

CAPSTONE

Faculty of Engineering and Computer Science

CRACKING THE CODE: CONCORDIA LEADS IN CYBERSECURITY RESEARCH



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MESSAGE FROM THE DEAN



From aerospace to energy, cybersecurity to building engineering, manufacturing to information and communication technologies and health monitoring to environmental sustainability, the Faculty of Engineering and Computer Science (ENCS) at Concordia University blends traditional branches of engineering with programs designed for the future.

With over 210 full-time professors, 30 research chairs, and approximately 8000 students, the Faculty offers an environment where students receive an education acknowledged to be among the best in Canada and work side-by-side with faculty members on cutting-edge research.

Over the last year, we undertook a planning process to define strategic initiatives that build on our solid foundation as a world-class engineering faculty with a distinct identity and a reputation for excellence.

Our goal was to involve everyone – students, faculty, staff, alumni and industry – from our community. Through polls, surveys, town halls, consultations with higher education experts and discussions with all of the ENCS committees, we received an overwhelming amount of useful feedback.

With this input, we crafted the 2016-2021 Strategic Plan entitled, “Inspiring a New Generation of Engineers and Computer Scientists”. Our plan serves as a measuring stick

to evaluate our decisions as we navigate our role within a next-generation university. It represents our aspirations as well as achievable objectives that will keep the faculty at the forefront of education and research while meeting the needs of a 21st-century society.

For the next five years, the following six strategic imperatives will help ENCS create a student-centric environment that increases opportunities for hands-on, experiential learning and that cultivates collaboration with our community partners. These imperatives contribute to the University Strategic Directions (that follow the ENCS imperatives and are shown in *italics*).

Enhancing research quality and reputation – *Double your research*

Excellence in academic programs through innovation – *Teach for tomorrow*

Elevating students’ learning experience to new heights – *Get your hands dirty; go beyond*

Embracing integration across engineering, arts, science and business – *Mix it up; Experiment boldly*

Empowering students, faculty, and staff to success – *Take pride; Grow smartly*

Enabling the intellectual and economic vitality of our community – *Embrace the city, embrace the world*

I am immensely proud of our community and excited to share how we have been living up to the goals we’ve set for ourselves thus far!

A handwritten signature in blue ink, appearing to read 'Amir Asif'.

Amir Asif

*Dean and Professor
Faculty of Engineering and
Computer Science
Concordia University*



INTRODUCING QUEBEC'S FIRST DOCTORAL PROGRAM IN SOFTWARE ENGINEERING

BY MEAGAN BOISSE

Concordia answers the industry's call for highly specialized graduates.

This fall, Concordia is welcoming a new cohort of doctoral students as it becomes the only university in Quebec, and one of two in the country, to offer a PhD in Software Engineering.

Concordia's Department of Computer Science and Software Engineering topped the list of Canadian Universities in SE Publications rankings between 2012-2016. Currently, the university offers popular bachelor's and master's programs in the burgeoning field, and with 16 professors presently conducting software-engineering research within the faculty, it is primed for expansion.

"It's a natural extension of the portfolio of programs we already offer," says Peter Rigby, an assistant professor in software engineering and lead writer and champion of the new program. "It will allow students to focus on core software-engineering topics instead of it being a sub-discipline of computer science."

Rigby says the implementation of the PhD program is important right now as a lot of doctoral students are doing work in software engineering yet getting their PhDs in computer science, despite their being notable differences between the two disciplines.

"Computer science focuses more on developing the theory behind new algorithms, whereas software engineering looks at patterns for the creation of large-scale systems and how large teams collaborate to create these systems. It's much more applied," explains Rigby.

Sudhir Mudur, chair of Computer Science and Software Engineering, worked closely with Rigby during the development of the program. He says the new PhD will focus on creating theories, tools and techniques that have direct applications within an industry concerned with efficiently producing correct, reliable and user-friendly software for different platforms.

"Graduate students who wish to pursue research in software engineering will find that this

degree appropriately reflects their research emphasis," says Mudur. "It is unique because it clearly differentiates their specialization in software engineering."

RESPONDING TO A GROWING NEED

Concordia has been steadily expanding its software-engineering roster, hiring four new tenure-track professors in the field since 2012. The department will continue to grow, with plans to take on more talent in the coming year.

The new PhD program is coming at a time when demand is high, with enrolment in the master's program higher than in the more general computer science designation,

"A number of graduates from our BEng and MASC programs have expressed interest in pursuing doctoral research here at Concordia," says Mudur. "So this new program meets the need of academia, evident from the large number of universities which advertise positions in software engineering, as well as industry research units who are looking for

people with advanced and specialized knowledge and skills in this field."

Mourad Debbabi, associate dean of Research and Graduate Studies, says the need for high-calibre software engineers has never been so present as it is today.

"Nowadays everything has to be smart — buildings have to be smart, power systems have to be smart, transportation systems have to be smart, homes have to be smart, phones have to be smart, and smart means there is software."

An expected 18 students will begin their PhD in software engineering this September; that number is expected to grow to 32 by September 2017, and to 82 by the year 2020.

"As the program evolves, it is bound to further enhance Concordia's reputation in the field of software engineering in Canada and internationally," says Mudur.

CONCORDIA'S 'EXCELLENT TRAINING AND RESEARCH OPPORTUNITIES' IN CHEMICAL AND MATERIALS ENGINEERING

FROM AEROSPACE TO BIOMEDICINE, THE NEW DEPARTMENT PROMISES TO EXPAND THE UNIVERSITY'S 'NICHE IN MODERN FIELDS'

BY MEAGAN BOISSE

At its October 7 meeting, Concordia's Senate approved a new department, which will offer both graduate and undergraduate programs in Chemical and Materials Engineering.

Amir Asif, dean of the Faculty of Engineering and Computer Science (ENCS), says the addition will complement the nine existing engineering programs currently on offer at Concordia.

It is exciting to us and contributes to developing Concordia's niche in modern fields, such as advanced materials, additive manufacturing, nanotechnology and molecular self-assembly," says Asif.

"As we stand on the cusp of a fourth industrial revolution that merges the worlds of production and network connectivity in an Internet-of-Things leading to smart management of industrial production processes, the role of specialized materials in microchips, nano-engineering,

advanced manufacturing and MEMS used in the implementation of such cyber-physical production systems cannot be understated."

"More importantly, this degree will provide excellent training and research opportunities. It will enable our students to be at the forefront of the latest chemical and materials technologies, and to contribute to this exciting field as entrepreneurs or by launching industry careers."

While there are currently five academic chemical engineering departments in Quebec, Asif says Concordia's program will be unique in the province because of its emphasis on developing new processes for producing specialized materials such as plastics, lightweight metal, composites, alloys and nanomaterial.

Asif says there is major demand for qualified chemical and material professionals in the aerospace, automotive, biomedical, electronic, environmental, medical and military industries.

"Our undergraduate and graduate students will be well trained to lead future developments in these industries," he says, adding that the department will also allow new opportunities for cross-disciplinary collaborations within ENCS and the Faculty of Arts and Science to flourish. "The uniqueness of the programs offered by the Department lies in the synergy between chemical engineering and

materials science. Our graduates will be specialists of industrial processes involving physico-chemical transformations of matter. They will possess an in-depth knowledge of the relationships between them, at the atomic level as much as at the level of their properties and their behaviour leading to commercial products that are safer, environmentally friendly yet optimally designed!"

Graduate students will be able to register to begin the program in 2017-18, while undergraduates can register during the 2018-19 academic year.



SECURING QUEBEC'S POWER SYSTEMS

CONCORDIA RESEARCHERS RECEIVE OVER \$2 MILLION IN FEDERAL FUNDING TO EXPLORE THE FUTURE OF SMART GRID TECHNOLOGY

BY MEAGAN BOISSE

This fall, the Natural Sciences and Engineering Research Council of Canada (NSERC) announced that it will provide \$2.16 million over five years to support new research in the domain of cybersecurity and power systems through its Industrial Research Chairs Grants program.

Mourad Debbabi, associate dean of Research and Graduate Studies in the Faculty of Engineering and Computer Science, was named principal chairholder of the NSERC/Hydro-Québec Thales Senior Industrial Research Chair in Smart Grid Security: Detection, Prevention, Mitigation and Recovery from Cyber-Physical Attacks.

As chairholder, Debbabi will work alongside leading industry giants and co-sponsors Hydro Québec and Thales Group to conduct cutting-edge research into Quebec's power grid system, with the intent of protecting the province's power supplier from the threat of cyber-physical attacks.

"I've worked actively with the industry over the last few years to put this research program into place," says Debbabi.

"It's a great pleasure to now be in a position to execute what we've envisaged. I have

no doubt it will strengthen Concordia's already prominent cybersecurity task force and cement our leadership in the area both nationwide and internationally."

Debbabi will lead a team of about 25 professors, graduate students, postdocs and industry experts in exploring smart grid technologies and protocols. Their objective will be to come up with new detection, prevention, mitigation and recovery methods to enhance the overall security of Quebec's power system.

"The current electric grid is considered one of the best engineering achievements of the 20th century. However, recent cybersecurity incidents and research demonstrate electrical grids can be subject to attacks that could lead to severe security and economic consequences, and even to the endangerment and loss of human lives," says Debbabi.

He also notes that Quebec's grid has experienced five major blackouts over the last four decades, three of which occurred in the past nine years alone.

As dean Amir Asif explains, "in power engineering, the traditional electric power grid framework will soon be





replaced by the smart grid technology that allows for two-way electrical flows and information transfers between the electrical utilities providers and their clients. While the smart grid empowers utilities providers by improving monitoring, control and management of the demands of customers, it makes the power grid vulnerable to serious damage by cyber attackers. Dr. Debbabi's IRC will help research new technologies to identify such vulnerabilities and offer solutions to reduce the risks in smart grids to an acceptable security level."

Representatives from co-sponsors Hydro Québec and Thales Group are confident that the Industrial Research Chair in Enhancing Smart Grid Security will further develop knowledge to protect affect crucial public services such as hospitals, police stations, banks and other organizations with computerized systems.

Hydro Québec's system is becoming increasingly automated. The company is adding functions to make the system even more productive, so that it can, for example, adapt to real-time operating conditions, more easily integrate renewables and increase potential interaction with its customers.

"Integrating more intelligence into the network does of course mean increased cybersecurity challenges," says Jérôme Gosset, general manager of IREQ, Hydro Québec's research institute. The new chair announced today will help advance current knowledge and develop new knowledge on cybersecurity applied to large power systems, which will benefit Hydro Québec."

Siegfried Usal, vice-president of strategy for Thales states: "As a world leader in cybersecurity solutions, Thales is committed to protecting critical infrastructure from increasingly sophisticated cyber-attacks through best in class cybersecurity technologies and solutions. This partnership with Concordia will allow us to develop new talents in the field of cybersecurity and explore more ways of guaranteeing network resilience in the face of emerging threats."

The university boasts seven full-time faculty members with core expertise in security, and specialized master's programs in information systems security with more than 150 graduate students presently enrolled.

Concordia also houses the Cyber Security Research Centre, which has more than 60 members. Their research touches on a variety of issues from cyber forensics to data mining and privacy protection.

"With this new funding program, we will have even more means to do interesting research and make waves in the areas of smart grid and cyber-physical security," says Debbabi.

"Our aim going into this is not only to provide a strong, positive impact on the cybersecurity of smart grids and the operations of Hydro Québec and Thales, but to go beyond that. Ultimately we want to contribute to better security in Canada and see our research reflected in products and innovations."



HACKCONCORDIA: ELEVATING STUDENTS' LEARNING EXPERIENCE

Last January, HackConcordia took the student learning experience into their own hands and held a "hackathon." With over 400 attendees, it's safe to say their event was a success.

We chatted with HackConcordia committee member, Avinanda Chattapadday, to de-code the group's events and find out what they will be taking on this year.

CAN YOU TELL US MORE ABOUT WHO HACKCONCORDIA IS?

HackConcordia is a student group that focuses on fostering a community of developers who use technology to learn about and create amazing things. It is also Concordia University's hacker collective where students get to meet new people, organize hacking events and receive updates on the latest hackathons Concordia will be attending.

HOW DID THE GROUP FIRST COME INTO BEING?

The team was formed when a group of enthusiastic students came together to plan and execute Concordia University's very own first hackathon, ConUHacks.

It was a 24h hackathon bringing together over 14 sponsoring tech companies and just under 400 students from 24 schools across Canada and the eastern United States. We received extremely positive feedback from both students and sponsors, which we value and are very proud of.

WHAT IS A HACKATHON?

Hackathons allow participants to show self-expression and creativity through technology. People with various backgrounds come together, form teams and collaborate to build something from scratch within a very limited amount of time.

WHAT ARE SOME OF THE GOALS OF HOSTING SUCH AN EVENT?

Hackathons have become very big and important in our field. They have become the new career fair since they allow companies to meet passionate students in a practical environment. They simplify the recruiting process by giving participants the opportunity to showcase their technical skills and passion for programming.

WHAT EVENTS SHOULD BE ON OUR RADAR?

ConUHacks II will be held on January 21-22, 2017. Technology enthusiasts won't want to miss it.

We plan to make this year bigger and better by having even more participants, top leading companies, amazing prizes and fun APIs.

HOW CAN STUDENTS GET INVOLVED?

Attend our events and volunteer! You should also join and follow us on social media. These are great ways to meet the team and start building a relationship with us, since it can come in handy during our recruiting season which is usually at the end of winter.

You can learn more about ConUHacks and HackConcordia at the following links:

conuhacks.io

hackconcordia.com



WANTED: STUDENTS TO DEVELOP INTERDISCIPLINARY IDEAS — AND SOLUTIONS

BY JASMINE STUART



Concordia introduces a new Graduate Certificate in Innovation, Technology and Society.

The winter 2017 term at Concordia will see the launch of the first ever program from the Faculty of Engineering and Computer Science's Centre for Engineering and Society.

The newly approved Graduate Certificate in Innovation, Technology and Society aims to develop students' knowledge across disciplines and provide them with the skills to effectively engage in innovation practices, lead interdisciplinary teams and enhance their independent entrepreneurial endeavours.

For Deborah Dysart-Gale, chair of the Centre for Engineering in Society, the new program is about "creating an interdisciplinary group driven by entrepreneurial spirit or vision, in order to generate an

environment for students to immediately put into practice design theory and user-centered communications pedagogy."

Cohorts will include engineers looking to expand their experience working with non-engineers in interdisciplinary teams, non-engineers wishing to develop skills working with technology, and professionals seeking additional skills for career success.

Students will finish their certificate with a practicum at District 3, Concordia's innovation accelerator, where they will have a chance to put their newly acquired theoretical knowledge to use with the mentorship of faculty members, entrepreneurs and coaches.

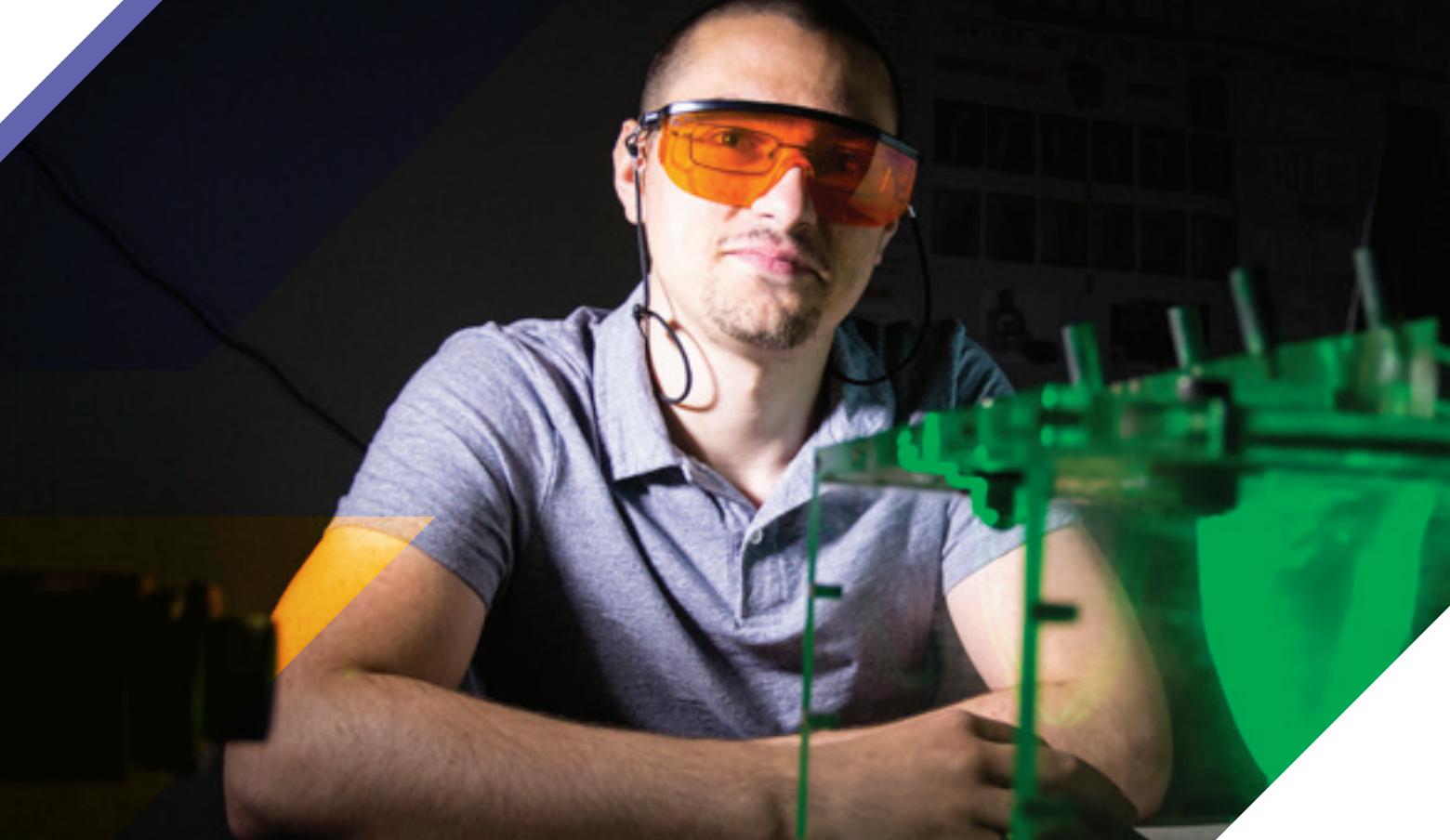
District 3 is a natural home for the practicum — since its creation the accelerator has seen more than 400 students and community members adapt

best practices in innovation, teaching and learning to develop a user-centred framework for entrepreneurial experiments.

For the students and faculty who have been with District 3, the new certificate program marks a milestone: pedagogical lessons developed through both technical and social innovation projects being brought into the classroom.

"This certificate takes the academic approach to teaching innovation — which is critical in all areas these days — to the next level," says Dysart-Gale.





MEET CONCORDIA'S NEW VANIER SCHOLARS

GIUSEPPE DI LABBIO AND MONA TAGHAVI PURSUE INNOVATIVE
SOLUTIONS FOR HEART DISEASES AND CLOUD COMPUTING

BY TATIANA ST-LOUIS

Giuseppe Di Labbio and Mona Taghavi are this year's recipients of the prestigious Vanier Canada Graduate Scholarships (NSERC), which recognize Canada's most promising doctoral students and establish the country as a global centre of excellence in research and higher learning.

Each scholarship carries an annual stipend of \$50,000 for three years. The awards are distributed among the social sciences and humanities, natural sciences and engineering, and health. A maximum of 167 are granted annually.

This year also marks a first for Concordia, as both scholars are housed within the Faculty of Engineering and Computer Science.

THE QUEST TO BETTER DIAGNOSE HEART DISEASES

A PhD student in the Department of Mechanical and Industrial Engineering, Giuseppe Di Labbio also completed both his bachelor's and master's degrees at Concordia. Specializing in fluid mechanics, he has been applying his expertise to cardiovascular systems since his undergraduate years.

In 2014, his team won second place at the Capstone Awards for designing the first complete heart duplicator in the world. Their creation is still in use at Concordia's Laboratory of Cardiovascular Fluid Dynamics, where Di Labbio will be conducting most of his current research.

Di Labbio's doctoral project is focused on developing new clinical parameters for earlier and more insightful diagnoses of heart diseases, particularly in the left ventricle, the heart's powerhouse.

"The objective is to understand what characterizes an efficient left ventricle in terms of blood flow topology," he explains. "This will help us assess particular cardiac diseases, including aortic or mitral regurgitation, tachycardia and dilated cardiomyopathy, to name a few."

A junior engineer of the Ordre des Ingénieurs du Québec and active member of the Mechanical and Industrial Engineering Graduate Student Committee, Di Labbio is working under the supervision and mentorship of associate professor Lyes Kadem, a specialist in experimental cardiovascular flows.

The impact Di Labbio's research could have on medical practice is huge. Results may allow for a better and earlier evaluation and treatment of heart diseases, the second leading cause of death in Canadian adults after cancers.

Although he has consulted with industry partners in the past, Di Labbio says his greatest motivation remains problem-solving. "I really enjoy the research journey... Figuring things out, learning new things. There's definitely more fun in searching for the answer than finding it, but having an end result is still important and is, of course, the reason we do the research in the first place."

CREATING VALUE FOR THE CLOUD COMPUTING INDUSTRY

The potential for her research to be turned into real-life products is a big part of what motivates Mona Taghavi. One of her biggest dreams is to build upon her doctoral project to establish her very own company.

The PhD candidate, who will be supervised by associate professor Jamal Bentahar, has great faith in the transformative potential of her project.

Working out of the Concordia Institute for Information Systems Engineering (CIISE), an interdisciplinary centre, Taghavi is set to develop an efficient, multi-criteria recommender system for cloud computing services.

"It's like when you want to buy a good camera, but you don't know which features are important," she says. "This system will help you decide what cloud service matches your needs."

Using intelligent recommendations, the system will capture knowledge about user preferences, experience of similar service users and the quality of cloud services in order to provide the end user an algorithm that will facilitate decision-making.

Born in Iran, Taghavi received her Master of Information Systems from UKM University in Malaysia. Prior to this she took a short study break and got involved in a national Iranian information and communication technology research project as well as other IT consulting activities.

Her CV lists an impressive number of international academic publications and collaborations.

Why did she choose Concordia to pursue her studies? "The CIISE offers a major that is found hardly anywhere else," Taghavi explains. "Moreover, Concordia has strong ties with industry partners, which is a big advantage for someone like me who wants to make the jump from academia to business."

With a market for cloud services estimated to reach \$270 billion by 2020, Taghavi's project will likely draw the attention of important key players in the IT world.



CYBERATTACKS: EVERYTHING YOU NEED TO KNOW

BY ARWEN JEAN FLEMING

On October 21, 2016, the United States–based internet firm Dyn fell victim to a wide-scale cyberattack. Millions of North American and European users were unable to access more than 60 popular websites, including Twitter, PayPal, Spotify, Amazon and Netflix.

But what exactly happened? And what does it mean for the future of internet security?

We asked Concordia expert — assistant professor Jeremy Clark, a faculty member of the Concordia Institute for Information Systems Engineering.

CAN YOU EXPLAIN THE OCTOBER 21 CYBERATTACK?

When you request information from a website or internet service, you get in a line behind other people who tried to connect to the same service before you.

Generally, servers can process requests very fast so there is never a noticeable wait.

However, if far more people try to connect to the same site at the same time than the service is prepared for, a lineup can form. Once the line gets too long, the website will start throwing away extra requests until it can reduce the backlog.

Criminals who want to disable a site will attempt to flood it with so many requests that the line is constantly saturated and real users connecting to the site will have their requests thrown away. This is called a distributed denial of service or DDoS attack, and that's what happened to Dyn on October 21.

It used to be that attackers would send as much traffic as they could from a single or small number of computers. However, if all the traffic is coming from

the same location, internet service providers (ISPs) like Rogers or Bell will see the traffic and block it.

Now, attackers operate from as many different locations as possible to make it harder to tell the difference between legitimate requests and ones that are part of the attack — this is what makes it “distributed.”

Attackers do not personally own computers all over the world, so they take over those of other people and then rent out access to sets of them (called a botnet) to others wanting to do a DDoS attack.

WHAT WAS NEW ABOUT THIS ATTACK, AND WHY IS IT SIGNIFICANT?

DDoS attacks have been around for a while, but there are two elements to this one that are



novel (each has been used individually but not together and not at this scale).

The first stems from the fact that it is becoming harder for criminals to take over computers, in particular when users regularly update their operating systems.

So, attackers are targeting smaller internet-connected devices that have much less security than a full-fledged computer, phone or tablet. These include things like cameras, lightbulbs and smart appliances (the so-called “internet of things” or IoT devices).

Because these devices generally do not have a keyboard or large screen, they are harder to update and many users leave insecure default settings in place. We do not know the full extent to which IoT devices played a role, but preliminary analysis seems to suggest it made up a large portion of the attack.

The second aspect is what was targeted — in this case, a large set of Dyn’s DNS servers responsible for many large websites.

While the company has servers all over the world, the attackers focused on a few of them and were able to disable DNS service for these sites for users of all ISPs from certain regions, most notably the east of Canada and the US.

WHAT NEEDS TO HAPPEN IN ORDER TO STAVE OFF FUTURE ATTACKS?

The security of IoT devices will improve over time and vendors will enable automatic updates that do not require user action. They will also rethink how default passwords are assigned to new devices.

In the meantime, ISPs may need to be more proactive in detecting vulnerable devices

amongst their users and blocking large volumes of traffic emanating from them. It is not clear how feasible this is — the DNS system has always been a target and there is no clear way to fix it.

In the short term, it seems more feasible to rely on ISPs and other entities along the “backbone” of the internet to identify and choke DDoS attacks before they reach their intended target.

HOW DO YOU THINK THIS ATTACK MAY AFFECT ELECTIONS?

If the US used internet voting, this could be a major issue and is one of several reasons to resist moving in this direction.

A Canadian parliamentary committee is currently considering internet voting. We have seen DDoS attacks here, however, such as the one that disrupted the 2012 New

Democratic Party leadership convention, and they were successful despite being much smaller.

Some US voting machines have internet capabilities. However, hitting them with a DDoS attack should not stop the collection of ballots. Malicious entities might target candidates’ websites, information about polling locations, etc., but for this attack to be effective, it would have to be targeted at specific sites and not the DNS system.



CHANGE LAB WANTS TO UNLOCK ENGINEERING'S FULL POTENTIAL

BY MEAGAN BOISSE

On October 1, the Engineering Change Lab convened in Ottawa to collaborate with the federal government on advancing its Inclusive Innovation challenge, which addresses many of the most pressing issues facing our country and the world.

Among the conference's attendees were Amir Asif, Concordia's dean of Engineering and Computer Science, who has been a vocal proponent of the multi-stakeholder social laboratory since its launch more than a year and a half ago.

"The Engineering Change Lab is a noble initiative intended to further enhance the contributions that engineers make to society," says Asif, who was behind Concordia's decision to champion the innovative platform. "By participating, we help lead the changes in the engineering education and profession that are needed to unlock its higher potential."

Asif explains that as a champion, Concordia shares responsibility for the lab's sustainability by providing leadership and by helping marshal the resources required for it to function effectively.

From guiding and overseeing secretariat functions alongside fellow lab champions to providing financial sponsorship, in-kind staff time towards specific lab initiatives, hosting events, and engaging outside organizations and resources to support the lab.

Mark Abbott, a member of the lab's secretariat, says Concordia is crucial to the group's governance. "By taking on an extra level of leadership as a champion, Concordia has shown it's willing to shake things up and keep a finger on the pulse of what needs to come next," says Abbott.

WHAT IS THE CHANGE LAB?

Co-convened in January 2015 by Engineers without Borders (EWB) and Engineers Canada, the Engineering Change Lab is dedicated to deepening a shared understanding of the higher potential of the profession and taking tangible action to help unlock this potential.

The group consists of 40 core members comprising CEOs, VPs, deans, and directors, each representing different organizations. "What we've done is convene a microcosm of the system we're trying to change — individuals who represent all corners of the Canadian engineering profession," says Abbott.

The group meets three times a year and has so far developed powerful insights into the future potential of the profession. They have also put together a portfolio of nine initiatives that focus on a range of issues, from lack of diversity to ethical failures, and from problems with education to low innovation rates.

"The need to open ourselves up to bigger questions is important," Abbott says. "Unlocking engineering's full potential will require us to consider what changes are needed to the structures and culture that underpin our profession."

In between meetings, the lab breaks into smaller teams to advance each respective initiative by conducting experiments and engaging those outside their group for support.

One example that grew out of the lab is the National Initiative on Capacity Building and Knowledge Creation for Engineering Leadership (NICHEL) which was co-created by representatives from three universities: University of Toronto, McMaster University and Concordia.

NICKEL's aim is to establish a distinct field of engineering leadership.

As Concordia trains one of the largest engineering cohorts in the country, Asif says the university must stay at the forefront of providing an exceptional learning experience. "That means going beyond technical education and including contributions to society in non-traditional areas."

ENGAGING YOUNG LEADERS

At an official lab meeting at Concordia in May 2016, twenty young leaders were invited to participate, in addition to regular lab participants from industry, government agencies, non-profit organizations and academic institutions.

Geordan Vine, a third-year mechanical engineering student and former president of EWB Concordia, was one of the participants. "To have a level discussion about what you think is wrong with the profession and how you want to see it change, and to have your profession's leaders listen to you — that's an incredible thing," says Vine.

"By including us they've provided the tools and knowledge to continue these types of critical discussions amongst ourselves here at Concordia."

Abbott says that engaging tomorrow's leaders is an important facet of the lab. "The change we're talking about includes the broader engineering community comprised of officially registered engineers, those currently studying any one of the profession's many fields and even the broader community of people who have graduated with an engineering degree, but who have not yet sought registration for whatever reason.

"That's the scale of the movement we're talking about — think 600,000 engineers taking on a bigger leadership role in society."

SIGNING OFF ON NEW TECHNOLOGY

ALUMNUS TOMMY PETROGIANNIS IS AN E-SIGNATURE PIONEER

BY WAYNE LARSEN

Submitting a contract or other official form over the internet used to be impossible — you had to print it out and sign it in ink because there was no other way to affix your signature. Yet that became old-fashioned a few years ago thanks to technology that allows us to securely sign legal documents with the click of a mouse.

One of the pioneers in that area is Tommy Petrogiannis, BEng (elec.) 88, president of eSignLive by VASCO (formerly Silanis Technology), the Montreal-based company behind eSignLive, one of the world's top three electronic signature products.

eSignLive made headlines across business pages last year when it was acquired by giant VASCO Data Security International in a \$113-million deal that helped to position eSignLive firmly in the international market. As

Petrogiannis pointed out at the time, the acquisition was mutually beneficial, as it also facilitated VASCO's access to the North American market.

A LOVE OF TECHNOLOGY

Describing himself as a “die-hard Montrealer,” Petrogiannis grew up in the city's Notre-Dame-de-Grâce-Snowdon area. He attended Vanier College CEGEP before coming to Concordia, where he was able to indulge his love of technology.

“I guess you could say I was a tech geek who gravitated toward electrical engineering just because of that time of evolution in the industry,” he says.

“I was very fortunate to have grown up during the whole semi-conductor revolution, where we saw PCs doubling in performance every 12 to 18 months. Every time you thought computers couldn't get any

better, a year later they were way better. There was always something new around the corner.”

Petrogiannis co-founded Silanis with Joseph Silvester and Michael Laurie — the name is an amalgamation of their surnames — whom he met while working at Matrox Electronic Systems in Dorval, Que.

The problem of designing a secure electronic signature to facilitate internet transactions was a primary focus of the new company, which today serves several thousand clients worldwide, mainly in the government, banking and insurance industries.

CONCORDIA OFFERED HANDS-ON EXPERIENCE

For Petrogiannis, the decision to get his degree in electrical engineering at Concordia was

easy. “One of the reasons I went to Concordia is because I loved the hands-on lab work that was part of the program,” he says.

“I've always liked the idea of doing something rather than just reading about it. I've always liked translating theory into reality, and that's what attracted me to Concordia.”

That hands-on experience would prove beneficial to Petrogiannis in the real world, where innovation often trumps theory. “When you try stuff out in the lab, you're not going to come anywhere near the theoretical results you should get to,” he points out.

“So you end up being more creative and try to troubleshoot things differently than you could have if you were just looking at it academically.”



CASHING IN ON CACHE



ALUMNUS KON LEONG'S COMPANY ZL
TECHNOLOGIES TAKES AIM AT DATA
ARCHIVING IN THE DIGITAL AGE
BY ISAAC OLSON

Kon Leong, BComm 79, graduated from Concordia well before the digital age took the world by storm, but that doesn't mean his minor in computer science is irrelevant in today's fast-paced world of smart phones, paperless offices and cloud computing.

Two decades after graduating, Leong co-founded ZL Technologies, which is located in Milpitas, Calif. — part of what's known the world over as Silicon Valley. The company is now widely recognized as a leader in enterprise information archiving.

With big-name partnerships ranging from Microsoft to IBM, Leong is now president and CEO of a company that got its foot in the digital archiving door before it became such a crucial component of today's large-scale enterprises and institutions.

However, his life took a few twists and turns before ZL Technologies got off the ground.

Leong's parents are from mainland China, although he was born and raised in India. After studying for a year at the Indian Institute of Technology, he immigrated to Canada at age 18 and enrolled in what was then Loyola College, one of Concordia's founding institutions.

He graduated with a degree in business and computer science from Concordia and went into the field of data processing, now known as information technology (IT).

In the two decades that followed his Concordia graduation, Leong had a hand in a few technology startups that didn't quite take hold. Along the way he earned his MBA from the University of

Pennsylvania's Wharton School in Philadelphia and then spent a decade on Wall Street working as an investment banker.

However, his passion for technology never wavered.

ZL Technologies was founded in 1999 as Ziplip. The company's principal product, Unified Archive, is a single-platform tool used by enterprises to consolidate information into a unified platform that complies with laws, protects data and enables users to more easily navigate across data silos. With about 120 employees, Leong describes the company as "quite long in the tooth by Silicon Valley standards."

Leong says large enterprises have massive amounts of unarchived, widely-dispersed information ranging from voicemails to

emails. That poorly archived, disorganized information cannot easily be searched through and it is often unsecured. Leong, seeing this growing problem, co-developed from the ground up a company and software that offers a solution.

"We represent the new generation of information management," says Leong, noting his software platform is delivered as a product or a cloud service. "It's never been done before."



FROM PART-TIME TO A LIFETIME

NIGHT SCHOOL PAVED WAY FOR GRADUATE

JOSEPH PATAKI'S INTERNATIONAL ENGINEERING FIRM

BY ISAAC OLSON

Joseph Pataki, BEng (mech.) 74, graduated from Sir George Williams University just before it merged with Loyola College to create Concordia on August 24, 1974. Now with a successful career winding down, Pataki still credits his alma mater for a lifetime of achievement in the field of mechanical engineering.

More than five decades later, he remains nostalgic about both his academic experience and his hometown of Montreal. That nostalgia has inspired him to reconnect with his past.

He returned to the university during Homecoming 2015 to receive a commemorative Concordia degree.

Pataki describes his academic experience as a key stepping stone toward his successful career not just as an engineer but as co-founder of an international engineering firm

that custom designs and builds machinery for metal mills around the globe.

"I actually started night school in 1965," says Pataki, noting he was working full-time by day for Canadair, the aircraft manufacturer that later became part of Bombardier.

In 1972, Pataki's daughter, Erika, was a year old. He brought her to daycare in the morning before class got underway while his wife, Gabriella, worked full-time for Bell Canada to support the family and fund Pataki's education.

He didn't take out school loans, he adds, and so "Gabriella was instrumental in helping me through school."

Pataki completed his studies in spring 1974, earning his mechanical engineering degree with about seven years' worth of professional experience already under his belt.

In the years that followed, Pataki took a position with Montreal-based Dominion Engineering Works, which was owned by General Electric, before heading west in 1978. He worked for the Ontario-based Ferrco Engineering Ltd. until the economy began to sour.

He and three other colleagues teamed up in the spring of 1983 to start their own business. With four people on the team, the group decided to name themselves Quad Engineering — and their goal was quite simple: "Our goal was to survive, actually," he says.

"It was a bad economic time. Jobs were very scarce. There was a very high unemployment rate. Ferrco Engineering was obviously going out of business. They couldn't sustain a business which at one time employed as many as 300 people," Pataki recounts.

"So, we decided we would go out independently and our goal at the time was to see if we could make a go at it. Everybody's dream is to start their own business and that was one of mine."

Quad Engineering's specialty is custom designing and building the machinery used by metal mills, be it steel or more exotic metals like titanium. These machines operate in extremely hot environments as they melt, mold, twist and shape metals.

In the years that followed, the company went from four people in an office to establishing its own facility in Toronto in 1998, with well over 30,000 square feet for its 100 or so employees at its peak. "We're still in those same facilities today," says Pataki.



MBA: AN ENGINEER'S TICKET TO SUCCESSFUL LEADERSHIP

Basma Afana, MEng '13, discusses the power of coupling an engineering degree with an MBA

Engineers are creative. They are problem-solvers. And most have experience working on cross-functional teams. It is perhaps because they possess these highly-transferable skills that so many engineers find themselves in managerial roles as their careers progress.

To be sure, success in management and in engineering requires many of the same competencies. Engineers and managers need to be able to absorb and interpret large amounts of data and then make efficient and effective decisions.

For those looking toward assuming leadership positions within their organizations or even transitioning careers, an MBA can be a potent asset. It is a valuable complement to a technical degree, adding the abilities to speak the language of

business, understand how the different functional areas of business operate and network effectively.

"Engineers tend to do very well in the MBA," says Sandra Betton, director of Concordia's MBA program at the John Molson School of Business (JMSB). "They work well on teams and approach problems from a variety of angles when considering how to best resolve a business issue." Betton says that 25% of the students pursuing an MBA at JMSB have an engineering degree. "It's a very powerful combination that adds instant credibility and is highly valued by recruiters" she adds.

"The MBA experience was tremendously challenging and rewarding both on a personal and professional level," says Basma Afana, a Concordia engineering graduate who secured a position as a business analyst at Fast Building Contracting after receiving her MBA. "In-class presentations

and active discussions of case studies really helped develop my business vocabulary and communication skills. I graduated feeling confident in my understanding of business fundamentals and my ability to apply them in the workplace."

The John Molson MBA program was recently revised to focus more on developing a big-picture business perspective while providing students with more hands-on business experience. It is offered both full-time and part-time.

"I don't think there is a more accessible program around," says Stéphane Brutus, JMSB's interim dean. "Through making all of our core classes available in the evening, we attract students who require a flexible schedule that allows them to pursue their personal, professional and entrepreneurial goals while completing their studies."

To learn more, visit concordia.ca/mba

FACULTY NEWS

DR. MARIA KLAWE, President of Harvey Mudd College, received an Honorary Doctorate from the Faculty of Engineering and Computer Science at the Fall 2016 Convocation. Dr. Klawe is a renowned computer scientist and scholar who has made significant contributions to the field, to the lives of students and faculty members, and to the tech industry.

DR. EHSAN REZABEIGI, Concordia grad (PhD, 2015) and postdoctoral researcher, won NSERC's first photo award. His

close-up image of a flower-like implant that promotes bone regrowth won first prize in the jury selection for Science Exposed, NSERC's first science image contest. The picture also captured the 2016 People's Choice Award, thanks to the popular votes from coast to coast.

DR. MUTHUKUMARAN PACKIRISAMY was awarded an NSERC Strategic Partnership Grant for Projects. Working with industry partner, Aeponyx, Professor Packirisamy will

carry out a project entitled: "Polarization insensitive, microsystem integrated, mono-order grating based, either discretely or continuously tunable wavelength, platform for communication network components." Given the exponential increase in data traffic over optical networks in the past years, new solutions are required to meet data demands. This project will address these needs by studying how to reduce the size and increase the performance of photonic components at the core of

networks, such as multiplexers and tunable lasers by integrating with microsystems technologies.

CIADI, the Concordia Institute of Aerospace Design & Innovation, celebrated its 15th anniversary in Fall 2016. From its inception as an internships program, CIADI has taken off into a fully-fledged institute offering students hands-on industry experience.

DR. HASSAN RIVAZ won the 2016 Petro-Canada Young Innovator Award for his work

WELCOMING OUR NEW FACULTY MEMBERS

ENCS IS EXCITED TO ADD 20 NEW COLLEAGUES THIS YEAR INCREASING ITS COMPLEMENT TO 210 TENURE-TRACK/TENURED FACULTY MEMBERS.

ALEX DE VISSCHER will take a leadership role in developing the academic and research programs in the faculty's new Department of Chemical and Materials Engineering. He obtained his undergraduate degree in Chemical Engineering and his MSc and PhD degrees in Bioscience Engineering at Ghent University, Belgium. He was a faculty member at the University of Calgary, where he held a Tier II Canada Research Chair position for ten years, and an Associate Head (Graduate) position for two years. His research interests include catalysis and kinetics, advanced oxidation processes and solution thermodynamics. His academic textbook "Air Dispersion Modeling: Foundations and Applications" was published by Wiley in 2013.

TRISTAN GLATARD became an assistant professor in the Department of Electrical and Computer Engineering this summer. He holds an engineering degree from École Centrale de Lyon and earned his PhD at the University of Nice Sophia-Antipolis. Before joining Concordia, he was a researcher

at the French National Centre for Scientific Research (CNRS) and a visiting scholar at McGill University. His research is on Big Data infrastructures, with applications to neuroinformatics.

MARTA KERSTEN became an assistant professor in the Department of Computer Science and Software Engineering this summer. She received a BA in Art History and BSc and MSc in Computer Science from Queen's University, Kingston. She completed her PhD in Biomedical Engineering at McGill University where her research involved developing and testing augmented-reality visualization, display and interaction methods in image-guided surgery. Since joining Concordia she has started the Applied Perception Lab, where the focus is on developing methods to improve spatial and depth understanding of multi-modal and multidimensional data and to study the impact of augmented and virtual reality visualization for specific tasks.

CHARLES BASENGA KIYANDA became an assistant professor in the Department

of Mechanical and Industrial Engineering in August 2016. He received his BEng and MEng from McGill University and earned his PhD in Theoretical and Applied Mechanics from the University of Illinois at Urbana-Champaign. His research is in reactive, compressible fluid dynamics and thermofluid equation of state modelling. He is interested in the behaviour of materials at high pressures and temperatures, the dynamics of non-linear fluid dynamic systems and harnessing energy for propulsion applications.

TSZ HO KWOK became an assistant professor in the Department of Mechanical and Industrial Engineering this fall. He received his PhD in the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong. He was a Postdoctoral Research Associate in the Department of Industrial and Systems Engineering at the University of Southern California. His research is on 3D printing, design for additive manufacturing, mass customization, geometric and solid modeling, and CAD/CAM. He has received awards

including the CAD/CG Best Paper Honorable Mention, the Chinese Youth Science and Technology Innovation Prize and the Postgraduate Research Output Award.

JOONHEE LEE is an assistant professor in the Department of Building, Civil and Environmental Engineering. He received his BSc from Seoul National University in South Korea. He completed an MSc in architectural sciences from Rensselaer Polytechnic Institute and a PhD in architectural engineering from The University of Nebraska-Lincoln. His research interests are building acoustics, psychoacoustics and noise control. Specifically, he investigates how annoying noises affect human perception and performance to apply findings to evidence-based building designs.

SUSAN LISCOUET-HANKE became an associate professor in the Department of Mechanical and Industrial Engineering this summer. She received her BSc and MSc from University of Technology Hamburg-Harburg, Germany, and earned her PhD at Institut National des Sciences

on the Diagnosis of rotator cuff pathology using ultrasound.

DR. HABIB BENALI was appointed as the interim scientific director of the PERFORM Centre. The PERFORM Centre provides an integrated and comprehensive environment to promote healthier lives through changes in behaviour and lifestyle by offering research opportunities, education and preventative-based programs. Benali's research examines how multimodal imaging and computational modelling can be used to better understand which factors promote a healthy lifestyle.

Appliquées Toulouse, France. She has 10 years of experience in the aerospace industry in conceptual design. Her research is on aircraft systems architecting, particularly for technology evaluation in conceptual design. She is also interested in model-based systems engineering, novel technologies for aircraft systems and sustainable mobility.

WALTER LUCIA is an assistant professor in the Concordia Institute for Information Systems Engineering. He received his MSc in Automation Engineering and his PhD in Systems and Computer Science Engineering from the University of Calabria, Italy. Lucia was a visiting research scholar in the ECE department at Northeastern University and visiting postdoctoral researcher in the ECE department at Carnegie Mellon University. His current research interests include control of unmanned vehicles, switching systems, fault-tolerant control, model predictive control and resilient control of cyber-physical systems.

MAZDAK NIK-BAKHT earned his BSc in Civil Engineering as well as MSc and first PhD in

DR. MARIA AMER, her former student, Dr. Meisam Rakhshanfar (PhD 2016) and engineers at wrnch Inc., created the Magic Bullet Denoiser III, which has been licensed to Red Giant, a Filmmaking and Motion Graphics Company. Backed by investor Mark Cuban, the Magic Bullet Denoiser is the best, fastest and easiest-to-use video denoiser available.

HONOURARY APPOINTMENTS:

Dr. Ted Stathopoulos (Fellow, Institution of Civil Engineers); Dr. Akshay Rathore (Executive Board, IEEE Industry Application Society); Dr. Emad Shihab, Dr.

Structural Engineering from the Iran University of Science and Technology. He received his second PhD in Construction Engineering and Management from the University of Toronto (2015). He joined the Department of Building, Civil and Environmental Engineering as an assistant professor in August 2016. Mazdak is a licensed PEng with PEO and has years of experience as a structural designer and project manager in structural and infrastructure rehabilitation projects. His research is focused on management of information in design, construction and operation of the built environment and (big) data analytics in construction and management of smart and resilient cities.

RASTKO SELMIC is a professor in the Department Electrical and Computer Engineering. He joined Concordia from Louisiana Tech University, where he was an AT&T Professor of Electrical Engineering (2014-2016), an associate professor (2008-2014) and an assistant professor (2002-2008). He was a research fellow at the

Hoi Dick Ng and Dr. Abdelrazik Sebak (Concordia University Research Chairs); Dr. Wen Fang Xie and Dr. Javad Dargahi (Fellow, Canadian Society for Mechanical Engineering).

Dimtcho Krastev and Matthew Silverstein led a team of 10 second, third and fourth year Mechanical Engineering undergraduates to win Best Overall in the CSME National Design Competition on their design of a 3D printer.

Lucas Hof (PhD student, MIE) won the CSME Graduate Student Paper Competition on integration of micro machining technology.

Air Force Research Laboratory (AFRL) during summers of 2015 and 2008. From 1997 to 2002, he was a Lead DSP Systems Engineer at Signalogic, Inc. in Dallas, Texas. He obtained his Bachelor's degree in Electrical Engineering at the University of Belgrade in 1994 and his Master's and PhD degrees in Electrical Engineering at the University of Texas at Arlington in 1997 and 2000, respectively. Dr. Selmic's current research interests include smart sensors and actuators, cooperative sensing and control, gesture-based computing and control and UAV formation control.

AHMED SOLIMAN became an assistant professor in the Department of Building, Civil and Environmental Engineering this summer. He obtained his PhD from Western University. Dr. Soliman specializes in green constructional materials. His research is in the areas of concrete technology, embodied energy of construction materials and recycling industrial wastes/by-products in construction applications. He pioneered self-restraining shrinkage materials, which use waste materials as

SPACE Concordia claimed first place in the Canadian Satellite Design Challenge and second place in the Intercollegiate Rocket Engineering Competition, ahead of teams from McGill, Yale, and MIT.

Co-led by Bruno Lee (Concordia), Carmela Cucuzella (Concordia) and Michael Jemtrud (McGill), students from Concordia's Faculties of Engineering and Computer Science and Fine Arts, as well as McGill's School of Architecture are competing in the Solar Decathlon China 2017 competition.

the main component providing safer disposal with a lower environmental impact.

BRIAN VERMEIRE became an assistant professor in the Department of Mechanical and Industrial Engineering this summer. He was most recently a postdoctoral scholar at Imperial College London and a visiting scholar at Cambridge University. He holds a PhD from McGill University and Bachelors and Master's degrees from Western University. His research is on computational aerodynamics and high-performance computing. More specifically, the development of novel numerical methods and simulation techniques for the design of next-generation cleaner and quieter aircraft and jet engines. He is also interested in optimization, turbulence, massively-parallel computing and heterogeneous computing.

Also joining us this year are Professors Farrah Fayyaz, Hany Gomaa, Sang Hyeok Han, Shahin Karimdorabati, Ida Karimfazli, Motjaba Kheiri, and Biao Li.

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Environmental Engineering (Grad Certificate)

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concordia.ca/alumni-giving