering Goes Global

—

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Engineering on a Global Scale
Page 14

"Our researchers are combating crucial global problems through international collaboration."

Message from the Chair

In 1890, Robert Alexander Ross was the first and only graduate from Mechanical Engineering. Today, 125 years later, we are proud to call nearly 12,000 mechanical and industrial engineering graduates our own.

Our alumni are spread out across the world—from India, to China, to the UK—while our MIE researchers and their collaborators are engineering solutions that can be felt in those very countries, and beyond. At the Department, we are also delighted to have such a diverse community of students who have come from all corners of the world, and have chosen MIE as their place of study.

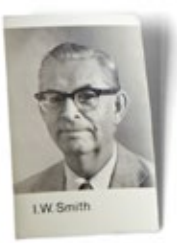
It is only appropriate then, to put a spotlight on MIE's global impact. In this new issue of *Momentum*, you will learn how we are transferring our engineering knowledge around the world using just a state-of-the-art camera and an internet connection. Through our first Massive Online Open Course on alternative energy systems, taught by award-winning educator Professor Jim Wallace, we are teaching a global audience. You will also find out how our researchers are combating crucial global problems through international collaboration. Whether it is Professor Javad Mostaghimi developing a simple and affordable technology to prevent hospital-associated infections, or Professor Birsen Donmez investigating personalized driver feedback systems to inhibit risky driving behaviours, our engineers are developing solutions to problems that affect the global community. Lastly, you will get to learn how we are enhancing our MIE students' world perspective through our international collaborations with engineering institutions such as Peking University (PKU). Through PKU's Global Educational Exchange (Globex) program, we are deepening partnerships between institutions by offering a framework for exceptional students and faculty to attain a global educational, research and professional experience.

This year's issue comes at the heels of a very important milestone for the Department: the celebration of 125 Years of Mechanical Engineering. Although we are celebrating a milestone in Mechanical Engineering, the momentous occasion is a testament to our whole Department's remarkable legacy—one that you have helped shape as our alumni. In 2011, you helped us celebrate 50 years of Industrial Engineering, and this year, we will be hosting special events to mark 125 Years of Mechanical Engineering. I hope you will join us again in celebrating our past, present and future.

Our Department will only grow more powerful as we gain momentum into the next 125 years.

Jean W. Zu
Professor & Chair

125



Mechanical Engineering is 125 years older & wiser. From a lone graduate in its first year, to 12,000 MIE alumni today. From the early days when research was seen as recreational, to now, where our research is world-renowned. Here we explore our past, present & future.

OPENING SPREAD
Research on a wind tunnel in a fluid mechanics laboratory

LEFT
The CDRU offered students a unique opportunity to develop prototypes for conceptual transportation design projects

—

RIGHT PAGE

ROW ONE
Researchers study light emission by an absorbing gas in a thermodynamics lab

Professor Emeritus and former MIE Chair, Ronald D. Venter

ROW TWO
A computer-controlled engine test

MIE laboratory in 1990

ROW THREE
The Machine Shop, circa 1990

Research conducted in the photoacoustic and photothermal lab

Then

In 1890, **Robert Alexander Ross** (1865–1936) was awarded the first BASc/diploma in Mechanical Engineering at U of T. Ross was the lone graduate that year when five departments were established within the School of Practical Science.

Led by **Robert W. Angus**, the first Professor and Head of Mechanical Engineering at U of T, the early decades of the Department saw it grow into specializing in the study of hydraulic engineering, heat engineering, machine design and electrical engineering. Angus himself was also instrumental in the design of the Mechanical Engineering building that opened in 1908 (the "Old Wing"), ensuring space for heat and hydraulics laboratories, allowing those fields to continue flourishing at the university. Another expansion of facilities wouldn't take place for another 40 years, when the "New Wing" was established in 1947—the first post-war building to be erected on campus—creating space for new labs for the study of river flow, air conditioning, machining and mechanical design.

"The early research activities were sparse, but often of world-leadership quality," wrote Professor Emeritus **F.C. Hooper** in 1990, when Mechanical Engineering celebrated 100 years. Although research up until 1955 was regarded almost as a recreational pursuit for professors, faculty members at Mechanical Engineering at U of T were still being recognized globally for their pioneering work in hydraulics and aerodynamics, to name a few.

In 1995, the Department of Industrial Engineering and the Department of Mechanical Engineering merged to form a new Department. On May 1, 1996, the Department of Mechanical & Industrial Engineering was born with Professor **Iain Currie** as the inaugural Chair.

LEFT
Students perform drag testing using a wind tunnel

—

RIGHT PAGE

ROW ONE
MIE faculty and staff at convocation 2014

A student presents their capstone design project

ROW TWO
MIE's capstone design course prepares students with real-world industry experience

PhD candidate Veronica Marin is a student and researcher in the Autonomous Systems and Biomechatronics Lab at MIE

ROW THREE
Professor Murray J. Thomson and his students, working in the Combustion Research Lab

Now

The Mechanical Engineering program of today is world-renowned.

Taught by award-winning educators, the applied and practical curriculum means students put their theory to practice with hands-on learning in state-of-the-art labs, in the field and in different parts of the world.

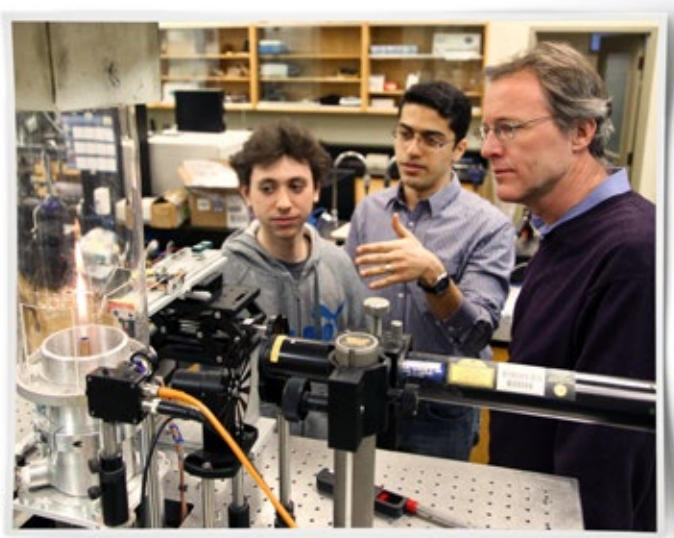
On the research front, the University of Toronto's mechanical engineers and graduate students are conducting work that is solving today's problems and tomorrow's pressing issues—from developing assistive robots for the elderly, to 3D-printing skin tissue, to leading the call for sustainable solutions. The impressive list goes on.

Throughout 2015, MIE will hold special celebrations that look at the past, present and future of mechanical engineering. Please join us in celebrating 125 years of excellence and innovation at the University of Toronto.

125 Celebrations

- **April 9:** 2015 Design Showcase & 125th Celebration of Mechanical Engineering
- **May 30:** MIE Spring Reunion
- **May/June:** MIE Graduate Research Symposium & 125 Banquet Dinner
- **September:** Welcome to MIE BBQ
- **November:** MIE Research Spotlight
- **November:** MIE Dinner Dance
- **November:** Faculty & Staff Dinner
- **Fall 2015:** Alumni Roundtable & Think-Tank – Invite only
- **Winter 2015:** Holiday Luncheon & 125 Closing Celebrations

More information and events will be added throughout the year, visit www.mie.utoronto.ca/mech125.



#uoftmech125

Help us celebrate by sharing your favourite MechE memories or photos on Twitter and Instagram using #uoftmech125.

UNIVERSITY OF TORONTO
MECHANICAL ENGINEERING
125
YEARS
1890–2015


Wind, Waves
& Tides:
Alternative
Energy
Systems
Getting
Started
Guide

Teaching the Online World

'Chalk-and-talk' goes digital & worldwide.

By Daniel Rouse

From his first year of teaching, Professor **James Wallace** soon learned that a spare piece of chalk was all he needed to ensure his lessons went uninterrupted. Now, with the introduction of MIE's first Massive Online Open Course—or MOOC—you can add a couple of IT technicians, a state-of-the-art camera and an internet connection to reach a worldwide classroom.

Such is the progress and ambition that Wallace recognises in his thirty-seventh year at the university.

"At U of T, we are learning about online education and what it can do and what it cannot do. I think it is in essence an experiment on online education," says Wallace.

His *Wind, Waves and Tides: Alternative Energy Systems* course looked into the equipment used to harness the specified energies and a brief examination into their historical influences. Then, looking into and comparing case studies from all over the world, Wallace and his class analyzed the strengths and weaknesses of the technologies we use today.

"One of my motivations for participating as a MOOC instructor is that your reach goes much further—student feedback from around the globe makes you aware of local projects or technologies that enrich the course for everyone."

A company which extracted energy from waves was featured in one module, but the business became insolvent the week after. This only enriched the course content, though. It highlighted the tough environment of the industry, sparking online discussion between the students and providing Professor Wallace with similar companies

"One of my motivations for participating as a MOOC instructor is that your reach goes much further—student feedback from around the globe makes you aware of local projects or technologies that enrich the course for everyone."

he was unaware of, both running and defunct, and current news on alternative energy systems from different parts of the world.

With his global online class providing such a wealth of information, Wallace found that he was learning of new methods and angles to compliment his alternative energy systems MOOC, and his continued work in environmental engineering.

"The MOOC enabled me to develop much better course materials that are now being used in my regular U of T Alternative Energy Systems course, which is also taught online," says Wallace, who in 2012 received U of T's prestigious President's Teaching Award.

The opportunity to pool information together from all corners of the world is something appreciated by the students too. Rodney Sumlin, from Baltimore, graduated from Georgia Tech last year and is pursuing a career in wind energy and found the MOOC a valuable opportunity to add to the knowledge he had already gained. He relished being part of an international classroom.

"[MOOCs allow] easy access to a large, global network of information from people—classmates, TAs, and professors—with similar interests," Sumlin said.

As well as allowing the university and MIE to boost its international reputation further through one of the world's largest MOOC providers, Coursera, Wallace also appreciates the flexibility online learning offers to students.

"Engineering students in particular are kept really busy. They have a demanding workload and a very full schedule so they greatly appreciate being able to watch the videos online at a time of their choice. The ability to self-schedule is a key feature of online course delivery," says Wallace.

These sentiments are echoed far beyond the walls of U of T. **Matthew Brown** studied the course from Perth in Australia to put him back in touch with his graduate qualification—an MEng in mechanical engineering from the University of Surrey, UK—and to continue to educate himself on the issue of climate change.

"This is a serious and significant issue that as a world community we need to address urgently," says Brown.

His home life in Western Australia is busy as he raises a young family while holding a full-time position in sales and marketing, but his initial concerns in being able to squeeze in time for study were soon quashed.

"I studied the course twice a week for a couple of hours at night," he said. This flexibility does inevitably result in participation dropping off as those who were initially attracted in the MOOC find they are too busy, or just not as interested as they thought they were. Overall, 11,000 people signed up from all over the planet. About 6,500 viewed the first lecture, and by the end of the final exam, there were just 10 per cent of that amount left. Still, you would struggle to squeeze 650 students into a U of T seminar.

Professor Wallace has future plans to broaden his online teaching portfolio in another MOOC on energy storage. Lessons learned from his debut MOOC is to keep content more succinct and to interact further with his global audience—it is an ongoing experiment to provide the best education possible to a large audience. Who knows, this time around he might leave that trusty piece of chalk in his office.

Daniel Rouse is a freelance writer & contributor to *The Telegraph*.

ENGINEERING ON A GLOBAL SCALE

How four researchers & their international collaborators are making the global community healthier, more efficient & safer.

By Mark Witten

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Lufthansa Boeing 747-200

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IF UNDELIVERED
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SUMIDA-K

Mechanical Engineering Professor **Javad Mostaghimi** has developed a simple and affordable technology to help combat the global problem of hospital-associated infections.

"Copper has been well-known for its anti-bacterial properties for a long time. We use wire-arc thermal spraying to deposit a thin layer of molten copper or its alloys on frequently touched surfaces in hospital settings. This can be done in a very economical way on wood, plastic, metal or almost any type of surface," says Mostaghimi, Distinguished Professor in Plasma Engineering and founding Director of the Centre for Advanced Coating Technologies (CACT). Dr. **Larry Pershin**, Senior Research Associate in Mostaghimi's group, and Associate Professor **Maurice Ringuette** in the Department of Cell & Systems Biology, also contributed to the development of this anti-bacterial coating technology.

The World Health Organization (WHO) has recognized healthcare-associated infection as a major patient safety issue for developing countries. Healthcare-associated infections affect hundreds of millions of people worldwide. In developing countries, the risk is up to 20 times higher than in industrialized countries and the proportion of infected patients often exceeds 25 per cent.

This is an important problem in industrialized countries too.

"Each year in Canada healthcare-associated infections result in 8,500 to 12,000 deaths, and more than 200,000 people get sick," says Mostaghimi, who was awarded a grant from Grand Challenges Canada to further develop and test the effectiveness of antibacterial copper coatings for reducing infections in a university hospital in Lima, Peru, and in Toronto's Mount Sinai Hospital.

In this international research study, Mostaghimi is copper-coating the most frequently touched surfaces in an ICU room at Mount Sinai and will compare bacteria counts and infection rates with non-coated ICU rooms. Many other hospital areas are important to target too. At the Hospital Nacional Cayetano Heredia in Lima, Mostaghimi is testing the effectiveness of copper coating on furniture in an outpatient clinic room and on other commonly touched surfaces such as push plates on doors around the hospital. "This is a new application of thermal spray coating, a well-established technology used in many industries such as aerospace. We want to see if our method will work well in a more challenging type of hospital environment in a developing country. If it does, this would allow it to be expanded globally more easily," says Mostaghimi, who expects to have preliminary results by the spring of 2015.

"We're developing a breast imaging technology that could be portable, low-cost and accurate, and used in local clinics in countries with large populations … or anywhere in the world."

Results from a recent study at a Toronto General Hospital waiting room are very encouraging. "We coated 36 chairs with a copper alloy and the coated chairs had 68 per cent less bacteria than the regular chairs," says Mostaghimi, noting that the anti-bacterial coating increases the cost of a chair by only a few dollars.

Peru is a testing ground that could demonstrate the benefits of a versatile, low-cost infection control technology for developing countries, and countries with much larger populations, such as China and India.

Mechanical Engineering Professor **Andreas Mandelis** has developed a unique ultrasensitive differential photoacoustic imaging method that can detect breast cancer tumours earlier than conventional imaging methods such as mammography, ultrasound and magnetic resonance imaging (MRI). It uses non-invasive lasers and radar principles to see into breast tissue and detect new blood vessels that accompany the growth of a tumour by means of minute differences in light absorption between blood-rich (cancerous) and blood-poor (healthy) tissues. "Using laser light energy converted to ultrasound (known as the photoacoustic effect), we can detect tumours earlier than with other techniques, which offers significant clinical benefits," says Mandelis, winner of the 2014 Killam Prize in Engineering and Director of the Centre for Advanced Diffusion-Wave Technologies (CADIFT).

In his 2012-2013 sabbatical, Mandelis travelled to Germany to collaborate with Professor Vasilis Ntziachristos, director of the Helmholtz Institute for Biomedical Imaging in Munich, and his research group. Mandelis saw this as an opportunity to further develop the technology and bring it closer to the marketplace. "They've benefited from our instrumentation ideas and expertise, and we've benefited from their biological imaging ideas and experience. So there is a complementarity to strengthen both groups," he says.

As a result of the ongoing German collaboration, Mandelis was able to increase the sensitivity of his imaging techniques through the detection of small changes in total hemoglobin concentration and oxygenation levels, identifying pre-malignant tumours before they are anatomically apparent. "With differential photoacoustics, we refined our method of detecting tumours early so that it has higher sensitivity than today's existing cancer diagnostic technologies," says Mandelis, also a Canada Research Chair (Tier 1) in Diffusion-Wave Sciences and Technologies.

Mandelis sees global potential for his biomedical imaging technology because of its early detection capabilities and other advantages. "It doesn't use ionizing radiation and is relatively inexpensive compared to existing imaging methods such as MRI, ultrasound and Positron Emission Tomography (PET). We're developing a breast imaging technology that could be portable, low-cost and accurate, and used in local clinics in countries with large populations like China, India and South Korea or anywhere in the world," he says.

Mandelis is also partnering with South Korea's Samsung on research to further develop the differential photoacoustic radar technology and potentially accelerate its commercialization. He envisions that the photoacoustic imaging techniques could be incorporated into the next generation of ultrasound breast imaging systems.

For Industrial Engineering Professor **Andrew Jardine**, hunches, intuition and years of experience aren't sufficient to make the best decisions about maintaining and replacing critical equipment in industrial settings. Jardine has been collaborating with the UK's Ministry of Defence (MOD) for more than 10 years to help the organization understand how to make optimal decisions about preventive maintenance and replacement of equipment such as diesel engines and gearboxes on a range of platforms.

"Our EXAKT software enables the MOD to make evidence-based decisions and they don't change a part unless it is justified by the potential liability or economics," says Jardine, Professor Emeritus and founding Director of the Centre for Maintenance Optimization and Reliability Engineering (C-MORE). The EXAKT software tool developed by C-MORE combines hard data and tacit expert knowledge to provide evidence-based guidance on decisions about equipment repair and replacement.

C-MORE also worked closely with France's Électricité de France (EDF) to identify a more efficient method of measuring the health of the bearings on turbines during shutdown of a nuclear power facility. "We used EXAKT in a diagnostic manner to show a potential to assess the condition of bearings using indirect measures that wouldn't require a time-consuming and expensive dismantling of the equipment," explains **Neil Montgomery**, a Senior Research Associate at C-MORE who worked with EDF on the project.

C-MORE's longstanding collaboration with the MOD has helped to fund the Centre's staff and research activities, and provides valuable defence contacts in other European countries, the United

Molten copper or its alloys can be sprayed on almost any type of surface, from wood, to plastic, to metal

Driver distraction is a large problem. That's why Professor Donmez is currently testing various driver distractions, including smartwatches

States and Australia, that could lead to additional international collaborations. "Another benefit is access to difficult real-world problems for us as researchers and for our students, who get the opportunity to work with experienced engineers," says Montgomery.

C-MORE's highly successful international education program —the Certificate in Physical Asset Management—complements its global research activities. The program has been running for 10 years in Toronto, Hong Kong, Chile, Iran, Qatar, the United Emirates and Australia, and was recently offered for the first time in Berlin. It exports knowledge developed at U of T and trains professionals working in industry to manage assets more efficiently and effectively. "People come to learn from us in Toronto and we go around the world to teach other people. This enhances C-MORE's reputation. We have a global network of contacts and future international collaborations are likely to come out of our educational programs," says Jardine.

Driver distraction is a contributing factor in about four million motor vehicle crashes in North America each year. Industrial Engineering Assistant Professor **Birsen Donmez** is investigating personalized driver feedback systems to inhibit risky driving behaviours to help make roads across North America safer for drivers, passengers and pedestrians.

"Driver distraction is a large problem. About 80 per cent of vehicle crashes and 65 per cent of near-crashes involve drivers taking their eyes off the road within three seconds of the event. We want to understand individual differences in terms of the causes of distraction and design strategies for mitigating distraction based on these individual differences," says Donmez, who has received funding from Toyota's Collaborative Safety Research Center (CSRC) in Ann Arbor, Michigan, to test and evaluate feedback systems to help prevent risky driving behaviours.

Using a newly developed driver distraction questionnaire and a driving simulator, Donmez studies two distinct types of drivers who are particularly susceptible to distraction while on the road. Donmez and her students surveyed 570 drivers on various distractions including talking on a cell phone, text messaging, interacting with in-vehicle technologies and reading roadside ads. They found that impulsive, sensation-seeking drivers voluntarily engage in distractions more often than those who are not. Sensation-seeking drivers generally have a positive attitude towards these distractions and believe they drive well while engaging in these secondary tasks.

A second type of driver is more susceptible to involuntary distraction. An older driver, for example, may have greater difficulty suppressing distracting stimuli while driving. This type of driver can be more easily distracted by a ringing phone, conversations with passengers, or a roadside accident, and may be slower to respond to a critical target, such as a stop sign or pedestrian. "As people age, attention and cognitive ability tend to decline. Older adults are more easily distracted and may find it harder to disengage and look back at the road," explains Donmez, who uses eye-tracking devices in the simulator to measure the number and average duration of a driver's glances off the road.

Her preliminary research findings suggest feedback systems should be tailored to individual driver characteristics to effectively change behaviour and reduce distractions that lead to accidents. Donmez hypothesizes that drivers susceptible to involuntary distraction are more receptive and likely to benefit from real-time, in-vehicle feedback systems, such as an on-dash warning light or beeping sound that redirects their attention to the road.

"Driver distraction is a large problem. About 80 per cent of vehicle crashes and 65 per cent of near-crashes involve drivers taking their eyes off the road within three seconds of the event."

But simple real-time warnings may not be as effective for sensation-seeking drivers, who would likely ignore them. "We are looking into engaging sensation-seeking people by creating challenges to change their driving behaviour," says Donmez, who is testing gamification strategies to motivate them to change their driving style. "We are designing challenges and rewards for them to reduce the amount of time their eyes are off the road. We give them feedback at the end of the drive and create a game out of it," she says.

Donmez and her Human Factors and Applied Statistics lab will help Toyota to design personalized feedback systems that alert and motivate different types of motorists in the North American market to drive more safely. Her findings will be of considerable interest to Toyota in the Japanese market as well, where 20 per cent of the population is at least 65 years old, compared with 13 per cent in Canada and the United States.

"The funding has allowed me to expand my lab and Toyota Canada recently donated a vehicle, which we will use to conduct experiments on the road in actual traffic conditions," she says.

Mark Witten is a freelance health and science writer in Toronto.

Honours & Awards

Award period of December 1 2013, to December 1, 2014. We apologize if your award is not listed. Please contact us at momentum@mie.utoronto.ca with details about your award and we will add it to our online record.

Alumni

International

American Meteorological Society: Fellow
James Norman Moum
(MechE 7T8, MechE MASc 7T9)

American Meteorological Society: The Henry Stommel Research Award
James Norman Moum
(MechE 7T8, MechE MASc 7T9)

National

Canadian Academy of Engineering (CAE): Fellow
Paul Acchione (MechE 7T1,MEng 7T6)
Ted Robertson (MechE 7T1, MEng 7T7)

NSERC Chair for Women in Science and Engineering: #30in30
Linda Gowman (MechE 8T7, MIE PhD 9T6)

University of Toronto

Arbor Award
Donald W. Dowds (MechE 5T3)
John H. Weber (MechE 7T9)
George E. Wildish (MechE 5T3)
Thomas D. Woods (IndE 7T5)

Inventor of the Year
Will Walmsley (MASc IndE 1T2);
Advisor: Paul Milgram

Faculty

International

American Society for Engineering Education (ASEE): Donald E. Marlowe Award
Jean Zu

American Society for Engineering Education (ASEE): Sharon Keillor Award for Women in Engineering Education
Susan McCahan

American Society of Mechanical Engineers (ASME): Fellow
Hani Naguib

ASM International: Fellow
Javad Mostaghimi

Human Factors & Ergonomics Society (HFES): Stephanie Binder Young Professional Award
Birsen Donmez

The Institute of Electrical and Electronics Engineers (IEEE): Fellow
Yu Sun

International Society of Engineering Asset Management (ISEAM): Honorary Fellow
Andrew K.S. Jardine

Society of Plastics Engineers: Outstanding Achievement Award: Thermoplastics and Foams Division
Chul B. Park

National

Canadian Association of Municipal Administrators (CAMA): Willis Award for Innovation
Andrew K.S. Jardine
Birsen Donmez

Canada Council for the Arts: Killam Prize
Andreas Mandelis

Canadian Academy of Engineering (CAE): Fellow
Yu Sun

Canadian Society for Mechanical Engineering (CSME): Fellow
Aimy Bazylak
Craig A. Simmons

Canadian Society for Mechanical Engineering (CSME): I. W. Smith Award
Tobin Filleter

Canadian Society for Mechanical Engineering (CSME): Robert W. Angus Medal
Cristina H. Amon

Engineering Institute of Canada (EIC): Fellow
Nasser Ashgriz

Government of Canada: Renewal of Canada Research Chair in Micro- and Nano-engineering Systems (Tier II)
Yu Sun

Natural Sciences and Engineering Research Council of Canada (NSERC): Strategic Project Grant (SPG)
David Sinton

NSERC Chair for Women in Science and Engineering: #30in30
Jean Zu

University of Toronto

Alexander von Humboldt Foundation: Fellowship
Aimy Bazylak

University of Toronto: Connaught Innovation Award
Yu Sun
Axel Guenther

Faculty of Applied Science & Engineering

Research Leader Award
Javad Mostaghimi

Students

International

AUTO21: TestDRIVE 2014
Turuna Seecharan

Human Factors & Ergonomics Society (HFES): Student Award
Farzan Sasangohar

James Dyson Award: 2014 Canada
Lian Leng

National

Canadian Society for Mechanical Engineering (CSME): Gold Medal
Edwin Wong (MechE $1T_4$)

Engineers Canada: G old Medal Student Award
Hanna Janossy (IndE $1T_3$ + PEY)

Mercedes-Benz Canada: Graduate Scholarship in Fuel Cell Research
Jongmin Lee
Olga Arevalo-Quintero

Society of Manufacturing Engineers: Top 30 under 30 Future Leaders in Manufacturing
Ali Rizvi

Regional: Provincial & City-wide

HATCH: Graduate Scholarship for Sustainable Energy Research
Faraz Arbabi
Bo Bao
Jim Y.J. Kuo
Eric Sheung-Chi Fan

University of Toronto

Gordon Cressy Student Leadership Award
Andy Chen (MechE $1T_3$ + PEY)
Hanna Janossy (IndE $1T_3$ + PEY)
Kazem Kutob (IndE $1T_3$ + PEY)
Alberto Picard-Ami (IndE $1T_3$ + PEY)
Chirag Variawa (PhD IndE $1T_4$)

Faculty of Applied Science & Engineering

Teaching Assistant Award
Farzan Sasangohar (MIE PhD $1T_5$)

Staff

University of Toronto

University of Toronto: 25 Year Service Award
Sue Eccles
Reception & Office Operations Assistant
Brenda Fung
Graduate Program Administrator

Faculty of Applied Science & Engineering

Agnes Kaneko Citizenship Award
Oscar del Rio
Senior Computer & Web Administrator

Innovation Award
Tom Bernreiter
Laboratory Engineer & Manager


Great Wall of China
万里⊠城
POST CARD


BAR


CANADA
PASSPORT
PASSEPORT

A joint program between MIE & the College of Engineering at Peking University (PKU), the Globex Capstone Design Initiative adds an international, collaborative twist to MIE students' projects. Over the course of the academic year, the students meet twice in person, including three days in Beijing, China.

72 HOURS IN BEIJ

By Amy Stupavsky

Mechanical and Industrial Engineering students' degrees culminate in their mandatory senior-year design projects—a chance for the future leaders and entrepreneurs to test their engineering knowledge and ability on real-world industry challenges. Most students take on domestic proposals, but some, driven by the growing workforce demand for internationally experienced engineers and a desire for new undertakings, choose to go global.

A joint program between MIE and the College of Engineering at Peking University (PKU), the Globex Capstone Design Initiative adds an international, collaborative twist to MIE students' projects. Currently in its third year, the program brings together U of T and PKU students who cooperate on mechanical or industrial engineering projects proposed by industry firms.

"Today's engineers must be ready to work with companies in any part of the world, often where English is not the first language," says Professor **Jean Zu**, Chair of MIE. "Through the cross-cultural capstone initiative, students gain early exposure to international teamwork and experience the real-time demands of working with a team that spans different continents and time zones."

The greatest benefit to the initiative is the advantage for career growth, especially in developing Chinese-North American engineering experience as China continues to evolve as a large market for work opportunities. Completing an international project with this level of complexity can boost résumés—and design strategies.

"The program helped develop my team and leadership skills. It expanded my professional network; I still remain in contact with my friends at PKU."

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Botton
"Simultaneously
poignant and
terribly funny . . .
De Botton's most
imaginative
work yet."
—The Spectator
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"This experience positively influences their future careers," says Professor **Kamran Behdinan**, NSERC Chair in Multidisciplinary Engineering Design and Director of the Institute for Multidisciplinary Design and Innovation (IMDI) at U of T, who coordinated last year's and this year's Globex program. "Learning how people of different cultures and educational backgrounds approach the same design has a favourable impact on innovation."

Anthony McLeod (MechE 1T3) worked with two U of T teammates and two students from PKU to create a dehumidification fan for Bombardier Aircraft. Their initial designs were rejected for feasibility reasons, but after several consultations with their client, they developed a successful design, which won third place in the MIE Design Showcase as well as the Wallace G. Chalmers Engineering Design Award.

McLeod attributes the accolades to successful teamwork and troubleshooting, skills the group honed during the Capstone Initiative.

"I believe this was the primary goal of Capstone: to bring together everything we have learned and apply it to a real-world problem," he says. "Collaborating with the PKU students definitely made for a better design and execution. They provided a new prospective and sources of knowledge to our team, and helped ensure our team was on track and progressing in the execution of our final deliverable."

This year, 15 mechanical engineering students are at work on seven projects. Over the course of the academic year, the students meet twice in person, for three days in Beijing in November and then again in April in Toronto, where they present their completed projects at the MIE Design Showcase.

The Beijing trip marks many U of T students' first visit to China—and often a first voyage overseas. Part of learning the soft skills necessary for working effectively on an international team involves awareness of different customs and traditions. While in Beijing, the students tour the major sites—including Tiananmen Square, the Forbidden City, and the Great Wall—and engage with Chinese culture.

While cultural understandings and negotiating language barriers are major components to effective collaboration, the students also face time and geographic constraints. The majority of the PKU and U of T students' interactions occur online, another hurdle to overcome in finishing their projects.

Last year, **Penny Chen** (IndE 1T4) worked on a project designing a smart-shopping solution to combat the long lines and disorganization in Chinese supermarkets. Working with her overseas PKU team members required ingenuity.

"We had to figure out ways to solve our communication problems," she says. "It's hard to work with people who live in a different time zone, especially when it comes to meetings. We started using mobile apps WeChat and WhatsApp to raise questions whenever we needed to."

Professor **Mark S. Fox**, faculty advisor for the smart-shopping project, credits successful products outcomes to the team-building and communication skills students learn first-hand with Capstone. "The measure of success has several dimensions, but in all my years running companies, I could never underestimate the importance of team relationships, the degree to which people develop a cooperative style and become partners in a project," he says.

McLeod, who currently works as a solution engineer at SAP, extolls the value of the program, calling it the highlight of his educational experience.

"It was very helpful job training," he says. "In my role at SAP, I communicate regularly with team members around the world. The program helped develop my team and leadership skills. It expanded my professional network; I still remain in contact with my friends at PKU."

Daniel Fonseca (MechE 1T3), now a junior engineer at Blendtech who also worked on the Bombardier project, echoes the same glowing sentiments.

"It was very challenging experience that helped grow to become a better engineer," he says. "This project helped me improve my time management, problem solving, and communication skills. Since completing the Capstone project, I've already applied what I've learned to my new job, which just goes to show how valuable the experience was."

Globex Summer Program

A Shanghai native, **XueCheng Wang** (MechE 1T7) knew she wanted to study in China at some point during her U of T degree.

"Although I was raised in China, my understanding of the country was underdeveloped," she says. "Studying abroad seemed like the best way to gain understanding of China, Chinese academic life, and the engineering terminologies that would be crucial to my career, due to growing relations between China and North America."

Wang was able to tick these items off her academic to-do list when she participated in the 2014 Globex summer program.

Globex—Global Education Exchange—is a program for educational exchange and research collaboration between the College of Engineering at Peking University (PKU) and the engineering faculties of its partner institutions from across the world. For an intensive four weeks in July, Globex draws students from these institutions to PKU's campus in Beijing, China, to study under world-class faculty from PKU, U of T, and other distinguished schools. U of T has been a Globex partner since 2012.

"It's important for U of T to rub shoulders with top schools," says Professor **Shaker Meguid**, who taught Solid Mechanics in 2013. "Globex attracts top students and top professors, which creates opportunities for other collaborations."

An important initiative in the internationalization of education, Globex offers students a unique opportunity to gain overseas experience, an important asset in building a career in the increasingly globalized engineering field.

"Globex allows U of T students to explore China while they are in their formative, most creative years of their lives," says Professor Ray P. S. Han, assistant dean of PKU's college of engineering. "Being from Canada's leading university with a diversified and informed student body, students can take advantage evolving China's opportunities."

Students enrol in one or two classes, ranging from specialized engineering classes—such as advanced control systems—to humanities and social science options on Chinese culture. Small-class sizes, transferable credits, and a taste of independence and local Chinese life draw students from MIE as well as other U of T engineering departments.

"My class had only two students with a mechanical engineering background—the other students came from computer science and other engineering disciplines," says Professor **Mike Munro**, who taught Manufacturing in 2013.

"This is one aspect of inter-cultural experience within engineering. I think our students found the perspectives of non-MIE students to be very interesting," he added.

Now in its fourth year, the Globex summer program continues to grow: 30 partner universities and an estimated 200 students will partake in the 2015 session. U of T professors **Lidan You** and **Hani Naguib** are slated to teach this year.

Amy Stupavsky is a freelance writer from Toronto & frequent contributor to *U of T Magazine*.

Facts & Figures

52
Faculty Members

374
Industrial Engineering Undergraduates

1,262
Undergraduates (Fall 2014)

888
Mechanical Engineering Undergraduates

540
Graduate Students (Fall 2014)

1st
in Canada, U of T Engineering

70+
Invention Disclosures in the Last Five Years

100+
PEY Companies

11,800+
Active/Living Alumni

160+

Industry Partners in Research & Learning

31

UT-IMDI Industry Partners

425

Undergraduate & Graduate Degrees Awarded (2013-2014)

50+

Specialized Research Labs

9

Interdisciplinary Centres

16

International Exchange Universities

65+

Domestic Capstone Projects

9

Canada Research Chairs

8

International Capstone Projects

13.5M

Total Research Funding (2013–2014)

30+

Capstone Industry Partners

50+

Student Clubs Financially Supported by MIE

Meine Momentum

Two summers ago, ***Hanna Janossy*** *(IndE 1T3+PEY, MEng 1T5) & her sister* ***Lea*** *(IndE 1T4+PEY) spent a year across the Atlantic Ocean in Zürich, Switzerland as international exchange students. In a personal essay, Janossy writes about her experience abroad & studying at the Swiss Federal Institute of Technology (ETH Zürich).*

By Hanna Jannosy

Did you know there is a country where there are enough nuclear fallout shelters to accommodate its entire population? It's also illegal to keep just one guinea pig (they must be kept in pairs). There is no Head of State and 95 per cent of energy is CO_2-free. Cyclists must buy liability insurance before they are allowed to pedal on public roads. And jewellers make rings worth $70 million which are made entirely out of diamonds. This is Switzerland—the beautiful country which my sister Lea and I had the honour of visiting for a six-month exchange semester at the Swiss Federal Institute of Technology (ETH).

I have grown up allergic to 'sheep mentality.' Back in kindergarten I determined that I would always be different from the status quo. Somehow, despite proceeding through the normal Toronto public school system, my life has always been exceptionally exciting. I decided in high school that I would always try to be unique, in terms of finding opportunities to give joy and serve the world in ways which require my specific capabilities.

I have approached university in a similar manner. I always made an effort to speak with many of my Professors about non-scientific topics, such as family life, hobbies, religion, culture, etc., outside


Swiss Federal
Institute of Technology
My Life in Zürich

the classroom. This experience of not being scared of Professors came very handy in Switzerland, where the exchange office told us on our first day that most exchange students fail courses, despite taking only two-thirds the courseload of an average Swiss student.

Swiss education is extremely challenging, particularly ETH (there's a reason it's ranked in the top five engineering universities in Europe). Although most of our courses were indeed brutally difficult, we tried to take some extra courses simply out of interest, including a fascinating Masters-level course in food security, which included a free trip to Rome for a captivating political conference at the home of the Food and Agriculture Organization of the UN.

The Swiss system is very different. Unlike Toronto where students have constant quizzes and homework assignments, many Swiss courses' final exams are worth 100 per cent, and there are both written and oral exams. In an oral exam, the Professor may delve into as minute detail as he pleases about any topic in the course—a really challenging experience. My courses during the semester were from the Masters-level Management of Technology Department, where I found that the technical MIE courses at U of T gave me a distinct advantage over the many students who had only studied business. In the summer, I did research at the Bioelectronics Lab of Professor Janos Veoreos, where I worked on optimizing the printing of tiny electrode arrays for implantation into animal and human spinal cords with the goal of enabling paraplegics to walk again. It was a fascinating experience.

Zürich is gorgeous. It is a land of snow-covered steeples on every corner, a river right through the centre of the city, and the Alps in our backyard. The only drawback for a foreigner is the unintelligible Swiss German spoken everywhere—even Swiss citizens can't understand each other if they happen to come from villages more than a few kilometres apart! Luckily most people spoke English, although for us this was a drawback since we were determined to learn German. We accomplished this only by organizing Deutsche-Potluck parties every week for 50 to 100 exchange students. The rule was: anything goes as long as you speak in German! I also took an acting/improvisation class in German, which was probably one of the best decisions I made there because I learned far more German through laughing and acting humorous scenes than we would have from a textbook class. I highly recommend to all exchange students taking a foreign language course prior to starting classes—nearly all universities have this possibility, and most people are surprised to find how quickly they can learn when immersed in the language and culture.

Both Lea and I organized classes so that we would only have courses Tuesday through Thursday, and therefore each weekend was a four-day weekend during which we explored Europe (note: this is highly discouraged by Swiss administration, and prospective exchange students should only contemplate this lifestyle if they are accustomed to overloading, such as taking more than 7 courses a semester at U of T, and/or are extremely efficient at studying). From skiing on pristine uncharted slopes, to silent retreats in enchanted mountain-top monasteries where hooded monks still sing Gregorian chant at 4:30 a.m. each morning, to the European Unicycling championships, to balls in London, Paris, and Rome, our life was a dream.

My passion for adventure was not diminished during my exchange studies. Since then, I completed a minor in Biophysics in Budapest, Hungary, worked a summer as a sailing Captain in Greece, and most recently started a company called Syncadian Inc., developing fatigue management software for the Canadian military.

Swiss people are very kind, and it was a joy to experience a completely different culture from that of Canada. I highly recommend completing an exchange semester to every Engineering student. Due to recent changes in the MIE Department in the process of transferring credits, it is now much easier to complete a semester abroad. The experience deeply broadens your horizons, builds your confidence enormously, and enables you to not just face, but excitedly relish, any challenges life throws at you in the future.

We hope you enjoyed this issue of *Momentum*.

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